U.S. Department of Energy
Hanford Site

March 8, 2021

21-SGD-000807

Mr. David Bowen, Program Manager
Nuclear Waste Program
Washington State Department of Ecology
3100 Port of Benton Boulevard
Richland, Washington 99354

Dear Mr. Bowen:

HANFORD SITE RESOURCE CONSERVATION AND RECOVERY ACT GROUNDWATER MONITORING REPORT FOR 2020, DOE/RL- 2020-59, REVISION 0

This letter transmits the Hanford Site Resource Conservation and Recovery Act Groundwater Monitoring Report for 2020, DOE/RL-2020-59, Revision 0 to the Washington State Department of Ecology in accordance with Washington Administrative code 173-303-645 and 40 CFR 265.90 through 265.94.

If you have any questions please contact me, or your staff can contact Kathy Higgins, of my staff at (509) 376-3658.

Sincerely,

Michael W. Cline Digitally signed by Michael W. Cline
Date: 2021.03.08 08:07:40 -08'00'

Michael W. Cline, Director
Soil and Groundwater Division
Richland Operations Office

SGD:KLH

Attachments:
1. DOE/RL-2020-59 Rev 0
2. 21-SGD-000807 - (2020-Chemistry)
3. 21-SGD-000807 - (Water levels)

cc: See page 2

cc w/ attach:
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DOE/RL-2020-59
Revision 0

Hanford Site RCRA Groundwater Monitoring Report for 2020

Prepared for the U.S. Department of Energy
Assistant Secretary for Environmental Management

U.S. DEPARTMENT OF ENERGY | Richland Operations Office

P.O. Box 550
Richland, Washington 99352

Approved for Public Release;
Further Dissemination Unlimited

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Hanford Site RCRA Groundwater Monitoring Report for 2020

Date Published
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Assistant Secretary for Environmental Management

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Executive Summary

The U.S. Department of Energy (DOE) conducts groundwater monitoring at 22 dangerous waste management units (DWMUs) regulated under the *Resource Conservation and Recovery Act of 1976* (RCRA)[1] at the Hanford Site. RCRA regulates the management of solid waste, hazardous waste, and certain underground storage tanks, and it applies to active or recently active DWMUs. Groundwater monitoring is required at land disposal units (including surface impoundments, landfills, or land treatment facilities) to determine impacts to groundwater quality in the uppermost aquifer. Groundwater monitoring requirements for Hanford Site RCRA DWMUs fall into one of two broad categories: final status or interim status. Final status units are incorporated into the *Hanford Facility Resource Conservation and Recovery Act (RCRA) Permit, Dangerous Waste Portion for the Treatment, Storage, and Disposal of Dangerous Waste*[2] (hereinafter referred to as the Hanford RCRA Permit) and require groundwater monitoring under Washington State dangerous waste regulations (WAC 173-303-645[3]). The units not currently incorporated into the Hanford RCRA Permit require interim status groundwater monitoring under WAC 173-303-400,[4] and by reference 40 CFR 265, Subpart F.[5] Annual reporting is required by March 1 of the following calendar year under interim status requirements (40 CFR 265.94(a)(2)(ii) and (iii)).[5]

During 2020, DOE monitored groundwater at two DWMUs under final status detection programs and eight DWMUs under interim status indicator evaluation programs. Seven DWMUs were monitored under interim status groundwater quality assessment programs to evaluate the potential nature and extent of contamination. Interim status indicator evaluation programs were reinstated at three DWMUs that were initially under an interim

[1] *Resource Conservation and Recovery Act of 1976*, 42 USC 6901, et seq. Available at: https://elr.info/sites/default/files/docs/statutes/full/rcra.pdf.

[2] WA7890008967, *Hanford Facility Resource Conservation and Recovery Act (RCRA) Permit, Dangerous Waste Portion for the Treatment, Storage, and Disposal of Dangerous Waste*, Revision 8c, as amended, Washington State Department of Ecology, Richland, Washington. Available at: https://fortress.wa.gov/ecy/nwp/permitting/hdwp/rev/8c/.

[3] WAC 173-303-645, "Dangerous Waste Regulations," "Releases from Regulated Units," *Washington Administrative Code*, Olympia, Washington. Available at: http://apps.leg.wa.gov/WAC/default.aspx?cite=173-303-645.

[4] WAC 173-303-400, "Dangerous Waste Regulations," "Interim Status Facility Standards," *Washington Administrative Code*, Olympia, Washington. Available at: http://apps.leg.wa.gov/wac/default.aspx?cite=173-303-400.

[5] 40 CFR 265, "Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities," Subpart F, "Ground-Water Monitoring," *Code of Federal Regulations*. Available at: https://www.ecfr.gov/cgi-bin/text-idx?SID=2cd7465519114fb3472b4864a0e3c42b&node=pt40.26.265&rgn=div5#sp40.28.265.f.

status groundwater quality assessment program. Two DWMUs continued to be monitored under final status corrective action programs in 2020.

The contamination indicator parameter specific conductance exceeded critical mean values in downgradient wells at the Nonradioactive Dangerous Waste Landfill (NRDWL) and Waste Management Area (WMA) A-AX in 2020, and the sites will be monitored under assessment programs (first determination) in 2021.

Monitoring plan revisions implemented during 2020 include the following:

- Groundwater quality assessment plans for WMA B-BX-BY, WMA C, WMA S-SX, WMA T, WMA TX-TY, and WMA U were revised and consolidated.
- Interim status indicator evaluation monitoring plans were reinstated at the 216-A-29 Ditch, NRDWL, and WMA A-AX.
- Interim status indicator parameter plans were revised with RCRA change notices for all of the other RCRA units monitored under this phase.

Updated predictions of future water-level declines in the 200 Areas indicate that 17 RCRA wells may have too little water to sample between 2020 and 2030. Additional wells proposed for installation at the Hanford Site are negotiated annually under Tri-Party Agreement Milestone M-24-00.[6]

[6] Ecology, EPA, and DOE, 1989b, *Hanford Federal Facility Agreement and Consent Order Action Plan*, as amended, Washington State Department of Ecology, U.S. Environmental Protection Agency, and U.S. Department of Energy, Olympia, Washington. Available at: https://www.hanford.gov/?page=82.

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Terms

CERCLA	*Comprehensive Environmental Response, Compensation, and Liability Act of 1980*
cis-1,2-DCE	*cis*-1,2-dichloroethene
Cr(VI)	hexavalent chromium
DOE	U.S. Department of Energy
DWMU	dangerous waste management unit
DWS	drinking water standard
Ecology	Washington State Department of Ecology
EPA	U.S. Environmental Protection Agency
ETF	Effluent Treatment Facility
IDF	Integrated Disposal Facility
LERF	Liquid Effluent Retention Facility
LLBG	low-level burial ground(s)
LOQ	limit of quantitation
MTCA	Model Toxics Control Act
NRDWL	Nonradioactive Dangerous Waste Landfill
NWP	Nuclear Waste Program
OU	operable unit
OUG	operating unit group
P&T	pump and treat
PCU	post-closure unit
PQL	practical quantitation limit
PUREX	Plutonium-Uranium Extraction (Plant)
RCRA	*Resource Conservation and Recovery Act of 1976*
REDOX	Reduction-Oxidation (Plant)
SST	single-shell tank
TCE	trichloroethene
TOC	total organic carbon
TOX	total organic halides
Tri-Parties	U.S. Department of Energy, U.S. Environmental Protection Agency, and Washington State Department of Ecology

Tri-Party Agreement	*Hanford Federal Facility Agreement and Consent Order*
UCL	upper confidence limit
VOC	volatile organic compound
WMA	waste management area

1 Introduction

The U.S. Department of Energy (DOE) conducts groundwater monitoring at 22 dangerous waste management units (DWMUs) at the Hanford Site (Figure 1-1). These units are regulated under Washington State dangerous waste regulations with authorization from the *Resource Conservation and Recovery Act of 1976* (RCRA). RCRA regulates the management of solid waste, hazardous waste, and certain underground storage tanks. It applies to active or recently active DWMUs. Groundwater monitoring is required at land disposal units (including surface impoundments, landfills, or land treatment facilities) to determine if these units are affecting water quality in the uppermost aquifer.

Groundwater monitoring requirements for Hanford Site RCRA DWMUs fall into two broad categories: final status or interim status. Final status units have been incorporated into WA7890008967, *Hanford Facility Resource Conservation and Recovery Act (RCRA) Permit, Dangerous Waste Portion for the Treatment, Storage, and Disposal of Dangerous Waste*, Revision 8c, as amended (hereinafter referred to as the Hanford RCRA Permit). A permitted RCRA unit requires final status monitoring under WAC 173-303-645, "Dangerous Waste Regulations," "Releases from Regulated Units." The RCRA units not currently incorporated into a permit require interim status monitoring under WAC 173-303-400, "Interim Status Facility Standards"; as implemented by 40 CFR 265, Subpart F, "Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities," "Ground-Water Monitoring."

In 1989, DOE, the U.S. Environmental Protection Agency (EPA), and the Washington State Department of Ecology (Ecology) (hereinafter referred to as the Tri-Parties) signed Ecology et al., 1989a, *Hanford Federal Facility Agreement and Consent Order* (Tri-Party Agreement). The Tri-Party Agreement implemented remediation of the Hanford Site under federal facility provisions of the *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* (CERCLA), Section 120, "Federal Facilities," and brought the Hanford Site into compliance with environmental requirements under RCRA, including groundwater monitoring. In the early 1990s, certain DWMUs had ceased operations and were scheduled for closure. These units included ponds, ditches, trenches, cribs, and retention basins. Tri-Party Agreement milestones were agreed upon for the submission of closure plans, and individual closure plans were submitted for regulatory approval and eventual implementation. While awaiting approval and implementation of these closure plans, DOE developed interim status groundwater monitoring plans to monitor the effects of these units on groundwater until closures could be implemented. Until these closures have been implemented or the units are included in the Hanford RCRA Permit, interim status groundwater monitoring will continue.

Chapters 2 through 4 in this report include summaries of the 2020 monitoring results from RCRA sampling campaigns. Only the well networks, constituents, and sampling events identified in the current RCRA monitoring plans are used to (1) determine statistically significant changes for interim status units; (2) assess unit impacts to groundwater, if any; and (3) conduct final status statistical evaluations. For informational purposes, Appendix A of this report provides all of the 2020 data for the RCRA wells, including data from other groundwater monitoring programs.

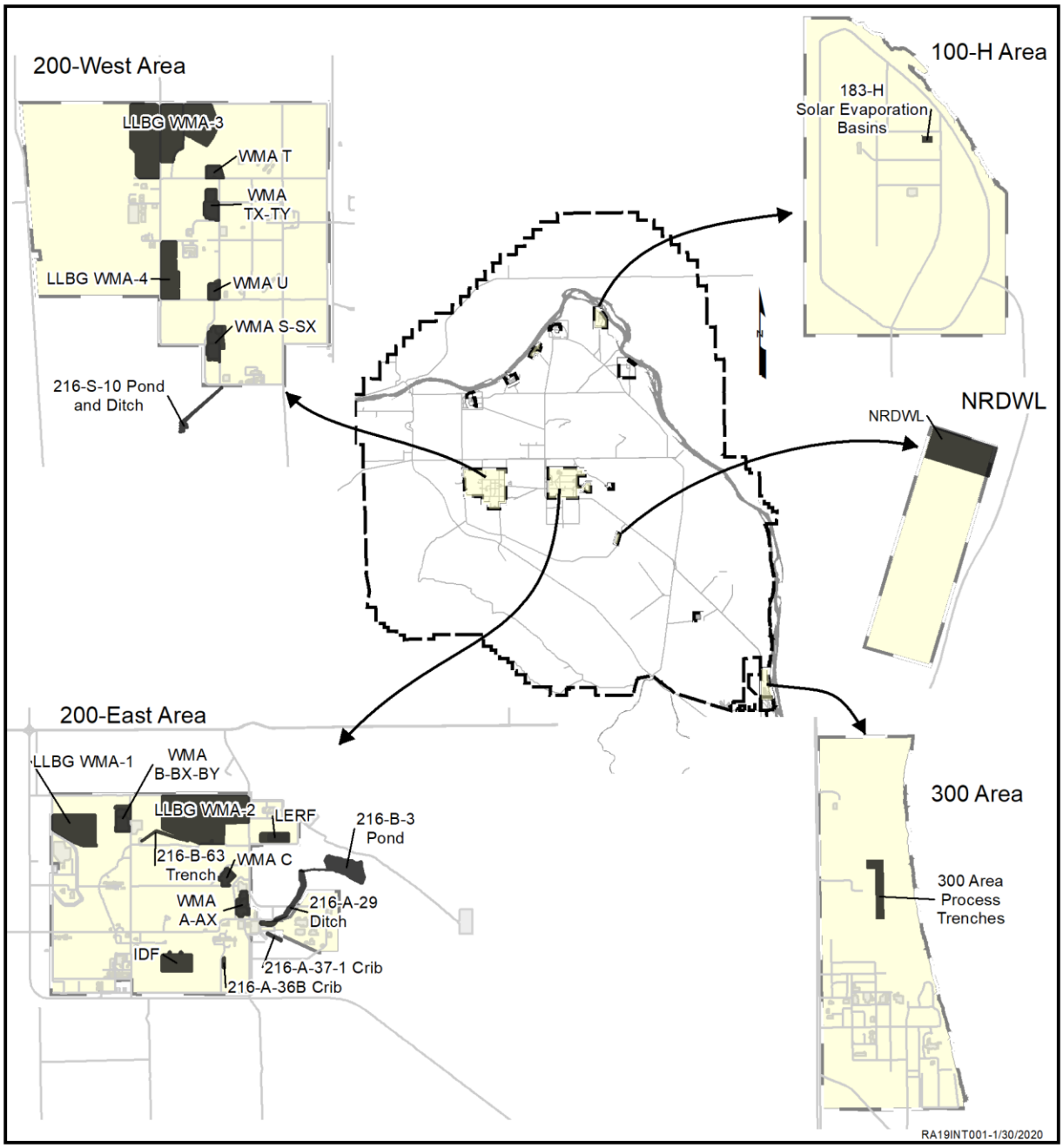


Figure 1-1. Hanford Site RCRA Units

Some of the data summary tables in this report include comparison values such as the federal primary drinking water standards (DWSs), secondary DWSs, and Model Toxics Control Act (MTCA) cleanup levels (WAC 173-340, "Model Toxics Control Act—Cleanup"), which are provided for information only. These comparison values are not used to determine RCRA or *Washington Administrative Code* groundwater monitoring exceedances, nor to satisfy any RCRA or *Washington Administrative Code* groundwater monitoring requirements at the 22 DWMUs at the Hanford Site.

1.1 RCRA Groundwater Monitoring Programs

DOE conducts RCRA groundwater monitoring under four types of programs:

- Interim status indicator evaluation
- Interim status groundwater quality assessment
- Final status detection
- Final status corrective action

Table 1-1 lists the Hanford Site RCRA units and the types of monitoring plans that were in effect during 2020. The table also provides information on planned changes to the monitoring networks or monitoring plans in 2021.

Natural or anthropogenic changes in groundwater flow and water quality (e.g., those imposed by pump and treat [P&T] systems) may affect the adequacy of RCRA groundwater monitoring networks. DOE is working with Ecology to review the monitoring networks and is evaluating the need for additional wells through the Hanford RCRA Permit working group. In anticipation of final status permitting, DOE is preparing RCRA engineering evaluation reports (Table 1-1) and related final status monitoring plans, which are expected to be added to the Hanford RCRA Permit. Some of the recommendations from the engineering evaluation reports are being applied to revised interim status monitoring plans.

Additional wells proposed for installation at the Hanford Site are negotiated annually by the Tri-Parties under Tri-Party Agreement Milestone M-24-00 (Ecology et al., 1989b, *Hanford Federal Facility Agreement and Consent Order Action Plan*). The well network tables presented in Chapters 2 through 4 list proposed wells only if they are specified in the current monitoring plan.

Interim status indicator evaluation programs monitor specific conductance, pH, total organic carbon (TOC), and total organic halides[1] (TOX) (collectively referred to as indicator parameters) (40 CFR 265.92(b)(3), "Sampling and Analysis") to determine if the RCRA unit has impacted groundwater in the uppermost aquifer. A statistically significant change is determined by comparing concentrations of the indicator parameters in downgradient wells to a statistical comparison value (referred to as a critical mean at the Hanford Site) that is derived from background measurements (usually from upgradient wells). If a downgradient well exceeds a critical mean value for any of the indicator parameters, the well is resampled. If the results of the second sampling event confirm the exceedance, the indicator evaluation program changes to a groundwater quality assessment program. The critical mean values for the indicator parameters represent 99% prediction limits, calculated using groundwater sample data from upgradient wells. The methodology used to calculate the critical mean value is the Student's t-test in accordance with 40 CFR 265.93(b), "Preparation, Evaluation, and Response."

[1] Total organic halides (TOX) are synonymous with total organic halogens, which is the term used in 40 CFR 265.92.

Table 1-1. Hanford Site RCRA Monitoring for 2020

RCRA Unit	Section	Type of Monitoring Program, Monitoring Plan(s) Active in 2020	Comments[a]	Engineering Evaluation[b]
183-H Solar Evaporation Basins	4.1	Final status corrective action during CERCLA remedial action, Hanford RCRA Permit	Two wells are dry seasonally.	Not applicable
216-A-29 Ditch	2.1	January–June: interim status assessment (first determination), DOE/RL-2016-23 July–December: interim status indicator evaluation, DOE/RL-2008-58	Three new wells planned and revised monitoring plan in progress in 2021.	SGW-60592 (2019)
216-A-36B Crib	2.2	Interim status indicator evaluation, DOE/RL-2010-93, as modified by: RCRA-CN-01_DOE/RL-2010-93_R2 (effective date June 8, 2020)	RCRA-CN-02_DOE/RL-2010-93_R2 (effective date October 1, 2020) implemented in 2021; one replacement well planned[c] and revised monitoring plan in progress in 2021. Well 299-E17-19 predicted sample dry in 2020 but was sampled successfully.	SGW-60595 (2019)
216-A-37-1 Crib	2.3	Interim status indicator evaluation, DOE/RL-2010-92, as modified by: RCRA-CN-01_DOE/RL-2010-92_R3 (effective date June 8, 2020)	RCRA-CN-02_DOE/RL-2010-92_R3 (effective date October 1, 2020) implemented in 2021; three replacement wells[c] and two new wells planned, and revised monitoring plan in progress in 2021.	SGW-60593 (2019)
216-B-3 Main Pond	2.4	Interim status indicator evaluation, DOE/RL-2008-59, as modified by: RCRA-CN-01_DOE/RL-2008-59_R2 (effective date September 17, 2019), RCRA-CN-02_DOE/RL-2008-59_R2 (effective date June 8, 2020)	RCRA-CN-03_DOE/RL-2008-59_R2 (effective date October 15, 2020) implemented in 2021; four new wells planned and revised monitoring plan in progress in 2021.	SGW-60591 (2019)
216-B-63 Trench	2.5	Interim status indicator evaluation, DOE/RL-2008-60, as modified by: RCRA-CN-01_DOE/RL-2008-60_R1 (effective date June 8, 2020)		SGW-60594 (2019)
216-S-10 Pond and Ditch	2.6	Interim status indicator evaluation, DOE/RL-2008-61, as modified by: RCRA-CN-01_DOE/RL-2008-61_R1 (effective date June 8, 2020)	Four new wells planned and revised monitoring plan in progress in 2021.	SGW-60585 (2018)

Table 1-1. Hanford Site RCRA Monitoring for 2020

RCRA Unit	Section	Type of Monitoring Program, Monitoring Plan(s) Active in 2020	Comments[a]	Engineering Evaluation[b]
300 Area Process Trenches	4.2	Final status corrective action during CERCLA remedial action, Hanford RCRA Permit		Not applicable
Integrated Disposal Facility	2.7	Collecting baseline data set for final status detection program (facility is not in use), Hanford RCRA Permit Additional sampling was performed under DOE/RL-2019-29 in 2020	Permit modification process underway.	SGW-62007 (2019)
Liquid Effluent Retention Facility	2.8	Final status detection, Hanford RCRA Permit	Revised monitoring plan and Permit modification in progress in 2021. Well 299-E26-10 predicted sample dry by 2021 but was used only for water levels.	SGW-41072 (2017)
LLBG WMA-1	2.9	Interim status indicator evaluation, DOE/RL-2009-75, as modified by: RCRA-CN-01_DOE/RL-2009-75_R1 (effective date June 8, 2020)	Three new wells planned and revised monitoring plan in progress in 2021.	SGW-60590 (Green Islands) (2019)
LLBG WMA-2	2.1	Interim status indicator evaluation, DOE/RL-2009-76, Rev. 0, as modified by: RCRA-CN-01_DOE/RL-2009-76_R0 (effective date June 8, 2020)	Revised monitoring plan released in 2021 (DOE/RL-2009-76, Rev. 1). Well 299-E34-9 predicted sample dry by 2021.	To be developed (Trench 94)
LLBG WMA-3	3.1	Interim status assessment (first determination), DOE/RL-2019-32, as modified by: RCRA-CN-01_DOE/RL-2019-32_R0 (effective date August 5, 2020)		SGW-59564 (Trenches 31 and 34) (2016) and SGW-60583 (Green Islands) (2018)
LLBG WMA-4	2.11	Interim status indicator evaluation, DOE/RL-2009-69, as modified by: RCRA-CN-01_DOE/RL-2009-69_R2 (effective date June 8, 2020)		SGW-60584 (2018)

Table 1-1. Hanford Site RCRA Monitoring for 2020

RCRA Unit	Section	Type of Monitoring Program, Monitoring Plan(s) Active in 2020	Comments[a]	Engineering Evaluation[b]
Nonradioactive Dangerous Waste Landfill	2.12	January–June: interim status assessment, DOE/RL-2017-19 July–December: interim status indicator evaluation, DOE/RL-2015-32; critical mean for specific conductance exceeded in August and confirmed in October	Assessment plan implemented in 2021 (DOE/RL-2020-57).	SGW-60589 (2019)
Single-Shell Tank WMA A-AX	2.13	January–June: interim status assessment, DOE/RL-2015-49, as modified by: RCRA-CN-01_DOE/RL-2015-49_R0 (effective date February 13, 2020) July–December: interim status indicator evaluation, DOE-RL-2019-44; critical mean for specific conductance exceeded in September and confirmed in December	Assessment plan being developed and implemented in 2021. Well 299-E25-41 predicted sample dry by 2027.	SGW-60586 (2019)
Single-Shell Tank WMA B-BX-BY	3.2	Interim status assessment, DOE/RL-2012-53 (January–June) and DOE/RL-2019-74 (July–December) Primary RCRA constituent is cyanide		SGW-60587 (2019)
Single-Shell Tank WMA C	3.3	Interim status assessment, DOE/RL-2009-77 (January–June) and DOE/RL-2019-74 (July–December) Primary RCRA constituent is cyanide		SGW-60588 (2019)
Single-Shell Tank WMA S-SX	3.4	Interim status assessment, DOE/RL-2009-73, as modified by: RCRA-CN-01_DOE/RL-2009-73_R1 (effective date March 22, 2020); and DOE/RL-2019-74 (July–December) Primary RCRA constituent is chromium		SGW-60577 (2018)
Single-Shell Tank WMA T	3.5	Interim status assessment, DOE/RL-2009-66, Rev. 2 (January–June) and DOE/RL-2019-74 (July–December) Primary RCRA constituent is chromium	Wells 299-W10-24, 299-W11-39, 299-W11-40, 299-W11-41, and 299-W11-42 predicted sample dry in 2022 to 2025. Wells sampled successfully in 2020.	SGW-60575 (2018)

Table 1-1. Hanford Site RCRA Monitoring for 2020

RCRA Unit	Section	Type of Monitoring Program, Monitoring Plan(s) Active in 2020	Comments[a]	Engineering Evaluation[b]
Single-Shell Tank WMA TX-TY	3.6	Interim status assessment, DOE/RL-2009-67 (January–June) and DOE/RL-2019-74 (July–December) Primary RCRA constituent is chromium	Wells 299-W10-26, 299-W10-27, 299-W14-13, 299-W14-14, 299-W14-15, 299-W14-18, 299-W14-19, and 299-W15-765 predicted sample dry 2020 to 2030. Wells sampled successfully in 2020.	SGW-60576 (2018)
Single-Shell Tank WMA U	3.7	Interim status assessment, DOE/RL-2009-74 (January–June) and DOE/RL-2019-74 (July–December) Primary RCRA constituent is chromium		SGW-60578 (2018)

Note: The references cited in this table are provided in Chapter 5.

a. Dry well predictions from SGW-63743, *Predicted Impact of Future Water-Level Declines on Groundwater Well Longevity Within the Central Plateau, Hanford Site*.

b. Engineering evaluations are used to determine the need for new or replacement monitoring wells for these units in anticipation of final status permitting.

c. Replacements for wells not constructed to *Washington Administrative Code* standards.

CERCLA = *Comprehensive Environmental Response, Compensation, and Liability Act of 1980*

LLBG = low-level burial grounds

RCRA = *Resource Conservation and Recovery Act of 1976*

WMA = waste management area

Critical mean values are recalculated annually, or whenever the number of analyses changes (e.g., due to adding or removing wells). ECF-HANFORD-20-0007, *Calculation of Critical Means for Calendar Year 2020 RCRA Groundwater Monitoring*, describes the critical mean calculations for 2020. The tables presented in Chapter 2 of this report provide the 2020 critical mean values and the results of statistical comparisons. Annual recalculation accounts for additional monitoring data and changing hydrologic conditions due to natural or manmade causes (e.g., P&T systems). If changes occur in a monitoring well network, critical mean values are recalculated for subsequent sampling events using the new well network. When a critical mean for TOC or TOX could not be calculated using a parametric statistical test because >50% of data from the upgradient well(s) were below detection limits, the limit of quantitation (LOQ) was used as the upper reporting limit. Similarly, when the calculated critical mean is below the LOQ, the LOQ is also used as a comparison value for detecting downgradient exceedances. In 2020, the LOQs were the laboratory's required detection limits (1,000 μg/L for TOC and 10 μg/L for TOX).

If an exceeded critical mean is verified in a downgradient well, an interim status groundwater quality assessment plan is implemented (40 CFR 265.93(d)). The objective of the assessment program is to determine the rate and extent of migration, as well as the groundwater concentration of the dangerous waste from the unit (if any).

Interim status groundwater quality assessments may also consider and test for alternative explanations for critical mean exceedances. For example, specific conductance exceedances may be caused by nondangerous waste constituents such as sulfate. Because of changes in the direction of groundwater flow and the presence of multiple past-practice CERCLA release sites, some assessments require determining if the cause of an indicator parameter exceedance originated from other sources. These assessments can take time to evaluate before a first determination is made, and some DWMUs in assessment can be returned to indicator evaluation monitoring in accordance with 40 CFR 265.93(d)(6).

For final status detection monitoring (WAC 173-303-645(9)), appropriate indicator parameters, waste constituents, or reaction products are specified in the Hanford RCRA Permit for groundwater monitoring. If statistically significant evidence of contamination is determined at the point of compliance, DOE must notify Ecology and resample the well(s). The results of these analyses form the basis for a final status compliance monitoring program, which is established through a permit modification.

For final status compliance monitoring (WAC 173-303-645(10)), if contaminant concentrations in groundwater have exceeded a permit concentration limit, a corrective action program must be established. Corrective action groundwater monitoring under WAC 173-303-645(11) would then be initiated to determine if the corrective action is effective. Currently, none of the units at the Hanford Site are monitored under final status compliance monitoring programs.

1.2 Interim Status Reporting Requirements

40 CFR 265.94, "Recordkeeping and Reporting," includes reporting requirements for interim status groundwater monitoring programs. For indicator evaluation programs, the owner/operator must report the following information no later than March 1 each year (40 CFR 265.94(a)(2)(ii) and (iii)):

- Concentrations of the contamination indicator parameters for each groundwater monitoring well, along with the required evaluations for these parameters (i.e., comparison to critical mean values)
- Any significant differences from initial background found in the upgradient wells
- Results of evaluations of groundwater surface elevations and a description of the response to that evaluation, where applicable (e.g., proposed changes to the monitoring network)

For groundwater quality assessments, the owner/operator must submit an annual report with the results of the groundwater quality assessment program no later than March 1 of the following year (40 CFR 265.94(b)(2)). The report must include the calculated (or measured) rate of migration of dangerous waste constituents in groundwater during the reporting period.

Chapter 2 of this report describes the results for sites monitored under interim status indicator evaluation for 2020, and Chapter 3 provides the interim status assessment results.

1.3 Final Status Reporting Requirements

Under the final status requirements of WAC 173-303-645(8)(j), reporting requirements are specified in the Hanford RCRA Permit. The following requirements apply to the final status units on the Hanford Site:

- The Liquid Effluent Retention Facility (LERF) is monitored under a final status detection program, with data reported annually by March 1 of the following year. Section 2.8 summarizes the monitoring results for 2020.
- For the Integrated Disposal Facility (IDF), the Hanford RCRA Permit (WA7890008967, Part III, Operating Unit Group 11 [OUG-11], Section 5.5.4.3.3, "Reporting") requires the following: "The results of the statistical evaluation and associated information will be submitted to Ecology quarterly in Hanford Site groundwater monitoring reports." Because the IDF is not in use, this statistical evaluation has not been prepared to date. Additional sampling began under a new monitoring plan (not yet in the Hanford RCRA Permit) in 2020, and the results are reported in this document for completeness. Section 2.7 summarizes the monitoring results for 2020.
- The 183-H Solar Evaporation Basins and 300 Area Process Trenches are monitored under corrective action, which is reported in semiannual and annual reports. Sections 4.1 and 4.2 summarize the monitoring results for 2020.

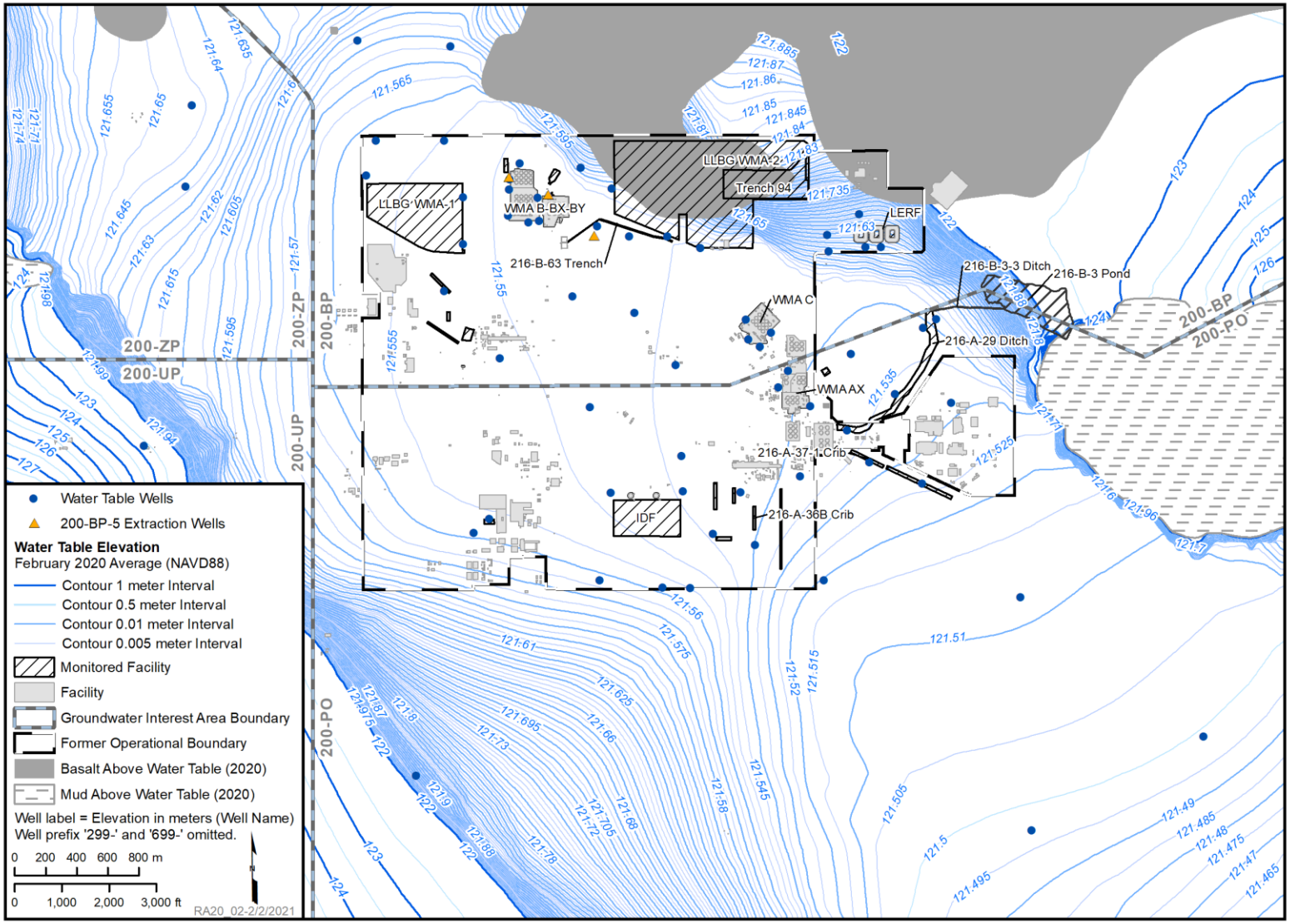
1.4 Water Table

Water table contours illustrated in figures for this report are taken from the Hanford Site water table map and are based on measurements made during the first quarter of 2020 (ECF-HANFORD-20-0078, *Preparation of the Hanford Site Water Table Map for January to March 2020*). Figures 1-2 and 1-3 illustrate the 200 East and 200 West Area portions of the sitewide water table map. Groundwater flow directions are generally perpendicular to the water table elevation contours.

Well network tables presented in Chapters 2 through 4 list the water-level elevation in each well, typically from the third or fourth quarter of 2020. Those measurements are used to calculate the remaining water column in each well and were not used to construct the first quarter water table maps. The elevations of the bottoms of screened intervals were taken from ECF-HANFORD-20-0070, *Open Interval Elevations for Central Plateau Groundwater Monitoring Wells*.

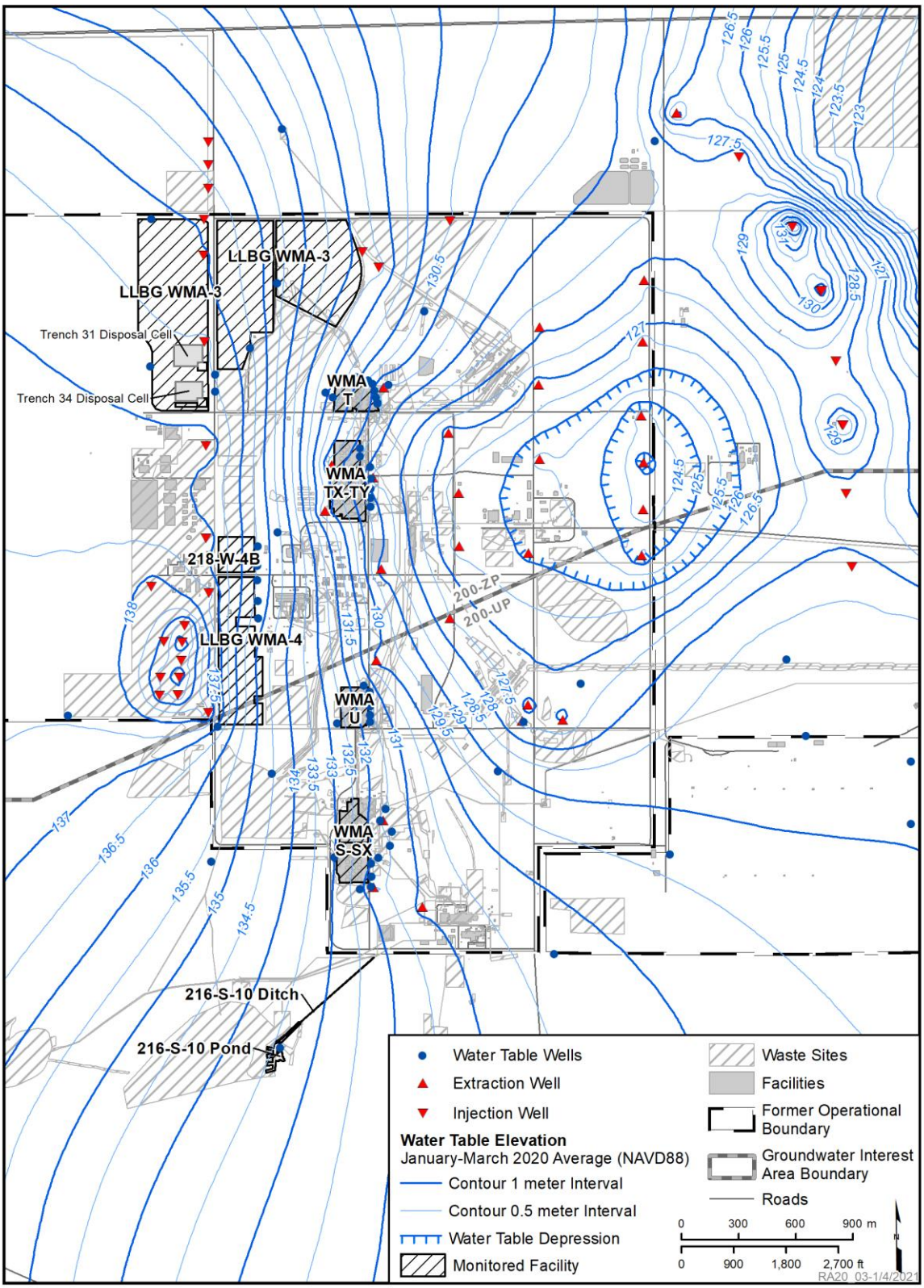
1.4.1 Hydraulic Gradients and Average Linear Velocity

The hydraulic gradient beneath each RCRA unit was calculated and used to determine the groundwater average linear velocity (Table 1-2). Mobile contaminants such as cyanide and dissolved chromium can be assumed to migrate at the same rate as groundwater.



Source: ECF-HANFORD-20-0078, *Preparation of the Hanford Site Water Table Map for January to March 2020*.

Figure 1-2. 200 East Area Water Table, February 2020



Source: ECF-HANFORD-20-0078, *Preparation of the Hanford Site Water Table Map for January to March 2020*.

Figure 1-3. 200 West Area Water Table, January Through March 2020

For the 300 Area Process Trenches, the magnitude and direction of the hydraulic gradient were estimated by trend-surface analysis calculations, using data from wells within the RCRA monitoring network (Table 1-2). A first order, linear trend surface (i.e., a plane) was fitted to the measured water-level elevation data using least squares regression. The slope of the fitted surface represents the hydraulic gradient magnitude, and the dip direction represents the hydraulic gradient direction. The gradient and hydraulic parameters were then used to calculate average linear velocity using Darcy's law. This method was also attempted at the 183-H Solar Evaporation Basins but was unsuccessful because of the hydraulic impacts of extraction wells within and around the monitoring network.

Table 1-2. Average Hydraulic Gradient and Average Linear Velocity for 2020

RCRA Unit	Average Gradient	Average Velocity, m/d (ft/d)	Direction	Comments
183-H Solar Evaporation Basins	Undetermined	Undetermined	Variable	Gradients vary due to the influence of upgradient and downgradient extraction and injection wells.
216-A-29 Ditch	1.7E-05	1.2 (3.9)	Southeast	
216-A-36B Crib	1.4E-05	0.0064 (0.021)	East-southeast	
216-A-37-1 Crib	1.5E-05	1.1 (3.7)	Southeast	
216-B-3 Main Pond	1.7E-03	34 (110)	Southwest	
216-B-63 Trench	Undetermined	Undetermined	Variable	Gradients are changing under influenced of extraction wells.
216-S-10 Pond and Ditch	2.5E-03	0.14 (0.45)	East	
300 Area Process Trenches	4.7E-04	25 (82)	Southeast	Velocity calculated using K = 9,000 m/d; n = 0.1 (ECF-300FF5-11-0151).
Integrated Disposal Facility	1.4E-05	0.77 (2.5)	Northeast	
Liquid Effluent Retention Facility	2.9E-04	0.0044 (0.014)	South	
LLBG WMA-1	8.8E-06	0.58 (1.9)	East-southeast	
LLBG WMA-2	2.5E-04	15 (49)	South	
LLBG Trench 94	Undetermined	Undetermined	Undetermined	No unconfined aquifer; Trench 94 is underlain by basalt.
LLBG WMA-3	2.6E-03	0.14 (0.47)	East of injection wells: east; west of injection wells: variable	Influenced by injection wells within LLBG WMA-3 and downgradient extraction wells.
LLBG Trenches 31 and 34	3.3E-03	0.18 (0.58)	Trench 31: south, turning east; Trench 34: east	Flow beneath Trench 31 influenced by adjacent injection well.
LLBG WMA-4	9.9E-03	0.54 (1.8)	East	Influenced by upgradient injection wells.

Table 1-2. Average Hydraulic Gradient and Average Linear Velocity for 2020

RCRA Unit	Average Gradient	Average Velocity, m/d (ft/d)	Direction	Comments
Nonradioactive Dangerous Waste Landfill	1.4E-05	0.95 (3.1)	Southeast	
WMA A-AX	7.4E-06	0.54 (1.8)	East-southeast	
WMA B-BX-BY	8.6E-06	0.62 (2.0)	South and east	Influenced by adjacent extraction wells.
WMA C	4.4E-06	0.26 (0.86)	Southeast	
WMA S-SX	5.0E-03	0.27 (0.90)	East	Influenced by downgradient extraction wells.
WMA T	7.9E-03	0.43 (1.4)	East-southeast	Influenced by downgradient extraction well.
WMA TX-TY	8.9E-03	0.48 (1.6)	Northern portion: southeast; southern portion: east-northeast	Influenced by upgradient and downgradient extraction wells.
WMA U	6.9E-03	0.38 (1.2)	East-northeast	

References:

ECF-300FF5-11-0151, *Groundwater Flow and Uranium Transport Modeling in Support of the 300 Area FF-5 RI/FS*.

ECF-HANFORD-20-0066, *Hydraulic Gradient and Average Linear Groundwater Velocity Calculations - Quarter 1 Calendar Year 2020*.

ECF-HANFORD-20-0078, *Preparation of the Hanford Site Water Table Map for January to March 2020*.

Notes:

Gradient and velocity for all units (except 183-H and 300 Area Process Trenches) were calculated from particle tracking as documented in ECF-HANFORD-20-0066.

For the 200 West Area, constant hydraulic conductivity and porosity values representing the Ringold unit E were specified for particle tracking. For the 200 East Area and Nonradioactive Dangerous Waste Landfill, the stratigraphic zones are from ECF-HANFORD-20-0078, and the hydraulic conductivity and porosity values were defined as homogeneous within those zones when calculating average linear velocity.

K = hydraulic conductivity
LLBG = low-level burial grounds
n = effective porosity
RCRA = *Resource Conservation and Recovery Act of 1976*
WMA = waste management area

The hydraulic gradient and average linear velocity calculations for the 200 Areas relied on water table maps. For RCRA units in the 200 East Area, depth-to-water measurements were obtained from the wells of the low-gradient network, supplemented with data from other wells when necessary. The low-gradient network includes wells in which gyroscope surveys were performed to correct for borehole deviation from vertical. This is done to reduce the borehole deviation (i.e., nonverticality) that was identified as the most critical source of error in the 200 East Area water-level measurements. Preparation of the 200 East Area map is documented in ECF-HANFORD-20-0078.

For the 200 West Area, the water levels were obtained from wells in the water-level and groundwater sampling networks. In some cases, monthly averages from the automated water-level network were used if representative manual measurements were not available. The 200 West Area map used for velocity estimates is documented in ECF-200W-20-0065, *Groundwater Elevation Mapping for 200 West Area – Quarter 1 Calendar Year 2020*.

To calculate average linear velocity, the 200 West and 200 East Area water table maps were used as the basis for particle tracking within a local region of each RCRA unit using a groundwater flow model (ECF-HANFORD-20-0066, *Hydraulic Gradient and Average Linear Groundwater Velocity Calculations – Quarter 1 Calendar Year 2020*). Particle release locations were placed upgradient of each RCRA unit and tracked considering only advective transport. The resulting particle path lines allow for visualizing the general groundwater flow directions and calculating gradients and average linear velocities based on those flow directions.

1.4.2 Water Table Decline

The water table beneath the Central Plateau has continued to decline in recent years. The impact of these declines on groundwater monitoring wells is predicted for 2020 through 2030 in SGW-63743, *Predicted Impact of Future Water-Level Declines on Groundwater Well Longevity Within the Central Plateau, Hanford Site*. The results of the 2020 update of that document differed from the 2019 version in the following ways:

- Elevations of screened and perforated intervals have been checked more rigorously and documented in ECF-HANFORD-20-0070
- Projections now use the Plateau to River Model (CP-57037, *Model Package Report: Plateau to River Groundwater Transport Model Version 8.3*) instead of the Central Plateau Groundwater Model (CP-47631, *Model Package Report: Central Plateau Groundwater Model, Version 8.4.5*).
- The Plateau to River Model incorporated planned increases in P&T extraction and injection rates.

Table 1-1 lists the RCRA wells that are predicted to have <0.9 m (3 ft) of water by 2030.

1.5 Well Corrosion Evaluation

Where concentrations of certain metals in unfiltered samples are higher than in filtered samples, this may indicate stainless-steel well corrosion. Requirements for reviewing groundwater data for evidence of monitoring well corrosion are contained in the Hanford RCRA Permit, Attachment 8, “Inspection and Training Plan for Groundwater Monitoring Wells.” Evaluation of potential corrosion products involves calculating ratios of chromium, nickel, and molybdenum to iron in unfiltered groundwater samples. The ratios are then compared to representative ratios in stainless steel. An increase in the trend of these metals could indicate well corrosion. Although these requirements are currently applicable only to units monitored under final status, many of the interim status groundwater monitoring plans have been revised to include analysis for corrosion indicator metals. Table 1-3 lists the reference ratios for various stainless-steel alloys. The results of the 2020 evaluations are discussed in Chapters 2 and 3, where applicable.

Table 1-3. Reference Ratios for Stainless-Steel Components

Alloy	Iron : Iron	Chromium : Iron	Nickel : Iron	Molybdenum: Iron	Manganese : Iron
304	1	0.28	0.13	—	0.03
304L	1	0.28	0.15	—	0.03
316	1	0.26	0.18	0.04	0.03
316L	1	0.26	0.18	0.04	0.03

1.6 RCRA Inspections

During 2020, Ecology conducted the following inspections of Hanford Site RCRA units:

- Dangerous waste compliance inspection on February 27, 2020, at the single-shell tank (SST) system farm (RCRA site ID WA7890008967, Nuclear Waste Program [NWP] Compliance Index No. 20.694). This inspection did not cite any areas of concern or noncompliance.
- Dangerous waste compliance inspection on March 5, 2020, at the IDF (RCRA Site ID WA7890008967, NWP Compliance Index No. 20.695). This inspection did not cite any areas of concern or noncompliance.
- Dangerous waste compliance inspection on March 11, 2020, at the Nonradioactive Dangerous Waste Landfill (NRDWL) (RCRA Site ID WA7890008967, NWP Compliance Index No. 20.696). This inspection identified three noncompliances not related to groundwater monitoring.
- Dangerous waste compliance inspection on April 30, 2020, at Low-Level Burial Ground (LLBG) 218-W-5, Trenches 31 and 34 (RCRA Site ID WA7890008967, NWP Compliance Index No. 20.700). This inspection did not cite any areas of concern or noncompliance.
- Dangerous waste compliance inspection on June 15, 2020, at Trench 94 (RCRA Site ID WA7890008967, NWP Compliance Index No. 20.703). This inspection did not cite any areas of noncompliance, but there was one area of concern not related to groundwater monitoring.
- Dangerous waste compliance inspection on June 24, 2020, at 216-A-29 Ditch, 216-A-37-1 Crib, 216-A-36b Crib, 216-B-63 Trench, 216-S-10 Pond and Ditch, 216-B-3 Main Pond, 183-H Solar Evaporation Basins, 300 Area Process Trenches, and LLBG Green Islands – Waste Management Area (WMA) 2 (RCRA Site ID WA7890008967, NWP Compliance Index Nos. 20.704 through 20.712). This inspection did not cite any areas of concern or noncompliance.
- Dangerous waste compliance inspection on July 28, 2020, at the LERF and Effluent Treatment Facility (ETF) (RCRA Site ID WA7890008967, NWP Compliance Index No. 20.713). There were no noncompliances, but there was one area of concern relating to the recommended holding time for hexavalent chromium (Cr(VI)).
- Dangerous waste compliance inspection on November 5, 2020, at LLBG 218-W-5, Trenches 31 and 34 (RCRA Site ID WA7890008967, NWP Compliance Index No. 20.718). The Ecology inspection report is pending.

- Dangerous waste compliance inspection on November 30, 2020, at LLBG 218-E-12b, Trench 94 (RCRA Site ID WA7890008967, NWP Compliance Index No. 20.720). The Ecology inspection report is pending.
- Dangerous waste compliance inspection on December 10, 2020, at SST Tank Farms (RCRA Site ID WA7890008967, NWP Compliance Index No. 20.721). The Ecology inspection report is pending.

1.7 Other Hanford Site Groundwater Reports

DOE has reported annually on RCRA groundwater monitoring since 1988. Table 1-4 lists the various forms and schedules that the reports have taken over the years. DOE combined the RCRA annual report with the annual Hanford Sitewide groundwater reports from 1996 through 2014. Since calendar year 2015, DOE has provided separate reports for the RCRA units by March 1, as specified in 40 CFR 265.94.

Table 1-4. Hanford Site RCRA Monitoring Reports

Years	Publication Date	Reporting Year	Explanation
1988 to 1995	March 1	Fiscal year (October 1 to September 30)	Standalone RCRA reports. Hanford Sitewide groundwater reports published separately.
1996 to 2008	March 1	Fiscal year (October 1 to September 30)	Comprehensive report (RCRA, Hanford Sitewide, and CERCLA*).
2009 to 2014	July or August	Calendar year	Comprehensive report (RCRA, Hanford Sitewide, CERCLA,* and AEA). DOE and Ecology agreed on alternative schedules to allow the change to calendar year and extend time for reviewing the draft report.
2015 to 2020	March 1	Calendar year	Standalone RCRA report.
	August or September	Calendar year	Comprehensive report (RCRA, Hanford Sitewide, CERCLA,* and AEA). Included revisions to RCRA sections based on Ecology comments on RCRA report.

*The comprehensive groundwater annual reports include the results of CERCLA monitoring. Additional details are provided in separate annual reports for operable units with active remedial actions.

AEA = *Atomic Energy Act of 1954*
CERCLA = *Comprehensive Environmental Response, Compensation, and Liability Act of 1980*
DOE = U.S. Department of Energy
Ecology = Washington State Department of Ecology
RCRA = *Resource Conservation and Recovery Act of 1976*

2 Indicator Evaluation and Detection Monitoring

This chapter discusses the monitoring results for 2 DWMUs monitored under final status detection programs and 11 DWMUs monitored under interim status indicator evaluation programs.

2.1 216-A-29 Ditch

The 216-A-29 Ditch is located just east of the 200 East Area fence line (Figures 1-1 and 2-1). The site is designated as a surface impoundment in accordance with WAC 173-303-040, "Definitions."
The 216-A-29 Ditch was placed into service in November 1955. It received continuous discharge of corrosive waste and potentially hazardous spilled chemical materials from the Plutonium-Uranium Extraction (PUREX) Plant. Discharges included acidic and caustic effluents from backwashing during demineralizer column regeneration. From 1955 to 1986, daily discharges of sodium hydroxide and sulfuric acid solutions occurred. Treatment of this waste involved the successive addition of acidic and caustic waste, which neutralized waste in the ditch. The ditch also received spills from the PUREX Plant chemical sewer (low-level contamination). Flow from the chemical sewer was continuous, with an average volume of 3,700 L/min (970 gal/min). After 1986, dangerous waste was no longer discharged to the chemical sewer. A complete estimated inventory of materials discharged to the 216-A-29 Ditch is provided in Appendix A of WHC-SD-EN-AP-045, *Ground Water Monitoring Plan for the 216-A-29 Ditch*.

The 216-A-29 Ditch was removed from service in 1991, partly backfilled with material from the ditch sides, and the portion of the ditch inside of the 200 East Area security fence was brought to grade with clean fill material. The ditch outside of the 200 East Area security fence was topped with clean fill material in a series of 11 terraces progressing down the length of the ditch. Both areas were revegetated and posted as underground radioactive material areas.

During the first half of 2020, the 216-A-29 Ditch was monitored under a groundwater quality assessment program (DOE/RL-2016-23, *216-A-29 Ditch Interim Status Groundwater Quality Assessment Monitoring Plan*). For the remainder of 2020, the ditch was monitored under an indicator evaluation program because previous assessment results indicated that no dangerous waste groundwater contamination was attributed to releases from the 216-A-29 Ditch (DOE/RL-2019-27, *Groundwater Assessment First Determination Report for the 216-A-29 Ditch*). Interim status indicator evaluation monitoring was reinstated under DOE/RL-2008-58, *Interim Status Groundwater Monitoring Plan for the 216-A-29 Ditch*, during the third quarter of 2020. The plan modified the monitored constituents and sampling frequency, but there was no change to the monitoring network.

Table 2-1 lists the 216-A-29 monitoring network, as well as screened intervals and water levels. All of the wells are expected to have sufficient water for continued sampling through at least 2030 (SGW-63743). SGW-60592, *Engineering Evaluation Report for the 216-A-29 Ditch Groundwater Monitoring*, recommended a modified network for final status monitoring, including all eight of the current wells and seven proposed new wells. The wells in the 216-A-29 monitoring network are screened across the uppermost portion of the unconfined aquifer, which includes members of the Cold Creek unit and the Hanford formation.

In 2020, the hydraulic gradient dipped to the southeast with a magnitude of 1.7×10^{-5} m/m, and the calculated average flow velocity was 1.2 m/d (3.9 ft/d) (Table 1-2).

Table 2-2 summarizes the results for constituents required by the groundwater quality assessment plan, (DOE/RL-2016-23), which was in effect during the January and June 2020 sampling events. Table 2-3 presents contamination indicator parameter results for samples collected in July/August sampling under the indicator evaluation monitoring plan (DOE/RL-2008-58). There were no exceedances of the indicator parameter critical mean values. Table 2-4 summarizes other constituents monitored under the indicator evaluation plan.

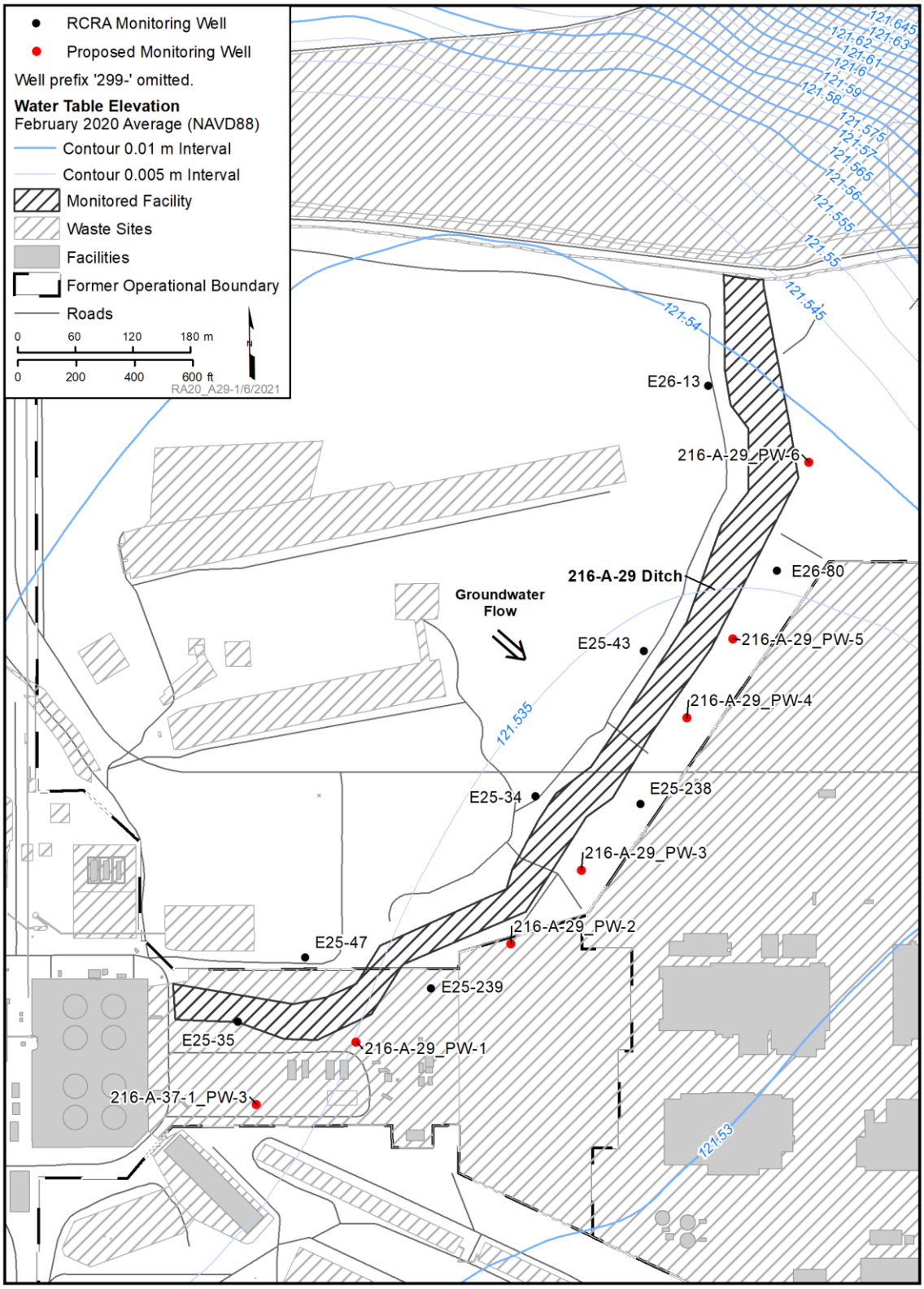
Groundwater quality parameters monitored for the site include chloride, iron, manganese, phenols, sodium, and sulfate (Table 2-4). Although not required by 40 CFR 265, Subpart F, site-specific constituents (alkalinity, nitrate, calcium, magnesium, chromium, molybdenum, nickel, and potassium) were also analyzed. Samples for analyses of alkalinity, anions, calcium, magnesium, potassium, and sodium are collected to support cation-anion balance calculations. Samples for iron, manganese, chromium, molybdenum, and nickel are collected to assess the potential for well corrosion.

Arsenic and barium were detected above the practical quantitation limit (PQL) in wells of the 216-A-29 Ditch monitoring network in 2020 during assessment monitoring (Table 2-2). Arsenic was detected above the PQL in only upgradient wells. Barium was detected above the PQL in all wells but at levels half of the Hanford Site background concentration (DOE/RL-96-61, *Hanford Site Background: Part 3, Groundwater Background*). These elements are naturally occurring, are not constituents of concern at the 216-A-29 Ditch based upon known process history, and are not listed waste codes on the unit's Hanford RCRA Permit Part A application.

Nickel, chromium, and iron were detected above the PQL in 2020. Section 3.1 of the 216-A-29 Ditch first determination report (DOE/RL-2019-27) documented nickel and chromium above Hanford Site background levels (DOE/RL-96-61) in upgradient and downgradient wells. Chromium was not an inventory component of waste streams disposed to the 216-A-29 Ditch; however, nickel was a minor component of PUREX Plant cooling water and chemical sewer effluent stream. Trivalent chromium and nickel are strongly sorbed to soil. Based upon these lines of evidence, the 216-A-29 Ditch first determination report concluded that the unit is not contributing chromium and nickel to groundwater. In addition to being naturally occurring, these metals are constituents associated with stainless-steel alloys typically found in Hanford Site well components (e.g., casings, screens, and pumps). However, because only low levels of manganese and molybdenum were detected in a few of the 216-A-29 Ditch wells, stainless-steel corrosion is not suspected at this time.

The nitrate concentration was above the 45 mg/L DWS in well 299-E25-47 for the January and the July/August sampling events. Nitrate values have been increasing at this location because of the encroachment of the regional nitrate groundwater plume from the 200-BP-5 Operable Unit (OU) to the northwest (Section 4.4 in SGW-60592).

Dissolved oxygen was not monitored at the 216-A-29 Ditch DWMU in 2020. Dissolved oxygen was not a required constituent under assessment groundwater monitoring plan (January and June sampling events) (DOE/RL-2016-23) but is a required constituent under the detection monitoring plan (July/August sampling event) (DOE/RL-2008-58). Due to a scheduling error, field screening for this constituent did not occur in 2020. The error was corrected in 2021.



Reference: ECF-HANFORD-20-0078, *Preparation of the Hanford Site Water Table Map for January to March 2020*.

Figure 2-1. 216-A-29 Ditch

Table 2-1. 216-A-29 Ditch Groundwater Monitoring Network

Well Name	Location	Year Installed	Head Date	Hydraulic Head		Elevation Screen Top		Elevation Screen Bottom		Water Column		Sample Frequency	Sampled Months; Comments[a]
				m	ft	m	ft	m	ft	m	ft		
299-E25-238	DG	2017	8/3/2020	121.52	398.69	122.3	401.3	113.2	371.3	8.3	27.4	Q/S	1, 6, 8
299-E25-239	DG	2017	8/3/2020	121.50	398.64	122.8	402.7	113.6	372.7	7.9	25.9	Q/S	1, 6, 8
299-E25-34[b]	UG	1988	8/3/2020	121.55	398.77	125.8	412.6	119.7	392.6	1.9	6.2	Q/S	1, 6, 8
299-E25-35[b]	DG	1988	7/30/2020	121.54	398.76	126.2	414.0	119.9	393.5	1.6	5.2	Q/S	1, 6, 7
299-E25-43	UG	1991	8/3/2020	121.51	398.65	125.5	411.6	119.1	390.9	2.4	7.7	Q/S	1, 6, 8
299-E25-47	UG	1992	7/30/2020	121.55	398.78	125.2	410.8	119.1	390.8	2.4	7.9	Q/S	1, 6, 7
299-E26-13[b]	UG	1991	8/3/2020	121.54	398.74	126.0	413.2	119.7	392.6	1.9	6.1	Q/S	1, 6, 8
299-E26-80	DG	2017	8/3/2020	121.52	398.70	122.5	402.0	113.4	372.0	8.1	26.7	Q/S	1, 6, 8

Note: Requirements are from Table 3-2 in DOE/RL-2016-23, *216-A-29 Ditch Interim Status Groundwater Quality Assessment Monitoring Plan*; and Table 2-1 in DOE/RL-2008-58, *Interim Status Groundwater Monitoring Plan for the 216-A-29 Ditch*. DOE/RL-2008-58 also proposes seven new monitoring wells.

a. Assessment sampling scheduled in April was delayed until June due to the COVID-19 pandemic. Detection sampling began in July.

b. Hydraulic head data for these wells were corrected for borehole deviation from vertical. Corrections are not available for other wells in this network, which may cause reported head to be less than actual head.

DG = downgradient

Q/S = quarterly under assessment and semiannual under indicator evaluation

UG = upgradient

Table 2-2. 216-A-29 Ditch Assessment Sampling Summary for 2020 (Quarters 1 and 2)

Constituent	Units	Maximum	Water Quality Standard[a]	PQL[b]	Comments
Dangerous Waste Constituents					**Wells Above PQL or Water Quality Standard**
Arsenic, unfiltered	µg/L	12.7	10[c]	10.5	Above PQL and water quality standard: 299-E25-34
Arsenic, filtered	µg/L	12.3	10[c]	10.5	Above PQL and water quality standard: 299-E25-34 and 299-E25-47
Barium, unfiltered	µg/L	50.6	2,000[c]	5.25	All wells above PQL
Barium, filtered	µg/L	53.4	2,000[c]	5.25	All wells above PQL
Chloroform	µg/L	6.46	70[c]	5.0	One value above PQL (299-E25-35); flagged as suspect
Chromium, unfiltered	µg/L	54	100[c]	10.5	Above PQL: 299-E25-34 and 299-E25-35
Chromium, filtered	µg/L	16	100[c]	10.5	Above PQL: 299-E25-35
Nickel, unfiltered	µg/L	29	—	21	Above PQL: 299-E25-35
Other Constituents					**Wells Above Water Quality Standard**
Alkalinity	mg/L	109	—	5.25	
Calcium, unfiltered	µg/L	70,700	—	1,050	
Calcium, filtered	µg/L	67,900	—	1,050	
Chloride	mg/L	34	250[d]	0.4	
Iron, unfiltered	µg/L	510	300[d]	105	Above water quality standard: 299-E25-35
Magnesium, unfiltered	µg/L	19,000	—	1,050	
Magnesium, filtered	µg/L	18,100	—	1,050	
Nitrate	mg/L	53.6	45[e]	0.525	Above water quality standard: 299-E25-47
pH measurement	unitless	8.35	6.5 – 8.5[d]	—	
Potassium, unfiltered	µg/L	8,800	—	5,250	
Potassium, filtered	µg/L	8,800	—	5,250	
Sodium, unfiltered	µg/L	31,000	—	1,050	
Sodium, filtered	µg/L	3,1000	—	1,050	

Table 2-2. 216-A-29 Ditch Assessment Sampling Summary for 2020 (Quarters 1 and 2)

Constituent	Units	Maximum	Water Quality Standard[a]	PQL[b]	Comments
Specific conductance	µS/cm	636	—	—	
Sulfate	mg/L	150	250[d]	1.05	
Temperature	°C	19.9	—	—	
Turbidity	NTU	4.5	—	—	

Note: Maximum is based on the required assessment sample results for this RCRA unit collected in January and June 2020 with concentrations above the PQL. Appendix A presents the full data set for 2020.

a. Water quality standards are provided for information only and are not used to determine RCRA groundwater monitoring exceedances.

b. Standardized PQL used in analytical requirements.

c. 40 CFR 141, Subpart G, "National Primary Drinking Water Regulations," "Maximum Contaminant Levels and Maximum Residual Disinfectant Levels."

d. 40 CFR 143.3, "National Secondary Drinking Water Regulations," "Secondary Maximum Contaminant Levels."

e. The federal drinking water standard for nitrate is 10 mg/L expressed as nitrogen (40 CFR 141, Subpart G). This equates to 45 mg/L when expressed as NO_3.

— = no comparison value or PQL

NTU = nephelometric turbidity unit

PQL = practical quantitation limit

RCRA = *Resource Conservation and Recovery Act of 1976*

Table 2-3. 216-A-29 Ditch Sampling Summary for Contamination Indicator Parameters for 2020 (Quarter 3)

Indicator Parameter		pH		Specific Conductance (µS/cm)		Total Organic Carbon (µg/L)		Total Organic Halides (µg/L)		
Critical Mean[a]		7.75	8.68	842		1,000[b]		10[b]		
Well	Sample Date	Average	SD	Average	SD	Average	SD	Average	SD	Comments
299-E25-238	8/3/2020	8.53	0.17	413	0	410 B	10	5.9 B	2.3	
299-E25-239	8/3/2020	8.02	0.01	369	8	442 B	16	4.7 B	1.7	
299-E25-34	8/3/2020	8.32	0.00	238	0	330 U	0	4.7 B	0.8	
299-E25-35	7/30/2020	8.22	0.02	477	0	427 B	19	8.3 B	1.3	
299-E25-43	8/3/2020	8.25	0.00	600	1	447 B	5	5.2 B	1.2	
299-E25-47	7/30/2020	8.14	0.01	585	5	463 B	29	4.3 B	1.5	
299-E26-13	8/3/2020	8.27	0.00	356	0	330 U	0	3.9 B	0.5	
299-E26-80	8/3/2020	8.22	0.00	434	1	414 B	6	5.4 B	0.7	

a. Critical mean values from Table 10 in ECF-HANFORD-20-0007, *Calculation of Critical Means for Calendar Year 2020 RCRA Groundwater Monitoring*. Required detection limits are used for comparison when they are higher than the calculated critical mean values.

b. Required detection limit.

B = all values were below the quantitation limit

SD = standard deviation of replicates

U = all values were below the detection limit

Table 2-4. 216-A-29 Ditch Sampling Summary for Water Quality Parameters and Other Constituents for 2020 (Quarter 3)

Constituent	Units	Maximum	Comparison Value[a]	PQL[b]	Wells Above Comparison Value; Comments
Alkalinity	mg/L	110	—	5.25	
Calcium, unfiltered	µg/L	72,100	—	1,050	
Calcium, filtered	µg/L	67,400	—	1,050	
Chloride	mg/L	35.0	250[c]	0.4	
Chromium, unfiltered	µg/L	31.2	100[d]	10.5	
Chromium, filtered	µg/L	18.9	100[d]	10.5	
Dissolved oxygen	mg/L	No data	—	—	Not measured
Magnesium, unfiltered	µg/L	19,700	—	1,050	
Magnesium, filtered	µg/L	18,500	—	1,050	
Molybdenum, unfiltered	µg/L	5.9	—	5.25	
Molybdenum, unfiltered	µg/L	6.4	—	5.25	
Nitrate	mg/L	62.9	45[e]	0.525	299-E25-47
Potassium, unfiltered	µg/L	7,730	—	5,250	
Potassium, filtered	µg/L	7,500	—	5,250	
Sodium, unfiltered	µg/L	31,800	—	1,050	
Sodium, filtered	µg/L	32,000	—	1,050	
Sulfate	mg/L	131	250[c]	1.05	
Temperature	°C	19.5	—	—	
Turbidity	NTU	3.34	—	—	

Note: Maximum is based on the required indicator evaluation sample results for this RCRA unit collected in July and August 2020 with concentrations above the PQL. Appendix A presents the full data set for 2020.

a. Comparison values are provided for information only and are not used to determine RCRA groundwater monitoring exceedances.

b. Standardized PQL used in analytical requirements.

c. 40 CFR 143.3, "National Secondary Drinking Water Regulations," "Secondary Maximum Contaminant Levels."

d. 40 CFR 141, Subpart G, "National Primary Drinking Water Regulations," "Maximum Contaminant Levels and Maximum Residual Disinfectant Levels."

e. The federal drinking water standard for nitrate is 10 mg/L expressed as nitrogen (40 CFR 141, Subpart G). This equates to 45 mg/L when expressed as NO_3.

— = no comparison value or PQL

NTU = nephelometric turbidity unit

PQL = practical quantitation limit

RCRA = *Resource Conservation and Recovery Act of 1976*

2.2 216-A-36B Crib

The 216-A-36B Crib is located in the southeastern portion of the 200 East Area (Figures 1-1 and 2-2). When in use, the crib was 7 m (23 ft) deep, 150 m (500 ft) long, and 2.3 to 3.4 m (7.5 to 11 ft) wide at the base; the sides sloped at 1:1.5 (drawing H-2-59129, *Crib 216-A36B, Plan Profiles & Details*). The crib construction included 7 m (23 ft) of naturally revegetated clean backfill soil. The crib was originally part of the 180 m (590 ft) long 216-A-36 Crib, which received PUREX Plant effluent from September 1965 to March 1966. In March 1966, the northernmost 30 m (98 ft) of the crib was isolated with a grout barrier and was no longer used. The southern portion of the 216-A-36 Crib (now known as 216-A-36B) is the only portion regulated as a RCRA DWMU. The 216-A-36B Crib operated from March 1966 to October 1972 and was reactivated in November 1982 for the PUREX Plant restart. It received 290 million L (76.6 million gal) of PUREX ammonia scrubber distillate and was permanently removed from service in September 1987. In 2010, 15 cm (6 in.) of gravel was added to the surface of the entire 216-A-36 Crib.

The 216-A-36B Crib is monitored under an interim status indicator evaluation program (DOE/RL-2010-93, *Interim Status Groundwater Monitoring Plan for the 216-A-36B PUREX Plant Crib*). An interim change notice, RCRA-CN-01_DOE/RL-2010-93_R2, *Interim Status Change Number 1: Interim Status Groundwater Monitoring Plan for the 216-A-36B PUREX Plant Crib*, was in effect for the July 2020 sampling event. Changes to the groundwater monitoring plan included removing speciated alkalinity in favor of total alkalinity, adding certain metals to monitor for well corrosion, and clarifying required constituents under the phenols monitoring requirement. The change notice did not affect the monitoring network or sampling frequency.

The monitoring network includes two upgradient wells and four downgradient wells (Figure 2-2; Table 2-5). The wells for the 216-A-36B Crib monitoring network are screened across the uppermost portion of the unconfined aquifer, which includes members of the Hanford formation and Ringold Formation. Section 7.4 in SGW-60595, *Engineering Evaluation Report for the 216-A-36B Crib Groundwater Monitoring*, concluded that the current well network is adequate to monitor the 216-A-36B Crib. Well 299-E17-19 currently has <0.9 m (3 ft) of water (Table 2-5), which may limit sampling as the water level continues to decline. The other wells are expected to have sufficient water for continued sampling through at least 2030 (SGW-63743).Well 299-E17-1 was installed in 1955, prior to the requirements of WAC 173-160, “Minimum Standards for Construction and Maintenance of Wells,” and a replacement well is planned (Section 9.3 in SGW-60595).

The hydraulic gradient in 2020 sloped to the east-southeast with a magnitude of 1.4×10^{-5} m/m, and the estimated average linear velocity was 0.0064 m/d (0.021 ft/d) (Table 1-2).

The 216-A-36B Crib groundwater wells were sampled twice in 2020 for RCRA indicator parameters (Table 2-6). There were no exceedances of the 2020 critical mean values for these parameters; consequently, the 216-A-36B Crib remains in indicator evaluation monitoring.

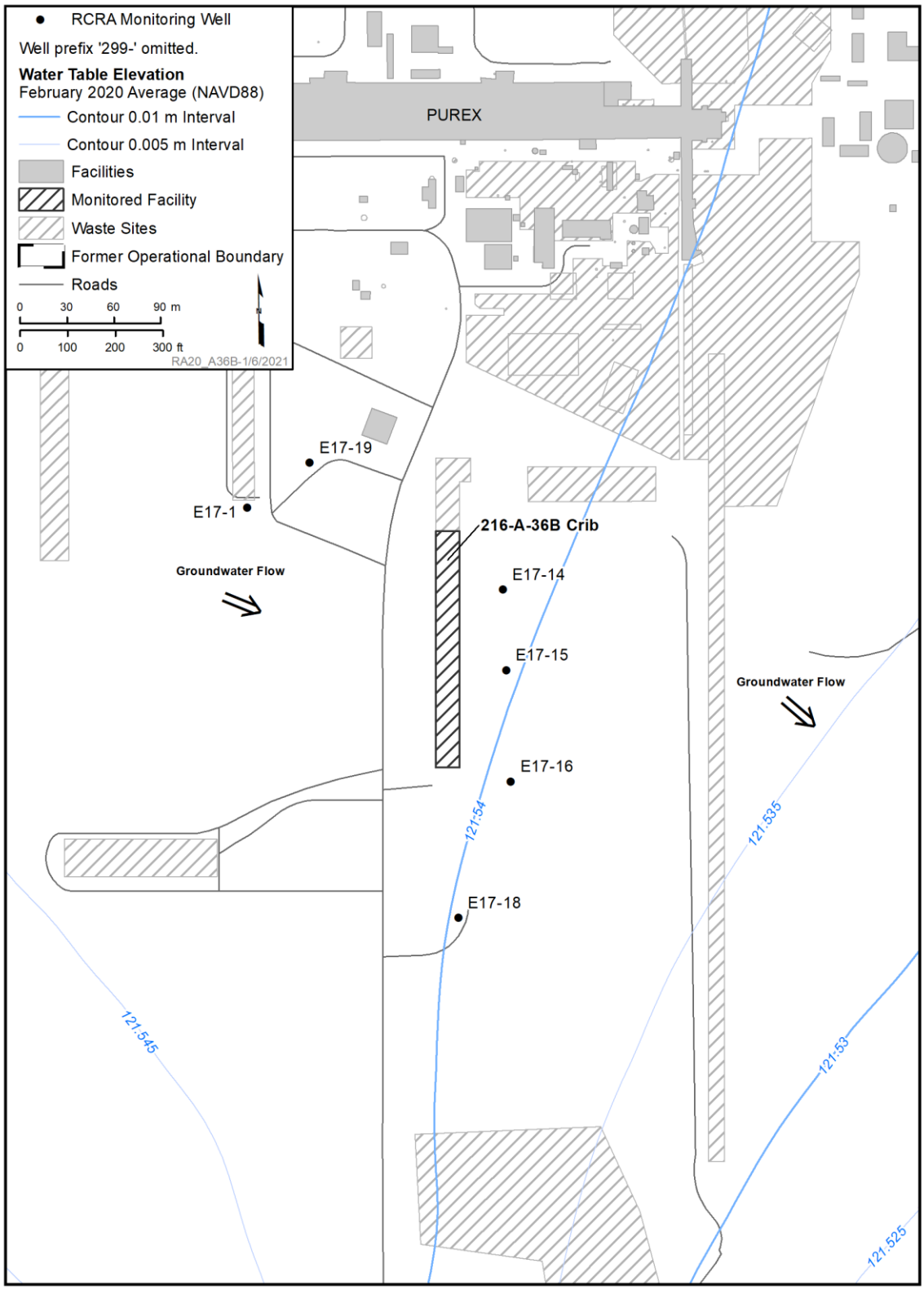
Groundwater quality parameters monitored for the site include chloride, iron, manganese, phenols, sodium, and sulfate (Table 2-7). Although not required by 40 CFR 265, Subpart F, site-specific constituents (alkalinity, fluoride, nitrate, nitrite, calcium, magnesium, chromium, molybdenum, nickel, and potassium) were also analyzed. Samples for analyses of alkalinity, anions, calcium, magnesium, potassium, and sodium are collected to support cation-anion balance calculations. Samples for iron, manganese, chromium, molybdenum, and nickel are collected to assess the potential for well corrosion.

Table 2-7 summarizes the 2020 results for groundwater quality parameters (40 CFR 265.92(b)(2)) and additional constituents required by the monitoring plan (Table 3-1 in DOE/RL-2010-93). Nitrate and iron were reported above the primary or secondary DWSs and are explained below:

- Nitrate concentrations were above the DWS (45 mg/L as nitrate) in all wells for the 216-A-36B Crib monitoring network and are associated with a regional nitrate plume (SGW-60595). Nitrate is a constituent of interest at the 216-A-36B Crib because it is a breakdown product of nitric acid, which was disposed to the 216-A-10 Crib (120 m [390 ft] to the west).
- Iron concentrations were above the secondary DWS (300 µg/L) in unfiltered sample bailed from well 299-E17-1 (Table 2-7). Iron concentrations at well 299-E17-1 have been above the DWS since November 2012.

Molybdenum was added as a required constituent by the interim change notice. However, due to a scheduling error, the sample from well 299-E17-15 was not analyzed for molybdenum. All wells in the 216-A-36B Crib network are scheduled to be sampled for molybdenum in 2021.

Sampling for volatile organic compounds (VOCs) is required every 3 years, and samples for this analysis were collected during the January 2020 sampling event. All required VOC constituents were either nondetects (“U” flagged) or were detected at less than the analyte-specific PQL (“J” flagged).



Reference: ECF-HANFORD-20-0078, *Preparation of the Hanford Site Water Table Map for January to March 2020*.

Figure 2-2. 216-A-36B Crib

Table 2-5. 216-A-36B Crib Groundwater Monitoring Network

Well Name	Location	Year Installed	Hydraulic Head Date	Hydraulic Head		Elevation Screen Top		Elevation Screen Bottom		Water Column		Sample Frequency	Comments
				m	ft	m	ft	m	ft	m	ft		
299-E17-1[a]	UG (P)	1955	7/30/2020	121.38	398.22	127.2	417.4	120.2	394.5	1.1	3.7	S	Sampled with bailer
299-E17-14	DG	1988	7/30/2020	121.54	398.76	126.0	413.2	119.7	392.6	1.9	6.1	S	
299-E17-15	DG	1988	7/30/2020	121.26	397.85	125.5	411.8	119.6	392.3	1.7	5.5	S	
299-E17-16	DG	1988	7/30/2020	121.42	398.37	125.4	411.4	119.3	391.4	2.1	7.0	S	
299-E17-18[b]	DG	1988	7/30/2020	121.50	398.62	125.8	412.6	119.5	392.0	2.0	6.6	S	
299-E17-19	UG	1988	7/30/2020	121.31	397.99	126.8	416.0	120.6	395.6	0.7	2.4	S	Little water[c]

Note: Requirements are from Table 3-1 in DOE/RL-2010-93, *Interim Status Groundwater Monitoring Plan for the 216-A-36B PUREX Plant Crib*.

a. Constructed prior to *Washington Administrative Code* requirements.

b. Hydraulic head data for this well corrected for borehole deviation from vertical. Corrections are not available for other wells in this network, which may cause reported head to be less than actual head.

c. Well is estimated to have <0.9 m (3 ft) water in the screened interval, which may limit sampling in the future if the water table continues to decline.

DG = downgradient

P = constructed prior to *Washington Administrative Code* requirements

S = semiannual

UG = upgradient

Table 2-6. 216-A-36B Crib Sampling Summary for Contamination Indicator Parameters for 2020

Indicator Parameter		pH		Specific Conductance (µS/cm)		Total Organic Carbon (µg/L)		Total Organic Halides (µg/L)		
Critical Mean*		6.83	8.83	920		1,200		16.2		
Well	Sample Date	Average	SD	Average	SD	Average	SD	Average	SD	Comments
299-E17-1	1/20/2020	8.10	0.05	566	5	412 B	20	3.3 U	0.0	
	7/30/2020	8.04	0.01	558	13	351 B	30	3.5 B	0.3	
299-E17-14	1/20/2020	7.90	0.00	725	1	330 U	0	3.8 B	0.5	
	7/30/2020	7.73	0.01	697	4	369 B	22	4.3 B	1.5	
299-E17-15	1/21/2020	8.00	0.00	632	5	330 U	0	5.2 B	2.2	
	7/30/2020	7.86	0.00	609	1	335 B	8	3.3 U	0.0	
299-E17-16	1/21/2020	7.90	0.00	587	1	330 U	0	5.8 B	2.4	
	7/30/2020	7.91	0.00	579	0	330 U	0	4.3 B	1.2	
299-E17-18	1/21/2020	8.02	0.00	619	0	330 U	0	3.4 B	0.1	
	7/30/2020	7.89	0.00	612	0	331 B	2	5.0 B	1.0	
299-E17-19	1/21/2020	7.96	0.00	711	6	330 U	0	5.5 B	1.7	
	7/30/2020	7.75	0.00	726	4	330 U	0	9.0	3.9	

*Critical mean values from Table 11 in ECF-HANFORD-20-0007, *Calculation of Critical Means for Calendar Year 2020 RCRA Groundwater Monitoring*.

B = all values were below the quantitation limit
SD = standard deviation of replicates
U = all values were below the detection limit

Table 2-7. 216-A-36B Crib Sampling Summary for Water Quality Parameters and Other Constituents for 2020

Constituent	Units	Maximum	Comparison Value[a]	PQL[b]	Wells Above Comparison Value
Alkalinity	mg/L	134	—	5.25	
Calcium, unfiltered	µg/L	76,000	—	1,050	
Calcium, filtered	µg/L	75,000	—	1,050	
Chloride	mg/L	16.1	250[c]	0.4	
Chromium, unfiltered[d]	µg/L	15.8	100[e]	10.5	
Dissolved oxygen	mg/L	9.0	—	—	
Iron, unfiltered	µg/L	995	300[c]	105	299-E17-1
Magnesium, unfiltered	µg/L	23,200	—	1,050	
Magnesium, filtered	µg/L	23,200	—	1,050	
Manganese, unfiltered	µg/L	19	50[c]	10.5	
Molybdenum, unfiltered[d]	µg/L	6.4	—	5.25	Not collected at well 299-E17-15
Molybdenum, filtered[d]	µg/L	6.7	—	5.25	
Nitrate	mg/L	113	45[f]	0.525	All
Potassium, unfiltered	µg/L	9,100	—	5,250	
Potassium, filtered	µg/L	9,100	—	5,250	
Sodium, unfiltered	µg/L	30,000	—	1,050	
Sodium, filtered	µg/L	30,000	—	1,050	
Sulfate	mg/L	96.6	250[c]	1.05	
Temperature	°C	21.4	—	—	
Turbidity	NTU	3.06	—	—	

Note: Maximum is based on the required sample results for this RCRA unit with concentrations above the PQL. Constituents required annually were collected in January 2020. Appendix A presents the full data set for 2020.

a. Comparison values are provided for information only and are not used to determine RCRA groundwater monitoring exceedances.

b. Standardized PQL used in analytical requirements.

c. 40 CFR 143.3, "National Secondary Drinking Water Regulations," "Secondary Maximum Contaminant Levels."

d. These metals were added to the analyte list by RCRA-CN-01_DOE/RL-2010-93_R2, *Interim Status Change Number 1: Interim Status Groundwater Monitoring Plan for the 216-A- 36B PUREX Plant Crib* (dated June 8, 2020). Although not yet required during the January 2020 annual sampling event, these metals are summarized here for completeness.

e. 40 CFR 141, Subpart G, "National Primary Drinking Water Regulations," "Maximum Contaminant Levels and Maximum Residual Disinfectant Levels."

f. The federal drinking water standard for nitrate and nitrite are 10 mg/L and 1 mg/L, expressed as nitrogen (40 CFR 141, Subpart G). These equate to 45 mg/L and 3.3 mg/L when expressed as NO_3 and NO_2.

— = no comparison value or PQL

PQL = practical quantitation limit

NTU = nephelometric turbidity unit

RCRA = *Resource Conservation and Recovery Act of 1976*

2.3 216-A-37-1 Crib

The 216-A-37-1 Crib is located east of the 200 East Area (Figures 1-1 and 2-3). During its operational life, the crib was 5.2 m (17.1 ft) deep, 213 m (699 ft) long, and 33 m (108 ft) wide at the base, with sides sloped at 1:1. The crib operated from March 1977 through April 1989 and was used to percolate 242A evaporator process condensate to the soil column. It received spent halogenated and nonhalogenated solvents, as well as ammonia. During its operational life, the crib received 380 million L (98 million gal) of process condensate. In 1994, the bottom of the diversion box used to route effluent to the crib was filled with grout to prevent inadvertent discharges to the crib. In July 2000, vent risers from the crib were sealed to prevent potential passive radioactive emissions.

The 216-A-37-1 Crib is monitored under an interim status indicator evaluation program under DOE/RL-2010-92, *Interim Status Groundwater Monitoring Plan for the 216-A-37-1 PUREX Plant Crib*. An interim change notice, RCRA-CN-01_DOE/RL-2010-92_R3, *Interim Status Change Number 1: Interim Status Groundwater Monitoring Plan for the 216-A-37-1 PUREX Plant Crib*, was in effect for the July 2020 sampling event. Changes to the groundwater monitoring plan included removing speciated alkalinity in favor of total alkalinity, adding metals for well casing corrosion assessment, adding the field screening constituent dissolved oxygen, and clarifying required constituents under the phenols monitoring requirement. The change notice did not affect the monitoring network or sampling frequency.

The monitoring network includes two upgradient wells and four downgradient wells (Figure 2-3, Table 2-8). The wells for the 216-A-37-A Crib monitoring network are screened across the uppermost portion of the unconfined aquifer, which includes members of the Cold Creek unit, Hanford formation, and Ringold unit A. All of the current monitoring wells are expected to have sufficient water for continued sampling through at least 2030 (SGW-63743). Section 7.4 in SGW-60593, *Engineering Evaluation Report for the 216-A-37-1 Crib Groundwater Monitoring*, recommended a modified network for monitoring under final status, including four of the current wells, two new downgradient wells, and one new upgradient well.

Near the 216-A-37-1 Crib, the estimated groundwater flow in 2020 was toward the southeast, the gradient magnitude was 1.5×10^{-5} m/m, and the estimated average linear velocity was 1.1 m/d (3.7 ft/d) (Table 1-2).

The 216-A-37-1 Crib network wells are monitored for RCRA indicator parameters (Table 2-9). There were no exceedances of the critical mean values for these parameters in 2020; consequently, the 216-A-37-1 Crib remains in indicator evaluation monitoring.

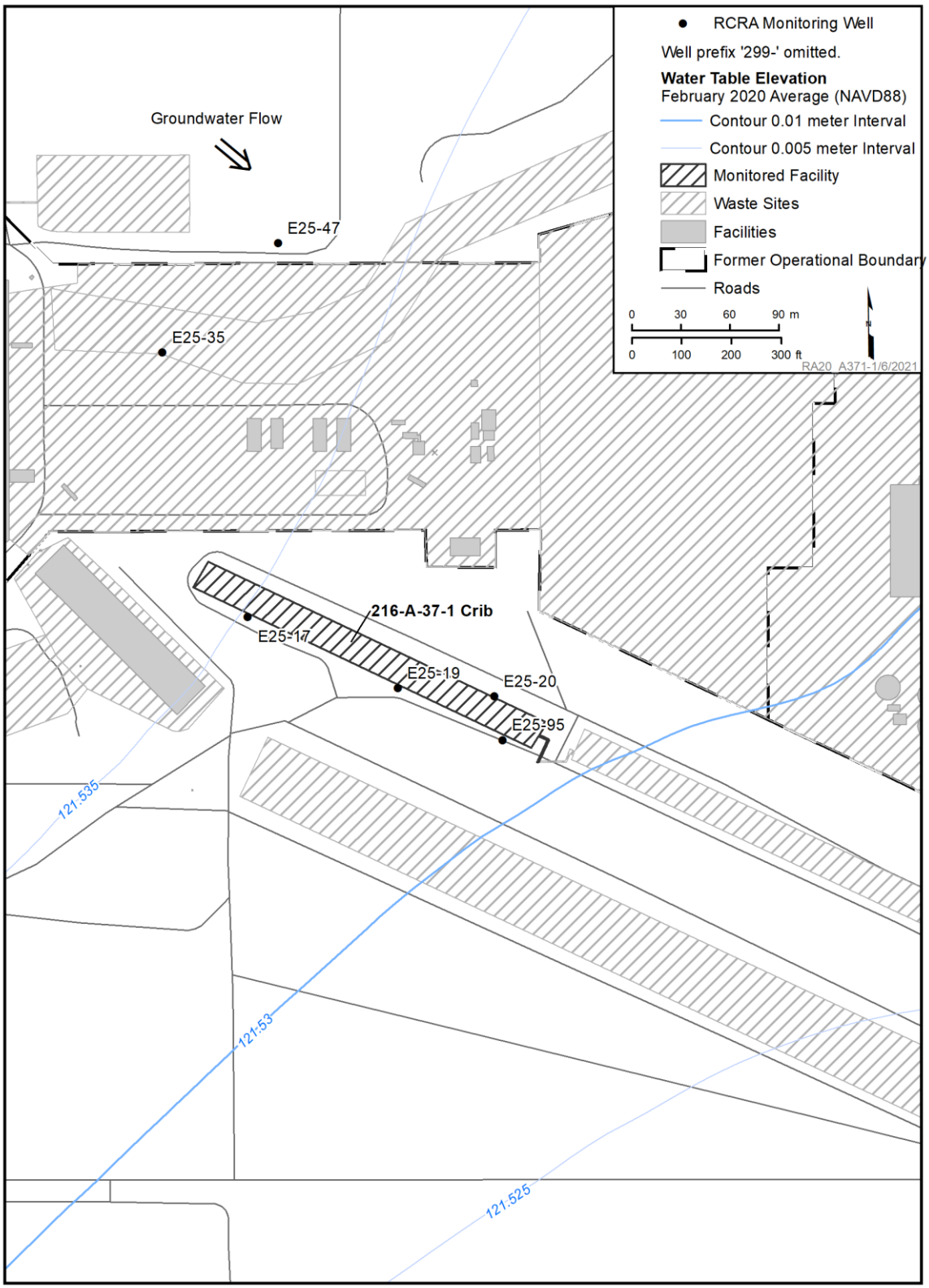
Groundwater quality parameters monitored for the site include chloride, iron, manganese, phenols, sodium, and sulfate (Table 2-10). Although not required by 40 CFR 265, Subpart F, site-specific constituents (alkalinity, fluoride, nitrate, nitrite, calcium, magnesium, chromium, and potassium) were also analyzed. Samples for analyses of alkalinity, anions, calcium, magnesium, and potassium are collected to support cation-anion balance calculations. Samples for iron, manganese, chromium, Cr(VI), molybdenum, and nickel are collected to assess the potential for well corrosion.

Table 2-10 summarizes the 2020 results for groundwater quality parameters (40 CFR 265.92(b)(2)) and additional constituents required by the monitoring plan (Table 3-1 in DOE/RL-2010-92). Nitrate, chromium, manganese, and iron were reported above the primary or secondary DWSs and are discussed in more detail below.

Iron, manganese, and chromium were detected above the primary and secondary DWSs in unfiltered samples from several wells in the 216-A-37-1 Crib monitoring network. In addition to being naturally occurring species in groundwater, these metals are constituents in the stainless-steel alloys used in Hanford Site monitoring wells and their components. However, because nickel concentrations were near or below detection limits, stainless-steel corrosion is not suspected at this time.

Nitrate concentrations were above the DWS (45 mg/L as nitrate) in downgradient well 299-E25-20 and upgradient well 299-E25-47. Nitrate concentrations have been above the DWS in well 299-E25-20 since March 2011. Nitrate concentrations at well 299-E25-47 have been above the DWS only since January 2020 and reflect a recent increase. The 216-A-37-1 Crib is likely a source of nitrate groundwater contamination (Section 2.5 in DOE/RL-2010-92).

Dissolved oxygen was added as a constituent by RCRA-CN-01_DOE/RL-2010-92_R3. However, due to a scheduling error, measurements for this constituent were not collected at all of the 216-A-37-1 Crib monitoring wells during the July sampling event. The error was corrected in 2021.



Reference: ECF-HANFORD-20-0078, *Preparation of the Hanford Site Water Table Map for January to March 2020*.

Figure 2-3. 216-A-37-1 Crib

Table 2-8. 216-A-37-1 Crib Groundwater Monitoring Network

Well Name	Location	Year Installed	Hydraulic Head Date	Hydraulic Head		Elevation Screen Top		Elevation Screen Bottom		Water Column		Sample Frequency	Comments
				m	ft	m	ft	m	ft	m	ft		
299-E25-17[a]	DG (P)	1976	7/30/2020	121.50	398.62	123.4	405.0	118.2	387.9	3.3	10.7	S	
299-E25-19[a, b]	DG (P)	1976	7/30/2020	121.53	398.70	124.6	408.8	120.3	394.6	1.3	4.1	S	
299-E25-20[a]	DG (P)	1976	7/30/2020	121.41	398.33	124.7	409.1	118.6	389.1	2.8	9.3	S	
299-E25-35[b]	UG	1988	7/30/2020	121.54	398.76	126.2	414.0	119.9	393.5	1.6	5.2	S	
299-E25-47	UG	1992	7/30/2020	121.55	398.78	125.2	410.8	119.1	390.8	2.4	7.9	S	
299-E25-95	DG	2017	7/30/2020	121.51	398.65	122.3	401.2	113.1	371.2	8.4	27.4	S	

Note: Requirements are from DOE/RL-2010-92, *Interim Status Groundwater Monitoring Plan for the 216-A-37-1 PUREX Plant Crib*.

a. Constructed prior to *Washington Administrative Code* requirements.

b. Hydraulic head data for these wells were corrected for borehole deviation from vertical. Corrections are not available for other wells in this network, which may cause reported head to be less than actual head.

DG = downgradient

P = constructed prior to *Washington Administrative Code* requirements

S = semiannual

UG = upgradient

Table 2-9. 216-A-37-1 Crib Sampling Summary for Contamination Indicator Parameters for 2020

Indicator Parameter		pH		Specific Conductance (µS/cm)		Total Organic Carbon (µg/L)		Total Organic Halides (µg/L)		
Critical Mean[a]		7.67	8.9	692		1,000[b]		12.3		
Well	Sample Date	Average	SD	Average	SD	Average	SD	Average	SD	Comments
299-E25-17	1/14/2020	7.82	0.00	563	0	345 U	0	3.3 U	0.0	
	7/30/2020	7.74	0.01	542	1	378 B	14	3.4 B	0.1	
299-E25-19	1/16/2020	8.01	0.00	406	1	393 B	10	3.6 B	0.5	
	7/30/2020	7.92	0.01	418	1	377 B	13	5.2 B	2.6	
299-E25-20	1/14/2020	7.69	0.00	499	1	330 U	0	3.8 B	0.8	
	7/30/2020	7.60	0.00	498	1	330 U	0	3.6 B	0.3	
299-E25-35	1/15/2020	8.17	0.03	527	6	330 U	0	3.3 U	0.0	
	7/30/2020	8.22	0.02	477	0	427 B	19	8.3 B	1.3	
299-E25-47	1/15/2020	8.22	0.00	575	4	330 U	0	5.0 B	1.2	
	7/30/2020	8.14	0.01	585	5	463 B	29	4.3 B	1.5	
299-E25-95	1/14/2020	7.97	0.01	522	1	330 U	0	5.1 B	1.4	
	7/30/2020	7.88	0.00	517	2	495 B	8	3.6 B	0.5	

a. Critical mean values are from Table 12 in ECF-HANFORD-20-0007, *Calculation of Critical Means for Calendar Year 2020 RCRA Groundwater Monitoring*. Required detection limits are used for comparison when they are higher than the calculated critical mean values.

b. Required detection limit.

B = all values were below the quantitation limit

SD = standard deviation of replicates

U = all values were below the detection limit

Table 2-10. 216-A-37-1 Crib Sampling Summary for Groundwater Quality Parameters and Other Constituents for 2020

Constituent	Units	Maximum	Comparison Value[a]	PQL[b]	Wells Above Comparison Value; Comments
Alkalinity	mg/L	100	—	5.25	
Calcium, unfiltered	µg/L	56,000	—	1,050	
Calcium, filtered	µg/L	57,000	—	1,050	
Chloride	mg/L	17.3	250[c]	0.4	
Chromium, unfiltered	µg/L	170	100[d]	10.5	299-E25-19
Dissolved oxygen[e]	mg/L	5.79	—	—	Not collected except in 299-E25-20 in January
Iron, unfiltered	µg/L	2,400	300[c]	105	299-E25-17, 299-E25-19, 299-E25-35
Iron, filtered	µg/L	150	300[c]	105	
Magnesium, unfiltered	µg/L	16,000	—	1,050	
Magnesium, filtered	µg/L	16,000	—	1,050	
Manganese, unfiltered	µg/L	109	50[c]	10.5	299-E25-19, 299-E25-20
Manganese, filtered	µg/L	105	50[c]	10.5	299-E25-20
Molybdenum, unfiltered[e]	µg/L	9.20	—	5.25	
Molybdenum, filtered[e]	µg/L	5.80	—	5.25	
Nickel, unfiltered	µg/L	92	—	21	
Nitrate	mg/L	95.6	45[f]	0.525	299-E25-20, 299-E25-47
Potassium, unfiltered	µg/L	9,000	—	5,250	
Potassium, filtered	µg/L	9,100	—	5,250	
Sodium, unfiltered	µg/L	31,000	—	1,050	
Sodium, filtered	µg/L	30,800	—	1,050	
Sulfate	mg/L	150	250[c]	1.05	
Temperature	°C	25.5	—	—	
Turbidity	NTU	28.5	—	—	

Note: Maximum is based on the required sample results for this RCRA unit with concentrations above the PQL. Constituents required annually were collected in January 2020. Appendix A presents the full data set for 2020.

a. Comparison values are provided for information only and are not used to determine RCRA groundwater monitoring exceedances.

b. Standardized PQL used in analytical requirements.

c. 40 CFR 143.3, "National Secondary Drinking Water Regulations," "Secondary Maximum Contaminant Levels."

d. 40 CFR 141, Subpart G, "National Primary Drinking Water Regulations," "Maximum Contaminant Levels and Maximum Residual Disinfectant Levels."

e. These constituents were added by RCRA-CN-01_DOE/RL-2010-92_R3, *Interim Status Change Number 1: Interim Status Groundwater Monitoring Plan for the 216-A-37-1 PUREX Plant Crib* (effective date June 8, 2020). Although not yet required during the January 2020 sampling event, these constituents are summarized here for completeness.

Table 2-10. 216-A-37-1 Crib Sampling Summary for Groundwater Quality Parameters and Other Constituents for 2020

Constituent	Units	Maximum	Comparison Value[a]	PQL[b]	Wells Above Comparison Value; Comments

f. The federal drinking water standard for nitrate is 10 mg/L and 1 mg/L, expressed as nitrogen (40 CFR 141, Subpart G). This equates to 45 mg/L when expressed as NO_3

— = no comparison value of PQL
PQL = practical quantitation limit
NTU = nephelometric turbidity unit
RCRA = *Resource Conservation and Recovery Act of 1976*

2.4 216-B-3 Main Pond

The inactive 216-B-3 main pond and an adjoining portion of the 216-B-3-3 Ditch (collectively known as B Pond) were located east of the 200 East Area fence line (Figures 1-1 and 2-4). The main pond was in a natural topographic depression, diked on the eastern margin, and encompassed 14.2 ha (35 ac). During its operation (which began in 1945), B Pond received effluent from several 200 East Area facilities, including PUREX Plant, B Plant, A Tank Farm, 242A evaporator, 244AR vault, and 284E power plant. Dangerous waste was received from the 216-A-29 Ditch, conveyed to the eastern portion of the 216-B-3-3 Ditch, and then flowed eastward into the main pond. The last known reportable discharge of chemical waste (sodium nitrite) occurred in 1987. All discharges ceased in 1994, and B Pond was backfilled with coarse-grained material and then covered with fine-grained material. The total estimated discharge to B Pond since 1945 exceeded 1 trillion L (260 billion gal) (PNNL-15479, *Groundwater Monitoring Plan for the Hanford Site 216-B-3 Pond RCRA Facility*).

The 216-B-3 main pond is monitored under an interim status indicator evaluation program (DOE/RL-2008-59, *Interim Status Groundwater Monitoring Plan for the 216-B-3 Pond*), as modified by RCRA-CN-01_DOE/RL-2008-59_R2, *RCRA Interim Status Change Number 1: Interim Status Groundwater Monitoring Plan for the 216-B-3 Pond*. A second change notice was in effect for the August 2020 sampling event (RCRA-CN-02_DOE/RL-2008-59_R2, *RCRA Interim Status Change Number 2: Interim Status Groundwater Monitoring Plan for the 216-B-3 Pond*). Changes to the groundwater monitoring plan included adding metals for well casing corrosion assessment and clarifying required constituents under the phenols monitoring requirement. The change notice did not affect the monitoring network or sampling frequency.

The uppermost aquifer is unconfined beneath most of the 216-B-3 main pond and consists of Ringold unit A gravel and sand (Figures 2-4 and 2-5 in DOE/RL-2008-59). The aquifer beneath the western portion of the 216-B-3-3 Ditch includes the Hanford formation and possibly the Cold Creek unit. Beneath the southeastern part of the main pond and the expansion lobes, the Ringold lower mud unit is present above the water table (Figure 2-3 in DOE/RL-2008-59), and the uppermost aquifer is confined.

The extent of mud above the water table shown in Figures 1-2 and 2-4 has been revised from that shown in previous annual reports and is based on the surface of the Ringold lower mud unit, as documented in ECF-HANFORD-13-0029, *Development of the Hanford South Geologic Framework Model, Hanford Site, Washington.* Maps in previous annual reports and other documents have illustrated a larger area of mud above the water table because those maps included an interpretation of an additional mud unit (a fine-grained layer within Ringold unit A). The extent of mud units in the region northeast of the 216-B-3 Pond is uncertain because there are few wells in that area.

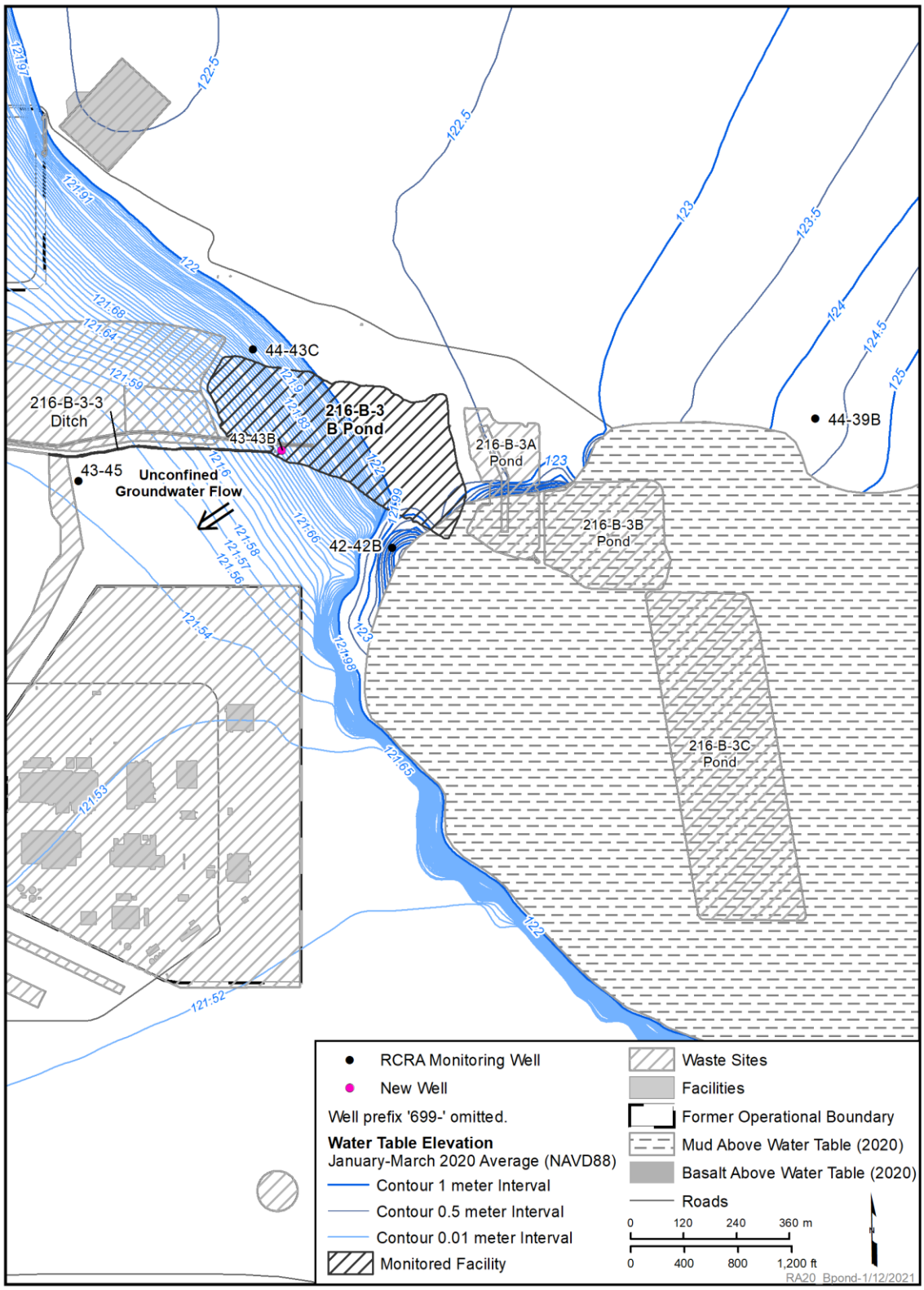
The B Pond groundwater monitoring network currently includes two upgradient wells, two downgradient wells, and an additional downgradient well (699-43-43B) installed in 2020 (Table 2-11; Figure 2-4). Sampling activities at the new monitoring well are scheduled to begin in 2021. The wells are screened across the upper portion of the unconfined aquifer and are expected to have sufficient water for continued sampling through at least 2030 (SGW-63743). Section 7.4 in SGW-60591, *Engineering Evaluation Report for the 216-B-3 Main Pond Groundwater Monitoring*, recommended installing four additional wells to support final status monitoring.

Groundwater flow in the unconfined aquifer of the Hanford formation (beneath the main pond) was toward the southwest at an estimated rate of 34 m/d (110 ft/d), and the hydraulic gradient was 1.7×10^{-3} m/m (Table 1-2; Figure 2-4).

The B Pond network wells are monitored semiannually for RCRA indicator parameters (TOC, TOX, pH, and specific conductance) (Table 2-12). There were no exceedances of the critical mean values for these parameters in 2020, and the 216-B-3 Pond remains in indicator evaluation monitoring.

Groundwater quality parameters monitored for the site include chloride, iron, manganese, phenols, sodium, and sulfate (Table 2-13). Although not required by 40 CFR 265, Subpart F, site-specific constituents (alkalinity, nitrate, calcium, magnesium, chromium, and potassium) were also analyzed. Samples for analyses of alkalinity, anions, calcium, magnesium, and potassium are collected to support cation-anion balance calculations. Samples for iron, manganese, chromium, molybdenum, and nickel are collected to assess the potential for well corrosion.

Table 2-13 summarizes the 2020 results for groundwater quality constituents (40 CFR 265.92(b)(2)) and the additional constituents required by Table 3-1 in the monitoring plan (RCRA-CN-02_DOE/RL-2008-59_R2). The iron concentration in an unfiltered sample from well 699-43-45 was above the primary DWS (300 µg/L). Manganese, chromium, molybdenum, and nickel were also detected in the unfiltered samples from well 699-43-45, but their concentrations and ratios to iron are not indicative of stainless-steel corrosion (Section 1.5).



Reference: ECF-HANFORD-20-0078, *Preparation of the Hanford Site Water Table Map for January to March 2020*.

Figure 2-4. 216-B-3 Main Pond and 216-B-3-3 Ditch (B Pond)

Table 2-11. B Pond Groundwater Monitoring Network

Well Name	Location	Year Installed	Hydraulic Head Date	Hydraulic Head*		Elevation Screen Top		Elevation Screen Bottom		Water Column		Sample Frequency	Comments
				m	ft	m	ft	m	ft	m	ft		
699-42-42B	DG	1988	8/4/2020	122.02	400.32	119.1	390.7	115.9	380.4	6.1	20.0	S	
699-43-45	DG	1989	8/4/2020	121.53	398.73	126.5	414.9	120.3	394.6	1.3	4.1	S	
699-44-39B	UG	1992	8/4/2020	123.19	404.15	126.2	414.1	120.1	394.1	3.1	10.1	S	
699-44-43C	UG	2017	8/4/2020	122.64	402.35	124.1	407.0	116.4	382.0	6.2	20.3	S	
699-43-43B	DG	2020	11/18/2020	121.95	400.10	123.3	404.5	115.6	379.3	6.4	20.8	Q/S	Water level measured during drilling

Note: Requirements are from Table 3-1 in DOE/RL-2008-59, *Interim Status Groundwater Monitoring Plan for the 216-B-3 Pond*.

*Hydraulic head data have not been corrected for borehole deviation from vertical. Corrections are not available for wells in this network, which may cause reported head to be less than actual head.

DG = downgradient
Q/S = quarterly first year; semiannual thereafter
S = semiannual
UG = upgradient

Table 2-12. B Pond Sampling Summary for Contamination Indicator Parameters for 2020

Indicator Parameter		pH		Specific Conductance (µS/cm)		Total Organic Carbon (µg/L)		Total Organic Halides (µg/L)		
Critical Mean[a]		7.48	8.61	441		1,150		10[b]		
Well	Sample Date	Average	SD	Average	SD	Average	SD	Average	SD	Comments
699-42-42B	1/6/2020	8.0	0.0	307	0	330 U	0	4.7 B	1.7	
	8/4/2020	8.0	0.0	309	0	335 B	5	3.3 B	0.0	
699-43-45	1/8/2020	8.2	0.0	311	4	330 U	0	5.0 B	1.7	
	8/4/2020	8.1	0.0	298	0	772 B	50	4.4 B	0.7	
699-44-39B	1/8/2020	8.2	0.0	258	0	330 U	0	3.3 U	0.0	
	8/4/2020	8.3	0.0	259	0	340 B	17	3.3 B	0.0	
699-44-43C	1/6/2020	8.1	0.0	274	0	371 B	11	4.3 B	1.5	
	8/4/2020	8.2	0.0	277	0	1,050	41	3.3 U	0.0	

a. Critical mean values are from Table 13 in ECF-HANFORD-20-0007, *Calculation of Critical Means for Calendar Year 2020 RCRA Groundwater Monitoring*. Required detection limits are used for comparison when they are higher than the calculated critical mean values.

b. Required detection limit.

B = all values were below the quantitation limit

SD = standard deviation of replicates

U = all values were below the detection limit

Table 2-13. B Pond Sampling Summary for Groundwater Quality Parameters and Other Constituents for 2020

Constituent	Units	Maximum	Comparison Value[a]	PQL[b]	Wells Above Comparison Value
Alkalinity	mg/L	120	—	5.25	
Calcium, unfiltered	µg/L	30,500	—	1,050	
Calcium, filtered	µg/L	31,200	—	1,050	
Chloride	mg/L	5.33	250[c]	0.4	
Chromium, unfiltered	µg/L	11.8	100[d]	10.5	
Dissolved oxygen	mg/L	11.9	—	—	
Iron, unfiltered	µg/L	840	300[c]	105	699-43-45
Magnesium, unfiltered	µg/L	10,000	—	1,050	
Magnesium, filtered	µg/L	10,200	—	1,050	
Molybdenum, unfiltered	µg/L	7.93	—	5.25	
Molybdenum, filtered	µg/L	7.05	—	5.25	
Nitrate	mg/L	18.5	45[e]	0.525	
Potassium, unfiltered	µg/L	6,210	—	5,250	
Potassium, filtered	µg/L	5,710	—	5,250	
Sodium, unfiltered	µg/L	19,300	—	1,050	
Sodium, filtered	µg/L	19,200	—	1,050	
Sulfate	mg/L	28.8	250[c]	1.05	
Temperature	°C	21.5	—	—	
Turbidity	NTU	174	—	—	

Note: Maximum is based on the required sample results for this RCRA unit with concentrations above the PQL. Constituents required annually were collected in January 2020. Appendix A presents the full data set for 2020.

a. Comparison values are provided for information only and are not used to determine RCRA groundwater monitoring exceedances.

b. Standardized PQL used in analytical requirements.

c. 40 CFR 143.3, "National Secondary Drinking Water Regulations," "Secondary Maximum Contaminant Levels."

d. 40 CFR 141, Subpart G, "National Primary Drinking Water Regulations," "Maximum Contaminant Levels and Maximum Residual Disinfectant Levels."

e. The federal drinking water standard for nitrate is 10 mg/L expressed as nitrogen (40 CFR 141, Subpart G). This equates to 45 mg/L when expressed as NO_3.

— = no comparison value or PQL
PQL = practical quantitation limit
NTU = nephelometric turbidity unit
RCRA = *Resource Conservation and Recovery Act of 1976*

2.5 216-B-63 Trench

The 216-B-63 Trench is located in the north-central portion of the 200 East Area (Figures 1-1 and 2-5). Beginning in 1970, it was used as an emergency percolation trench for chemical sewer waste from B Plant (RHO-CD-798, *Current Status of the 200 Area Ponds*). Major contributors to this waste stream

were the 2902B high tank (contained potable sanitary water), cooling water from B Plant and the 225B Waste Encapsulation and Separation Facility, some 221B steam condensate, and demineralizer effluent. Minor contributions may have included the chemical makeup overflow system (sodium hydroxide and sodium nitrite), air conditioning units, and space heaters (radiators).

Before November 1985, acidic effluent from anion exchanger regeneration and the basic effluent from cation exchanger regeneration were discharged without neutralization (WHC-EP-0287, *Waste Stream Characterization Report*, p. A.9-2). In March and April 1987, incidental corrosive liquid waste releases were discharged to the 216-B-63 Trench. The corrosive waste discharges were regulated under RCW 70.105, "Hazardous Waste Management," and its implementing requirements in WAC 173-303. Discharges to the 216-B-63 Trench ceased in 1992.

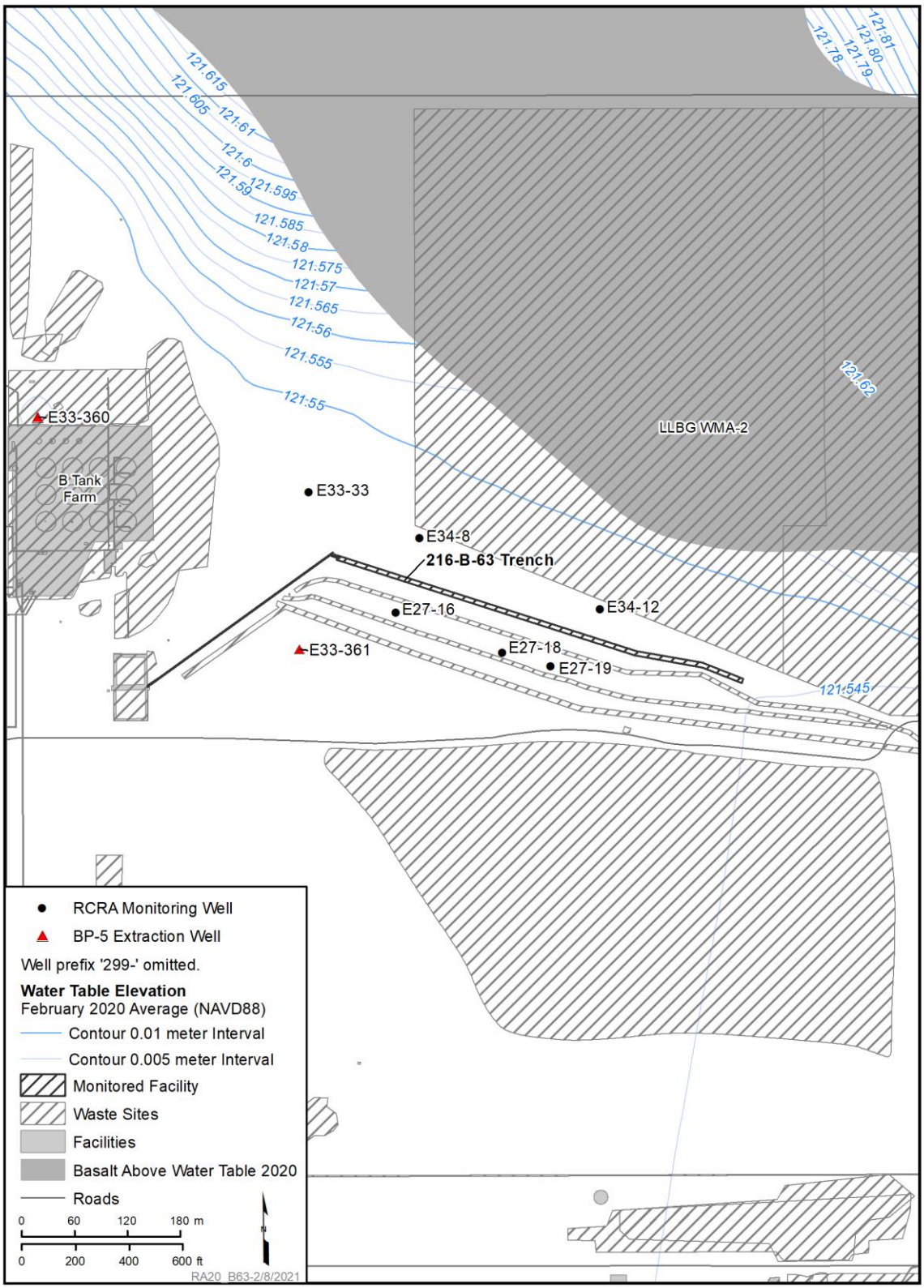
DOE monitors groundwater at the 216-B-63 Trench under an interim status indicator evaluation program as defined in DOE/RL-2008-60, *Interim Status Groundwater Monitoring Plan for the 216-B-63 Trench*. An interim status change notice, RCRA-CN-01_DOE/RL-2008-60_R1, *Interim Status Change Number 1: Interim Status Groundwater Monitoring Plan for the 216-B-63 Trench*, was in effect for the November 2020 sampling event. Changes to the groundwater monitoring plan included adding metals for water chemistry and well casing corrosion assessment, as well as clarifying required constituents under the phenols monitoring requirement. The change notice did not affect the monitoring network or sampling frequency.

Table 2-14 lists the wells in the 216-B-63 Trench monitoring network, as well as screened intervals and water levels. The monitoring network consists of three upgradient and three downgradient wells, with screens extending across most of the thin, unconfined aquifer. The current interim status monitoring network is the same as the proposed final status network described in Section 7.4 of SGW-60594, *Engineering Evaluation Report for the 216-B-63 Trench Groundwater Monitoring*. The unconfined aquifer under the 216-B-63 Trench is contained within the Cold Creek unit gravels. All of the wells are expected to have sufficient water for continued sampling through at least 2030 (SGW-63743).

CERCLA remedial actions in the vicinity of the 216-B-63 Trench are beginning to affect local groundwater flow. Because of the growing influence of extraction well 299-E33-361, it is not currently possible to make reliable estimates of hydraulic gradient and average linear velocity. Assessments of changes to localized groundwater flow are ongoing and will continue into 2021.

The 216-B-63 Trench network wells are monitored semiannually for RCRA indicator parameters (Table 2-15). Additionally, because of a lost phenols sample from well 299-E34-8 in the June 2020 sampling event, the entire network was resampled for all of the constituents listed in Table 3-1 of DOE/RL-2008-60 in July 2020. There were no exceedances of the critical mean values for contamination indicator parameters in 2020, and the 216-B-63 Trench remains in indicator evaluation monitoring.

Groundwater quality parameters monitored for the site include chloride, iron, manganese, phenols, sodium, and sulfate (Table 2-16). Although not required by 40 CFR 265, Subpart F, site-specific constituents (alkalinity, fluoride, nitrate, nitrite, calcium, magnesium, chromium, and potassium) were also analyzed. Samples for analyses of cations and anions are collected to support cation-anion balance calculations. Samples for iron, manganese, chromium, molybdenum, and nickel are collected to assess the potential for well corrosion. Nitrate was the only parameter with a concentration above a water quality standard. Nitrate reflects contaminant migration from sources northwest of the 216-B-63 Trench.



Reference: ECF-HANFORD-20-0078, *Preparation of the Hanford Site Water Table Map for January to March 2020*.

Figure 2-5. 216-B-63 Trench

Table 2-14. 216-B-63 Trench Groundwater Monitoring Network

Well Name	Location	Year Installed	Head Date	Hydraulic Head		Elevation Screen Top		Elevation Screen Bottom		Water Column		Sample Frequency	Comments
				m	ft	m	ft	m	ft	m	ft		
299-E27-16	DG	1990	11/3/2020	121.50	398.64	126.2	414.1	119.8	393.1	1.7	5.6	S	
299-E27-18*	DG	1992	11/3/2020	121.56	398.82	124.7	409.1	118.6	389.0	3.0	9.8	S	
299-E27-19	DG	1992	11/3/2020	121.46	398.50	124.7	409.1	118.6	389.0	2.9	9.5	S	
299-E33-33	UG	1989	11/3/2020	121.54	398.74	126.0	413.4	119.6	392.4	1.9	6.3	S	
299-E34-12	UG	1992	11/3/2020	121.46	398.47	126.6	415.3	120.3	394.7	1.2	3.8	S	
299-E34-8	UG	1990	11/3/2020	121.42	398.35	126.0	413.2	119.9	393.2	1.6	5.1	S	

Note: Requirements are from Table 3-1 in DOE/RL-2008-60, *Interim Status Groundwater Monitoring Plan for the 216-B-63 Trench*.

*Hydraulic head data for this well were corrected for borehole deviation from vertical. Corrections are not available for other wells in this network, which may cause reported head to be less than actual head.

DG = downgradient

S = semiannual

UG = upgradient

Table 2-15. 216-B-63 Trench Sampling Summary for Contamination Indicator Parameters for 2020

Indicator Parameter		pH		Specific Conductance (µS/cm)		Total Organic Carbon (µg/L)		Total Organic Halides (µg/L)		
2020 Critical Mean[a]		7.69	8.52	907		1,000[b]		10[b]		
Well	Sample Date	Average	SD	Average	SD	Average	SD	Average	SD	Comments
299-E27-16	6/11/2020	8.28	0.01	567	1	330 U	0	3.3 U	0.0	
	7/28/2020	8.21	0.01	559	1	396 B	14	4.5 B	2.1	See footnote c
	11/3/2020	8.36	0.00	563	0	330 U	0	3.3 U	0.0	
299-E27-18	6/11/2020	8.17	0.01	510	1	330 U	0	5.1 B	1.8	
	7/28/2020	8.00	0.00	578	0	414 B	9	3.3 U	0.0	See footnote c
	11/3/2020	8.32	0.01	528	1	330 U	0	3.5 B	0.1	
299-E27-19	6/11/2020	8.17	0.01	634	1	330 U	0	4.5 B	2.1	
	7/28/2020	8.26	0.01	619	1	393 B	16	3.3 U	0.0	See footnote c
	11/3/2020	8.30	0.01	633	1	330 U	0	4.2 B	0.8	
299-E33-33	6/10/2020	8.14	0.00	568	0	330 U	0	4.2 B	1.5	
	7/29/2020	7.90	0.00	566	1	330 U	0	3.8 B	0.9	See footnote c
	11/3/2020	8.28	0.00	561	0	330 U	0	3.3 U	0.0	
299-E34-12	6/11/2020	8.02	0.00	473	1	330 U	0	3.3 U	0.0	
	7/29/2020	7.89	0.00	474	0	330 U	0	3.6 B	0.5	See footnote c
	11/3/2020	8.07	0.01	507	0	330 U	0	3.3 U	0.0	
299-E34-8	6/11/2020	8.08	0.02	661	2	330 U	0	3.3 U	0.0	
	7/29/2020	7.83	0.00	675	2	387 B	31	3.6 B	0.4	See footnote c
	11/3/2020	8.12	0.03	671	0	330 U	0	4.7 B	0.8	

Table 2-15. 216-B-63 Trench Sampling Summary for Contamination Indicator Parameters for 2020

Indicator Parameter		pH		Specific Conductance (µS/cm)		Total Organic Carbon (µg/L)		Total Organic Halides (µg/L)		
2020 Critical Mean[a]		7.69	8.52	907		1,000[b]		10[b]		
Well	Sample Date	Average	SD	Average	SD	Average	SD	Average	SD	Comments

a. Critical mean values from Table 14 in ECF-HANFORD-20-0007, *Calculation of Critical Means for Calendar Year 2020 RCRA Groundwater Monitoring*. Required detection limits are used for comparison when they are higher than the calculated critical mean values.

b. Required detection limit.

c. The entire 216-B-63 Trench monitoring network was resampled in July to compensate for a lost phenols sample from the June sampling event (well 299-E34-8).

B = all values were below the quantitation limit

SD = standard deviation of replicates

U = all values were below the detection limit

Table 2-16. 216-B-63 Trench Sampling Summary for Water Quality Parameters and Other Constituents for 2020

Constituent	Units	Maximum	Comparison Value[a]	PQL[b]	Wells Above Comparison Value
Alkalinity	mg/L	109	—	5.25	
Calcium, unfiltered	µg/L	73,500	—	1,050	
Calcium, filtered	µg/L	73,100	—	1,050	
Chloride	mg/L	27.1	250[c]	0.4	
Chromium, unfiltered[d]	µg/L	58.0	100[e]	10.5	
Chromium, filtered[d]	µg/L	19.7	100[e]	10.5	
Dissolved oxygen	mg/L	9.4	—	—	
Iron, unfiltered	µg/L	240	300[c]	105	
Magnesium, unfiltered	µg/L	20,200	—	1,050	
Magnesium, filtered	µg/L	20,200	—	1,050	
Molybdenum, unfiltered[d]	µg/L	8.7	—	5.25	
Molybdenum, filtered[d]	µg/L	8.2	—	5.25	
Nickel, unfiltered[d]	µg/L	24	—	21	
Nitrate	mg/L	105	45[f]	0.525	All wells
Potassium, unfiltered	µg/L	9,700	—	5,250	
Potassium, filtered	µg/L	9,700	—	5,250	
Sodium, unfiltered	µg/L	28,700	—	1,050	
Sodium, filtered	µg/L	28,200	—	1,050	
Sulfate	mg/L	111	250[c]	1.05	
Temperature	°C	28.4	—	—	
Turbidity	NTU	4.97	—	—	

Note: Maximum is based on the required sample results for this RCRA unit with concentrations above the PQL. Appendix A presents the full data set for 2020.

a. Comparison values are provided for information only and are not used to determine RCRA groundwater monitoring exceedances.

b. Standardized PQL used in analytical requirements.

c. 40 CFR 143.3, "National Secondary Drinking Water Regulations," "Secondary Maximum Contaminant Levels."

d. These constituents were added annually by RCRA-CN-01_DOE/RL-2008-60_R1, 2020, *Interim Status Change Number 1: Interim Status Groundwater Monitoring Plan for the 216-B-63 Trench* (effective date June 8, 2020). Although not yet required during the June 2020 sampling event, these constituents are summarized here for completeness.

e. 40 CFR 141, Subpart G, "National Primary Drinking Water Regulations," "Maximum Contaminant Levels and Maximum Residual Disinfectant Levels."

f. The federal drinking water standard for nitrate is 10 mg/L as nitrogen (40 CFR 141, Subpart G). This equates to 45 mg/L when expressed as NO_3 and NO_2.

— = no comparison value or PQL
NTU = nephelometric turbidity unit
PQL = practical quantitation limit
RCRA = *Resource Conservation and Recovery Act of 1976*

2.6 216-S-10 Pond and Ditch

The 216-S-10 Pond and Ditch, located outside the southwestern corner of the 200 West Area, comprised an unlined ditch, 1.2 m (3.9 ft) wide at its base and 686 m (2,250 ft) long, and was connected to a pond. The ditch was also connected to the 216-S-11 Pond between 1954 and 1965, which was an overflow pond to accommodate excess discharges. The 216-S-10 Pond and Ditch and the 216-S-11 Pond received 6.6 billion L (1.7 billion gal) of effluent from the Reduction-Oxidation (REDOX) Plant chemical sewer between 1951 and 1991. Figure 2-6 shows the major site features and monitoring well locations.

The groundwater beneath the 216-S-10 Pond and Ditch is monitored under an interim status indicator evaluation program to determine whether dangerous waste constituents have affected groundwater (DOE/RL-2008-61, *Interim Status Groundwater Monitoring Plan for the 216-S-10 Pond and Ditch*). An interim change notice, RCRA-CN-01_DOE/RL-2008-61_R1, *Interim Status Change Number 1: Interim Status Groundwater Monitoring Plan for the 216-S-10 Pond and Ditch*, was in effect for the November 2020 sampling event. The change notice updated the monitoring constituents.

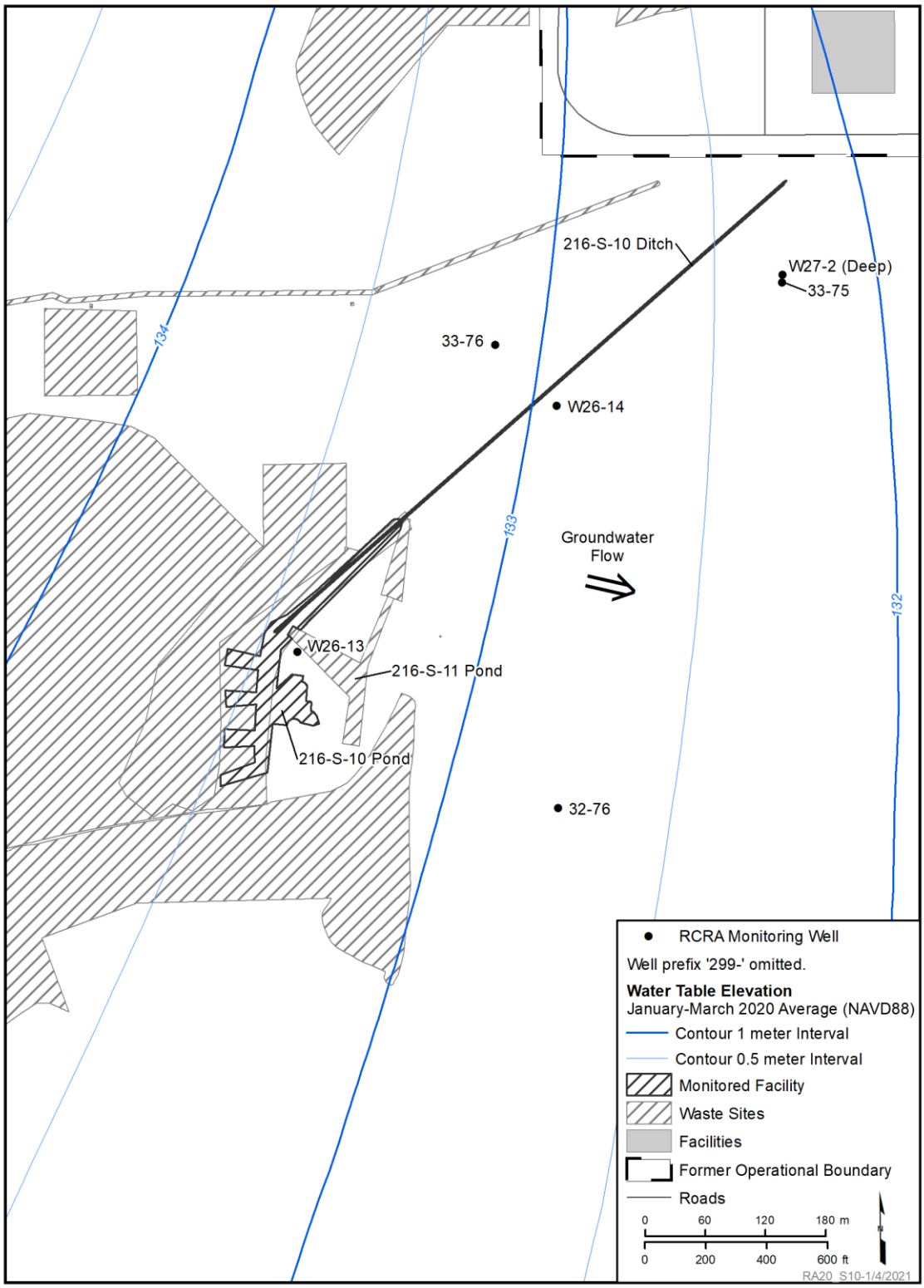
The monitoring network consists of one upgradient well, four downgradient wells screened in the upper portion of the aquifer (Ringold unit E), and a downgradient well screened 50 m (164 ft) below the water table (Table 2-17). All of the wells are expected to have sufficient water for continued sampling through at least 2030 (SGW-63743). Section 7.4 in SGW-60585, *Engineering Evaluation Report for the 216-S-10 Pond and Ditch Groundwater Monitoring*, recommended a modified network for monitoring under final status, including five wells from the existing network and four new wells.

In 2020, groundwater flow was calculated to be toward the east with a gradient of 2.5×10^{-3} m/m, and the velocity was estimated at 0.14 m/d (0.45 ft/d) (Table 1-2).

All of the network wells were sampled as planned in 2020 for RCRA contamination indicator parameters (Table 2-18), groundwater quality parameters, and site-specific analytes (Table 2-19). No indicator parameter critical mean exceedances occurred in 2020. Although TOC was detected above the critical mean value at downgradient well 299-W26-14 in June, it was less than the required detection limit. TOC was also detected in the associated quality control blank. Well 299-W26-14 was resampled in August 2020, and the TOC results were below the critical mean value. Based on the results of the resample event, the June 2020 samples were rejected.

In 2020, total chromium concentrations in well 299-W26-13 remained above the 100 µg/L DWS, and Cr(VI) concentrations were above the 48 µg/L MTCA standard (WAC 173-340) (Table 2-19). The 216-S-10 Pond and Ditch system was a substantial source of chromium in this area (Appendix C of RPP-26744, *Hanford Soil Inventory, Rev. 1*), but other sources of chromium also exist (e.g., 216-S-5 Crib, 216-S-6 Crib, 216-S-11 Pond, 216-S-16 Pond, 216-S-17 Pond, and associated ditches). In particular, the 216-S-11 overflow pond received waste similar to the 216-S-10 Pond but is not part of the RCRA unit (Section 2.8 in DOE/RL-2016-66, *Hanford Site RCRA Groundwater Monitoring Report for 2016*).

Concentrations of some stainless-steel corrosion products (chromium, iron, manganese, molybdenum, and/or nickel) are elevated in unfiltered samples from downgradient wells 299-W26-13 and 699-33-76. However, corrosion is not suspected because measured concentrations of stainless-steel constituents do not match ratios of common stainless-steel alloys used in Hanford Site wells (Section 1.5), and concentrations do not demonstrate a continuous upward trend. Although iron was observed at well 699-33-76 above the DWS of 300 µg/L in one of two duplicate samples collected in November 2020, the difference between the two duplicates is >20%, qualifying both samples with a review qualifier of “Q.”



Reference: ECF-HANFORD-20-0078, *Preparation of the Hanford Site Water Table Map for January to March 2020*.

Figure 2-6. 216-S-10 Pond and Ditch

Table 2-17. 216-S-10 Pond and Ditch Groundwater Monitoring Network

Well Name	Location	Year Installed	Head Date	Hydraulic Head		Elevation Screen Top		Elevation Screen Bottom		Water Column		Sample Frequency	Comments
				m	ft	m	ft	m	ft	m	ft		
299-W26-13	DG	1999	11/2/2020	133.22	437.08	137.4	450.8	126.7	415.7	6.5	21.4	S	
299-W26-14	DG	2003	11/2/2020	132.52	434.79	136.6	448.1	125.9	413.1	6.6	21.7	S	
299-W27-2	DG/deep	1992	6/16/2020	131.90	432.74	82.7	271.3	79.6	261.2	52.3	171.5	A	
699-32-76	DG	2008	11/2/2020	132.20	433.74	134.8	442.2	124.1	407.2	8.1	26.5	S	
699-33-75	DG	2008	11/2/2020	131.93	432.84	135.0	442.8	124.3	407.8	7.6	25.0	S	
699-33-76	UG	2008	11/2/2020	132.76	435.57	135.5	444.7	124.9	409.7	7.9	25.9	S	

Note: Requirements are from Table 3-1 in DOE/RL-2008-61, *Interim Status Groundwater Monitoring Plan for the 216-S-10 Pond and Ditch*.

A = annually
S = semiannual
DG = downgradient
UG = upgradient

Table 2-18. 216-S-10 Pond and Ditch Sampling Summary for Contamination Indicator Parameters for 2020

Indicator Parameter		pH		Specific Conductance (µS/cm)		Total Organic Carbon (µg/L)		Total Organic Halides (µg/L)		
2020 Critical Mean[a]		6.64	8.58	356		1,000[b]		14.4		
Well	Sample Date	Average	SD	Average	SD	Average	SD	Average	SD	Comments
299-W26-13	6/15/2020	7.89	0.00	312	0	412 B	14	3.5 B	0.2	
	11/2/2020	7.73	0.00	315	0	330 U	0	3.9 B	0.9	
299-W26-14	6/15/2020	7.84	0.00	281	0	586 R	15	4.8 B	0.4	TOC data rejected; see text discussion
	8/6/2020	7.80	0.00	279	0	338 U	8	—	—	Resampled for TOC
	11/2/2020	7.70	0.00	285	0	330 U	0	3.9 B	0.9	
299-W27-2	6/16/2020	7.80	N/A	361	N/A	330 U	N/A	3.3 U	N/A	Deep well; no quadruplicates or statistics required
699-32-76	6/15/2020	7.83	0.00	299	1	385 B	7	3.9 B	1.0	
	11/2/2020	7.44	0.04	301	0	330 U	0	4.0 B	0.7	
699-33-75	6/16/2020	7.88	0.00	288	0	330 U	0	4.2 B	1.2	
	11/2/2020	7.71	0.00	293	0	330 U	0	4.2 B	1.5	
699-33-76	6/15/2020	7.83	0.00	307	0	529 B	31	3.9 B	0.9	
	11/2/2020	7.67	0.00	307	0	330 U	0	4.5 B	1.6	

a. Critical mean values from Table 16 in ECF-HANFORD-20-0007, *Calculation of Critical Means for Calendar Year 2020 RCRA Groundwater Monitoring*. Required detection limits are used for comparison when they are higher than the calculated critical mean values.

b. Required detection limit.

B = all values were below the quantitation limit
N/A = not applicable
R = rejected (see text discussion)
SD = standard deviation of replicates
TOC = total organic carbon
U = all values were below the detection limit

Table 2-19. 216-S-10 Pond and Ditch Sampling Summary for Water Quality Parameters and Other Constituents for 2020

Constituent	Units	Maximum	Comparison Value[a]	PQL[b]	Wells Above Comparison Value
Alkalinity	mg/L	128	—	5.25	
Calcium, unfiltered	µg/L	35,600	—	1,050	
Calcium, filtered	µg/L	34,400	—	1,050	
Carbon tetrachloride	µg/L	4.47	5.0[c]	3.0	
Chloride	mg/L	19.8	250[d]	0.4	
Chromium, unfiltered	µg/L	210	100[c]	10.5	299-W26-13
Chromium, filtered	µg/L	140	100[c]	10.5	299-W26-13
Hexavalent chromium	µg/L	150	48[e]	10.5	299-W26-13
Iron, unfiltered	µg/L	360	300[d]	105	299-W26-13, 699-33-76
Magnesium, unfiltered	µg/L	13,200	—	1,050	
Magnesium, filtered)	µg/L	12,700	—	1,050	
Molybdenum, unfiltered	µg/L	14	—	5.25	
Molybdenum, filtered	µg/L	13	—	5.25	
Nickel, unfiltered	µg/L	32	—	21	
Nitrate	mg/L	32.1	45[f]	0.525	
Sodium, unfiltered	µg/L	22,400	—	1,050	
Sodium, filtered	µg/L	21,500	—	1,050	
Sulfate	mg/L	21.5	250[d]	1.05	
Temperature	°C	21.1	—	—	
Turbidity	NTU	4.93	—	—	

Note: Maximum is based on sample results collected specifically for this RCRA unit with concentrations above the PQL. Appendix A presents the full data set for 2020.

a. Comparison values are provided for information only and are not used to determine RCRA groundwater monitoring exceedances.

b. Standardized PQL used in analytical requirements.

c. 40 CFR 141, Subpart G, "National Primary Drinking Water Regulations," "Maximum Contaminant Levels and Maximum Residual Disinfectant Levels."

d. 40 CFR 143.3, "National Secondary Drinking Water Regulations," "Secondary Maximum Contaminant Levels."

e. Individual risk based concentration levels as derived from WAC 173-340-720, "Groundwater Cleanup Standards," as calculated in ECF-100NPL-10-0462, *Calculation of Standard Method B Groundwater Cleanup Levels for Potable Groundwater for the 100 Areas and 300 Area Remedial Investigation/Feasibility Study Reports*.

f. The federal drinking water standard for nitrate is 10 mg/L, expressed as nitrogen (40 CFR 141, Subpart G). This equate to 45 mg/L when expressed as NO_3.

— = no comparison value or PQL

NTU = nephelometric turbidity unit

PQL = practical quantitation limit

RCRA = *Resource Conservation and Recovery Act of 1976*

2.7 Integrated Disposal Facility

The IDF is an expandable, double-lined landfill in the 200 East Area (Figures 1-1 and 2-7) with 0.07 km^2 (0.027 mi^2) of liner. It includes two distinct cells: an east cell for low-level radioactive waste, and a west cell for mixed waste. The IDF is not yet in use.

Construction of the first phase for the IDF was completed in April 2006. DOE submitted a Part B RCRA Permit application to Ecology, which was incorporated into the Hanford RCRA Permit on April 9, 2006. In 2020, it was monitored under a pre-operational final status detection monitoring program under the Hanford RCRA Permit (WA7890008967, Part III, OUG-11, Chapter 5.0, "Groundwater Monitoring" [modification date of June 30, 2010]).

In 2019, DOE submitted a plan for a revised groundwater monitoring program to Ecology (DOE/RL-2019-29, Rev. 1, *Groundwater Monitoring Plan for the Integrated Disposal Facility*). The revised monitoring program will be incorporated into the Hanford RCRA Permit in the future. Ecology approved DOE's request to begin baseline sampling under the revised monitoring program in 2020 (19-NWP-197, "Approval of Request for Integrated Disposal Facility Groundwater Sample Activities"). Table 2-20 and Figure 2-7 present the IDF monitoring networks in effect in 2020, including the revised monitoring program.

Because the IDF is not yet operating, the current monitoring objective is to collect baseline groundwater information. During 2020, the IDF was sampled in compliance to the requirements specified in the Hanford RCRA Permit (annual sampling schedule), as well as in the DOE monitoring plan (quarterly sampling). All of the wells are expected to have sufficient water for continued sampling through at least 2030 (SGW-63743). Well 299-E18-1 was sampled with a bailer in 2020 due to low groundwater production in the well.

The groundwater flow direction in 2020 was northeast, with an estimated gradient of 1.4×10^{-5} m/m and an average linear velocity of 0.77 m/d (2.5 ft/d) (Table 1-2). In recent years, the flow direction has varied from northeast to southeast. Hydraulic conductivity is markedly different between the two unconfined aquifer units beneath the IDF, the Ringold Formation, and the Hanford formation. Because the Hanford formation comprises a majority of the total saturated thickness, its associated hydraulic conductivity is considered the primary driver for overall groundwater flow velocity.

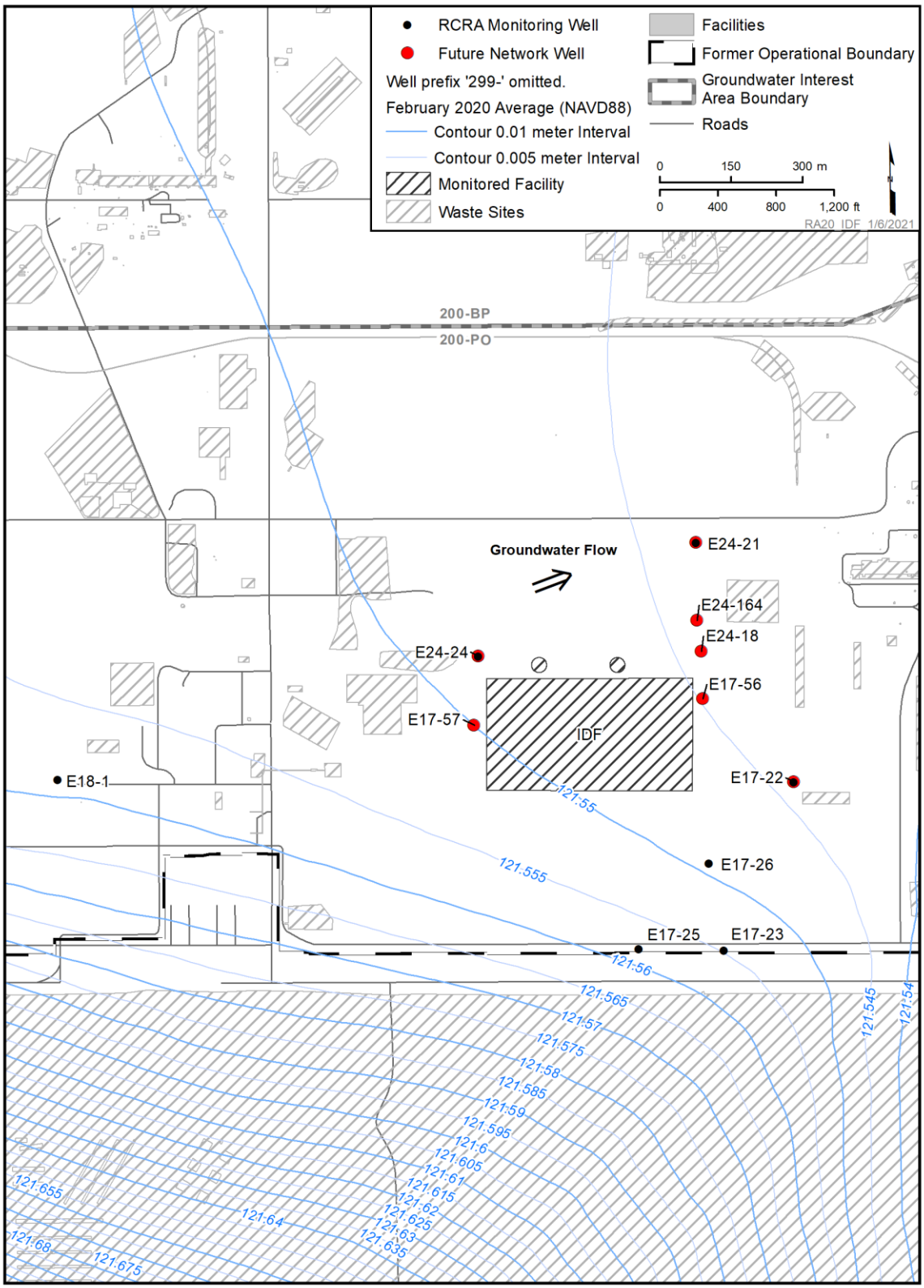
In 2020, the wells were sampled once as required for indicator parameters chromium (filtered), pH, specific conductance, TOC, and TOX (Table 2-21). In addition, monitoring includes the supplemental constituents alkalinity, anions, metals, and turbidity (Table 2-22). Upgradient/downgradient comparisons of indicator parameters are not required because the IDF is not in use.

In 2020, the IDF was additionally sampled quarterly for the constituents and wells listed in the revised monitoring plan (DOE/RL-2019-29). Monitoring included site-specific constituents and dangerous waste constituents as identified in Ecology Publication No. 97-407, *Chemical Test Methods For Designating Dangerous Waste, WAC 173-303-090 & -100*. Monitoring results for the revised monitoring program are summarized in Table 2-23.

Nitrate concentrations in 2020 were above the DWS in six IDF wells (Table 2-22). Wells monitoring the IDF are within the regional 200 East Area nitrate plume (Sections 2.4 and 4.4 in SGW-62007, *Engineering Evaluation Report for the Integrated Disposal Facility Groundwater Monitoring*). Anions are required for permit-only wells on an annual basis but are not a required constituent in the revised monitoring plan (DOE/RL-2019-29).

Chromium and iron concentrations in unfiltered samples from well 299-E24-18 (required in the revised monitoring plan) (Table 2-23) were above the DWS in June (both) and August (iron only). Corrosion is currently not suspected in well 299-E24-18 because measured concentrations of stainless-steel constituents do not match ratios of common alloys used in Hanford Site wells (Section 1.5), and concentrations do not demonstrate a continuous upward trend.

All of the synthetic, organic, site-specific constituents required by DOE/RL-2019-29 were either nondetects or were detected at concentrations below the PQL.



Reference: ECF-HANFORD-20-0078, *Preparation of the Hanford Site Water Table Map for January to March 2020*.

Figure 2-7. Integrated Disposal Facility

Table 2-20. IDF Groundwater Monitoring Network

Well Name	Location	Year Installed	Hydraulic Head Date	Hydraulic Head		Elevation Screen Top		Elevation Screen Bottom		Water Column		2020 Sample Frequency[a]	Comments
				m	ft	m	ft	m	ft	m	ft		
299-E17-22	DG	2002	9/28/2020	121.53	398.71	122.6	402.1	111.9	367.0	9.7	31.7	Q	In current and revised plans
299-E17-23	DG	2002	9/28/2020	121.56	398.83	122.3	401.4	111.6	366.3	9.9	32.5	A	Not in revised plan[b]
299-E17-25	DG	2002	9/28/2020	121.53	398.71	122.4	401.7	111.8	366.7	9.8	32.0	A	Not in revised plan[b]
299-E17-26[c]	DG	2005	8/7/2020	121.85	399.75	121.4	398.3	110.7	363.3	11.1	36.5	A	Not in revised plan[b]
299-E17-56	DG	2019	8/14/2020	121.54	398.74	122.1	400.6	116.0	380.6	5.5	18.2	Q	Added in revised plan[b]
299-E17-57	UG	2019	8/14/2020	120.89	396.63	121.1	397.3	115.0	377.2	5.9	19.4	Q	Added in revised plan[b]
299-E18-1	UG	1988	7/28/2020	121.60	398.95	125.5	411.6	119.2	391.1	2.4	7.9	A	Sampled with a bailer; not in revised plan[b]
299-E24-164	DG	2019	8/14/2020	121.43	398.40	121.8	399.5	114.1	374.4	7.3	24.0	Q	Added in revised plan[b]
299-E24-18	DG	1988	9/28/2020	121.52	398.68	126.0	413.4	119.6	392.4	1.9	6.2	Q	Added in revised plan[b]
299-E24-21	UG/DG[d]	2001	9/28/2020	121.53	398.72	122.7	402.5	116.6	382.5	4.9	16.2	Q	In current and revised plans
299-E24-24[e]	UG	2005	9/28/2020	121.53	398.71	122.5	402.0	111.9	367.0	9.7	31.7	Q	In current and revised plans

Note: Requirements are from the Hanford RCRA Permit (WA7890008967, *Hanford Facility Resource Conservation and Recovery Act (RCRA) Permit, Dangerous Waste Portion for the Treatment, Storage, and Disposal of Dangerous Waste*, Revision 8c [modification date of June 30, 2010], Part III, Operating Unit Group 11 (OUG-11), Chapter 5.0, "Groundwater Monitoring"); and DOE/RL-2019-29, *Groundwater Monitoring Plan for the Integrated Disposal Facility*.

a. The IDF is not yet in use. In accordance with the Hanford RCRA Permit, OUG-11, Unit-Specific Condition III.11.E.1.b, groundwater sampling under the permit will continue annually during the pre-active life of the IDF.

b. A revised monitoring plan (DOE/RL-2019-29) will be incorporated into the Hanford RCRA Permit in the future. The Washington State Department of Ecology approved the U.S. Department of Energy's request to begin baseline sampling under the revised monitoring program in 2020 (19-NWP-197, "Approval of Request for Integrated Disposal Facility Groundwater Sample Activities").

c. Listed in Part III, OUG-11, Chapter 5.0 of the Hanford RCRA Permit as "New Downgradient Well #1."

Table 2-20. IDF Groundwater Monitoring Network

Well Name	Location	Year Installed	Hydraulic Head Date	Hydraulic Head		Elevation Screen Top		Elevation Screen Bottom		Water Column		2020 Sample Frequency[a]	Comments
				m	ft	m	ft	m	ft	m	ft		

d. Well 299-E24-21 is designated as upgradient in Part III, OUG-11, Chapter 5.0 of the Hanford RCRA Permit and as downgradient in the revised plan (DOE/RL-2019-29).

e. Listed in Part III, OUG-11, Chapter 5.0 of the Hanford RCRA Permit as "New Upgradient Well."

A = annually
DG = downgradient
IDF = Integrated Disposal Facility
OUG = operating unit group
Q = quarterly
RCRA = *Resource Conservation and Recovery Act of 1976*
UG = upgradient

Table 2-21. IDF Permit Contamination Indicator Parameters for 2020

Well Name	Sample Date	Chromium, Filtered (µg/L)	pH (unitless)	Specific Conductance (µS/cm)	Total Organic Carbon (µg/L)	Total Organic Halides (µg/L)
299-E17-22	1/26/2020	4.9 U	8.15	627	330 U	3.33 U
299-E17-23	1/26/2020	10.3	7.81	496	330 U	4.06 BN
299-E17-25	1/26/2020	7.81 B	7.74	499	330 U	3.33 NU
299-E17-26	1/26/2020	6.45 B	7.77	524	330 U	3.33 NU
299-E18-1	1/27/2020	6.0 B	8.47	393	698 BD	7.36 B
299-E24-21	1/26/2020	3.56 B	8.08	573	468 B	3.33 U
299-E24-24	1/26/2020	3.0 U	7.73	535	330 U	3.62 B

B = result is below the quantitation limit
D = reported at a secondary dilution factor
N = spike and/or spike duplicate sample recovery is outside control limits
U = result is below the detection limit

Table 2-22. IDF Sampling Summary for Supplemental Permit Constituents for 2020

Constituent	Units	Maximum	Comparison Value[a]	PQL[b]	Wells Above Comparison Value
Alkalinity	mg/L	143	—	5.25	
Calcium, unfiltered	µg/L	60,000	—	1,050	
Calcium, filtered	µg/L	60,000	—	1,050	
Chloride	mg/L	14.5	250[c]	0.4	
Chromium, unfiltered	µg/L	24	100[d]	10.5	
Magnesium, unfiltered	µg/L	19,000	—	1,050	
Magnesium, filtered	µg/L	19,000	—	1,050	
Nitrate	mg/L	78.4	45[e]	0.525	299-E17-22, 299-E17-23, 299-E17-25, 299-E17-26, 299-E24-21, 299-E24-24
Potassium, unfiltered	µg/L	8,300	—	5,250	
Potassium, filtered	µg/L	8,400	—	5,250	
Sodium, unfiltered	µg/L	29,000	—	1,050	
Sodium, filtered	µg/L	29,000	—	1,050	
Sulfate	mg/L	90.0	250[c]	1.05	
Temperature	°C	22.7	—	—	
Turbidity	NTU	2.13	—	—	

Table 2-22. IDF Sampling Summary for Supplemental Permit Constituents for 2020

Constituent	Units	Maximum	Comparison Value[a]	PQL[b]	Wells Above Comparison Value

Notes:

Maximum is based on sample results for IDF permit requirements (January 2020) with concentrations above the PQL. Appendix A presents the full data set for 2020.

Table 5.2 in the groundwater monitoring plan (WA7890008967, *Hanford Facility Resource Conservation and Recovery Act (RCRA) Permit, Dangerous Waste Portion for the Treatment, Storage, and Disposal of Dangerous Waste,* Revision 8c, as amended, Part III, Operating Unit Group 11 (OUG-11), Chapter 5.0, "Groundwater Monitoring") calls for alkalinity, anions, metals, and turbidity to provide supplemental data on general groundwater chemistry. The plan does not list specific metals or anions. This table lists the constituents typically needed to characterize general groundwater chemistry.

a. Comparison values are provided for information only and are not used to determine RCRA groundwater monitoring exceedances.

b. Standardized PQL used in analytical requirements.

c. 40 CFR 143.3, "National Secondary Drinking Water Regulations," "Secondary Maximum Contaminant Levels."

d. 40 CFR 141, Subpart G, "National Primary Drinking Water Regulations," "Maximum Contaminant Levels and Maximum Residual Disinfectant Levels").

e. The federal drinking water standard for nitrate is 10 mg/L expressed as nitrogen (40 CFR 141, Subpart G, "National Primary Drinking Water Regulations," "Maximum Contaminant Levels and Maximum Residual Disinfectant Levels"). This equates to 45 mg/L when expressed as NO_3.

— = no comparison value or PQL
IDF = Integrated Disposal Facility
NTU = nephelometric turbidity unit
PQL = practical quantitation limit
RCRA = *Resource Conservation and Recovery Act of 1976*

Table 2-23. IDF Sampling Summary for Revised Monitoring Plan for 2020

Constituent	Units	Maximum	Comparison Value[a]	PQL[b]	Wells Above Comparison Value
Barium, unfiltered	µg/L	91.4	2,000[c]	5.25	
Barium, filtered	µg/L	90.6	2,000[c]	5.25	
Chromium, unfiltered	µg/L	130	100[c]	10.5	299-E24-18
Chromium, filtered	µg/L	13.6	100[c]	10.5	
Cyanide (total)	µg/L	25.5	—	15.75	
Dissolved oxygen	mg/L	9.31	—	—	
Iron, unfiltered	µg/L	600	300[d]	105	299-E24-18
Iron, filtered	µg/L	120	300[d]	105	
Manganese, unfiltered	µg/L	12.0	50[d]	10.5	
Molybdenum, unfiltered	µg/L	9.9	—	5.25	
Molybdenum, filtered	µg/L	9.9	—	5.25	
Nickel, unfiltered	µg/L	62.0	—	21	
pH measurement	unitless	8.23	6.5 – 8.5[d]	—	
Specific conductance	µS/cm	668	—	—	

Table 2-23. IDF Sampling Summary for Revised Monitoring Plan for 2020

Constituent	Units	Maximum	Comparison Value[a]	PQL[b]	Wells Above Comparison Value
Temperature	°C	22.4	—	—	
Turbidity	NTU	4.56	—	—	
Zinc, unfiltered	µg/L	37.9	5,000[d]	21	
Zinc, filtered	µg/L	24.0	5,000[d]	21	

Note: Maximum is based on sample results for IDF revised monitoring plan requirements (2020) with concentrations above the PQL. Appendix A presents the full data set for 2020.

a. Comparison values are provided for information only and are not used to determine RCRA groundwater monitoring exceedances.

b. Standardized PQL used in analytical requirements.

c. 40 CFR 141, Subpart G, "National Primary Drinking Water Regulations," "Maximum Contaminant Levels and Maximum Residual Disinfectant Levels").

d. 40 CFR 143.3, "National Secondary Drinking Water Regulations," "Secondary Maximum Contaminant Levels."

— = no comparison value or PQL
IDF = Integrated Disposal Facility
NTU = nephelometric turbidity unit
PQL = practical quantitation limit
RCRA = *Resource Conservation and Recovery Act of 1976*

2.8 Liquid Effluent Retention Facility

Located at the eastern boundary of the 200 East Area, the LERF consists of three lined surface impoundment basins (Figures 1-1 and 2-8). The LERF construction was completed in 1991 using a dual-confinement barrier concept (i.e., dual basin liners and pipe-in-a-pipe transfer piping system) to minimize human exposure and the potential for accidental releases to the environment. A leachate detection, collection, and removal system and the basin covers also reduce possible environmental or personnel exposure. The basins are located side by side, with 18 m (60 ft) of separation between each basin. Each basin (cell) is 100 m by 82 m (330 ft by 270 ft), with a maximum fluid depth of 6.7 m (22 ft).

The LERF provides aqueous waste storage and treatment prior to final treatment at the 200 Area ETF. Treatment at the LERF consists of flow and pH equalization. Flow equalization allows for several smaller waste streams that are intermittently received at the LERF basins to accumulate for continuous higher volume campaign processing at the ETF. The LERF continues to receive liquid waste from a number of onsite facilities, with the largest volume from the 242A evaporator.

Groundwater at the LERF is monitored under a final status detection monitoring program under the Hanford RCRA Permit (WA7890008967, Part III, OUG-3, Addendum D, "Groundwater Monitoring Plan" [modification date of January 23, 2018]).

The uppermost aquifer suprabasalt sediments beneath the LERF range from not present to >8 m (26 ft) in thickness. The sediments beneath and north of the LERF are interpreted as Hanford formation gravels, but the groundwater gradient and hydraulic conductivity indicate that the sediments are characteristic of the Ringold Formation. South of the LERF, the hydraulic conductivity increases substantially, which is more characteristic of Hanford formation and Cold Creek unit gravels. Weathered and fractured Elephant Mountain basalt underlies the suprabasalt sediments. Basalt observations and geophysical investigations indicate that the upper 2 to 3 m (6 to 9 ft) of the fractured basalt is part of the unconfined aquifer in much

of the area beneath the LERF (Figures D-6 and D-11 in the LERF groundwater monitoring plan in the Hanford RCRA Permit [WA7890008967, Part III, OUG-3, Addendum D]).

The current LERF monitoring network (Table 2-24) was evaluated in SGW-41072, *Liquid Effluent Retention Facility Engineering Evaluation and Characterization Report*, and is compliant with WAC 173-303-806, "Dangerous Waste Regulations," "Final Facility Permits." Four of the five well screens extend to the underlying basalt or within the basalt fracture zone. Well 299-E26-14 extends to within 0.9 m (3 ft) of the underlying basalt surface. Well 299-E26-10 was predicted to have <0.9 m (3 ft) of water by 2021 (SGW-63743), and the well had 0.9 m (3 ft) of water in the screened interval in August 2020. The well is monitored for water levels only, so the small water column is sufficient for its continued use. The other wells are expected to have sufficient water for continued sampling through at least 2030.

LERF downgradient well 299-E26-81 was installed in 2020 in anticipation of a future modification to the monitoring network. The water table at this location is at the top of basalt, and the well is screened in the top of the weathered, permeable basalt.

In 2020, the magnitude of the hydraulic gradient beneath the LERF was calculated at 2.9×10^{-4} m/m (Table 1-2). The flow direction was generally south, and the estimated average linear velocity was 0.0044 m/d (0.014 ft/d).

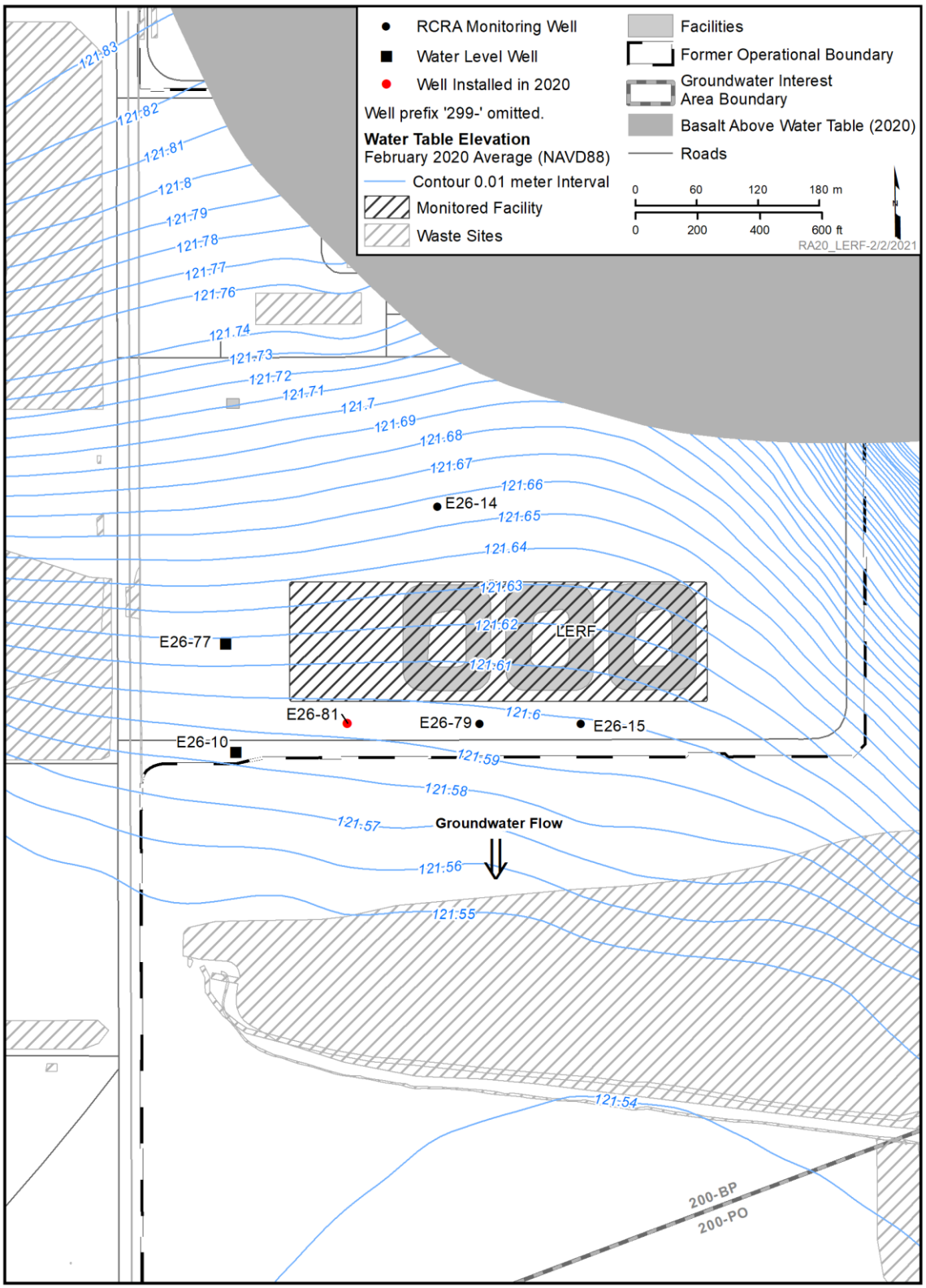
In 2020, the LERF monitoring well network was sampled quarterly to complete a 2-year baseline for regional plume characteristics, groundwater quality, and field parameters. Additionally, indicator waste constituents (specific synthetic compounds and Cr(VI) (Table 2-25) were also sampled and analyzed. The baseline sampling requirement was met following the August 2020 sampling event.

Of the three sampling events at the LERF in 2020, the wells used for water-level measurements only (299-E26-10 and 299-E26-77) were visited only twice. Water-level measurements were not collected in June due to work restrictions associated with the COVID-19 pandemic.

In 2020, the indicator waste constituents 1-butanol, carbon tetrachloride, and n-nitrosodimethylamine were not detected, and Cr(VI) was below the PQL (Table 2-25). Table 2-26 summarizes the monitoring results for other constituents for 2020.

Nitrate was detected above the primary DWS of 45 mg/L in all wells in the LERF groundwater monitoring network, and sulfate was measured above the secondary DWS of 250 mg/L in downgradient well 299-E26-15. The LERF overlies regional nitrate and sulfate plumes in the 200 East Area (Appendix G of SGW-41072).

Iron was detected above the secondary DWS in an unfiltered sample from well 299-E26-15 during the August 2020 sampling event. However, other corrosion products (chromium and nickel) were not detected, and the ratios of metals (Section 1.5) do not indicate stainless-steel corrosion.



Reference: ECF-HANFORD-20-0078, *Preparation of the Hanford Site Water Table Map for January to March 2020*.

Figure 2-8. Liquid Effluent Retention Facility

Table 2-24. LERF Groundwater Monitoring Network

Well Name	Purpose	Year Installed	Head Date	Hydraulic Head		Elevation Screen Top		Elevation Screen Bottom		Water Column		Sample Frequency	Comments
				m	ft	m	ft	m	ft	m	ft		
299-E26-10[a]	Water level	1990	8/3/2020	121.56	398.82	125.4	411.6	120.7	396.0	0.9	2.8	—	Used for quarterly water levels only
299-E26-14	BG	2011	8/3/2020	121.66	399.15	122.8	402.8	116.7	382.8	5.0	16.3	Q/S	
299-E26-15	POC	2015	8/3/2020	121.57	398.84	124.2	407.4	119.5	392.0	2.1	6.8	Q/S	
299-E26-77	Water level	2008	8/3/2020	121.65	399.11	122.8	402.8	115.2	378.1	6.4	21.0	—	Used for quarterly water levels only
299-E26-79	POC	2008	8/3/2020	121.59	398.91	122.9	403.1	115.2	378.1	6.3	20.8	Q/S	
299-E26-81	Future monitoring	2020	11/11/2020	121.84[b]	399.74[b]	122.4	401.6	119.4	391.6	2.5	8.1	—	Not yet in network

Note: Requirements are from Table D-7 in the Hanford RCRA Permit (WA7890008967, *Hanford Facility Resource Conservation and Recovery Act (RCRA) Permit, Dangerous Waste Portion for the Treatment, Storage, and Disposal of Dangerous Waste*, Revision 8c [modification date of January 23, 2018], Part III, Operating Unit Group 3 (OUG-3), Addendum D, "Groundwater Monitoring Plan").

a. Well is predicted to have <0.9 m (3 ft) water in the screened interval by 2021, which may limit sampling in the future if the water table continues to decline. However, this well is used only for water-level measurements.

b. Water-level measured during drilling; considered approximate. Hydraulic head in this well has not been corrected for borehole deviation from vertical.

— = no RCRA sampling required

BG = background

POC = point of compliance

Q/S = quarterly for first 2 years beginning January 2018; semiannual thereafter

RCRA = *Resource Conservation and Recovery Act of 1976*

Table 2-25. LERF Sampling Summary for Waste Constituents for 2020

Well Name	Sample Date	1-Butanol (µg/L)	Carbon Tetrachloride (µg/L)	Hexavalent Chromium (µg/L)	n-Nitrosodi-methylamine (µg/L)
299-E26-14	1/9/2020	40 U	0.38 U	1.71 BXH	3.0 U
	6/10/2020	40 U	0.38 U	1.3 U	2.8 U
	8/3/2020	40 U	0.38 U	1.3 UXH	2.94 U
299-E26-15	1/9/2020	40 U	0.38 U	1.6 BXH	3.0 U
	6/10/2020	40 U	0.38 U	1.3 UXH	2.9 U
	8/3/2020	40 U	0.38 U	1.3 UXH	2.91 U
299-E26-79	1/9/2020	40 U	0.38 U	1.76 BXH	3.05 U
	6/10/2020	40 U	0.38 U	1.3 U	2.9 U
		40 U	0.38 U	1.3 U	2.81 U
	8/3/2020	40 U	0.38 U	1.3 UXH	2.94 U

B = result is below the quantitation limit
U = result is below the detection limit
H = recommended holding time exceeded (review qualifier)
X = recommended holding time exceeded (laboratory qualifier)

Table 2-26. LERF Sampling Summary for Other Constituents for 2020

Constituent	Units	Maximum	Comparison Value[a]	PQL[b]	Wells Above Comparison Value; Comments
Alkalinity	mg/L	100	—	5.25	
Calcium, unfiltered)	µg/L	122,000	—	1,050	
Calcium, filtered)	µg/L	123,000	—	1,050	
Chromium, unfiltered	µg/L	15.4	100[c]	10.5	
Chromium, filtered	µg/L	4.21	100[c]	10.5	
Dissolved oxygen	mg/L	9.2	—	—	Outlier excluded
Iron, unfiltered	µg/L	340	300[d]	105	299-E26-15
Magnesium, unfiltered	µg/L	37,200	—	1,050	
Magnesium, filtered	µg/L	36,100	—	1,050	
Nitrate	mg/L	115	45[e]	0.525	299-E26-14, 299-E26-15, 299-E26-79
Oxidation-reduction potential	mV	N/A	—	—	Data rejected[f]
pH measurement	unitless	8.02	6.5 – 8.5[d]	—	
Potassium, unfiltered	µg/L	13,000	—	5,250	
Potassium, filtered	µg/L	13,000	—	5,250	

Table 2-26. LERF Sampling Summary for Other Constituents for 2020

Constituent	Units	Maximum	Comparison Value[a]	PQL[b]	Wells Above Comparison Value; Comments
Sodium, unfiltered	µg/L	48,200	—	1,050	
Sodium, filtered	µg/L	47,100	—	1,050	
Sulfate	mg/L	334	250[d]	1.05	299-E26-15
Temperature	°C	20.4	—	—	
Turbidity	NTU	4.86	—	—	

Note: Maximum is based on the required sample results for this RCRA unit with concentrations above the PQL. Constituents required annually were collected in January 2020. Appendix A presents the full data set for 2020.

a. Comparison values are provided for information only and are not used to determine RCRA groundwater monitoring exceedances.

b. Standardized PQL used in analytical requirements.

c. 40 CFR 141, Subpart G, "National Primary Drinking Water Regulations," "Maximum Contaminant Levels and Maximum Residual Disinfectant Levels."

d. 40 CFR 143.3, "National Secondary Drinking Water Regulations," "Secondary Maximum Contaminant Levels."

e. The federal drinking water standard for nitrate is 10 mg/L expressed as nitrogen (40 CFR 141, Subpart G). This equates to 45 mg/L as NO_3.

f. Data review concluded that the oxidation-reduction potential readings are not reliable. Review qualifiers indicate data should be rejected.

— = no comparison value or PQL
PQL = practical quantitation limit
NTU = nephelometric turbidity units
RCRA = *Resource Conservation and Recovery Act of 1976*

2.9 Low-Level Burial Grounds Waste Management Area 1

LLBG WMA-1 is located in the northwest corner of the 200 East Area and comprises the 218-E-10 Burial Ground, with 14 soil covered unlined trenches (Figures 1-1 and 2-9). LLBG WMA-1 received low-level radiological waste from 1955 to 2000 and low-level mixed waste between 1987 and 1993. Portions of Trench 9 that received dangerous chemicals are referred to as "Green Islands," and are regulated under RCRA and its implementing requirements in 40 CFR 265, Subpart F.

The LLBG WMA-1 monitoring network is designed to detect indicators of dangerous waste or dangerous waste constituents affecting groundwater from the 218-E-10 Burial Ground. The LLBG WMA-1 monitoring network encompasses the 218-E-10 Burial Ground boundary to provide coverage for potential groundwater flow direction changes.

DOE monitors groundwater under an interim status indicator evaluation program as described in DOE/RL-2009-75, *Interim Status Groundwater Monitoring Plan for the LLBG WMA-1*. An interim change notice, RCRA-CN-01_DOE/RL-2009-75_R1, *Interim Status Change Number 1: Interim Status Groundwater Monitoring Plan for the LLBG WMA-1*, was in effect for the July 2020 sampling event. Changes to the groundwater monitoring plan included adding certain metals to monitor for corrosion, clarifying required constituents under the phenols monitoring requirement, and removing wells 299-E28-26 and 299-E28-28. The change notice did not affect the sampling frequency.

At the end of 2020, the monitoring network included two upgradient wells and three downgradient wells (Figure 2-9; Table 2-27). The monitoring well screens extend across most of the unconfined aquifer, which is contained within the Cold Creek unit gravels. All of the wells are expected to have sufficient water for continued sampling through at least 2030 (SGW-63743). Section 7.4 in SGW-60590, *Engineering Evaluation Report for Low-Level Burial Grounds Waste Management Area-1 Green Islands Groundwater Monitoring*, recommended a modified network for monitoring the LLBG WMA-1 Green Islands under final status, including five of the current wells and three proposed new wells. Particle tracking analysis (SGW-60590) indicated that two wells (299-E28-26 and 299-E28-28) were cross-gradient and were subsequently removed from the network during the July 2020 sampling activity.

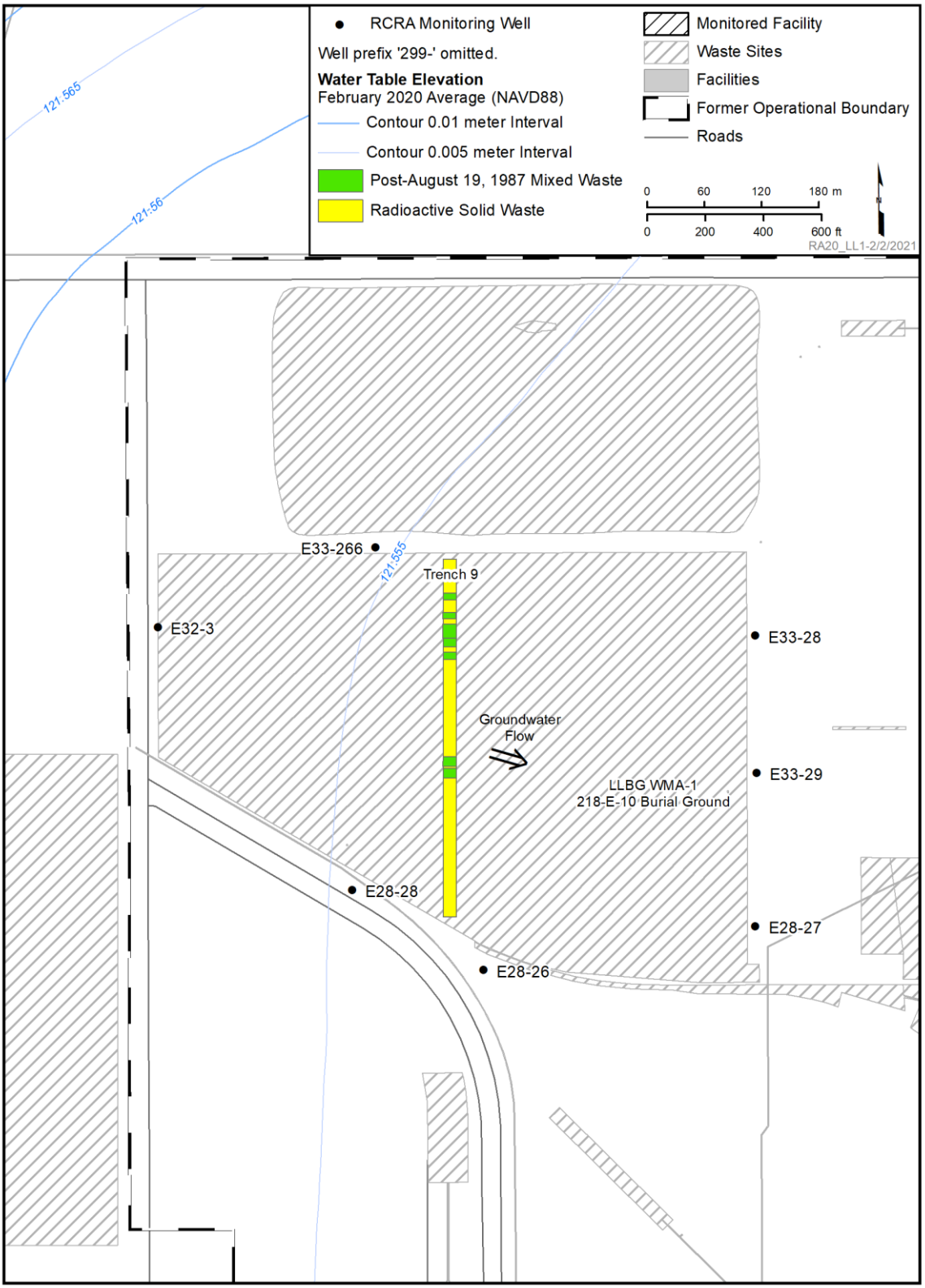
The average hydraulic gradient beneath LLBG WMA-1 was 8.8×10^{-6} m/m, sloping to the east-southeast (Table 1-2). The associated average linear velocity was 0.58 m/d (1.9 ft/d).

In 2020, LLBG WMA-1 monitoring wells were sampled semiannually for indicator parameters as scheduled (Table 2-28). There were no exceedances of the critical mean values for pH, TOC, and TOX during 2020. Specific conductance was initially reported above the critical mean value in well 299-E28-26 during the January 2020 sampling, but the exceedance was not confirmed by verification sampling. LLBG WMA-1 remains in indicator evaluation monitoring.

Groundwater quality parameters monitored for the site include chloride, iron, manganese, phenols, sodium, and sulfate (Table 2-29). Although not required by 40 CFR 265, Subpart F, site-specific constituents (alkalinity, fluoride, nitrate, nitrite, calcium, magnesium, chromium, and potassium) were also analyzed. Samples for analyses of cations and, anions are collected to support cation-anion balance calculations. Samples for iron, manganese, chromium, molybdenum, and nickel are collected to assess the potential for well corrosion.

Molybdenum was added by RCRA-CN-01_DOE/RL-2009-75_R1 to assess the potential for corrosion. However, due to a scheduling error, the samples from the July sampling event were not analyzed for this constituent, except at well 299-E33-266. Analysis for molybdenum is scheduled for 2021, which will be used for corrosion analysis for wells constructed with the 316 stainless-steel alloy.

Nitrate concentrations were above the 45 mg/L primary DWS in two wells (299-E28-26 and 299-E33-28). Elevated nitrate levels have been previously documented in LLBG WMA-1 wells and are attributed to a regional nitrate plume (SGW-60590).



Reference: ECF-HANFORD-20-0078, *Preparation of the Hanford Site Water Table Map for January to March 2020*.

Figure 2-9. Low-Level Burial Grounds Waste Management Area 1

Table 2-27. LLBG WMA-1 Groundwater Monitoring Network

Well Name	Location	Year Installed	Hydraulic Head Date	Hydraulic Head		Elevation Screen Top		Elevation Screen Bottom		Water Column		Sample Frequency	Comments
				m	ft	m	ft	m	ft	m	ft		
299-E28-26[a]	DG	1987	7/29/2020	121.56	398.80	124.9	409.6	118.8	389.6	2.8	9.2	S/0	Removed from network
299-E28-27[b]	DG	1987	7/29/2020	121.56	398.82	125.6	411.9	119.5	391.9	2.1	6.9	S	
299-E28-28[a]	DG	1990	7/29/2020	121.52	398.70	125.6	412.1	119.5	392.1	2.0	6.6	S/0	Removed from network
299-E32-3	UG	1987	7/29/2020	121.52	398.69	125.8	412.7	119.7	392.7	1.8	6.0	S	
299-E33-266	UG	2010	7/29/2020	121.40	398.28	123.4	404.8	117.3	384.8	4.1	13.5	S	
299-E33-28[b]	DG	1987	7/29/2020	121.54	398.74	125.1	410.5	119.0	390.5	2.5	8.2	S	
299-E33-29	DG	1987	7/29/2020	121.49	398.58	125.7	412.2	119.6	392.2	1.9	6.3	S	

Note: Requirements are from Table 3-1 in DOE/RL-2009-75, *Interim Status Groundwater Monitoring Plan for the LLBG WMA-1*, as modified by RCRA-CN-01_DOE/RL-2009-75_R1, 2020, *Interim Status Change Number 1: Interim Status Groundwater Monitoring Plan for the LLBG WMA-1* (effective date June 8, 2020, and implemented beginning in July 2020).

a. Particle tracking analysis determined that due to remedial actions, this well was cross-gradient and subsequently removed from the network.

b. Hydraulic head data for these wells were corrected for borehole deviation from vertical. Corrections are not available for other wells in this network, which may cause reported head to be less than actual head.

c. Listed as "Proposed Well" in Table 3-1 of DOE/RL-2009-75.

— = no information (well not installed)

DG = downgradient

S = semiannual

S/0 = semiannual but removed from network by RCRA-CN-01_DOE/RL-2009-75_R1

UG = upgradient

Table 2-28. LLBG WMA-1 Sampling Summary for Contamination Indicator Parameters for 2020

Indicator Parameter		pH		Specific Conductance (µS/cm)		Total Organic Carbon (µg/L)		Total Organic Halides (µg/L)		
1st Quarter Critical Mean*		**7.41**	**8.52**	**517**		**1,040**		**12.0**		
2nd Quarter Critical Mean*		**7.43**	**8.50**	**513**		**1,020**		**11.6**		
Well	**Sample Date**	**Average**	**SD**	**Average**	**SD**	**Average**	**SD**	**Average**	**SD**	**Comments**
299-E28-26	1/9/2020	7.79	0.00	1,360	2	330 U	0	5.5 B	2.2	
	2/28/2020	8.01	0.00	495	16	N/A	N/A	N/A	N/A	Verification sampling; January specific conductance exceedance not confirmed. Well removed from network before July sampling event.
299-E28-27	1/9/2020	8.16	0.00	432	1	330 U	0	3.3 U	0.0	
	7/29/2020	8.01	0.00	434	1	330 U	0	6.5	3.3	
299-E28-28	1/9/2020	8.25	0.01	447	2	330 U	0	3.3 U	0.0	Well removed from network before July sampling event.
299-E32-3	1/9/2020	8.07	0.00	427	0	345 U	0	3.3 U	0.0	
	7/29/2020	7.95	0.00	440	0	330 U	0	3.5 B	0.3	
299-E33-266	1/9/2020	7.97	0.01	419	0	330 U	0	3.3 U	0.0	
	7/29/2020	7.98	0.00	407	0	520 B	55	3.7 B	0.6	
299-E33-28	1/9/2020	8.12	0.00	488	0	330 U	0	3.3 U	0.0	
	7/29/2020	8.00	0.00	473	0	330 U	0	3.3 U	0.0	
299-E33-29	1/9/2020	8.18	0.00	413	0	330 U	0	3.3 U	0.0	
	7/29/2020	8.05	0.00	412	0	331 B	1	3.3 U	0.0	

Table 2-28. LLBG WMA-1 Sampling Summary for Contamination Indicator Parameters for 2020

Indicator Parameter		pH		Specific Conductance (µS/cm)		Total Organic Carbon (µg/L)		Total Organic Halides (µg/L)		
1st Quarter Critical Mean*		7.41	8.52	517		1,040		12.0		
2nd Quarter Critical Mean*		7.43	8.50	513		1,020		11.6		
Well	Sample Date	Average	SD	Average	SD	Average	SD	Average	SD	Comments

Note: Yellow highlighting indicates critical mean exceedance.

*Critical mean values are from ECF-HANFORD-20-0007, *Calculation of Critical Means for Calendar Year 2020 RCRA Groundwater Monitoring* (Table 18 for quarter 1 and Table 19 for quarter 3 after the network was revised).

B = all values were below the quantitation limit

N/A = not applicable

SD = standard deviation of replicates

U = all values were below the detection limit

Table 2-29. LLBG WMA-1 Sampling Summary for Water Quality Parameters and Other Constituents for 2020

Constituent	Units	Maximum	Comparison Value[a]	PQL[b]	Wells Above Comparison Value; Comments
Calcium, unfiltered	µg/L	50,600	—	1,050	
Calcium, filtered	µg/L	52,200	—	1,050	
Chloride	mg/L	14.5	250[c]	0.4	
Chromium, unfiltered)	µg/L	86.1	100[d]	10.5	
Chromium, filtered)	µg/L	18.3	100[d]	10.5	
Dissolved oxygen	mg/L	10.5	—	—	
Iron, unfiltered	µg/L	250	300[c]	105	
Iron, filtered	µg/L	70.0	300[c]	105	
Magnesium, unfiltered	µg/L	16,600	—	1,050	
Magnesium, filtered	µg/L	15,700	—	1,050	
Molybdenum, unfiltered	µg/L	6.3	—	5.25	Analyzed only in 299-E33-266
Molybdenum, filtered	µg/L	6.2	—	5.25	
Nickel, unfiltered	µg/L	41.0	—	21	
Nitrate	mg/L	51.8	45[e]	0.525	299-E28-26, 299-E33-28
Potassium, unfiltered	µg/L	6,900	—	5,250	
Potassium, filtered	µg/L	6,800	—	5,250	
Sodium, unfiltered	µg/L	27,000	—	1,050	
Sodium, filtered	µg/L	27,000	—	1,050	
Sulfate	mg/L	61.2	250[c]	1.05	
Temperature	°C	21.4	—	—	
Turbidity	NTU	3.33	—	—	

Note: Maximum is based on sample results collected specifically for this RCRA unit with concentrations above the PQL. Appendix A presents the full data set for 2020.

a. Comparison values are provided for information only and are not used to determine RCRA groundwater monitoring exceedances.

b. Standardized PQL used in analytical requirements.

c. 40 CFR 143.3, "National Secondary Drinking Water Regulations," "Secondary Maximum Contaminant Levels."

d. 40 CFR 141, Subpart G, "National Primary Drinking Water Regulations," "Maximum Contaminant Levels and Maximum Residual Disinfectant Levels."

e. The federal drinking water standard for nitrate is 10 mg/L, expressed as nitrogen (40 CFR 141, Subpart G). This equate to 45 mg/L when expressed as NO_3.

— = no comparison value or PQL

NTU = nephelometric turbidity unit

PQL = practical quantitation limit

RCRA = *Resource Conservation and Recovery Act of 1976*

2.10 Low-Level Burial Grounds Waste Management Area 2

LLBG WMA-2 is located in the northeast corner of the 200 East Area and includes the 218-E-12B Burial Ground and Trench 94 (Figures 1-1 and 2-10). While LLBG WMA-2 received solid, low-level, radiological and transuranic waste from 1967 to 2004, it did not receive dangerous waste constituents. However, because Trench 94 continues to receive defueled U.S. Navy reactor compartments that use lead as a shielding material, Ecology considers the lead subject to regulation as a state-only dangerous waste (18-NWP-062, "Request for Removal of 218-E-12B Trench 94 from the Hanford Facility Resource Conservation and Recovery Act/Dangerous Waste Permit Application Part A Form for the Low-Level Burial Grounds Operating Unit Group, letter 16-AMRP-0032, dated November 20, 2015").

LLBG WMA-2 is monitored under an interim status indicator evaluation program (DOE/RL-2009-76, Rev. 0, *Interim Status Groundwater Monitoring Plan for the LLBG WMA-2*). An interim change notice, RCRA-CN-01_DOE/RL-2009-76_R0, *Interim Status Change Number 1: Interim Status Groundwater Monitoring Plan for the LLBG WMA-2*, was in effect for the November sampling event at LLBG WMA-2. Changes to the groundwater monitoring plan included adding molybdenum and nickel to monitor for corrosion and clarifying required constituents under the phenols monitoring requirement. The change notice did not affect the monitoring network or sampling frequency.

The monitoring network includes one cross-gradient well and eight downgradient wells (Figure 2-10; Table 2-30). The network is constrained by the presence of basalt above the water table in the northern portion of the unit (Figure 2-10). There is no unconfined aquifer in this region, so there is no upgradient well. On the southern edge of the LLBG WMA-2, monitoring well screens extend across most or all of the thin unconfined aquifer, which is contained in the gravel-dominated unit of the Hanford formation. In 2020, data from well 299-E27-10 were used to calculate critical mean values.

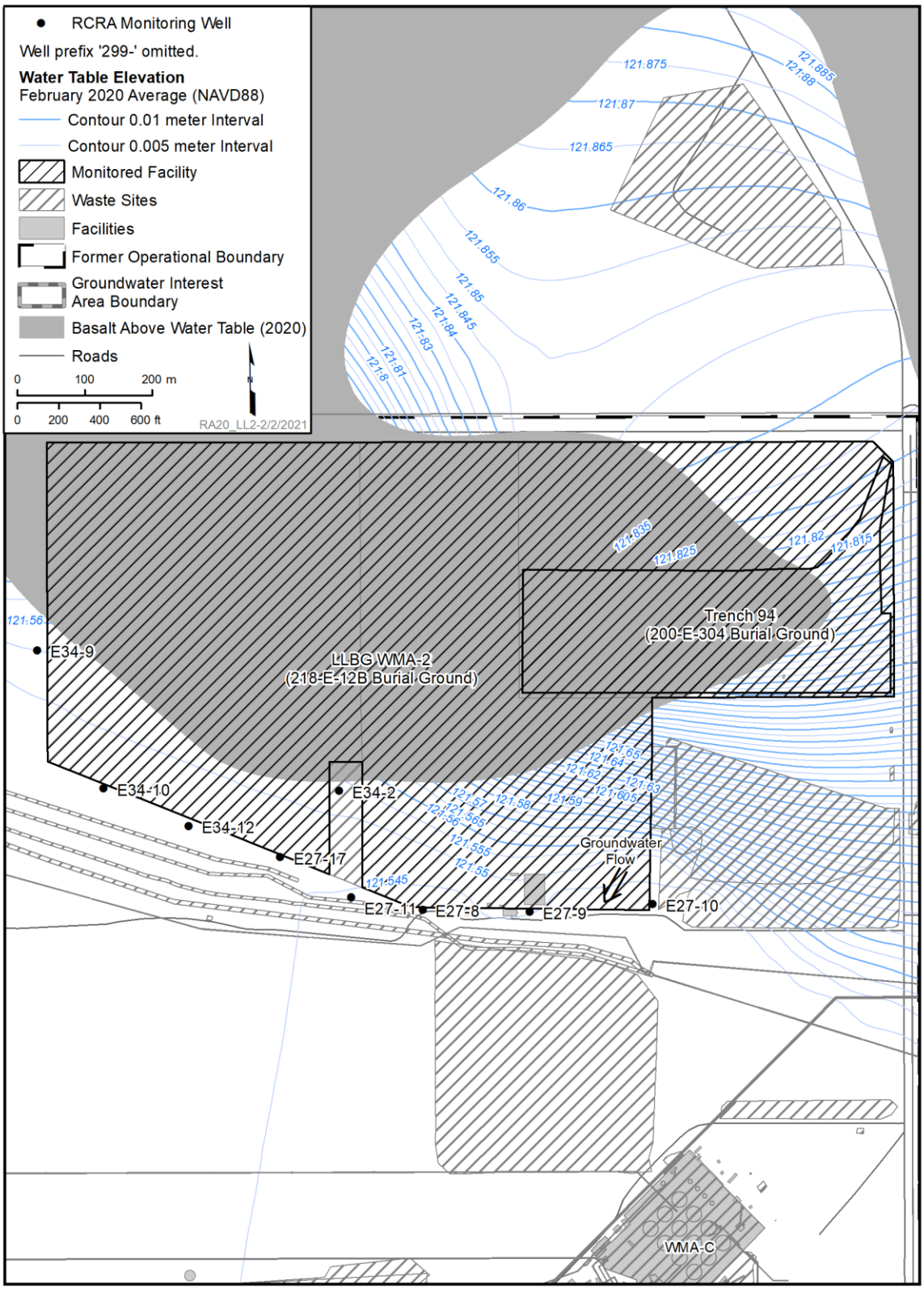
A revision to the interim status monitoring plan has been developed and will be implemented in 2021 (DOE/RL-2009-76, Rev. 1). The wells in the revised plan have sufficient water for continued sampling through at least 2030 (SGW-63743). Well 299-E34-9, which is not in the revision, is predicted to be sample dry by 2021.

The hydraulic gradient dipped to the south-southwest in 2020, with an average magnitude of 2.5×10^{-4} m/m. The average linear velocity was 15 m/d (49 ft/d) (Table 1-2). Groundwater extraction well 299-E33-361 was brought online for the 200-BP-5 OU in April 2019 and has likely changed flow directions beneath portions of LLBG WMA-2. Assessments of changes to localized groundwater flow are ongoing and will continue into 2021.

The LLBG WMA-2 groundwater wells were sampled twice in 2020 for RCRA indicator parameters (Table 2-31). There were no exceedances of the critical mean values for these parameters in 2020; consequently, LLBG WMA-2 remains in indicator evaluation monitoring.

Groundwater quality parameters monitored for the site include chloride, iron, manganese, phenols, sodium, and sulfate (Table 2-32). Although not required by 40 CFR 265, Subpart F, cations and anions were also analyzed to support charge balance calculations. Samples for iron, manganese, chromium, molybdenum, and nickel are collected to assess the potential for well corrosion. Iron, nitrate, and sulfate concentrations were above DWSs but did not originate from the 218-E-12B Burial Ground, as explained below:

- Iron concentrations were above the 300 µg/L secondary DWS in two unfiltered samples (wells 299-E27-9 and 299-E27-11) but were below the Hanford Site background value of 570 µg/L (DOE/RL-96-61). Other metals associated with stainless-steel corrosion (chromium and nickel) are also monitored at these wells. The ratios of corrosion products in LLBG WMA-2 monitoring wells currently are not similar to those of stainless-steel alloys used in Hanford Site wells (Section 1.5).
- Nitrate concentrations were above the 45 mg/L DWS in five wells due to regional nitrate plumes. Nitrate concentrations in the western part of LLBG WMA-2 are associated with groundwater migration of B Complex waste. Section 9.2.3 of DOE/RL-2019-66, *Hanford Site Groundwater Monitoring Report for 2019*, cites the 216-B-2 Ditches and leaks from the 216-A-25 pipeline as potential sources of elevated nitrate levels near the southeastern corner of LLBG WMA-2.
- Sulfate concentrations were above the secondary DWS (250 µg/L) in two wells in the LLBG WMA-2 monitoring network (299-E27-10 and 299-E27-9) due to a regional sulfate plume not associated with LLBG WMA-2 waste. Sulfate concentrations in the western part of LLBG WMA-2 are associated with groundwater migration of B Complex waste.



Reference: ECF-HANFORD-20-0078, *Preparation of the Hanford Site Water Table Map for January to March 2020*.

Figure 2-10. Low-Level Burial Grounds Waste Management Area 2

Table 2-30. LLBG WMA-2 Groundwater Monitoring Network

Well Name	Location	Year Installed	Head Date	Hydraulic Head		Elevation Screen Top		Elevation Screen Bottom		Water Column		Sample Frequency	Comments
				m	ft	m	ft	m	ft	m	ft		
299-E27-10[a]	CG	1987	11/4/2020	121.55	398.77	126.2	413.9	120.0	393.6	1.6	5.2	S	
299-E27-11	DG	1989	11/4/2020	121.49	398.60	126.0	413.5	119.6	392.5	1.9	6.1	S	
299-E27-17[b]	DG	1991	11/4/2020	121.54	398.75	125.5	411.9	119.1	390.9	2.4	7.9	S	
299-E27-8[b]	DG	1987	11/3/2020	121.55	398.78	125.8	412.7	119.7	392.7	1.8	6.1	S	
299-E27-9[b]	DG	1987	11/3/2020	121.57	398.85	125.3	411.1	119.4	391.8	2.2	7.1	S	
299-E34-10[b]	DG	1991	11/4/2020	121.55	398.80	126.5	415.1	120.1	394.0	1.5	4.8	S	
299-E34-12	DG	1992	11/3/2020	121.46	398.47	126.6	415.3	120.3	394.7	1.2	3.8	S	
299-E34-2[b]	DG	1987	11/4/2020	121.54	398.76	125.8	412.7	119.7	392.7	1.9	6.1	S	
299-E34-9[c]	DG	1991	11/4/2020	121.56	398.83	127.0	416.7	120.7	395.9	0.9	2.9	S	

Note: Requirements are from Table 3-1 in DOE/RL-2009-76, *Interim Status Groundwater Monitoring Plan for the LLBG WMA-2*. Planned wells 299-E34-13 through 299-E34-16 were cancelled during negotiations of Tri-Party Agreement Milestone M-24-00 (Ecology et al., 1989b, *Hanford Federal Facility Agreement and Consent Order Action Plan*).

a. Although designated as a cross-gradient well in DOE/RL-2009-76, well 299-E27-10 provided the data used to calculate critical mean values.

b. Hydraulic head data for these wells were corrected for borehole deviation from vertical. Corrections are not available for other wells in this network, which may cause reported head to be less than actual head.

c. Well is predicted to have <0.9 m (3 ft) water in the screened interval by 2021, which may limit sampling in the future if the water table continues to decline. This well will not be included in the upcoming revised monitoring plan.

CG = cross-gradient
DG = downgradient
S = semiannual
UG = upgradient

Table 2-31. LLBG WMA-2 Sampling Summary for Contamination Indicator Parameters for 2020

Indicator Parameter		pH		Specific Conductance (µS/cm)		Total Organic Carbon (µg/L)		Total Organic Halides (µg/L)		
Critical Mean*		7.11	8.47	2,090		2,870		35.5		
Well	Sample Date	Average	SD	Average	SD	Average	SD	Average	SD	Comments
299-E27-10	6/10/2020	7.81	0.01	1,530	4	1,418	31	4.2 B	0.5	
	11/4/2020	7.89	0.02	1,574	1	1,445	5	5.3 B	2.0	
299-E27-11	6/10/2020	8.09	0.00	493	1	330 U	0	3.4 B	0.1	
	11/4/2020	8.14	0.00	504	1	330 U	0	5.0 B	2.0	
299-E27-17	6/10/2020	7.99	0.00	513	0	330 U	0	4.6 B	1.4	
	11/4/2020	7.95	0.01	533	0	330 U	0	4.7 B	2.3	
299-E27-8	6/10/2020	7.98	0.01	497	1	330 U	0	4.7 B	2.3	
	11/3/2020	8.04	0.00	502	1	330 U	0	4.7 B	2.5	
299-E27-9	6/11/2020	7.99	0.01	1,280	4	962 B	11	5.4 B	2.2	
	11/3/2020	7.94	0.01	1,342	3	982	19	11.1	8.5	
299-E34-10	6/11/2020	7.93	0.00	704	0	330 U	0	3.4 B	0.1	
	11/4/2020	7.87	0.00	723	1	330 U	0	3.3 B	0.0	
299-E34-12	6/11/2020	8.02	0.00	473	1	330 U	0	3.3 U	0.0	
	11/3/2020	8.07	0.01	507	0	330 U	0	3.3 U	0.0	
299-E34-2	6/11/2020	7.92	0.01	608	0	330 B	0	6.2	5.0	
	11/4/2020	7.92	0.00	628	0	330 U	0	6.4	3.0	
299-E34-9	6/11/2020	7.87	0.01	951	2	392 B	19	3.3 U	0.0	
	11/4/2020	7.73	0.01	1,166	1	414 B	16	4.1 B	1.0	

Table 2-31. LLBG WMA-2 Sampling Summary for Contamination Indicator Parameters for 2020

Indicator Parameter		pH		Specific Conductance (µS/cm)		Total Organic Carbon (µg/L)		Total Organic Halides (µg/L)		
Critical Mean*		7.11	8.47	2,090		2,870		35.5		
Well	Sample Date	Average	SD	Average	SD	Average	SD	Average	SD	Comments

*Critical mean values from Table 20 in ECF-HANFORD-20-007, *Calculation of Critical Means for Calendar Year 2020 RCRA Groundwater Monitoring*.

B = all values were below the quantitation limit

SD = standard deviation of replicates

U = all values were below the detection limit

Table 2-32. LLBG WMA-2 Sampling Summary for Water Quality Parameters and Other Constituents for 2020

Constituent	Units	Maximum	Comparison Value[a]	PQL[b]	Wells Above Comparison Value
Alkalinity	mg/L	110	—	5.25	
Calcium, unfiltered	µg/L	212,000	—	1,050	
Calcium, filtered	µg/L	216,000	—	1,050	
Chloride	mg/L	150	250[c]	0.4	
Chromium, unfiltered	µg/L	100	100[d]	10.5	
Chromium, filtered	µg/L	21.0	100[d]	10.5	
Dissolved oxygen	mg/L	9.7	—	—	
Fluoride	mg/L	0.67	4.0[d]	0.525	
Iron, unfiltered	µg/L	460	300[c]	105	299-E27-9, 299-E27-11
Magnesium, unfiltered	µg/L	55,100	—	1,050	
Magnesium, filtered	µg/L	55,900	—	1,050	
Manganese, unfiltered	µg/L	11.6	50[c]	10.5	
Molybdenum, unfiltered	µg/L	9.7	—	5.25	
Molybdenum, filtered	µg/L	9.3	—	5.25	
Nickel, unfiltered	µg/L	113	—	21	
Nickel, filtered	µg/L	89.5	—	21	
Nitrate	mg/L	133	45[e]	0.525	299-E27-10, 299-E27-9, 299-E34-10, 299-E34-12, 299-E34-9
Potassium, unfiltered	µg/L	15,000	—	5,250	
Potassium, filtered	µg/L	15,000	—	5,250	
Sodium, unfiltered	µg/L	44,500	—	1,050	
Sodium, filtered	µg/L	44,600	—	1,050	
Sulfate	mg/L	490	250[c]	1.05	299-E27-10, 299-E27-9
Temperature	°C	19	—	—	
Turbidity	NTU	4.1	—	—	

Note: Maximum is based on sample results collected specifically for this RCRA unit with concentrations above the PQL. Appendix A presents the full data set for 2020.

a. Comparison values are provided for information only and are not used to determine RCRA groundwater monitoring exceedances.

b. Standardized PQL used in analytical requirements.

c. 40 CFR 143.3, "National Secondary Drinking Water Regulations," "Secondary Maximum Contaminant Levels."

d. 40 CFR 141, Subpart G, "National Primary Drinking Water Regulations," "Maximum Contaminant Levels and Maximum Residual Disinfectant Levels."

e. The federal drinking water standards for nitrate and nitrite are 10 mg/L and 1 mg/L, expressed as nitrogen (40 CFR 141, Subpart G). These equate to 45 mg/L and 3.3 mg/L when expressed as NO_3 and NO_2.

Table 2-32. LLBG WMA-2 Sampling Summary for Water Quality Parameters and Other Constituents for 2020

Constituent	Units	Maximum	Comparison Value[a]	PQL[b]	Wells Above Comparison Value

— = no comparison value or PQL
NTU = nephelometric turbidity unit
PQL = practical quantitation limit
RCRA = *Resource Conservation and Recovery Act of 1976*

2.11 Low-Level Burial Grounds Waste Management Area 4

LLBG WMA-4 (Figure 2-11) is located in the 200 West Area and includes the 218-W-4B and 218-W-4C Burial Grounds, which collectively contain 28 unlined trenches used to dispose low-level radioactive waste and low-level mixed waste. After August 19, 1987, mixed waste was not disposed to the 218-W-4B Burial Ground, and it was closed in 1990. The 218-W-4C Burial Ground contains post-August 19, 1987, mixed waste in select areas of Trenches NC, 14, and 58; these areas are referred to as "Green Islands" (Figure 2-11). The 281-W-4B Burial Ground was closed in 2004.

RCRA monitoring is conducted under DOE/RL-2009-69, *Interim Status Groundwater Monitoring Plan for the LLBG WMA-4*, as modified by TPA-CN-718, *Tri-Party Agreement Change Notice Form: DOE/RL-2009-69, Interim Status Groundwater Monitoring Plan for the LLBG WMA-4, Revision 2*. An interim change notice (RCRA-CN-01_DOE/RL-2009-69_R2, *Interim Status Change Number 1: Interim Status Groundwater Monitoring Plan for the LLBG WMA-4*) was in effect for the August 2020 sampling. The change notice updated monitoring constituents, the quality assurance project plan, and sampling protocols.

Table 2-33 lists the wells in the current monitoring network. Well 299-W18-21 is located cross-gradient from LLBG WMA-4 (Figure 2-11); however, due to the injection mound west of the WMA, it is the best available upgradient well. Six of the eight wells in the LLBG WMA-4 monitoring network are screened across the uppermost portion of the unconfined aquifer, which includes Ringold unit E. Two additional wells (one upgradient and one downgradient) are deep monitoring wells that are used for information purposes only and are not required to satisfy regulatory requirements. All of the wells in the monitoring network are expected to have sufficient water for continued sampling through at least 2030 (SGW-63743). The water level in upgradient well 299-W18-21 (screened at the top of the aquifer) varies in response to changes in operation of nearby injection wells. The well was sampled with a bailer because it typically does not contain sufficient water to sample with a pump. An engineering evaluation report in support of final status monitoring recommended a modified network that includes several new wells (SGW-60584, *Engineering Evaluation Report for Low-Level Burial Grounds Waste Management Area-4 Green Islands Groundwater Monitoring*).

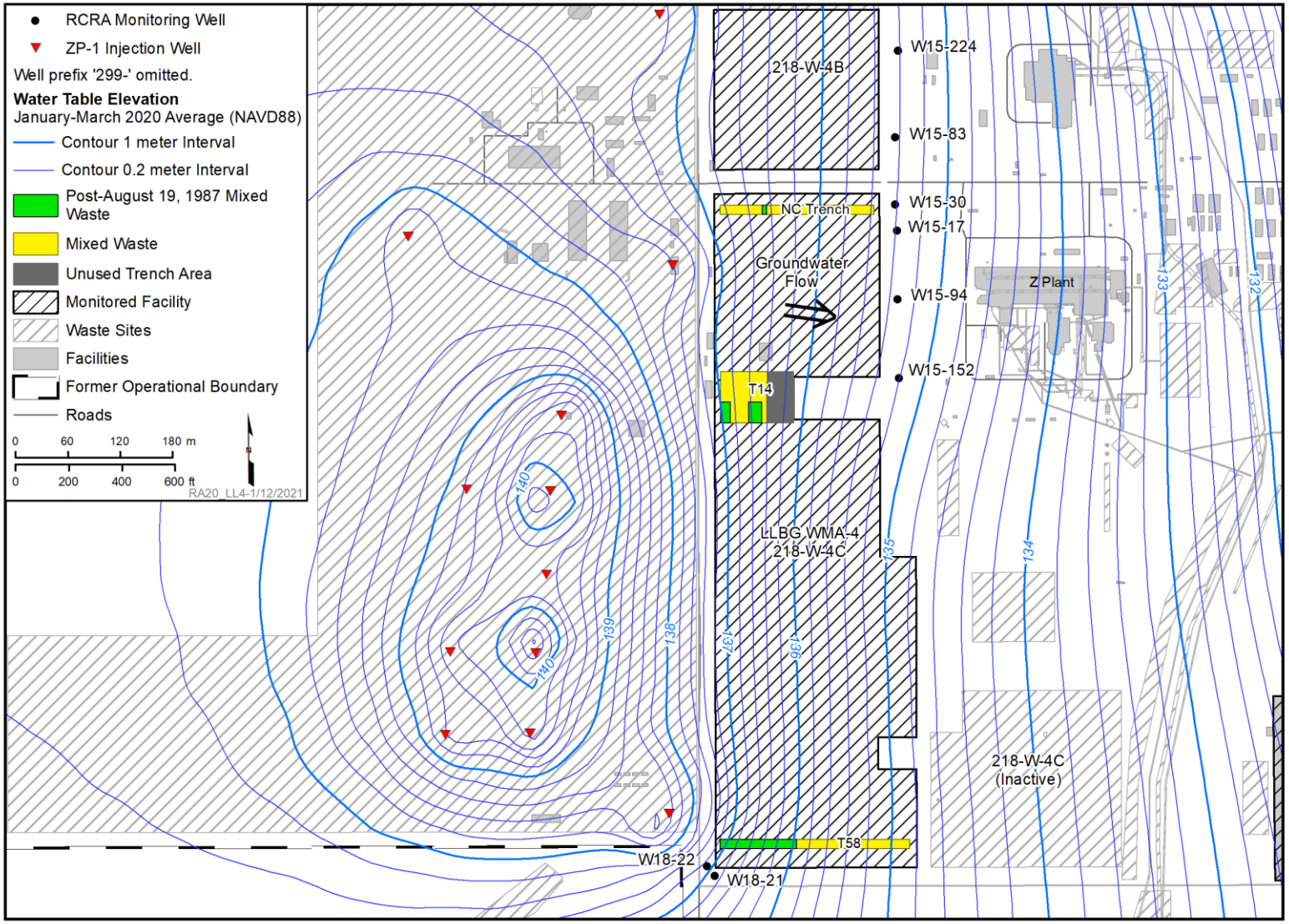
Since 2012, operation of 200 West P&T injection wells upgradient of LLBG WMA-4 (Figure 2-11) created a groundwater mound and steepened the hydraulic gradient. The general direction of groundwater flow is east, the gradient magnitude in 2020 was 9.9×10^{-3} m/m, and the estimated average linear velocity was 0.54 m/d (1.8 ft/d) beneath LLBG WMA-4 (Table 1-2).

The well network was sampled in 2020 for indicator parameters, and critical mean values were not exceeded in downgradient wells (Table 2-34). During the August 2020 sampling event, TOC exceeded the critical mean in two of the four samples collected at upgradient well 299-W18-21. A reanalysis of the two out-of-trend samples returned TOC results well below the critical mean of 731 µg/L. Although the

samples were reanalyzed outside of the 28-day holding time for TOC, the results are in agreement with the two lower quadruplicate sample results from the August 2020 event.

Nitrate concentrations were above the 45 mg/L DWS in six upgradient and downgradient water table wells in 2020 (Table 2-35). The footprint of LLBG WMA-4 is located immediately adjacent to or within the edges of a regional plume (Section 4.4 in SGW-60584).

Concentrations of iron in wells 299-W15-17, 299-W18-21, and 299-W18-22 and concentrations of chromium and manganese in well 299-W18-21 were above their secondary DWSs in unfiltered samples. Corrosion is not suspected because measured concentrations of stainless-steel constituents do not match ratios of common stainless-steel alloys used in Hanford Site wells (Section 1.5), and concentrations do not demonstrate a continuous upward trend.



Reference: ECF-HANFORD-20-0078, *Preparation of the Hanford Site Water Table Map for January to March 2020*.

Figure 2-11. Low-Level Burial Grounds Waste Management Area 4

Table 2-33. LLBG WMA-4 Groundwater Monitoring Network

Well Name	Location	Year Installed	Head Date	Hydraulic Head		Elevation Screen Top		Elevation Screen Bottom		Water Column		Sample Frequency	Comments
				m	ft	m	ft	m	ft	m	ft		
299-W15-152	DG	2005	8/7/2020	134.89	442.55	137.5	451.0	126.8	416.0	8.1	26.5	S	
299-W15-17	DG deep	1987	8/7/2020	135.52	444.62	80.5	264.0	77.4	254.0	58.1	190.7	S	Deep well
299-W15-224	DG	2006	8/6/2020	135.53	444.65	136.5	447.9	125.9	412.9	9.7	31.7	S	
299-W15-30	DG	1995	8/7/2020	135.62	444.93	142.8	468.5	130.6	428.6	5.0	16.3	S	
299-W15-83	DG	2005	8/7/2020	135.49	444.52	137.3	450.5	126.7	415.5	8.8	29.0	S	
299-W15-94	DG	2005	8/7/2020	135.40	444.24	137.4	450.9	126.8	415.9	8.6	28.3	S	
299-W18-21	UG*	1987	8/5/2020	137.30	450.45	144.7	474.6	135.5	444.6	1.8	5.8	S	Sampled with a bailer
299-W18-22	UG deep	1987	8/5/2020	136.54	447.97	77.3	253.6	67.9	222.6	68.7	225.4	S	Deep well

Note: Requirements are from Table 3-1 in DOE/RL-2009-69, *Interim Status Groundwater Monitoring Plan for the LLBG WMA-4*; as modified by TPA-CN-718, *Tri-Party Agreement Change Notice Form: DOE/RL-2009-69, Interim Status Groundwater Monitoring Plan for the LLBG WMA-4, Revision 2* (dated May 12, 2016); and RCRA-CN-01_DOE/RL-2009-69_R2, *Interim Status Change Number 1: Interim Status Groundwater Monitoring Plan for the LLBG WMA-4* (effective date June 8, 2020).

*Well 299-W18-21 is not directly upgradient of Low-Level Burial Ground Waste Management Area 4, but due to the locations of injection wells, it is the best available upgradient well.

DG = downgradient

S = semiannual

UG = upgradient

Table 2-34. LLBG WMA-4 Sampling Summary for Contamination Indicator Parameters for 2020

Indicator Parameter		pH		Specific Conductance (µS/cm)		Total Organic Carbon (µg/L)		Total Organic Halides (µg/L)		
Critical Mean[a]		7.26	8.95	797		1,000[b]		38.8		
Well	Sample Date	Average	SD	Average	SD	Average	SD	Average	SD	Comments
299-W15-152	1/26/2020	7.79	0.00	580	1	458 B	20	5.1 B	2.4	
	8/7/2020	7.78	0.01	578	0	404 B	38	5.6 B	1.5	
299-W15-17	1/26/2020	7.91	N/A	396	N/A	330 U	N/A	3.7 B	N/A	Sampled for information only; no quadruplicates or statistics required
	8/7/2020	7.95	N/A	404	N/A	330 U	N/A	3.3 U	N/A	
299-W15-224	1/26/2020	7.81	0.00	564	0	413 B	6	13.2	1.6	
	8/6/2020	7.82	0.00	571	0	343 B	10	9.5	1.3	
299-W15-30	1/26/2020	8.10	0.01	553	3	505 B	10	10.9	2.3	
	8/7/2020	8.04	0.01	579	1	424 B	22	7.4	5.0	
299-W15-83	1/26/2020	7.83	0.00	578	0	360 B	11	8.3 B	1.8	
	8/7/2020	7.86	0.00	577	0	441 B	3	9.0	1.6	
299-W15-94	1/26/2020	7.78	0.00	593	1	331 B	1	3.5 B	0.4	
	8/7/2020	7.82	0.00	594	0	396 B	15	14.3	4.3	
299-W18-21	1/22/2020	7.99	0.03	634	2	607 B	126	8.8	2.1	
	8/5/2020	7.76	0.13	642	4	453 B	191	8.3 B	0.5	
299-W18-22	1/22/2020	7.85	0.00	448	1	330 U	0	5.0 B	1.2	Sampled for information only; no quadruplicates or statistics required
	8/5/2020	7.98	0.00	449	0	330 U	0	3.8 B	0.8	

a. Critical mean values from Table 25 in ECF-HANFORD-20-0007, *Calculation of Critical Means for Calendar Year 2020 RCRA Groundwater Monitoring*. Required detection limits are used for comparison when they are higher than the calculated critical mean values.

b. Required detection limit.

B = all results were below the quantitation limit

N/A = not applicable

SD = standard deviation of replicates

U = all results were below the detection limit

Table 2-35. LLBG WMA-4 Sampling Summary for Water Quality Parameters and Other Constituents for 2020

Constituent	Units	Maximum	Comparison Value[a]	PQL[b]	Wells Above Comparison Value
Alkalinity	mg/L	131	—	5.25	
Calcium, unfiltered	µg/L	67,900	—	1,050	
Calcium, filtered[c]	µg/L	67,600	—	1,050	
Chloride	mg/L	39.5	250[d]	0.4	
Chromium, unfiltered	µg/L	170.0	100[e]	10.5	299-W18-21
Chromium, filtered[c]	µg/L	19.0	100[e]	10.5	
Dissolved oxygen	mg/L	9.22	—	—	
Fluoride	mg/L	0.533	4.0[e]	0.525	
Iron, unfiltered	µg/L	13,500	300[d]	105	299-W15-17, 299-W18-21, 299-W18-22
Magnesium, unfiltered	µg/L	24,300	—	1,050	
Magnesium, filtered[c]	µg/L	22,400	—	1,050	
Manganese, unfiltered	µg/L	174	50[d]	10.5	299-W18-21
Molybdenum, unfiltered[c]	µg/L	7.00	—	5.25	
Molybdenum, filtered[c]	µg/L	5.87	—	5.25	
Nickel, unfiltered[c]	µg/L	127	—	21	
Nickel, filtered[c]	µg/L	57	—	21	
Nitrate	mg/L	79.2	45[f]	0.525	299-W15-152, 299-W15-224, 299-W15-30, 299-W15-83, 299-W15-94, 299-W18-21
Potassium, unfiltered	µg/L	6,500	—	5,250	
Potassium, filtered[c]	µg/L	6,500	—	5,250	
Sodium, unfiltered	µg/L	29,000	—	1,050	
Sodium, filtered[c]	µg/L	29,000	—	1,050	
Sulfate	mg/L	98.0	250[d]	1.05	
Temperature	°C	24.1	—	—	
Turbidity	NTU	207	—	—	

Note: Maximum is based on the required sample results for this RCRA unit at concentrations above the PQL. Appendix A presents the full data set for 2020

a. Comparison values are provided for information only and are not used to determine RCRA groundwater monitoring exceedances.

b. Standardized PQL used in analytical requirements.

c. Molybdenum, nickel, and filtered metals were not required the first quarter of 2020 and are only required annually under the revised monitoring plan. All 2020 results are summarized here for information only.

d. 40 CFR 143.3, "National Secondary Drinking Water Regulations," "Secondary Maximum Contaminant Levels."

e. 40 CFR 141, Subpart G, "National Primary Drinking Water Regulations," "Maximum Contaminant Levels and Maximum Residual Disinfectant Levels."

Table 2-35. LLBG WMA-4 Sampling Summary for Water Quality Parameters and Other Constituents for 2020

Constituent	Units	Maximum	Comparison Value[a]	PQL[b]	Wells Above Comparison Value

f. The federal drinking water standard for nitrate is 10 mg/L, expressed as nitrogen (40 CFR 141, Subpart G). This equates to 45 mg/L when expressed as NO_3.

— = no comparison value or PQL

NTU = nephelometric turbidity unit

PQL = practical quantitation limit

RCRA = *Resource Conservation and Recovery Act of 1976*

2.12 Nonradioactive Dangerous Waste Landfill

The NRDWL is located southeast of the 200 East Area, next to the Solid Waste Landfill (Figures 1-1 and 2-12). The NRDWL encompasses an area of 0.045 km^2 (0.017 mi^2) and consists of 19 parallel unlined trenches, each about 122 m (400 ft) long, 4.9 m (16 ft) wide at the base, and 4.6 m (15 ft) deep. The landfill received chemical, asbestos, and nonhazardous waste from 1975 to 1985.

Table 3-36 lists the current monitoring well network, as well as screened intervals and water levels. SGW-60589, *Engineering Evaluation Report for the Nonradioactive Dangerous Waste Landfill Groundwater Monitoring*, concluded that the existing monitoring network is adequate to detect a potential release from NRDWL. Wells were sampled as planned in 2020 and are expected to have sufficient water for continued sampling through at least 2030 (SGW-63743). Most of the wells in the NRDWL monitoring network are screened across the uppermost portion of the unconfined aquifer, which includes members of the Cold Creek unit and the Hanford formation. Two additional information-only wells (699-25-33A and 699-26-35C) are screened deeper in the aquifer.

In 2020, the hydraulic gradient was calculated to be 1.4×10^{-5} m/m, sloping to the southeast (Table 1-2; Figure 2-12). The average linear velocity was 0.95 m/d (3.1 ft/d).

For the first half of 2020, the NRDWL was monitored under a groundwater quality assessment program (DOE/RL-2017-19, *Groundwater Quality Assessment Plan for the Nonradioactive Dangerous Waste Landfill, Hanford Site*). Beginning in August 2020, the site was monitored under an indicator parameter monitoring plan (DOE/RL-2015-32, *Groundwater Monitoring Plan for the Nonradioactive Dangerous Waste Landfill*) because assessment monitoring concluded that no dangerous waste groundwater contamination is attributed to releases from the NRDWL (DOE/RL-2019-22, *Groundwater Assessment First Determination Report for the Nonradioactive Dangerous Waste Landfill*). The revised monitoring plan (DOE/RL-2015-32) removed two information-only wells (699-26-35C and 699-25-33A) from the monitoring network, revised the list of constituents monitored, and adjusted the sampling schedule to semiannual.

Table 2-37 summarizes 2020 assessment monitoring results, and Table 2-38 presents contamination indicator parameter data. Specific conductance in downgradient well 699-25-34B exceeded the critical mean value in August 2020, and verification sampling in October confirmed the exceedance. Ecology was notified, and a new groundwater quality assessment monitoring plan will be implemented in 2021 (DOE/RL-2020-57, *Groundwater Quality Assessment Plan for the Nonradioactive Dangerous Waste Landfill*).

Additional groundwater quality parameters monitored for the NRDWL in 2020 included chloride, iron, manganese, phenols, sodium, and sulfate (Table 2-39). Although not required by 40 CFR 265, Subpart F, site-specific constituents (alkalinity, nitrate, calcium, magnesium, chromium, and potassium) were also analyzed. Samples for analyses of alkalinity, anions, calcium, magnesium, and potassium are collected to support cation-anion balance calculations. Samples for iron, manganese, chromium, molybdenum, and nickel are collected to assess the potential for well corrosion.

In 2020, with one exception, the NRDWL monitoring wells were sampled as required by applicable monitoring plans. The indicator evaluation plan (DOE/RL-2015-32) added the field screening measurement for dissolved oxygen. However, due to a scheduling error, these measurements were not made during the August sampling event. Dissolved oxygen will be measured in 2021.

Several dangerous waste constituents were detected at levels above the PQL during assessment monitoring (Table 2-37), as discussed below:

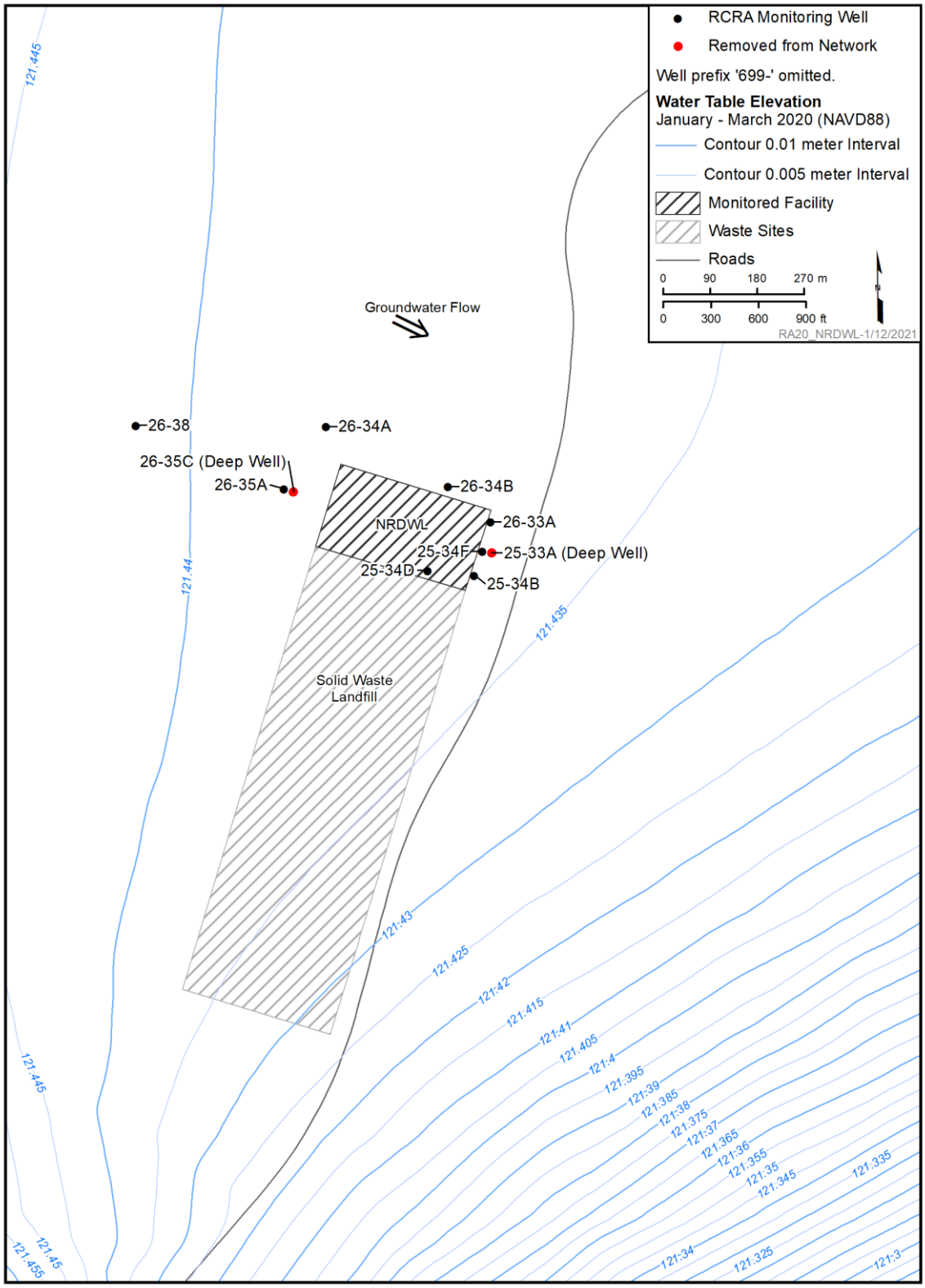
- Barium was observed above the PQL in all NRDWL wells, including the upgradient wells. Barium occurs naturally in groundwater, and the observed concentrations in NRDWL wells (maximum value 70.3 µg/L) were less than the Hanford Site background value of 105 µg/L (DOE/RL-96-61). The DWS for barium is 2,000 µg/L.
- Copper was detected above the PQL (10 µg/L) in the deep, information-only well 699-26-35C (maximum concentration of 11 µg/L in June 2020), but the result was not consistent with previous data.
- Chromium was observed above the PQL (10.5 µg/L) in four NRDWL monitoring wells, including an upgradient well. Chromium occurs naturally in groundwater, and the Hanford Site background value for this metal (2.4 µg/L) (DOE/RL-96-61) is less than typical laboratory PQLs. None of the chromium concentrations were greater than the DWS of 100 µg/L. The first determination report for the NRDWL (DOE/RL-2019-22) concluded that elevated chromium and nickel concentrations, particularly in the unfiltered aliquots, were derived from well screens and do not represent contamination from NRDWL.
- Nickel was detected above the PQL (21 µg/L) in one unfiltered sample from NRDWL cross-gradient monitoring well 699-25-34D. Nickel occurs naturally in groundwater and, like chromium, the Hanford Site background concentration for this metal (1.56 µg/L) (DOE/RL-96-61) is less than typical laboratory PQLs. The first determination report for the NRDWL (DOE/RL-2019-22) concluded that elevated chromium and nickel concentrations, particularly in the unfiltered aliquots, were derived from well screens and do not represent contamination from NRDWL.

Manganese (not a dangerous waste constituent) was detected in an unfiltered sample from upgradient well 699-26-34A. The maximum concentration observed (52 µg/L) is slightly over the DWS of 50 µg/L.

Iron was observed above the DWS in unfiltered samples from wells 699-25-33A and 699-25-34D. Iron in the corresponding filtered fractions from these same wells was not detectable.

In addition to being naturally occurring, chromium, nickel, manganese, and iron are all components of stainless steel. Elevated concentrations of these metals in unfiltered samples in ratios similar to those found in common stainless-steel alloys may indicate possible corrosion within the well. The ratios of these metals in NRDWL groundwater monitoring samples are not similar to those found in the stainless-steel alloys, and they do not show an increasing trend (Section 1.5). Therefore, these metals do not indicate a degree of well corrosion that warrants well maintenance.

DOE/RL-2017-19 required monitoring at the NRDWL of all synthetic organic compounds listed in Appendix 5 of Ecology Publication No. 97-407. Additionally, DOE/RL-2015-32 required the monitoring of four specific VOCs (chloroform, tetrachloroethene, trichloroethene, and trichlorofluoromethane). No synthetic organic compounds were detected above the PQL in NRDWL monitoring wells during 2020.



Reference: ECF-HANFORD-20-0078, *Preparation of the Hanford Site Water Table Map for January to March 2020*.

Figure 2-12. Nonradioactive Dangerous Waste Landfill

Table 2-36. NRDWL Groundwater Monitoring Network

Well Name	Location	Year Installed	Head Date	Hydraulic Head		Elevation Screen Top		Elevation Screen Bottom		Water Column		Sample Frequency	Sampled Months; Comments[a]
				m	ft	m	ft	m	ft	m	ft		
699-25-33A[b]	DG deep	1987	6/22/2020	121.39	398.27	103.4	339.1	100.3	329.1	21.1	69.2	Q/0	1, 6; removed from network[c]
699-25-34B	DG	1986	6/23/2020	121.41	398.33	125.5	411.9	119.6	392.4	1.8	5.9	Q/S	1, 6, 8, 10[d]
699-25-34D	CG/DG	1992	6/23/2020	121.41	398.34	125.3	411.0	114.5	375.8	6.9	22.6	Q/S	1, 6, 8
699-25-34F	DG	2015	6/23/2020	121.43	398.38	122.6	402.2	113.4	372.2	8.0	26.2	Q/S	1, 6, 8
699-26-33A	DG	2015	6/23/2020	121.41	398.31	122.7	402.6	113.6	372.6	7.8	25.8	Q/S	1, 6, 8
699-26-34A	UG	1986	6/24/2020	121.42	398.37	125.7	412.5	119.6	392.5	1.8	5.9	Q/S	1, 6, 8
699-26-34B	CG/DG	1992	6/24/2020	121.43	398.38	125.4	411.4	114.7	376.2	6.8	22.2	Q/S	1, 6, 8
699-26-35A	UG	1986	6/22/2020	121.42	398.37	126.0	413.3	119.9	393.3	1.6	5.1	Q/S	1, 6, 8
699-26-35C[b]	UG deep	1987	6/24/2020	121.41	398.31	103.9	341.0	100.9	331.0	20.5	67.4	Q/0	1, 6; removed from network[c]
699-26-38	UG	2014	6/24/2020	121.43	398.39	123.1	403.8	114.0	373.9	7.5	24.5	Q/S	1, 6, 8

Note: Requirements are from Table 3-2 in DOE/RL-2017-19, *Groundwater Quality Assessment Plan for the Nonradioactive Dangerous Waste Landfill, Hanford Site*; and DOE/RL-2015-32, *Groundwater Monitoring Plan for the Nonradioactive Dangerous Waste Landfill*.

a. Sampled for assessment in January and June (delayed from April due to the COVID-19 pandemic). Sampled for indicator evaluation in August. Confirmatory sampling for specific conductance exceedance in October.

b. Hydraulic head data for these wells were not corrected for borehole deviation from vertical, which may cause reported head to be less than actual head.

c. Wells removed from monitoring network, as specified in DOE/RL-2015-32.

d. October sampling at well 699-25-34B was to verify August potential specific conductance exceedance of the calculated critical mean.

CG = cross-gradient

DG = downgradient

Q/0 = quarterly under assessment; not included under indicator evaluation

Q/S = quarterly under assessment; semiannual under indicator evaluation

UG = upgradient

Table 2-37. NRDWL Assessment Sampling Summary for 2020 (Quarters 1 and 2)

Constituent	Units	Maximum	Water Quality Standard[a]	PQL[b]	Comments
Dangerous Waste Constituents					**Wells Above PQL or Water Quality Standard**
Barium, unfiltered	µg/L	68.2	2,000[c]	5.25	All wells above PQL
Barium, filtered	µg/L	70.3	2,000[c]	5.25	All wells above PQL
Chromium, unfiltered	µg/L	52	100[c]	10.5	Above PQL: 699-25-34D, 699-25-34F, 699-26-33A, 699-26-35A
Chromium, filtered	µg/L	11.5	100[c]	10.5	Above PQL: 699-26-33A, 699-26-35A
Copper, unfiltered	µg/L	11.0	1,000[d]	10	Above PQL: 699-26-35C
Copper, filtered	µg/L	10.3	1,000[d]	10	Above PQL: 699-26-35C
Nickel, unfiltered	µg/L	23	—	21	Above PQL: 699-25-34D
Other Constituents					**Wells Above Water Quality Standard**
Alkalinity	mg/L	250	—	5.25	
Calcium, unfiltered	µg/L	72,500	—	1,050	
Calcium, filtered	µg/L	73,700	—	1,050	
Chloride	mg/L	14	250[d]	0.4	
Iron, unfiltered	µg/L	640	300[d]	105	Above water quality standard: 699-25-33A, 699-25-34D
Magnesium, unfiltered	µg/L	20,400	—	1,050	
Magnesium, filtered	µg/L	20,700	—	1,050	
Manganese, unfiltered	µg/L	52.0	50[d]	10.5	Above water quality standard: 699-26-34A
Manganese, filtered	µg/L	21.6	50[d]	10.5	
Nitrate	mg/L	37.6	45[e]	0.525	
pH	unitless	8.41	6.5 – 8.5[d]	—	
Potassium, unfiltered	µg/L	8,520	—	5,250	
Potassium, filtered	µg/L	8,640	—	5,250	
Sodium, unfiltered	µg/L	32,100	—	1,050	

Table 2-37. NRDWL Assessment Sampling Summary for 2020 (Quarters 1 and 2)

Constituent	Units	Maximum	Water Quality Standard[a]	PQL[b]	Comments
Sodium, filtered	µg/L	32,200	—	1,050	
Specific conductance	µS/cm	668	—	—	
Sulfate	mg/L	64.3	250[d]	1.05	
Temperature	°C	22.4	—	—	
Total organic carbon	µg/L	1,340	—	1,050	
Turbidity	NTU	4.48	—	—	

Note: Maximum is based on the required assessment sample results for this RCRA unit collected in January and June 2020 with concentrations above the PQL. Appendix A presents the full data set for 2020.

a. Water quality standards are provided for information only and are not used to determine RCRA groundwater monitoring exceedances.

b. Standardized PQL used in analytical requirements.

c. 40 CFR 141, Subpart G, "National Primary Drinking Water Regulations," "Maximum Contaminant Levels and Maximum Residual Disinfectant Levels."

d. 40 CFR 143.3, "National Secondary Drinking Water Regulations," "Secondary Maximum Contaminant Levels."

e. The federal drinking water standard for nitrate is 10 mg/L expressed as nitrogen (40 CFR 141, Subpart G). This equates to 45 mg/L when expressed as NO_3.

— = no comparison value or PQL

NTU = nephelometric turbidity unit

PQL = practical quantitation limit

RCRA = *Resource Conservation and Recovery Act of 1976*

Table 2-38. NRDWL Sampling Summary for Contamination Indicator Parameters for 2020 (Quarter 3)

Indicator Parameter		pH		Specific Conductance (µS/cm)		Total Organic Carbon (µg/L)		Total Organic Halides (µg/L)		Comments
Critical Mean[a]		6.98	7.76	582		1,000[b]		10[b]		
Well	Sample Date	Average	SD	Average	SD	Average	SD	Average	SD	
699-25-34B	8/24/2020	7.62	0.01	593	2	443 B	9	3.4 B	0.0	
	10/22/2020	7.46	0.00	591[c]	20	—	—	—	—	Verification sampling for August exceedance of specific conductance
				616[d]	10					
699-25-34D	8/25/2020	7.41	0.00	567	0	330 U	0	5.8 B	2.4	
699-25-34F	8/25/2020	7.41	0.00	578	0	345 B	5	5.5 B	0.6	
699-26-33A	8/20/2020	7.47	0.00	558	0	426 B	10	4.5 B	1.5	
699-26-34A	8/24/2020	7.48	0.01	501	0	330 U	0	4.1 B	1.3	
699-26-34B	8/24/2020	7.59	0.00	490	0	330 U	0	3.8 B	0.5	
699-26-35A	8/24/2020	7.48	0.01	527	0	343 B	23	4.9 B	1.3	
699-26-38	8/20/2020	7.42	0.00	483	0	343 B	19	5.0 B	2.4	

Note: Yellow shading indicates critical mean exceedance.

a. Critical mean values are from Table 17 in ECF-HANFORD-20-0007, *Calculation of Critical Means for Calendar Year 2020 RCRA Groundwater Monitoring*. Required detection limits are used for comparison when they are higher than the calculated critical mean values.

b. Required detection limit.

c. Average of field readings.

d. Average of laboratory results.

B = all values were below the quantitation limit

SD = standard deviation of replicates

U = all values were below the detection limit

Table 2-39. NRDWL Sampling Summary for Groundwater Quality Parameters and Other Constituents for 2020 (Quarter 3)

Constituent	Units	Maximum	Comparison Value[a]	PQL[b]	Wells Above Comparison Value; Comments
Alkalinity	mg/L	232	—	5.25	
Calcium, unfiltered	µg/L	76,800	—	1,050	
Calcium, filtered	µg/L	73,900	—	1,050	
Chloride	mg/L	13.1	250[c]	0.4	
Chromium, unfiltered	µg/L	12.8 B	100[d]	10.5	
Chromium, filtered	µg/L	12.4 B	100[d]	10.5	
Dissolved oxygen	mg/L	—	—	—	Not collected
Magnesium, unfiltered	µg/L	20,600	—	1,050	
Magnesium, filtered	µg/L	19,800	—	1,050	
Manganese, unfiltered	µg/L	10.8	50[c]	10.5	
Molybdenum, unfiltered	µg/L	8.2	—	5.25	
Molybdenum, filtered	µg/L	8.0	—	5.25	
Nitrate	mg/L	35.5	45[e]	0.525	
Potassium, unfiltered	µg/L	9,490	—	5,250	
Potassium, filtered	µg/L	9,150	—	5,250	
Sodium, unfiltered	µg/L	32,900	—	1,050	
Sodium, filtered	µg/L	31,700	—	1,050	
Sulfate	mg/L	60.1	250[c]	1.05	
Temperature	°C	25.4	—	—	
Turbidity	NTU	4.82	—	—	

Note: Maximum is based on the required sample results for this RCRA unit collected in August 2020 with concentrations above the PQL. Appendix A presents the full data set for 2020.

a. Comparison values are provided for information only and are not used to determine RCRA groundwater monitoring exceedances.

b. Standardized PQL used in analytical requirements.

c. 40 CFR 143.3, "National Secondary Drinking Water Regulations," "Secondary Maximum Contaminant Levels."

d. 40 CFR 141, Subpart G, "National Primary Drinking Water Regulations," "Maximum Contaminant Levels and Maximum Residual Disinfectant Levels."

e. The federal drinking water standard for nitrate is 10 mg/L expressed as nitrogen (40 CFR 141, Subpart G). This equates to 45 mg/L when expressed as NO_3.

— = no comparison value

NTU = nephelometric turbidity unit

PQL = practical quantitation limit

RCRA = *Resource Conservation and Recovery Act of 1976*

2.13 Waste Management Area A-AX

WMA A-AX is located in the southeastern quarter of the 200 East Area (Figures 1-1 and 2-13) and consists of 10 underground storage tanks with an operating capacity of 3,785,000 L (1,000,000 gal), two of which are confirmed or assumed to have leaked in the past (HNF-EP-0182, Rev. 359, *Waste Tank Summary Report for Month Ending November 30, 2017*). Leaks were reassessed in the 2014 revision of RPP-ENV-37956, *Hanford 241-A/AX Farm Leak Inventory Assessment Report*. To minimize the probability and severity of future leaks, most of the drainable liquid in each tank has been removed and transferred to double-shell tanks.

During the first half of 2020, WMA A-AX was monitored under an interim status assessment program under DOE/RL-2015-49, *Interim Status Groundwater Quality Assessment Plan for the Single-Shell Tank Waste Management Area A-AX*, as modified by RCRA-CN-01_DOE/RL-2015-49_R0, *Interim Status Change Number 1: Interim Status Groundwater Monitoring Plan for the Single-Shell Tank Waste Management Area A-AX* (effective date February 13, 2020). In September and December 2020, WMA A-AX was monitored under an indicator evaluation monitoring plan (DOE/RL-2019-44, *Interim Status Groundwater Monitoring Plan for the Single-Shell Tank Waste Management Area A-AX*) because a first determination assessment report (DOE/RL-2019-21, *Groundwater Assessment First Determination Report for Waste Management Area A-AX*) concluded that no dangerous waste groundwater contamination is attributed to releases from WMA A-AX. The revised monitoring plan (DOE/RL-2019-44) removed well 299-E25-2 (an older well not compliant with WAC 173-160), revised the monitored constituents, and adjusted the sampling frequency to semiannual.

Table 2-40 lists the WMA A-AX monitoring network. The estimated thickness of the unconfined aquifer is from 24 to 31 m (79 to 102 ft), and wells are screened across the uppermost portion of the unconfined aquifer, which includes members of the Cold Creek unit. Water-level predictions indicate that well 299-E25-41 will have <0.9 m (3 ft) of water by 2027, and the other wells of the monitoring network will have sufficient water for continued sampling through at least 2030 (SGW-63743). Section 7.4 in SGW-60586, *Engineering Evaluation Report for Single-Shell Tank Waste Management Area A-AX Groundwater Monitoring*, recommended a modified network for monitoring under final status, including the eight current wells and two proposed new wells.

In 2020, groundwater near WMA A-AX was interpreted to flow to the east-southeast (Table 1-2). The estimated hydraulic gradient was 7.4×10^{-6} m/m, with an estimated average linear velocity of 0.54 m/d (1.8 ft/d). The surface of the uppermost unconfined aquifer at WMA A-AX is extremely flat, and Figure 2-13 includes just one water table contour. Figure 1-2 illustrates the water table over a wider region.

Tables 2-41 through 2-43 summarize the monitoring results for 2020. Due to work restrictions related to the COVID-19 pandemic, groundwater monitoring did not occur at WMA A-AX in the first quarter of 2020. This missed sampling event was communicated to Ecology.

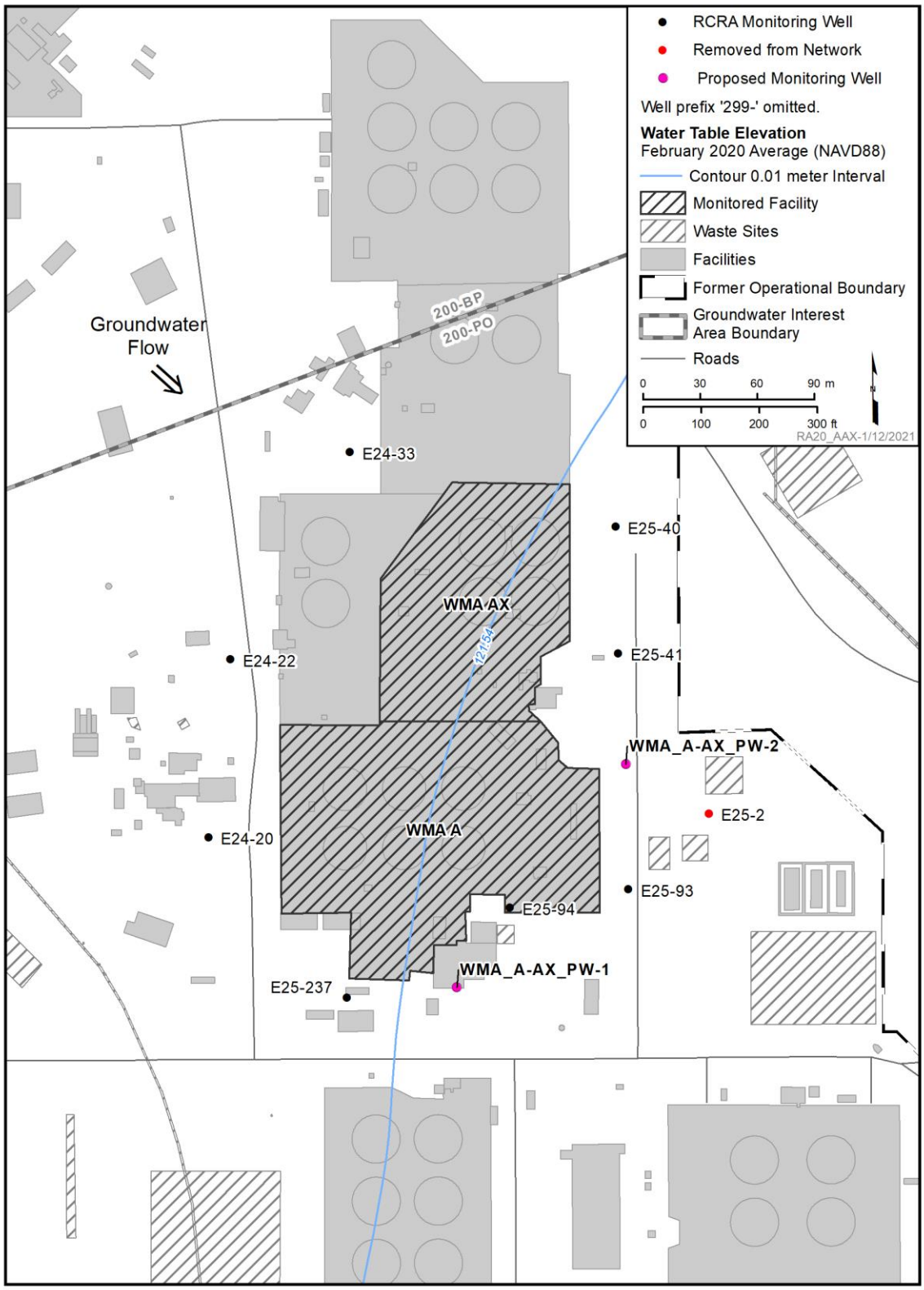
The indicator parameter specific conductance exceeded the critical mean value in well 299-E25-93 in September and in December confirmatory samples (Table 2-42). In December 2020, the TOC concentrations in downgradient well 299-E25-237 exceeded the critical mean value; verification samples were collected in January 2021 and results are pending. Ecology was notified of the confirmed exceedance of specific conductance in well 299-E25-93 and the initial exceedance of TOC in well 299-E25-237. A new groundwater quality assessment monitoring plan is being developed.

Additional groundwater quality parameters monitored for WMA A-AX under the revised plan included chloride, iron, manganese, phenols, sodium, and sulfate (Table 2-43). Although not required by 40 CFR 265, Subpart F, site-specific constituents (alkalinity, nitrate, calcium, magnesium, chromium, and potassium) were also analyzed. Samples for analyses of alkalinity, anions, calcium, magnesium, and potassium are collected to support cation-anion balance calculations. Samples for iron, manganese, chromium, molybdenum, and nickel are collected to assess the potential for well corrosion.

Several dangerous waste constituents were detected at levels above the PQL during assessment monitoring (Table 2-41), as discussed below:

- Barium was observed in all wells in the WMA A-AX monitoring network above the PQL of 5.25 µg/L. Barium occurs naturally in groundwater, and the concentrations observed at WMA A-AX are less than the Hanford Site background value of 105 µg/L (DOE/RL-96-61) and less than the DWS of 2,000 µg/L.
- Selenium was observed above the PQL of 10.5 µg/L in two wells in the WMA A-AX monitoring network, including upgradient well 299-E24-22. Selenium occurs naturally in groundwater. The maximum observed values at WMA A-AX are slightly above the Hanford Site background (9.5 µg/L) (DOE/RL-96-61) and are about one-fifth of the DWS of 50 µg/L. Because it is detected in the upgradient well and concentrations are near background levels, selenium is not attributed to WMA A-AX.
- Silver was detected above the PQL (5.25 µg/L) in one filtered sample from an upgradient well. The concentration in the corresponding unfiltered sample was below the PQL, as were the results from all other wells. As with barium and selenium, silver also occur naturally in groundwater, with the Hanford Site background concentration at 5.28 µg/L (DOE/RL-96-61). Because it is detected in the upgradient well and concentrations are near background levels, silver is not attributed to WMA A-AX.
- Zinc was detected above the PQL (21 µg/L) and the Hanford Site background value (21.8 µg/L) (DOE/RL-96-61) in one unfiltered sample from downgradient well 299-E25-40. The result was not consistent with previous results from that well, and all other zinc results from the WMA A-AX monitoring network in 2020 were below the PQL. Because zinc is not consistently detected, it is not attributed to WMA A-AX.
- Chromium was detected above the PQL (10.5 µg/L) in unfiltered samples from three WMA A-AX wells, including upgradient well 299-E24-20. The first determination assessment report (DOE/RL-2019-21) identified elevated chromium as potentially caused by stainless-steel corrosion rather than from the unit itself. However, none of the wells in the WMA A-AX monitoring network are exhibiting concentrations or ratios to iron reflective of the stainless-steel alloys typically used in Hanford Site monitoring wells (Section 1.5) and do not indicate a degree of well corrosion that warrants well maintenance. The observed maximum concentration reported at WMA A-AX in 2020 was 29 µg/L, less than the DWS of 100 µg/L.

Nitrate concentrations (not a dangerous waste constituent) were above the 45 mg/L DWS in several wells due to a regional plume. Sulfate (not a dangerous waste constituent) was observed above the 250 mg/L secondary DWS in well 299-E25-93 (Table 2-43). Elevated and rising levels of sulfate have been documented in this well and are attributed to a regional sulfate plume (Section 4.4.2 in SGW-60586).



Reference: ECF-HANFORD-20-0078, *Preparation of the Hanford Site Water Table Map for January to March 2020*.

Figure 2-13. Waste Management Area A-AX

Table 2-40. WMA A-AX Groundwater Monitoring Network

Well Name	Location	Year Installed	Head Date	Hydraulic Head		Elevation Screen Top		Elevation Screen Bottom		Water Column		Sample Frequency	Sampled Months; Comments[a]
				m	ft	m	ft	m	ft	m	ft		
299-E24-20	UG	1991	6/25/2020	121.58	398.87	125.0	410.1	118.9	390.0	2.7	8.9	Q	6, 9, 12
299-E24-22[b]	UG	2003	6/25/2020	121.54	398.74	122.3	401.3	111.6	366.3	9.9	32.5	Q	6, 9, 12
299-E24-33[b]	UG	2004	6/25/2020	121.54	398.74	122.2	400.9	111.5	365.9	10.0	32.9	Q	6, 9, 12
299-E25-2[c]	DG	1955	6/24/2020	121.53	398.72	122.3	401.1	110.1	361.1	11.5	37.6	Q/0	6, 9
299-E25-237	DG	2015	6/25/2020	121.46	398.49	123.2	404.1	112.5	369.1	9.0	29.4	Q	6, 9, 12
299-E25-40	DG	1989	6/24/2020	121.53	398.72	126.3	414.4	119.9	393.4	1.6	5.3	Q	6, 9, 12
299-E25-41[d]	DG	1989	6/29/2020	121.52	398.70	126.9	416.4	120.5	395.4	1.0	3.3	Q	6, 9, 12
299-E25-9[b]	DG	2003	6/25/2020	121.54	398.76	122.5	401.8	111.8	366.7	9.8	32.0	Q	6, 9, 12
299-E25-94[b]	DG	2004	6/25/2020	121.48	398.57	121.4	398.2	110.7	363.2	10.8	35.4	Q	6, 9, 12
WMA_AAX_PW-1	DG	Proposed	—	—	—	—	—	—	—	—	—	0/Q	Not yet installed
WMA_AAX_PW-2	DG	Proposed	—	—	—	—	—	—	—	—	—	0/Q	Not yet installed

Note: Requirements are from Table 3-2 in DOE/RL-2015-49, *Interim Status Groundwater Quality Assessment Plan for the Single-Shell Tank Waste Management Area A-AX*, (as modified by RCRA-CN-01_DOE/RL-2015-49_R0, *Interim Status Change Number 1: Interim Status Groundwater Monitoring Plan for the Single-Shell Tank Waste Management Area A-AX*, effective date February 13, 2020]); and DOE-RL-2019-44, *Interim Status Groundwater Monitoring Plan for the Single-Shell Tank Waste Management Area A-AX*.

a. March assessment sampling missed due to the COVID-19 pandemic.

b. Hydraulic head data for these wells were corrected for borehole deviation from vertical. Corrections are not available for other wells in this network, which may cause the reported head to be less than actual head.

c. Constructed prior to *Washington Administrative Code* requirements. Removed from network in revised monitoring plan.

d. Well is predicted to have <0.9 m (3 ft) water in the screened interval by 2027, which may limit sampling in the future if the water table continues to decline.

0/Q = not included in assessment; quarterly in indicator evaluation

DG = downgradient

Q = quarterly sampling (required under assessment) continues under indicator evaluation until critical mean values can be calculated

Q/0 = quarterly under assessment; not included in indicator evaluation

UG = upgradient

Table 2-41. WMA A-AX Assessment Sampling Summary for 2020 (Quarters 1 and 2)

Constituent	Units	Maximum	Water Quality Standard[a]	PQL[b]	Comments
Dangerous Waste Constituents					**Wells Above PQL or Water Quality Standard**
Barium, unfiltered	µg/L	86.6	2,000[c]	5.25	All wells above PQL
Barium, filtered	µg/L	86.3	2,000[c]	5.25	All wells above PQL
Chromium, unfiltered	µg/L	29.0	100[c]	10.5	Above PQL: 299-E24-20, 299-E25-40, 299-E25-41
Selenium, unfiltered	µg/L	12.9	50[c]	10.5	Above PQL: 299-E25-94
Selenium, filtered	µg/L	11.0	50[c]	10.5	Above PQL: 299-E24-22
Silver, filtered	µg/L	8.8	100[d]	5.25	Above PQL: 299-E24-20
Zinc, unfiltered	µg/L	81.2	5,000[d]	21	Above PQL: 299-E25-40
Other Constituents					**Wells Above Water Quality Standard**
Alkalinity	mg/L	125	—	5.25	
Calcium, unfiltered	µg/L	113,000	—	1,050	
Calcium, filtered	µg/L	113,000	—	1,050	
Chloride	mg/L	38.9	250[d]	0.4	
Iron, unfiltered	µg/L	180	300[d]	105	
Iron, filtered	µg/L	110	300[d]	105	
Magnesium, unfiltered	µg/L	30,600	—	1,050	
Magnesium, filtered	µg/L	30,300	—	1,050	
Nitrate	mg/L	66.4	45[e]	0.525	Above water quality standard: 299-E24-20, 299-E25-237, 299-E25-93, 299-E25-94
pH measurement	unitless	7.99	6.5 – 8.5[d]	—	
Potassium, unfiltered	µg/L	10,900	—	5,250	
Potassium, filtered	µg/L	10,500	—	5,250	
Sodium, unfiltered	µg/L	30,800	—	1,050	

Table 2-41. WMA A-AX Assessment Sampling Summary for 2020 (Quarters 1 and 2)

Constituent	Units	Maximum	Water Quality Standard[a]	PQL[b]	Comments
Sodium, filtered	µg/L	30,200	—	1,050	
Specific conductance	µS/cm	871	—	—	
Sulfate	mg/L	245	250[d]	1.05	
Temperature	°C	21.6	—	N/A	
Turbidity	NTU	3.78	—	N/A	

Note: Maximum is based on the required assessment sample results for this RCRA unit collected in June 2020, with concentrations above the PQL. Appendix A presents the full data set for 2020.

a. Water quality standards are provided for information only and are not used to determine RCRA groundwater monitoring exceedances.

b. Standardized PQL used in analytical requirements.

c. 40 CFR 141, Subpart G, "National Primary Drinking Water Regulations," "Maximum Contaminant Levels and Maximum Residual Disinfectant Levels."

d. 40 CFR 143.3, "National Secondary Drinking Water Regulations," "Secondary Maximum Contaminant Levels."

e. The federal drinking water standard for nitrate is 10 mg/L expressed as nitrogen (40 CFR 141, Subpart G). This equates to 45 mg/L when expressed as NO_3.

— = no comparison value or PQL

NTU = nephelometric turbidity unit

PQL = practical quantitation limit

RCRA = *Resource Conservation and Recovery Act of 1976*

Table 2-42. WMA A-AX Sampling Summary for Contamination Indicator Parameters for 2020

Indicator Parameter		pH		Specific Conductance (µS/cm)		Total Organic Carbon (µg/L)			TOX (µg/L)			
Critical Mean*		7.47	8.4	884		1,060			23.1*			
Well	Sample Date	Average	SD	Average	SD		Average	SD		Average	SD	Comments
299-E24-20	9/24/2020	8.17	0.00	616	1	B	341	17	B	4.6	1.2	
	12/1/2020	8.06	0.00	606	1	U	330	0.0	U	3.3	0.0	
299-E24-22	9/25/2020	8.09	0.00	697	1	B	446	9	—	8.2	4.8	Excluded one rejected TOX result
	12/1/2020	7.96	0.00	631	2	U	330	0.0	B	3.6	0.2	
	12/18/2020	7.93	0.00	653	2	—	—	—	—	3.5 B (lab 1) 7.7 U (lab 2)	0.4 0.0	Confirmatory sampling for September TOX outlier
299-E24-33	9/24/2020	7.97	0.01	755	4	B	475	28	B	5.7	1.8	
	12/1/2020	7.88	0.00	731	3	B	374	15	B	3.4	0.1	
299-E25-237	9/25/2020	8.06	0.00	726	0	B	715	15	B	3.5	0.4	
	12/1/2020	7.94	0.00	712	0		1,180	29	U	3.3	0.0	
299-E25-40	9/25/2020	8.24	0.02	563	2	B	339	9	B	5.6	0.5	
	12/2/2020	8.16	0.01	562	2	U	330	0.0	B	4.7	1.4	
299-E25-41	9/25/2020	8.08	0.01	735	0	B	474	12	B	4.6	1.5	
	12/2/2020	7.99	0.01	727	0	B	346	6	B	6.4	2.0	
299-E25-93	9/24/2020	8.07	0.00	910	1	B	614	6	B	3.38	0.08	
	12/2/2020	7.89	0.00	895	0	B	346	6	B	6.4	2.0	
	12/18/2020	7.87	0.00	883 (field) 940 (lab 1) 895 (lab 2)	28 9 9	—	—	—	—	—	—	Confirmatory sampling for September specific conductance exceedance

Table 2-42. WMA A-AX Sampling Summary for Contamination Indicator Parameters for 2020

Indicator Parameter		pH		Specific Conductance (µS/cm)		Total Organic Carbon (µg/L)			TOX (µg/L)			
Critical Mean*		7.47	8.4	884		1,060			23.1*			
Well	Sample Date	Average	SD	Average	SD		Average	SD		Average	SD	Comments
299-E25-94	9/24/2020	8.02	0.01	815	1	B	533	11	B	3.56	0.39	
	12/2/2020	7.91	0.00	814	0	B	440	15	B	4.87	1.67	

Note: Yellow shading indicates critical mean exceedance.

*Critical mean values are from Table 26 in ECF-HANFORD-20-0007, *Calculation of Critical Means for Calendar Year 2020 RCRA Groundwater Monitoring*, except for TOX, which are from Table B.2 in PNNL-15670, *Hanford Site Groundwater Monitoring For Fiscal Year 2005*. A new critical mean for total organic halides will be calculated when there are sufficient data from the upgradient wells.

B = all values were below the quantitation limit

SD = standard deviation of replicates

TOX = total organic halides

U = all values were below the detection limit

Table 2-43. WMA A-AX Sampling Summary for Water Quality Parameters and Other Constituents for 2020 (Quarters 3 and 4)

Constituent	Units	Maximum	Comparison Value[a]	PQL[b]	Wells Above Comparison
Alkalinity	mg/L	127	—	5.25	
Calcium, unfiltered	µg/L	110,000	—	1,050	
Calcium, filtered	µg/L	110,000	—	1,050	
Chloride	mg/L	38.4	250[c]	0.4	
Chromium, unfiltered	µg/L	44	100[d]	10.5	
Dissolved oxygen	mg/L	9.5	—	—	
Iron, unfiltered	µg/L	180	300[c]	105	
Magnesium, unfiltered	µg/L	30,000	—	1,050	
Magnesium, filtered	µg/L	31,000	—	1,050	
Nitrate	mg/L	70.4	45[e]	0.525	299-E24-20, 299-E24-22, 299-E25-93, 299-E25-94, 299-E25-237
Potassium, unfiltered	µg/L	11,000	—	5,250	
Potassium, filtered	µg/L	11,000	—	5,250	
Sodium, unfiltered	µg/L	30,000	—	1,050	
Sodium, filtered	µg/L	30,000	—	1,050	
Sulfate	mg/L	256	250[c]	1.05	299-E25-93
Temperature	°C	20.6	—	—	
Turbidity	NTU	4.57	—	—	

Note: Maximum is based on the required detection sample results for this RCRA unit collected in September and December 2020 with concentrations above the PQL. Appendix A presents the full data set for 2020.

a. Comparison values are provided for information only and are not used to determine RCRA groundwater monitoring exceedances.

b. Standardized PQL used in analytical requirements.

c. 40 CFR 143.3, "National Secondary Drinking Water Regulations," "Secondary Maximum Contaminant Levels."

d. 40 CFR 141, Subpart G, "National Primary Drinking Water Regulations," "Maximum Contaminant Levels and Maximum Residual Disinfectant Levels."

e. The federal drinking water standard for nitrate is 10 mg/L expressed as nitrogen (40 CFR 141, Subpart G). This equates to 45 mg/L when expressed as NO_3.

— = no comparison value

NTU = nephelometric turbidity unit

PQL = practical quantitation limit

RCRA = *Resource Conservation and Recovery Act of 1976*

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3 Groundwater Quality Assessment Monitoring

This chapter presents the groundwater monitoring results for units monitored under interim status groundwater quality assessment programs, which includes LLBG WMA-3 and six SST WMAs.

3.1 Low-Level Burial Grounds Waste Management Area 3

LLBG WMA-3 (Figure 3-1) is located in the northwest quadrant of the 200 West Area and has four burial grounds (218-W-3A, 218-W-3AE, 218-W-5, and 200-W-254) within its boundary. The 218-W-3A Burial Ground (0.204 km^2 [0.079 mi^2]) has 57 unlined trenches and operated between 1970 and 1998. The 218-W-3AE Burial Ground (0.200 km^2 [0.077 mi^2]) has eight unlined trenches and operated between 1981 and July 2004. The 218-W-5 Burial Ground (0.27 km^2 [0.103 mi^2]) has 10 unlined trenches and began operating in 1986. The 200-W-254 Burial Ground (0.105 km^2 [0.041 mi^2] was originally within the 218-W-5 Burial Ground boundary.

In 2014, a new waste site code (200-W-254) was placed in the Hanford Site Waste Information Data System database to specifically identify the active areas of the 218-W-5 Burial Ground containing Trenches 31 and 34 and associated waste treatment and storage pads. Constructed with double polyethylene liners, the trenches and pads are unique within LLBG WMA-3 and direct all surface runoff to a leachate collection and removal system. The 200-W-254 Burial Ground began operating in 1999 and continues to receive waste. Trenches 31 and 34 and their associated waste treatment and storage pads are considered to be four separate DWMUs. LLBG WMA-3 received primarily nondangerous, low-level radiological waste, but there are discrete areas within the LLBG (referred to as “Green Islands”) (Figure 3-1) where regulated mixed waste (waste with both a radioactive and dangerous waste component) was disposed in unlined trenches.

In 2020, LLBG WMA-3 was monitoring under an interim status groundwater assessment plan (DOE/RL-2019-32, *Interim Status Groundwater Quality Assessment Plan for the Low-Level Burial Grounds Waste Management Area-3*). An interim status change notice was in effect for the third and fourth quarter sampling events (RCRA-CN-01_DOE/RL-2019-32_R0, *Interim Status Change Number 1: Interim Status Groundwater Quality Assessment Plan for the Low-Level Burial Grounds Waste Management Area-3*). The change notice did not affect the quarterly sampling schedule but added constituents, removed fluoride and nitrite, and substituted total alkalinity for speciated alkalinity. All of the wells were sampled as required during the reporting period.

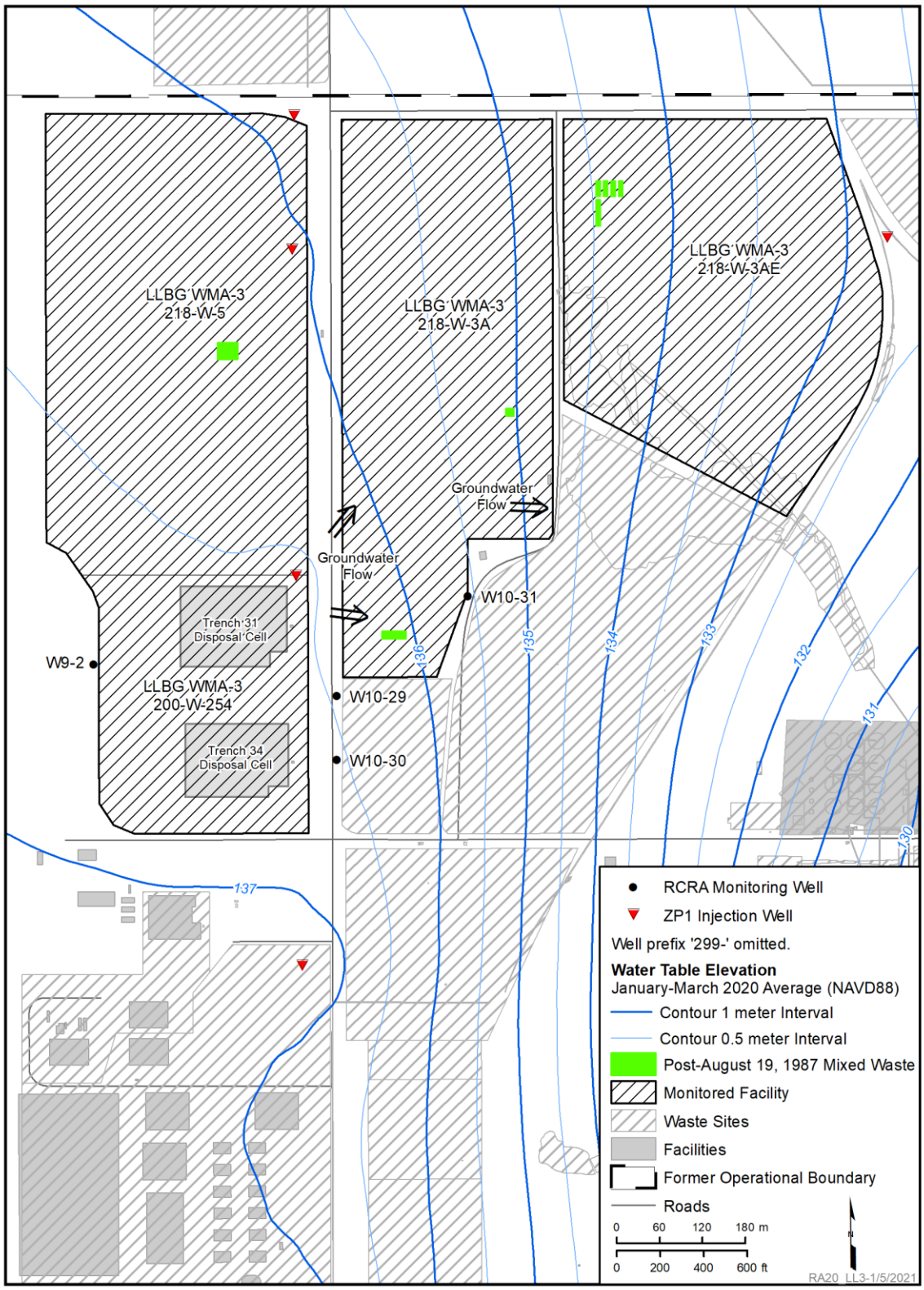
The monitoring network consists of one upgradient well and three downgradient wells (Table 3-1). All of the wells are expected to have sufficient water for continued sampling through at least 2030 (SGW-63743). Two engineering evaluation reports have been published for portions of LLBG WMA-3 to support final status monitoring in the future: SGW-59564, *Engineering Evaluation of the 200 West Pump and Treat Influence on Groundwater Monitoring for the Low-Level Burial Ground Trenches 31 and 34*; and SGW-60583, *Engineering Evaluation Report for Low-Level Burial Grounds Waste Management Area-3 Green Islands Groundwater Monitoring*. These engineering evaluation reports propose additional monitoring wells. The wells in the LLBG WMA-3 monitoring network are screened across the uppermost portion of the unconfined aquifer, which includes Ringold unit E.

Treated water from the 200 West P&T is injected into wells within and adjacent to LLBG WMA-3, creating groundwater mounds (Figure 3-1). East of the P&T injection wells, the general direction of groundwater flow is eastward. West of the injection wells, groundwater flow direction varies due to the influence of the P&T wells. The average gradient is 2.6×10^{-3} m/m, with an estimated velocity of 0.14 m/d (0.47 ft/d) (Table 1-2). Beneath Trenches 31 and 34, the average gradient is 3.3×10^{-3} m/m, and the estimated velocity is 0.18 m/d (0.58 ft/d).

Table 3-2 summarizes the dangerous waste constituents, supporting constituents, and other groundwater quality parameters required by DOE/RL-2019-32, as modified by RCRA-CN-01_DOE/RL-2019-32_R0. The following dangerous waste constituents were detected at levels above their PQLs in 2020:

- Barium was observed in all wells in the LLBG WMA-3 monitoring network above the PQL of 5.25 µg/L. Barium occurs naturally in groundwater, and the concentrations observed at LLBG WMA-3 are less than the Hanford Site background value of 105 µg/L (DOE/RL-96-61) and less than the DWS of 2,000 µg/L.
- Carbon tetrachloride was observed above the primary DWS of 5 µg/L in downgradient wells 299-W10-30 and 299-W10-31 and above the PQL of 3 µg/L in downgradient well 299-W10-29. The 2020 results were consistent with previous data and indicate that the wells are within the regional carbon tetrachloride plume (Section 3.1.5 in SGW-59564).
- Tin was detected in one unfiltered sample from upgradient well 299-W9-2 above the PQL value of 10.5 µg/L but below the Hanford Site background value of 21.6 µg/L (DOE/RL-96-61). The subsequent October 2020 sample resulted in nondetect filtered and unfiltered values. Because the concentration was less than background levels, tin is not attributed to LLBG WMA-3.

Nitrate (not a dangerous waste constituent) was observed above the DWS of 45 mg/L in downgradient well 299-W10-31. The 2020 results were consistent with previous data and indicate that the wells are within the regional nitrate plume (Section 3.1.5 in SGW-59564).



Reference: ECF-HANFORD-20-0078, *Preparation of the Hanford Site Water Table Map for January to March 2020*.

Figure 3-1. Low-Level Burial Grounds Waste Management Area 3

Table 3-1. LLBG WMA-3 Groundwater Monitoring Network

Well Name	Location	Year Installed	Head Date	Hydraulic Head		Elevation Screen Top		Elevation Screen Bottom		Water Column		Sample Frequency	Comments
				m	ft	m	ft	m	ft	m	ft		
299-W10-29	DG	2006	10/9/2020	136.50	447.84	136.9	449.3	126.3	414.3	10.2	33.6	Q	
299-W10-30	DG	2006	10/9/2020	136.55	448.01	137.0	449.5	126.3	414.5	10.2	33.6	Q	
299-W10-31	DG	2006	10/9/2020	135.86	445.74	136.5	448.0	125.8	412.9	10.0	32.9	Q	
299-W9-2	UG	2011	10/9/2020	136.82	448.87	137.0	449.4	126.3	414.5	10.5	34.4	Q	

Note: Requirements are from Table 3-1 in DOE/RL-2019-32, *Interim Status Groundwater Quality Assessment Plan for the Low-Level Burial Grounds Waste Management Area-3*.

DG = downgradient
S = semiannual
UG = upgradient

Table 3-2. LLBG WMA-3 Assessment Sampling Summary for 2020

Constituent	Units	Maximum	Water Quality Standard[a]	PQL[b]	Comments
Dangerous Waste Constituents					**Wells Above PQL or Water Quality Standard**
Barium, unfiltered	µg/L	48.1	2,000[c]	5.25	All wells above PQL
Barium, filtered	µg/L	49.0	2,000[c]	5.25	All wells above PQL
Carbon tetrachloride	µg/L	27	5.0[c]	3.0	Above water quality standard: 299-W10-30, 299-W10-31; above PQL: 299-W10-29
Tin, unfiltered	µg/L	15.8	—	10.5	Above PQL: 299-W9-2
Other Constituents					**Wells Above Water Quality Standard**
Alkalinity	mg/L	116	—	5.25	
Calcium, unfiltered	µg/L	58,000	—	1,050	
Calcium, filtered	µg/L	60,100	—	1,050	
Chloride	mg/L	28.8	250[d]	0.4	
Iron, unfiltered	µg/L	180	300[d]	105	
Magnesium, unfiltered	µg/L	19,000	—	1,050	
Magnesium, filtered	µg/L	19,700	—	1,050	
Molybdenum, unfiltered	µg/L	9.6	—	5.25	
Molybdenum, filtered	µg/L	9.8	—	5.25	
Nitrate	mg/L	50.0	45[e]	0.525	Above water quality standard: 299-W10-31
pH measurement	unitless	8.1	6.5 – 8.5[d]	—	
Potassium, unfiltered	µg/L	5,610	—	5,250	
Potassium, filtered	µg/L	5,800	—	5,250	
Sodium, unfiltered	µg/L	13,000	—	1,050	
Sodium, filtered	µg/L	13,000	—	1,050	
Specific conductance	µS/cm	517	—	—	

Table 3-2. LLBG WMA-3 Assessment Sampling Summary for 2020

Constituent	Units	Maximum	Water Quality Standard[a]	PQL[b]	Comments
Sulfate	mg/L	57.6	250[d]	1.05	
Temperature	°C	22.1	—	—	
Turbidity	NTU	4.35	—	—	

Note: Maximum is based on the required assessment sample results for this RCRA unit with concentrations above the PQL. Appendix A presents the full data set for 2020.

a. Water quality standards are provided for information only and are not used to determine RCRA groundwater monitoring exceedances.

b. Standardized PQL used in analytical requirements.

c. 40 CFR 141, Subpart G, "National Primary Drinking Water Regulations," "Maximum Contaminant Levels and Maximum Residual Disinfectant Levels."

d. 40 CFR 143.3, "National Secondary Drinking Water Regulations," "Secondary Maximum Contaminant Levels."

e. The federal drinking water standard for nitrate is 10 mg/L expressed as nitrogen (40 CFR 141, Subpart G). This equates to 45 mg/L when expressed as NO_3.

— = no comparison value or PQL

NTU = nephelometric turbidity unit

PQL = practical quantitation limit

RCRA = *Resource Conservation and Recovery Act of 1976*

3.2 Waste Management Area B-BX-BY

WMA B-BX-BY is located in the northern part of the 200 East Area (Figures 1-1 and 3-2). It was constructed in stages: B Tank Farm between 1943 and 1944, BX Tank Farm between 1946 and 1947, and BY Tank Farm between 1948 and 1949. All three tank farms provided interim storage for radioactive mixed waste, primarily from the bismuth phosphate and uranium extraction processes. SSTs at the B-BX-BY Tank Farms range in size from 208,000 to 2 million L (55,000 to 530,000 gal) capacity. Ancillary equipment at WMA B-BX-BY includes diversion boxes, underground catch tanks, connecting underground pipelines, and the 244BXR waste transfer vault.

Of the 40 SSTs in WMA B-BX-BY, 20 SSTs are assumed or confirmed to have leaked in the past (Table 4-1 in HNF-EP-0182, Rev. 359). To minimize the probability and severity of future leaks, most of the drainable liquid in each tank has been removed and transferred to double-shell tanks. Additional sources of unplanned releases within WMA B-BX-BY include tank overfills, waste loss from spare inlet nozzles or cascade lines, pipeline leaks, and surface releases.

DOE monitors groundwater beneath WMA B-BX-BY under an interim status assessment program in accordance with 40 CFR 265.93(d)(4). In the first and second quarters of 2020, sampling was performed in compliance to DOE/RL-2012-53, *Groundwater Quality Assessment Plan for Single-Shell Tank Waste Management Area B-BX-BY*. While developing DOE/RL-2012-53, an assessment of historical process chemistry, leak assessment reports, and groundwater contaminants concluded that cyanide had affected groundwater quality beneath the B Tank Farm. The probable cyanide source and a conceptual model for transport were provided as part of the determination. In the third and fourth quarters of 2020, groundwater monitoring was performed in compliance with DOE/RL-2019-74, *Interim Status Groundwater Quality Assessment Plan for the Single-Shell Tank System*. Both the original assessment plan (DOE/RL-2012-53) and the revised assessment plan (DOE/RL-2019-74) implement the monitoring network recommended in Section 7.4 of SGW-60587, *Engineering Evaluation Report for Single-Shell Tank Waste Management Area B-BX-BY Groundwater Monitoring*, including one proposed new well. The revised plan did not affect the quarterly sampling schedule but added constituents and substituted total alkalinity for speciated alkalinity.

Table 3-3 lists the WMA B-BX-BY monitoring well attributes. Most of the well screens extend across the entire unconfined aquifer to the underlying basalt surface. The unconfined aquifer at WMA B-BX-BY is contained within the Cold Creek unit gravels. Water-level predictions indicate that all of the wells will have sufficient water for continued sampling through at least 2030 (SGW-63743).

The 2020 regional hydraulic gradient was estimated at 8.6×10^{-6} m/m, dipping to the south and east (Table 1-2), with an average linear velocity of 0.62 m/d (2.0 ft/d). However, local flow directions beneath WMA B-BX-BY are influenced by groundwater extraction wells 299-E33-360 and 299-E33-361, as described in DOE/RL-2017-11, *Removal Action Work Plan for the 200-BP-5 Operable Unit Groundwater Extraction*.

The monitoring network was sampled as planned in 2020. An error occurred during the November 6, 2020, water-level measurement in well 299-E33-32, and the result has been flagged as rejected.

Table 3-4 summarizes the groundwater quality parameters and other constituents required by DOE/RL-2012-53 and DOE/RL-2019-74. Assessment monitoring at WMA B-BX-BY focuses on cyanide, which is a dangerous waste constituent that was present in groundwater upgradient, beneath, and downgradient of WMA B-BX-BY in 2020. Section 2.4 in SGW-60587 attributes this cyanide contamination to the BY Cribs, with some secondary contribution from the leak at tank 241-BX-102 in the 1950s. Total cyanide concentrations at downgradient wells 299-E33-44 and 299-E33-47 ranged from 775 to 1,180 µg/L. Free cyanide concentrations are lower than total cyanide, and only well 299-E33-44 had concentrations above the 4.8 µg/L MTCA cleanup level for free cyanide in 2020 (WAC 173-340). Wells 299-E33-20, 299-E33-38, and 299-E33-44 had free cyanide results greater than the PQL of 4 µg/L in 2020.

Other dangerous waste constituents detected at levels above the PQL were as follows:

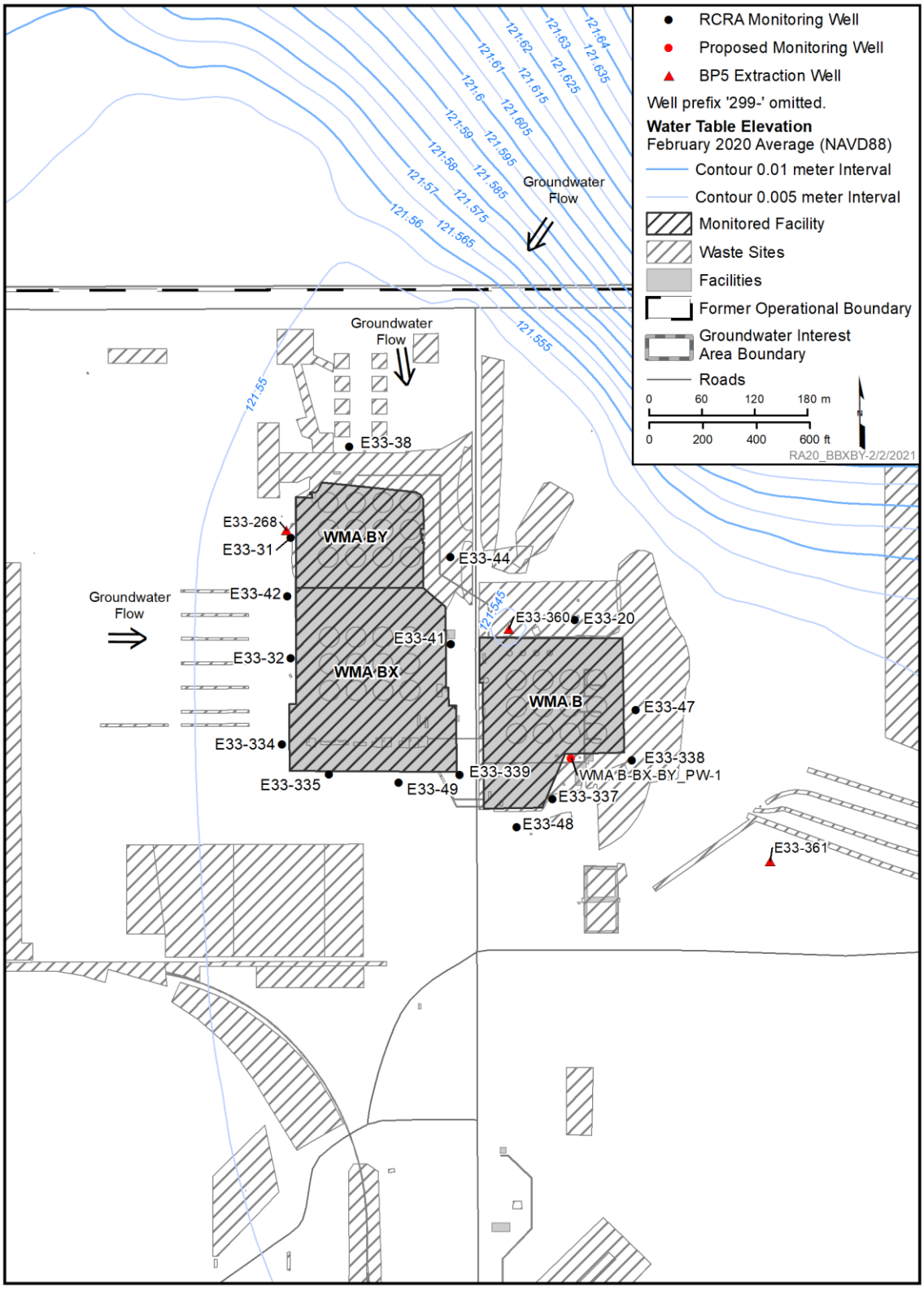
- Barium was observed in all wells in the WMA B-BX-BY monitoring network above the PQL of 5.25 µg/L. Barium occurs naturally in groundwater, and the concentrations observed at WMA B-BX-BY are less than the Hanford Site background value of 105 µg/L (DOE/RL-96-61) and less than the DWS of 2,000 µg/L. Barium is listed as a possible waste constituent at WMA B-BX-BY, but observed concentrations are less than background and do not indicate an impact to groundwater from WMA B-BX-BY.

- Nickel and chromium were detected above the PQL in wells in the WMA B-BX-BY monitoring network in 2020. In addition to naturally occurring in groundwater, these metals are constituents associated with stainless-steel alloys typically found in Hanford Site well components (e.g., casings, screens, and pumps). The ratios of these metals (and also of molybdenum and manganese) to iron are not similar to those found in stainless-steel alloys, and they do not show an increasing trend (Section 1.5). Therefore, these metals do not indicate a degree of well corrosion that warrants well maintenance.

- Selenium was observed above the PQL of 10.5 µg/L in well 299-E33-47. Selenium occurs naturally in groundwater, and the maximum observed values at WMA B-BX-BY, although slightly above Hanford Site background (9.5 µg/L) (DOE/RL-96-61), are less than the DWS of 50 µg/L. It is likely that this detection represents normal background variability and is not attributed to WMA B-BX-BY.

- Zinc was observed above the PQL (21 µg/L) and the Hanford Site background value (21.8 µg/L) (DOE/RL-96-61) in one filtered sample from downgradient well 299-E33-41, but the result was not consistent with a duplicate sample or with unfiltered samples and is flagged as a suspected error.

Nitrate (not a dangerous waste constituent) concentrations were above the 45 mg/L DWS at most of the wells at WMA B-BX-BY, including some of the upgradient wells, due to regional and local nitrate plumes (Section 2.4 in SGW-60587).



Reference: ECF-HANFORD-20-0078, *Preparation of the Hanford Site Water Table Map for January to March 2020*.

Figure 3-2. Waste Management Area B-BX-BY

Table 3-3. WMA B-BX-BY Groundwater Monitoring Network

Well Name	Location	Year Installed	Head Date	Hydraulic Head		Elevation Screen Top		Elevation Screen Bottom		Water Column		Sample Frequency	Sampled Months; Comments
				m	ft	m	ft	m	ft	m	ft		
299-E33-20[a]	DG	1956 (P)	11/9/2020	121.54	398.74	—[b]	—[b]	118.7	389.5	2.8	9.2	Q	2, 6, 8, 11
299-E33-31	UG	1989	11/6/2020	121.55	398.79	125.8	412.9	119.4	391.9	2.1	6.9	Q	2, 6, 8, 11
299-E33-32	UG	1989	9/29/2020[c]	121.56	398.82	126.2	413.9	119.8	392.9	1.8	5.9	Q	2, 6, 8, 11
299-E33-334	UG	2000	11/6/2020	121.54	398.75	124.7	409.3	117.1	384.2	4.4	14.5	Q	2, 6, 8, 11
299-E33-335[a]	DG	2000	11/6/2020	121.52	398.68	124.2	407.4	118.1	387.3	3.5	11.3	Q	2, 6, 8, 11
299-E33-337	DG	2001	11/10/2020	121.54	398.76	124.2	407.3	116.5	382.3	5.0	16.5	Q	2, 6, 8, 11
299-E33-338	DG	2001	11/10/2020	121.56	398.80	123.8	406.1	117.7	386.1	3.9	12.7	Q	2, 6, 8, 11
299-E33-339	DG	2001	11/10/2020	121.55	398.78	123.2	404.3	117.2	384.4	4.4	14.4	Q	2, 6, 8, 11
299-E33-38	UG	1991	11/9/2020	121.54	398.76	126.4	414.7	120.0	393.7	1.5	5.1	Q	2, 6, 8, 11
299-E33-41	DG	1991	11/9/2020	121.53	398.73	124.9	409.9	120.0	393.8	1.5	4.9	Q	2, 6, 8, 11
299-E33-42	UG	1991	11/6/2020	121.52	398.69	126.7	415.7	120.4	395.0	1.1	3.7	Q	2, 6, 8, 11
299-E33-44	DG	1998	11/10/2020	121.56	398.82	123.5	405.2	118.9	390.2	2.6	8.7	Q	2, 6, 8, 11
299-E33-47	DG	2004	11/10/2020	121.56	398.82	123.3	404.7	117.3	384.7	4.3	14.1	Q	2, 6, 8, 11
299-E33-48	DG	2004	11/9/2020	121.55	398.78	123.3	404.5	115.7	379.5	5.9	19.3	Q	2, 6, 8, 11
299-E33-49	DG	2004	11/23/2021	121.54	398.76	122.9	403.3	116.8	383.3	4.7	15.5	Q	2, 6, 8, 11
WMA_B-BX-BY_PW-1 (D0062)	DG	Proposed	—	—	—	—	—	—	—	—	—	Q	Not yet installed

Note: Requirements are from Table 2-1 in DOE/RL-2012-53, *Groundwater Quality Assessment Plan for the Single-Shell Tank Waste Management Area B-BX-BY*; and Table 2-4 in DOE/RL-2019-74, *Interim Status Groundwater Quality Assessment Plan for the Single-Shell Tank System*.

a. Hydraulic head data for these wells were not corrected for borehole deviation from vertical, which may cause reported head to be less than actual head.

b. Elevation of top of perforated interval is uncertain.

c. November water level was erroneous and flagged as "R" (rejected).

— = no information
DG = downgradient
P = constructed prior to *Washington Administrative Code* requirements
Q = quarterly
UG = upgradient
WMA = waste management area

Table 3-4. WMA B-BX-BY Assessment Sampling Summary for 2020

Constituent	Units	Maximum	Water Quality Standard[a]	PQL[b]	Comments
Dangerous Waste Constituents					**Wells Above PQL or Water Quality Standard**
Barium, unfiltered	µg/L	92.2	2,000[c]	5.25	All wells above PQL
Barium, filtered	µg/L	90	2,000[c]	5.25	All wells above PQL
Chromium, unfiltered	µg/L	61	100[c]	10.5	All wells except 299-E33-334 and 299-E33-49 above PQL
Chromium, filtered	µg/L	21.3	100[c]	10.5	Above PQL: 299-E33-20, 299-E33-337, 299-E33-44, 299-E33-47
Cyanide, free[d]	µg/L	4.75	4.8[e]	4.0	Outlier excluded. Above PQL: 299-E33-20, 299-E33-38, 299-E33-44
Cyanide, total	µg/L	1,180	—	15.75	Above PQL: 299-E33-20, 299-E33-31, 299-E33-337, 299-E33-38, 299-E33-41, 299-E33-42, 299-33-44, 299-E33-47
Nickel, unfiltered	µg/L	31.8	—	21	Above PQL: 299-E33-41, 299-E33-42
Selenium, unfiltered	µg/L	16.6	50[c]	10.5	Above PQL: 299-E33-47
Selenium, filtered	µg/L	15	50[c]	10.5	Above PQL: 299-E33-47
Zinc, filtered	µg/L	27.8	5,000[f]	21	Above PQL: 299-E33-41
Other Constituents					**Wells Above Water Quality Standard**
Alkalinity	mg/L	130	—	5.25	
Calcium, unfiltered	µg/L	210,000	—	1,050	
Calcium, filtered	µg/L	210,000	—	1,050	
Chloride	mg/L	42.2	250[f]	0.4	
Dissolved oxygen	mg/L	10.4	—	—	
Hexavalent chromium	µg/L	26.02	48[e]	10.5	
Iron, unfiltered	µg/L	14,50	300[e]	105	Above water quality standard: 299-E33-20, 299-E33-41, 299-E33-44
Iron, filtered	µg/L	440	300[e]	105	Above water quality standard: 299-E33-44

Table 3-4. WMA B-BX-BY Assessment Sampling Summary for 2020

Constituent	Units	Maximum	Water Quality Standard[a]	PQL[b]	Comments
Magnesium, unfiltered	µg/L	57,000	—	1,050	
Magnesium, filtered	µg/L	57,000	—	1,050	
Manganese, unfiltered	µg/L	86.3	50[e]	10.5	Above water quality standard: 299-E33-20
Manganese, filtered	µg/L	53.8	50[e]	10.5	Above water quality standard: 299-E33-20
Molybdenum, unfiltered	µg/L	8.0	—	5.25	
Molybdenum, filtered	µg/L	7.62	—	5.25	
Nitrate	mg/L	930	45[g]	0.525	Outlier excluded. Above water quality standard: 299-E33-20, 299-E33-31, 299-E33-32, 299-E33-337, 299-E33-338, 299-E33-38, 299-E33-41, 299-E33-42, 299-E33-44, 299-E33-47, 299-E33-48
pH measurement	unitless	8.2	6.5 – 8.5 [e]	—	
Potassium, unfiltered	µg/L	22,000	—	5,250	
Potassium, filtered	µg/L	22,000	—	5,250	
Sodium, unfiltered	µg/L	168,000	—	1,050	
Sodium, filtered	µg/L	170,000	—	1,050	
Specific conductance	µS/cm	2,251	—	—	
Sulfate	mg/L	230	250 [e]	1.05	
Temperature	°C	21.3	—	—	
Turbidity	NTU	3.72	—	—	

Table 3-4. WMA B-BX-BY Assessment Sampling Summary for 2020

Constituent	Units	Maximum	Water Quality Standard[a]	PQL[b]	Comments

Note: Maximum is based on the required assessment sample results for this RCRA unit with concentrations above the PQL. Appendix A presents the full data set for 2020.

a. Water quality standards are provided for information only and are not used to determine RCRA groundwater monitoring exceedances.

b. Standardized PQL used in analytical requirements.

c. 40 CFR 141, Subpart G, "National Primary Drinking Water Regulations," "Maximum Contaminant Levels and Maximum Residual Disinfectant Levels."

d. Free cyanide was not required during the first two quarters of 2020 but is summarized here for the entire year for completeness.

e. Individual risk based concentration levels as derived from WAC 173-340-720, "Groundwater Cleanup Standards," as calculated in ECF-100NPL-10-0462, *Calculation of Standard Method B Groundwater Cleanup Levels for Potable Groundwater for the 100 Areas and 300 Area Remedial Investigation/Feasibility Study Reports*.

f. 40 CFR 143.3, "National Secondary Drinking Water Regulations," "Secondary Maximum Contaminant Levels."

g. The federal drinking water standard for nitrate is 10 mg/L expressed as nitrogen (40 CFR 141, Subpart G). This equates to 45 mg/L when expressed as NO_3.

— = no comparison value or PQL

NTU = nephelometric turbidity unit

PQL = practical quantitation limit

RCRA = *Resource Conservation and Recovery Act of 1976*

3.3 Waste Management Area C

WMA C is located in the east-central portion of the 200 East Area (Figures 1-1 and 3-3). Constructed in 1943 and 1944, WMA C provided interim storage for radioactive mixed waste, primarily from the bismuth phosphate and uranium recovery processes. High-level liquid waste from these processes was stored in 12 SSTs, each with a capacity of 2.01 million L (530,000 gal). Four additional SSTs, each with a capacity of 208,000 L (55,000 gal), were also used to store high-level liquid waste. Ancillary equipment at WMA C includes diversion boxes, underground catch tanks, connecting underground pipelines, and the 244CR vault. Of the 16 underground SSTs in WMA C, 7 tanks were confirmed or assumed to have leaked in the past (DOE/RL-2009-77, Rev. 0, *Groundwater Quality Assessment Plan for the Single-Shell Waste Management Area C*), and retrieval processes since 1998 have removed the remaining liquid waste. Additional release sources include past waste losses from spare inlet nozzles or cascade lines, pipeline leaks, and surface releases.

DOE monitors groundwater beneath WMA C under an interim status assessment program in accordance with 40 CFR 265.93(d)(4). In the first and second quarters of 2020, sampling was performed in compliance with DOE/RL-2009-77, Rev. 1, *Interim Status Groundwater Quality Assessment Plan for the Single-Shell Tank Waste Management Area C*). While developing DOE/RL-2009-77, Rev. 1, an assessment of historical process chemistry, leak assessment reports, and groundwater contaminant distribution concluded that cyanide had affected groundwater beneath the C Tank Farm. In the third and fourth quarters of 2020, groundwater monitoring was performed in compliance with DOE/RL-2019-74. Both the original assessment plan (DOE/RL-2009-77) and the revised assessment plan (DOE/RL-2019-74) use the same monitoring well network recommended in Section 9.3 of SGW-60588, *Engineering Evaluation Report for Single-Shell Tank Waste Management Area C Groundwater Monitoring*, including two proposed wells. The revised plan did not affect the quarterly sampling schedule but added constituents and substituted total alkalinity for speciated alkalinity. All of the wells were sampled as required during the reporting period.

Table 3-5 lists the SST WMA C monitoring well attributes. Most of the wells are screened across the uppermost portion of the unconfined aquifer. Well 299-E27-26 is screened across the entire unconfined aquifer, and well 299-E27-155 is screened in the lower portion of the aquifer. The unconfined aquifer beneath WMA C is contained within the Hanford formation gravels and Cold Creek unit gravels overlying the Columbia River Basalt Group. Water-level predictions indicate that all of the wells will have sufficient water for continued sampling through at least 2030 (SGW-63743).

Groundwater gradient magnitude and flow direction were determined using a low-gradient monitoring network across the 200 East Area. The estimated average gradient was 4.4×10^{-6} m/m, dipping toward the southeast (Table 1-2). The estimated average linear velocity was 0.26 m/d (0.86 ft/d). The surface of the uppermost unconfined aquifer at SST WMA C is extremely flat. As shown in Figure 3-3, there is a change of <0.005 m (0.016 ft) across the entire unit. Figure 1-2 illustrates the water table over a wider region. An error occurred during the March 13, 2020, water-level measurement at well 299-E27-15; the result has been qualified as suspect in the Hanford Environmental Information System database.

Table 3-6 summarizes the monitoring results for 2020. Assessment monitoring at WMA C focuses on cyanide, which is a dangerous waste constituent that was detected as total cyanide in three of the WMA C wells in 2020. Free cyanide was not detected above the PQL (4 µg/L) or the 4.8 µg/L MTCA cleanup level (WAC 173-340) in any of the WMA C monitoring wells in 2020. Cyanide concentrations along the western side of WMA C appear to be associated with an advancing plume from the B Complex area. Well 299-E27-155 had the highest total cyanide concentration at WMA C in 2020 (63.3 µg/L in December), similar to 2019.

The following dangerous waste constituents were detected at levels above their PQLs in 2020:

- Barium was observed in all wells in the WMA C monitoring network above the PQL of 5.25 µg/L. Barium occurs naturally in groundwater, and the maximum concentration observed at WMA C (upgradient well 299-E27-22) is less than the Hanford Site background value of 105 µg/L (DOE/RL-96-61) and less than the DWS of 2,000 µg/L. Because it is detected in the upgradient well and concentrations are near background levels, barium is not attributed to WMA C.
- Selenium was observed above the PQL of 10.5 µg/L in five wells in the WMA C monitoring network, including two upgradient wells. Selenium occurs naturally in groundwater; the maximum observed values at WMA C, although above the Hanford Site background (9.5 µg/L) (DOE/RL-96-61), are less than half the DWS of 50 µg/L. Because it is detected in the upgradient wells and concentrations are near background levels, selenium is not attributed to WMA C.
- Total chromium and nickel were elevated in several WMA C wells in 2020. These metals (as well as iron, molybdenum, and manganese) are evaluated as indicators of possible corrosion in either stainless-steel casings or well components. These metals were only collectively elevated in wells 299-E27-15 and 299-E27-21 and only in June and September, respectively. However, the ratios of these metals to iron were not similar to the ratios for these metals on the stainless-steel alloys used in Hanford Site wells (Section 1.5). Corrosion sufficient to warrant well maintenance is not suspected at this time.

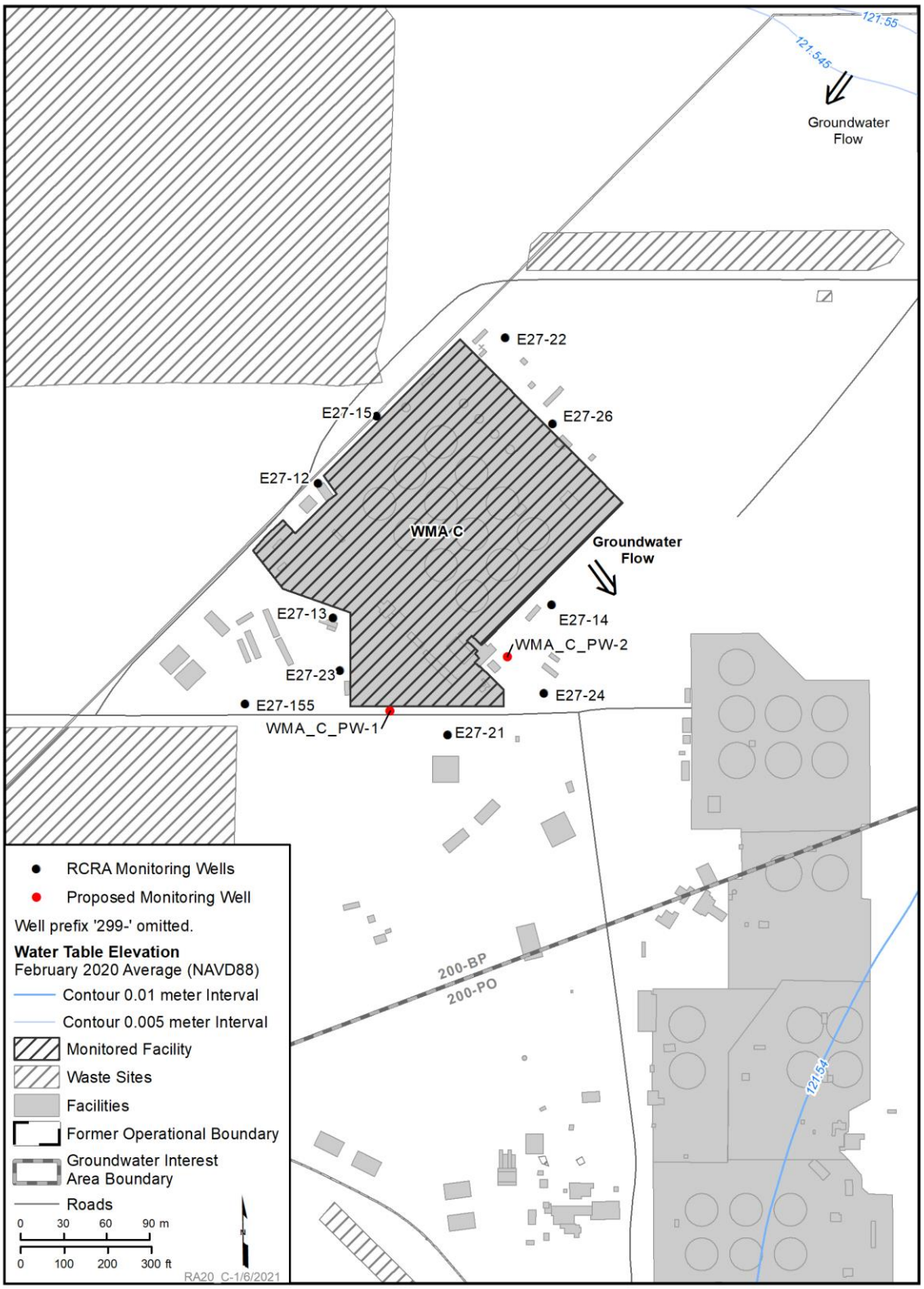
Cr(VI) was observed above the PQL (10.5 µg/L) in three WMA C wells. The maximum value of 18.4 µg/L is less than the 48 µg/L MTCA cleanup level for this constituent (WAC 173-340). Cr(VI) was added to the monitoring constituent list by DOE/RL-2019-74 to support information collected on chromium results.

In 2020, pH was measured above the upper secondary DWS (pH of 8.5) in two wells in the WMA C monitoring network, including in upgradient well 299-E27-12. The observed concentrations were not out of trend for the respective wells.

Concentrations of nitrate (not a dangerous waste constituent) were above the 45 mg/L DWS at all but three of the WMA C wells, including two of the four upgradient wells in 2020 due to regional nitrate plumes (Section 2.2 in SGW-60588). The highest nitrate concentrations were at downgradient wells 299-E27-155 (184 mg/L) and 299-E27-14 (165 mg/L).

Sulfate concentrations were above the 250 mg/L secondary DWS in four wells in 2020, including two upgradient wells (299-E27-22 and 299-E27-26). The elevated sulfate levels are attributed to regional sulfate plumes (Section 2.2 in SGW-60588).

The revised assessment monitoring plan (DOE/RL-2019-74) includes a considerable list of synthetic organic compounds (VOCs, semivolatile organic compounds, pesticides, and herbicides). None of the required organic compounds were detected above their respective PQLs in 2020.



Reference: ECF-HANFORD-20-0078, *Preparation of the Hanford Site Water Table Map for January to March 2020*.

Figure 3-3. Waste Management Area C

Table 3-5. WMA C Groundwater Monitoring Network

Well Name	Location	Year Installed	Head Date	Hydraulic Head		Elevation Screen Top		Elevation Screen Bottom		Water Column		Sample Frequency	Sampled Months; Comments
				m	ft	m	ft	m	ft	m	ft		
299-E27-12[a]	UG	1989	9/11/2020	121.54	398.75	126.4	414.7	120.0	393.6	1.6	5.1	Q	3, 6, 9, 12
299-E27-13	DG	1989	9/11/2020	121.51	398.64	126.8	416.0	120.4	394.9	1.1	3.8	Q	3, 6, 9, 12
299-E27-14[a]	DG	1989	9/17/2020	121.55	398.80	125.9	413.1	119.5	392.1	2.0	6.7	Q	3, 6, 9, 12
299-E27-15[b]	UG	1989	9/11/2020	121.65	399.10	126.6	415.4	120.2	394.4	1.4	4.7	Q	3, 6, 9, 12
299-E27-155	DG (deep)	2007	9/11/2020	121.44	398.42	116.1	380.9	105.4	345.9	16.0	52.5	Q	3, 6, 9, 12
299-E27-21[a]	DG	2003	9/11/2020	121.55	398.79	122.3	401.2	111.6	366.1	10.0	32.7	Q	3, 6, 9, 12
299-E27-22[a]	UG	2003	9/17/2020	121.57	398.86	123.1	403.8	110.9	363.9	10.7	35.0	Q	3, 6, 9, 12
299-E27-23[a]	DG	2003	9/11/2020	121.55	398.77	122.3	401.2	111.6	366.2	9.9	32.6	Q	3, 6, 9, 12
299-E27-24	DG (deep)	2010	9/17/2020	121.49	398.58	113.1	370.9	107.0	350.9	14.5	47.7	Q	3, 6, 9, 12
299-E27-26[b]	UG	2016	9/11/2020	121.02	397.04	122.9	403.2	110.7	363.2	10.3	33.9	Q	3, 6, 9, 12
WMA_C_PW-1 (D0044)	DG	Proposed	—	—	—	—	—	—	—	—	—	—	Not yet installed
WMA_C_PW-2 (D0045)	DG	Proposed	—	—	—	—	—	—	—	—	—	—	Not yet installed

Note: Requirements are from Table 2-1 in DOE/RL-2009-77, Rev. 1, *Interim Status Groundwater Quality Assessment Plan for the Single-Shell Tank Waste Management Area C*; and Table 2-5 in DOE/RL-2019-74, *Interim Status Groundwater Quality Assessment Plan for the Single-Shell Tank System.*

a. Hydraulic head data for these wells were corrected for borehole deviation from vertical. Corrections are not available for other wells in this network, which may cause reported head to be less than actual head.

b. Head in well 299-E27-26 is consistently much lower than other wells in the network, suggesting that the well is deviated from vertical. The measurement for March 13, 2020, was qualified as suspect (Y) in the Hanford Environmental Information System database.

DG = downgradient
UG = upgradient
Q = quarterly
WMA = waste management area

Table 3-6. WMA C Assessment Sampling Summary for 2020

Constituent	Units	Maximum	Water Quality Standard[a]	PQL[b]	Comments
Dangerous Waste Constituents					**Wells Above PQL or Water Quality Standard**
Barium, unfiltered	µg/L	93.2	2,000[c]	5.25	All wells above PQL
Barium, filtered	µg/L	94.1	2,000[c]	5.25	All wells above PQL
Chromium, unfiltered	µg/L	82	100[c]	10.5	Above PQL: 299-E27-12, 299-E27-13, 299-E27-14, 299-E27-15, 299-E27-155, 299-E27-21, 299-E27-22, 299-E27-23
Chromium, filtered	µg/L	16.5	100[c]	10.5	Above PQL: 299-E27-21, 299-E27-22, 299-E27-23
Cyanide (total)	µg/L	63.3	—	15.75	Above PQL: 299-E27-14, 299-E27-155, 299-E27-24
Hexavalent chromium	µg/L	18.43	48[d]	10.5	Above PQL: 299-E27-155, 299-E27-21, 299-E27-23
Nickel, unfiltered	µg/L	191	—	21	Above PQL: 299-E27-15, 299-E27-21
Nickel, filtered	µg/L	159	—	21	Above PQL: 299-E27-21
Selenium, unfiltered	µg/L	21.8	50[c]	10.5	Above PQL: 299-E27-14, 299-E27-21, 299-E27-22, 299-E27-24, 299-E27-26
Selenium, filtered	µg/L	22.7	50[c]	10.5	Above PQL: same as unfiltered
Other Constituents					**Wells Above Water Quality Standard**
Alkalinity	mg/L	113	—	5.25	
Calcium, unfiltered	µg/L	154,000	—	1,050	
Calcium, filtered	µg/L	155,000	—	1,050	
Chloride	mg/L	86.6	250[e]	0.4	
Dissolved oxygen	mg/L	10.6	—	—	
Iron, unfiltered	µg/L	335	300[e]	105	Above water quality standard: 299-E27-15, 299-E27-21
Magnesium, unfiltered	µg/L	40,600	—	1,050	
Magnesium, filtered	µg/L	42,600	—	1,050	
Manganese, unfiltered	µg/L	38.2	50[e]	10.5	
Manganese, filtered	µg/L	32.4	50[e]	10.5	

Table 3-6. WMA C Assessment Sampling Summary for 2020

Constituent	Units	Maximum	Water Quality Standard[a]	PQL[b]	Comments
Molybdenum, unfiltered	µg/L	3.3	—	5.25	
Molybdenum, filtered	µg/L	3.3	—	5.25	
Nitrate	mg/L	184	45[f]	0.525	Above water quality standard: 299-E27-14, 299-E27-155, 299-E27-21, 299-E27-22, 299-E27-23, 299-E27-24, 299-E27-26
pH measurement	unitless	8.56	6.5 – 8.5[e]	—	Above water quality standard: 299-E27-12, 299-E27-13
Potassium, unfiltered	µg/L	12,100	—	5,250	
Potassium, filtered	µg/L	12,400	—	5,250	
Sodium, unfiltered	µg/L	31,700	—	1,050	
Sodium, filtered	µg/L	32,600	—	1,050	
Specific conductance	µS/cm	1,241	—	—	
Sulfate	mg/L	393.0	250[e]	1.05	Above water quality standard: 299-E27-14, 299-E27-22, 299-E27-24, 299-E27-26
Temperature	°C	20.0	—	—	
Turbidity	NTU	4.6	—	—	

Note: Maximum is based on the required assessment sample results for this RCRA unit with concentrations above the PQL. Appendix A presents the full data set for 2020.

a. Water quality standards are provided for information only and are not used to determine RCRA groundwater monitoring exceedances.

b. Standardized PQL used in analytical requirements.

c. 40 CFR 141, Subpart G, "National Primary Drinking Water Regulations," "Maximum Contaminant Levels and Maximum Residual Disinfectant Levels."

d. Individual risk based concentration levels as derived from WAC 173-340-720, "Groundwater Cleanup Standards," as calculated in ECF-100NPL-10-0462, *Calculation of Standard Method B Groundwater Cleanup Levels for Potable Groundwater for the 100 Areas and 300 Area Remedial Investigation/Feasibility Study Reports*.

e. 40 CFR 143.3, "National Secondary Drinking Water Regulations," "Secondary Maximum Contaminant Levels."

f. The federal drinking water standard for nitrate is 10 mg/L expressed as nitrogen (40 CFR 141, Subpart G). This equates to 45 mg/L when expressed as NO_3.

— = no comparison value or PQL

NTU = nephelometric turbidity unit

PQL = practical quantitation limit

RCRA = *Resource Conservation and Recovery Act of 1976*

3.4 Waste Management Area S-SX

WMA S-SX (Figure 3-4) is located in the 200 West Area and consists of the S and the SX Tank Farms. The S Tank Farm contains 12 SSTs, each with a capacity of 2.9 million L (758,000 gal). The SX Tank Farm contains 15 SSTs, each with a capacity of 3.8 million L (1,000,000 gal) (Section 1.2 in RPP-7884, *Field Investigation Report for Waste Management Area S-SX*). The WMA also includes the following ancillary equipment: three catch tanks; one receiver tank; six diversion boxes; and associated piping, valve pits, and pumps (Section 1.2 in RPP-7884). Both tank farms received waste from the REDOX Plant in the 1950s and 1960s. To minimize the probability and severity of future leaks, most of the drainable liquid in each tank has been removed and transferred to double-shell tanks.

In 1996, at the direction of Ecology, WMA S-SX was placed into assessment monitoring status due to elevated specific conductance in downgradient monitoring wells. The first determination assessment found that multiple sources within the WMA had affected groundwater quality with elevated chromium (Chapter 5 in PNNL-11810, *Results of Phase I Groundwater Quality Assessment for Single-Shell Tank Waste Management Areas S-SX at the Hanford Site*).

In the first quarter of 2020, sampling was performed in compliance with DOE/RL-2009-73, *Interim Status Groundwater Quality Assessment Plan for the Single-Shell Tank Waste Management Area S-SX*. An interim status change notice was issued and implemented in the second quarter of 2020 (RCRA-CN-01_DOE/RL-2009-73_R1, *Interim Status Change Number 1: Interim Status Groundwater Quality Assessment Plan for the Single-Shell Tank Waste Management Area S-SX*. In the third and fourth quarters of 2020, groundwater monitoring was performed in compliance with a new assessment plan (DOE/RL-2019-74). The revised plan did not affect the quarterly sampling schedule but added constituents and substituted total alkalinity for speciated alkalinity. All of the wells were sampled as required during the reporting period.

The objective of RCRA monitoring at WMA S-SX is to assess the rate and extent of migration and the concentration of the dangerous waste constituent chromium in the groundwater. Cr(VI) is monitored as a supporting constituent. Dissolved chromium in Hanford Site groundwater is nearly all hexavalent, so filtered total chromium and Cr(VI) concentrations are similar.

Table 3-7 lists the monitoring wells for WMA S-SX. Both the change notice to the original assessment plan (RCRA-CN-01_DOE/RL-2009-73_R1) and the revised assessment plan (DOE/RL-2019-74) (effective in July 2020) implement the monitoring network recommended in SGW-60577, *Engineering Evaluation Report for Single-Shell Tank Waste Management Area S-SX Groundwater Monitoring*. However, well 299-W23-19 was removed from the WMA S-SX monitoring network with the change notice implementation. Water-level measurements cannot be collected from well 299-W23-19 because the well is located within the SX Tank Farm security fence, adjacent to tank SX-115, which is within a radiological control area. The pump discharge line and electrical wires for the sampling pump in this well pass through an underground pipe into a vault located outside the tank farm boundary. This allows the well to be sampled from the vault without field personnel entering the radiological control area. However, this configuration does not allow for water-level measurements to be collected. Therefore, well 299-W23-19 cannot meet the water-level monitoring requirement under RCRA. All of the network wells are expected to have sufficient water for continued sampling through at least 2030 (SGW-63743). The wells in the WMA S-SX monitoring network are screened across the uppermost portion of the unconfined aquifer, which includes Ringold unit E.

In 2020, the hydraulic gradient was estimated to be 5.0×10^{-3} m/m toward the east, with an estimated average linear velocity of 0.27 m/d (0.90 ft/d) (Table 1-2).

Table 3-8 summarizes the assessment data. Groundwater beneath WMA S-SX is contaminated with chromium at levels above the DWS. The chromium is attributed to a 91,000 L (24,000 gal) overfill event from tank S-104 in the S Tank Farm (Sections 3.7.2 and 4.6 in RPP-RPT-48589, *Hanford 241-S Farm Leak Assessment Report*) and a 190,000 L (51,000 gal) leak from tank SX-115 during 1965 in the SX Tank Farm (Section 4.3 and Table ES-1 in RPP-ENV-39658, *Hanford SX-Farm Leak Assessments Report*). The Cr(VI) concentrations are similar to total chromium. Depth-discrete sampling while drilling well 299-W22-47 in 2004 and 2005 indicated that chromium was present within the upper 20 m (65 ft) of the aquifer. The maximum unfiltered chromium concentration at WMA S-SX in 2020 was 291 µg/L in March at downgradient well 299-W22-94, and the maximum concentration of Cr(VI) was 269 µg/L at downgradient well 299-W22-93. Additionally, downgradient wells 299-W22-116 and 299-W23-19 also detected concentrations of chromium and Cr(VI) above the 48 µg/L MTCA standard for Cr(VI) (WAC 173-340).

The following dangerous waste constituents were detected at levels above their PQLs in 2020:

- Barium was observed in all wells in the WMA S-SX monitoring network above the PQL of 5.25 µg/L. Barium occurs naturally in groundwater, and the concentrations observed at WMA S-SX are less than the Hanford Site background value of 105 µg/L (DOE/RL-96-61) and less than the DWS of 2,000 µg/L. Because it is detected in the upgradient well and concentrations are below background levels, barium is not attributed to WMA S-SX.

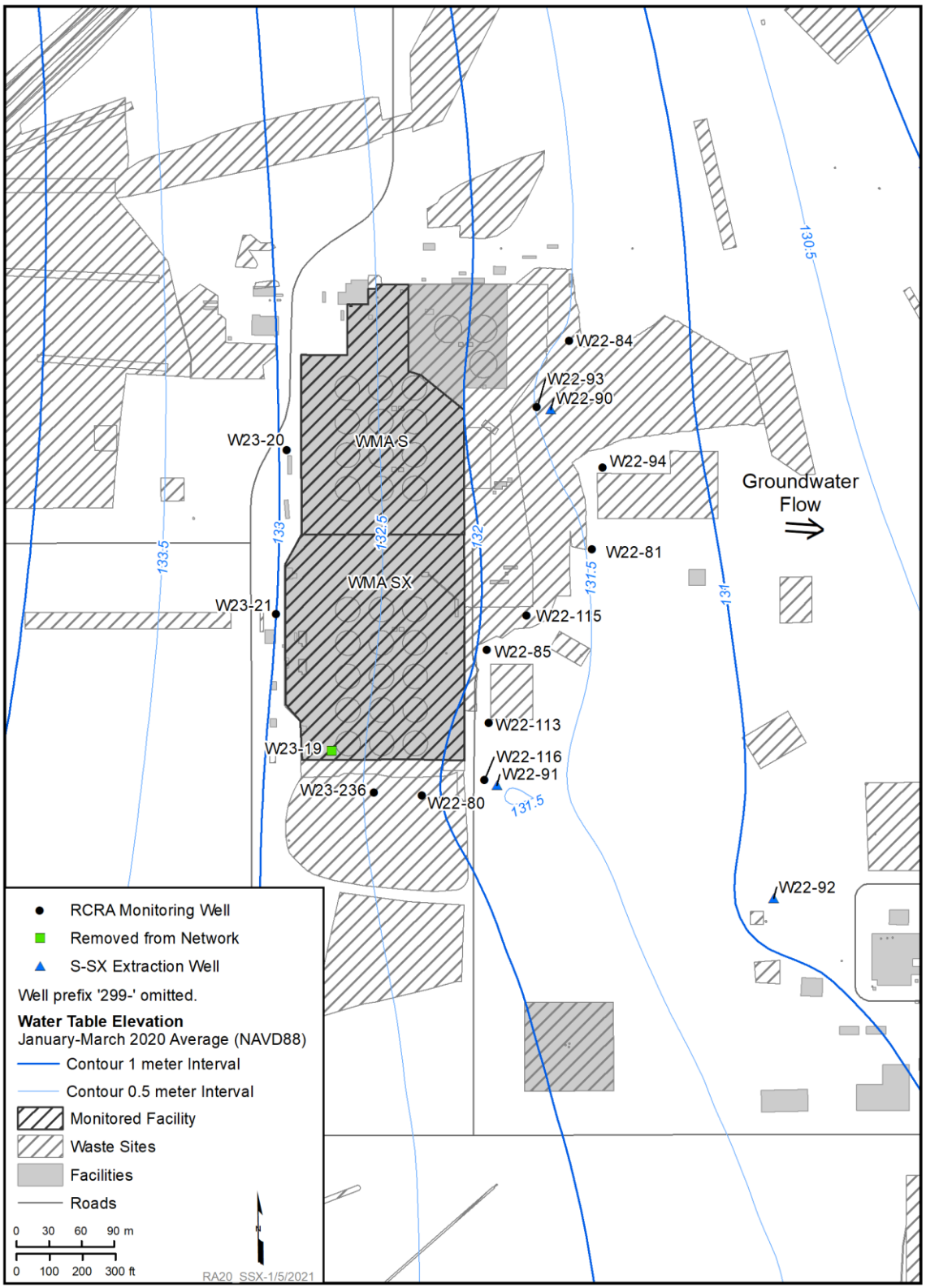
- Carbon tetrachloride was observed in all of the network wells above the primary DWS of 5 µg/L. Although carbon tetrachloride is listed in the dangerous wastes identified from the SST system Hanford RCRA Part A application, upgradient well values indicate that detections at WMA S-SX in 2020 originated from a regional contaminant plume.

- Filtered copper was detected at 64.2 µg/L in downgradient well 299-W22-94, but the result was not consistent with the unfiltered sample and was flagged as a suspected error. Unfiltered copper was detected at 16 µg/L in well 299-W22-113, which is above the PQL (10 µg/L) but below the secondary DWS (1,000 µg/L). Copper occurs naturally in groundwater, and its background concentration in Hanford Site groundwater is 0.81 µg/L (DOE/RL-96-61). The observed concentrations in WMA S-SX monitoring wells is two orders of magnitude below the DWS (1,000 µg/L). Because copper is not consistently detected, it is not attributed to WMA S-SX.

- Selenium was observed in filtered and unfiltered samples from downgradient well 299-W22-115, above the PQL of 10.5 µg/L and slightly above the Hanford Site background (9.5 µg/L) (DOE/RL-96-61). Concentrations observed at WMA S-SX are less than the DWS of 50 µg/L. It is likely that this detection represents normal background variability and is not attributed to WMA S-SX.

Five downgradient wells had concentrations of nitrate (not a dangerous waste constituent) above the 45 mg/L DWS (Table 3-8). Although there are regional nitrate plumes in the 200 West Area, the local nitrate plume is associated with WMA S-SX (Section 4.4 in SGW-60577).

Iron, manganese, and/or nickel were detected above the PQL in both upgradient and downgradient wells in the WMA S-SX monitoring network in 2020. These metals (as well as chromium) are naturally occurring in groundwater and are constituents associated with stainless-steel alloys typically found in Hanford Site well components (e.g., casings, screens, and pumps). However, none of the wells are exhibiting concentrations or ratios to iron reflective of the stainless-steel alloys typically used in Hanford Site monitoring wells, and concentrations are not increasing (Section 1.5). Therefore, these metals do not indicate a degree of well corrosion that warrants well maintenance.



Reference: ECF-HANFORD-20-0078, *Preparation of the Hanford Site Water Table Map for January to March 2020*.

Figure 3-4. Waste Management Area S-SX

Table 3-7. WMA S-SX Groundwater Monitoring Network

Well Name	Location	Year Installed	Head Date	Hydraulic Head		Elevation Screen Top		Elevation Screen Bottom		Water Column		Sample Frequency	Sampled Months; Comments
				m	ft	m	ft	m	ft	m	ft		
299-W22-113	DG	2014	9/9/2020	131.86	432.60	132.7	435.5	123.6	405.4	8.3	27.2	Q	3, 6, 9, 12
299-W22-115	DG	2015	9/10/2020	131.80	432.42	133.3	437.2	122.6	402.2	9.2	30.3	Q	3, 6, 9, 12
299-W22-116	DG	2015	9/9/2020	131.82	432.49	132.5	434.9	121.9	399.8	10.0	32.7	Q	3, 6, 9, 12
299-W22-80	DG	2000	9/8/2020	132.00	433.07	137.5	451.1	126.8	416.0	5.2	17.0	Q	3, 6, 9, 12
299-W22-81	DG	2001	9/8/2020	131.44	431.24	136.8	448.8	126.1	413.8	5.3	17.4	Q	3, 6, 9, 12
299-W22-84	DG	2001	9/9/2020	131.53	431.51	137.1	449.7	126.4	414.7	5.1	16.8	Q	3, 6, 9, 12
299-W22-85	DG	2001	9/9/2020	131.96	432.92	137.5	451.1	126.9	416.2	5.1	16.7	Q	3, 6, 9, 12
299-W22-93	DG	2015	9/8/2020	132.23	433.82	132.3	434.1	121.6	399.1	10.6	34.8	Q	3, 6, 9, 12
299-W22-94	DG	2013	9/8/2020	131.34	430.92	133.2	436.9	122.5	401.9	8.8	29.0	Q	3, 6, 9, 12
299-W23-19*	DG	1999	8/28/2020	132.51	434.74	138.5	454.3	129.1	423.6	3.4	11.1	Q/0	3
299-W23-20	UG	2000	9/10/2020	130.18	427.11	137.4	450.8	126.7	415.8	3.4	11.3	Q	3, 6, 9, 12
299-W23-21	UG	2000	9/10/2020	132.85	435.84	137.8	452.1	126.5	415.0	6.4	20.9	Q	3, 6, 9, 12

Note: Requirements are from Table 2-1 in DOE/RL-2009-73, *Interim Status Groundwater Quality Assessment Plan for the Single-Shell Tank Waste Management Area S-SX*; and Table 2-6 in DOE/RL-2019-74, *Interim Status Groundwater Quality Assessment Plan for the Single-Shell Tank System.*

*Water-level measurements are not possible from well 299-W23-19 because it is located within the tank farm fence line and is sampled remotely from outside the fence. The water level was estimated as 0.2 m higher than at nearby well 299-W23-236.

DG = downgradient
Q = quarterly
Q/0 = quarterly under DOE/RL-2009-73; not included in DOE/RL-2019-74
UG = upgradient

Table 3-8. WMA S-SX Assessment Sampling Summary for 2020

Constituent	Units	Maximum	Water Quality Standard[a]	PQL[b]	Comments
Dangerous Waste Constituents					**Wells Above PQL or Water Quality Standard**
Barium, unfiltered	µg/L	39	2,000[c]	5.25	All wells above PQL
Barium, filtered	µg/L	38	2,000[c]	5.25	All wells above PQL
Carbon tetrachloride	µg/L	72.9	5.0[c]	3.0	Above PQL and water quality standard: all wells
Chromium, unfiltered	µg/L	291	100[c]	10.5	Above PQL and water quality standard: 299-W22-116, 299-W22-81, 299-W22-93, 299-W22-94, 29-W23-19; above PQL: 299-W22-80, 299-W22-113, 299-W23-20,
Chromium, filtered	µg/L	250	100[c]	10.5	Above PQL and water quality standard: 299-W22-116, 299-W22-93, 299-W23-19; above PQL: 299-W22-94
Copper, unfiltered	µg/L	16.0	1,000[d]	10	Above PQL: 299-W22-113
Copper, filtered	µg/L	64.2	1,000[d]	10	Above PQL: 299-W22-94; flagged as suspected error
Nickel, unfiltered	µg/L	150	—	21	Above PQL: 299-W22-80, 299-W22-81, 299-W22-94, 299-W23-20
Nickel, filtered	µg/L	63.7	—	21	Above PQL: 299-W22-81, 299-W22-94
Selenium, unfiltered	µg/L	12	50[c]	10.5	Above PQL: 299-W22-115
Selenium, filtered	µg/L	13	50[c]	10.5	Above PQL: 299-W22-115
Other Constituents					**Wells Above Water Quality Standard**
Alkalinity	mg/L	107	—	5.25	
Calcium, unfiltered	µg/L	42,400	—	1,050	
Calcium, filtered	µg/L	41,400	—	1,050	
Chloride	mg/L	17.9	250[d]	0.4	
Dissolved oxygen	mg/L	9.7	—	—	
Hexavalent chromium	µg/L	269	48[e]	10.5	Above water quality standard: 299-W22-116, 299-W22-93, 299-W23-19; above PQL: 299-W22-80
Iron, unfiltered	µg/L	10,500	300[d]	105	Above water quality standard: 299-W22-113, 299-W22-80, 299-W22-81, 299-W22-94, 299-W23-21

Table 3-8. WMA S-SX Assessment Sampling Summary for 2020

Constituent	Units	Maximum	Water Quality Standard[a]	PQL[b]	Comments
Iron, filtered	µg/L	381	300[d]	105	Above water quality standard: 299-W22-81
Magnesium, unfiltered	µg/L	14,700	—	1,050	
Magnesium, filtered	µg/L	14,200	—	1,050	
Manganese, unfiltered	µg/L	229	50[d]	10.5	Above water quality standard: 299-W22-21, 299-W22-81, 299-W22-113
Manganese, filtered	µg/L	108	50[d]	10.5	Above water quality standard: 299-W22-21, 299-W22-81
Molybdenum, unfiltered	µg/L	9.8	—	5.25	
Molybdenum, filtered	µg/L	9.7	—	5.25	
Nitrate	mg/L	85.9	45[f]	0.525	Above water quality standard: 299-W22-113, 299-W22-115, 299-W22-116, 299-W22-93, 299-W23-19
pH measurement	unitless	7.94	6.5 – 8.5[d]	—	
Sodium, unfiltered	µg/L	31,000	—	1,050	
Sodium, filtered	µg/L	31,000	—	1,050	
Specific conductance	µS/cm	438	—	—	
Sulfate	mg/L	31.0	250[d]	1.05	
Temperature	°C	24.1	—	—	
Turbidity	NTU	244	—	—	

Note: Maximum is based on the required assessment sample results for this RCRA unit with concentrations above the PQL. Appendix A presents the full data set for 2020.

a. Water quality standards are provided for information only and are not used to determine RCRA groundwater monitoring exceedances.

b. Standardized PQL used in analytical requirements.

c. 40 CFR 141, Subpart G, "National Primary Drinking Water Regulations," "Maximum Contaminant Levels and Maximum Residual Disinfectant Levels."

d. 40 CFR 143.3, "National Secondary Drinking Water Regulations," "Secondary Maximum Contaminant Levels."

e. WAC 173-340-705; individual risk-based concentration levels as derived from WAC 173-340-720, "Model Toxics Control Act—Cleanup," "Groundwater Cleanup Standards," as calculated in ECF-100NPL-10-0462, *Calculation of Standard Method B Groundwater Cleanup Levels for Potable Groundwater for the 100 Areas and 300 Area Remedial Investigation/ Feasibility Study Reports*.

f. The federal drinking water standard for nitrate is 10 mg/L expressed as nitrogen (40 CFR 141, Subpart G). This equates to 45 mg/L when expressed as NO_3.

Table 3-8. WMA S-SX Assessment Sampling Summary for 2020

Constituent	Units	Maximum	Water Quality Standard[a]	PQL[b]	Comments

— = no comparison value

NTU = nephelometric turbidity unit

PQL = practical quantitation limit

RCRA = *Resource Conservation and Recovery Act of 1976*

3.5 Waste Management Area T

WMA T (Figure 3-5), which includes the T Tank Farm, is located in the northern portion of the 200 West Area. WMA T contains 16 underground SSTs constructed in 1943 and 1944. Tanks T-101 through T-112 have capacities of 2,000,000 L (528,000 gal), and tanks T-201 through T-204 have capacities of 208,000 L (55,000 gal). WMA T also includes diversion boxes, ancillary pumps, valves, and pipes.

The tanks in WMA T began receiving waste in 1944 and were in almost continual use until 1980, when all of the tanks in the WMA were removed from service. The SSTs received transuranic, high-level metal, and first-cycle waste from chemical processing of uranium-bearing, irradiated reactor fuel rods. Lesser amounts of other waste were also stored in the WMA T tanks. WHC-MR-0132, *A History of the 200 Area Tank Farms*; WRPS-55779-FP, *Hanford Tank Waste to WIPP – Maximizing the Value of our National Repository Asset – 14230*; and RPP-7218, *Preliminary Inventory Estimates for Single-Shell Tank Leaks in T, TX, and TY Tank Farms*, provide more detailed information on WMA T waste inventory. Most of the drainable liquid in each tank has been removed, and the tanks have been interim stabilized. As an interim corrective action, berms were constructed around the tank farms in 2001 to stop run-on of natural precipitation, and all known water lines were tested or cut off. In 2008, interim surface barriers were placed over the tanks in WMA T to inhibit precipitation infiltration.

WMA T was placed in assessment monitoring in 1993 due to elevated specific conductance. Chromium is a dangerous waste constituent monitored under the RCRA assessment program. Past leaks from SSTs and waste pipelines within the WMA are the sources of chromium contamination, as described in DOE/RL-2009-66, Rev. 1, *Interim Status Groundwater Quality Assessment Plan for the Single-Shell Tank Waste Management Area T*.

In the first and second quarters of 2020, sampling was performed in accordance with DOE/RL-2009-66, Rev. 2. During the third and fourth quarters of 2020, groundwater monitoring was performed in accordance with DOE/RL-2019-74. In comparison to the previous plan, the revised plan expands the groundwater quality assessment constituents and removes fluoride as a supporting constituent. This assessment plan implements the monitoring network recommended in SGW-60575, *Engineering Evaluation Report for Single-Shell Tank Waste Management Area T Groundwater Monitoring*, including one upgradient well, five downgradient wells, and three proposed new wells (Table 3-9).

Because of planned increases in groundwater extraction at the 200 West P&T, updated water-level predictions (SGW-63743) indicate that five of the wells will have <0.9 m (3 ft) of water within the next 10 years (Table 3-9). The need for replacement wells is being evaluated; new wells at the Hanford Site are negotiated annually by the Tri-Parties under Tri-Party Agreement Milestone M-24-00 (Ecology et al., 1989b). The wells in the WMA T monitoring network are screened across the uppermost portion of the unconfined aquifer, which includes Ringold unit E.

Extraction well 299-W11-50, east of WMA T, affects local groundwater flow (Figure 3-5). Groundwater generally flows to the east-southeast with a gradient of 7.9×10^{-3} m/m. The estimated average linear velocity beneath WMA T is 0.43 m/d (1.4 ft/d) (Table 1-2). The direction of groundwater flow is not expected to change with continued operation of the 200 West P&T.

In 2020, concentrations of the dangerous waste constituent chromium were above the 100 µg/L DWS in filtered and unfiltered samples from upgradient well 299-W10-28 and were above the PQL (10.5 µg/L) at additional wells (Table 3-10). Concentrations of Cr(VI) were above the 48 µg/L MTCA standard for Cr(VI) (WAC 173-340) in wells 299-W10-28, 299-W11-40, and 299-W11-41.

Other dangerous waste constituents detected at concentrations above the PQLs include the following:

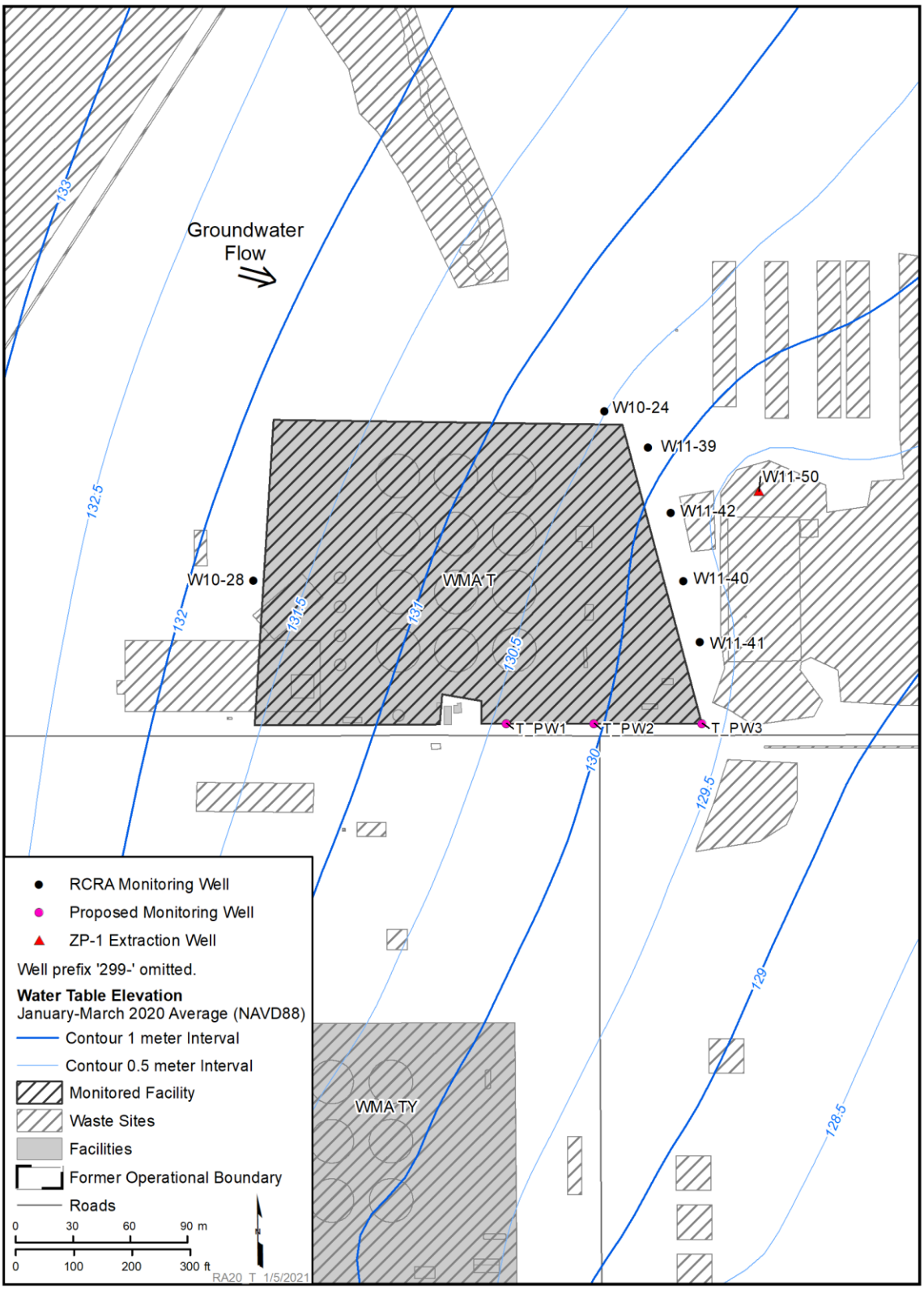
- Barium was detected above the PQL in wells of the WMA T monitoring network in 2020 (Table 3-10). Barium was observed above the Hanford Site background value of 105 µg/L (DOE/RL-96-61) in upgradient well 299-W10-28, indicating its presence upgradient of WMA T.
- Carbon tetrachloride was detected in all of the network wells above the primary DWS of 5 µg/L. Although carbon tetrachloride is listed in the dangerous wastes from the SST system in the Hanford RCRA Part A application, upgradient wells indicate that detections at WMA T are derived from a regional contaminant plume and not from WMA T (Section 4.4 and Figure 4-3 in SGW-60575). Carbon tetrachloride is present in the unconfined aquifer beneath most of the 200 West Area (Chapter 12 in DOE/RL-2019-66).
- Although naturally occurring, arsenic is a potential constituent of concern at WMA T based upon known process history and is listed in the waste codes on the unit's Hanford RCRA Permit Part A application. Filtered and unfiltered arsenic were observed above the PQL (10.5 µg/L) and DWS (10 µg/L) at downgradient wells 299-W10-24 and 299-W11-39 in November 2020, consistent with previous data. It has not yet been evaluated whether this detection can be attributed to WMA T.
- Vanadium was detected above the PQL (52.5 µg/L) at downgradient wells 299-W10-24 and 299-W11-39. This element is naturally occurring, is not considered a potential constituent of concern at WMA T based on known process history, and is not listed in the waste codes on the unit's Hanford RCRA Permit Part A application.
- Zinc was detected in an unfiltered sample from downgradient well 299-W11-39 at 30 µg/L during the November 2020 sampling event; however, it was undetected in the filtered sample. The detection was above the PQL of 21 µg/L but was well below the secondary DWS of 5,000 µg/L. Because zinc is not consistently detected, it is not attributed to WMA T.

Nitrate (not a dangerous waste constituent) is also found in groundwater beneath WMA T in all of the network wells. The nitrate plume beneath WMA T is within a regional nitrate plume and did not change substantially between 2019 and 2020. The highest nitrate concentrations in 2020 were in upgradient well 299-W10-28 (1,860 mg/L in August 2020) and downgradient well 299-W11-41 (371 mg/L in November 2020). While WMA T is a source of a local, high-concentration nitrate plume, other upgradient sources are considered to be larger contributors to nitrate contamination (Section 2.4 and Figure 4-5 in SGW-60575).

In 2020, fluoride concentrations were above the primary DWS (4 mg/L) in downgradient well 299-W10-24, which is consistent with previous results. However, fluoride was removed from the list of WMA T monitoring constituents in DOE/RL-2019-74.

In 2020, pH was measured above the upper secondary DWS (pH of 8.5 pH) at downgradient wells 299-W10-24 and 299-W11-39. The observed concentrations were not out of trend for the respective wells.

Iron, manganese, and nickel were detected above the PQL and respective DWS in both upgradient and downgradient wells in the WMA T monitoring network in 2020 (Table 3-10). These metals (included with chromium) are naturally occurring in groundwater and are constituents associated with stainless-steel alloys typically found in Hanford Site well components (e.g., casings, screens, and pumps). However, none of the wells are exhibiting concentrations or ratios to iron reflective of the stainless-steel alloys typically used in Hanford Site monitoring wells, and concentrations are not increasing (Section 1.5). Therefore, these metals do not indicate a degree of well corrosion that warrants well maintenance.



Reference: ECF-HANFORD-20-0078, *Preparation of the Hanford Site Water Table Map for January to March 2020*.

Figure 3-5. Waste Management Area T

Table 3-9. WMA T Groundwater Monitoring Network

Well Name	Location	Year Installed	Head Date	Hydraulic Head		Elevation Screen Top		Elevation Screen Bottom		Water Column		Sample Frequency	Sampled Months; Comments
				m	ft	m	ft	m	ft	m	ft		
299-W10-24*	DG	1998	11/12/2020	130.38	427.76	138.0	452.7	127.3	417.6	3.1	10.2	Q	2, 6, 8, 11
299-W10-28	UG	2001	11/13/2020	131.43	431.20	137.5	451.0	126.8	416.0	4.6	15.2	Q	2, 6, 8, 11
299-W11-39*	DG	2000	11/12/2020	130.19	427.15	137.2	450.0	126.5	414.9	3.7	12.2	Q	2, 6, 8, 11
299-W11-40*	DG	2000	11/12/2020	129.98	426.45	137.1	449.9	126.4	414.8	3.5	11.6	Q	2, 6, 8, 11
299-W11-41*	DG	2000	11/16/2020	129.89	426.14	137.5	451.2	126.9	416.2	3.0	10.0	Q	2, 6, 8, 11
299-W11-42*	DG	2000	11/12/2020	130.19	427.13	138.0	452.8	127.3	417.8	2.8	9.3	Q	2, 6, 8, 11
T_PW1 (D0017)	DG	Proposed	—	—	—	—	—	—	—	—	—	Q	Not yet installed
T_PW2 (D0018)	DG	Proposed	—	—	—	—	—	—	—	—	—	Q	Not yet installed
T_PW3 (D0019)	DG	Proposed	—	—	—	—	—	—	—	—	—	Q	Not yet installed

Note: Requirements are from Table 2-1 in DOE/RL-2009-66, Rev. 2, *Interim Status Groundwater Quality Assessment Plan for the Single-Shell Tank Waste Management Area T*; and Table 2-7 in DOE/RL-2019-74, *Interim Status Groundwater Quality Assessment Plan for the Single-Shell Tank System*.

*Wells are predicted to have <0.9 m (3 ft) water in the screened interval within the next 10 years, which may limit sampling in the future if the water table continues to decline.

— = no information (not yet installed)
DG = downgradient
Q = quarterly
UG = upgradient

Table 3-10. WMA T Sampling Summary for 2020

Constituent	Units	Maximum	Water Quality Standard[a]	PQL[b]	Comments
Dangerous Waste Constituents					**Wells Above PQL or Water Quality Standard**
Arsenic, unfiltered	µg/L	15.4	10[c]	10.5	Above PQL and water quality standard: 299-W10-24, 299-W11-39
Arsenic, filtered	µg/L	15.8	10[c]	10.5	Same as unfiltered
Barium, unfiltered	µg/L	394	2,000[c]	5.25	All wells above PQL
Barium, filtered	µg/L	405	2,000[c]	5.25	All wells above PQL
Carbon tetrachloride	µg/L	352	5.0[c]	3.0	All wells above PQL and water quality standard
Chromium, unfiltered	µg/L	483	100[c]	10.5	Above water quality standard: 299-W10-28; all wells above PQL
Chromium, filtered	µg/L	484	100[c]	10.5	Above water quality standard: 299-W10-28; Above PQL: 299-W11-39, 299-W11-40, 299-W11-41, 299-W11-42
Nickel, unfiltered	µg/L	44.2	—	21	Above PQL: 299-W11-39
Vanadium, unfiltered	µg/L	130	—	52.5	Above PQL: 299-W10-24, 299-W11-39
Vanadium, filtered	µg/L	130	—	52.5	Same as unfiltered
Zinc, unfiltered	µg/L	30	5,000[d]	21	Above PQL: 299-W11-39
Other Constituents					**Wells Above Water Quality Standard**
Alkalinity	mg/L	132	—	5.25	
Calcium, unfiltered	µg/L	395,000	—	1,050	
Calcium, filtered	µg/L	413,000	—	1,050	
Chloride	mg/L	40.0	250[d]	0.4	
Dissolved oxygen	mg/L	10.53	—	—	
Fluoride	mg/L	4.48	4.0[c]	0.525	Above water quality standard: 299-W10-24
Hexavalent chromium	µg/L	506.8	48[e]	10.5	Above water quality standard: 299-W10-28, 299-W11-40, 299-W11-41

Table 3-10. WMA T Sampling Summary for 2020

Constituent	Units	Maximum	Water Quality Standard[a]	PQL[b]	Comments
Iron, unfiltered	µg/L	4,770	300[d]	105	Above water quality standard: 299-W10-28, 299-W11-41
Iron, filtered	µg/L	109	300[d]	105	
Magnesium, unfiltered	µg/L	104,000	—	1,050	
Magnesium, filtered	µg/L	108,000	—	1,050	
Manganese, unfiltered	µg/L	80.7	50[d]	10.5	Above water quality standard: 299-W11-41
Molybdenum, unfiltered	µg/L	9.7	—	5.25	
Molybdenum, filtered	µg/L	9.79	—	5.25	
Nitrate	mg/L	1,860	45[f]	0.525	All wells above water quality standard
pH measurement	unitless	8.89	6.5 – 8.5[d]	—	Above water quality standard: 299-W10-24, 299-W11-39
Potassium, unfiltered	µg/L	8,710	—	5,250	
Potassium, filtered	µg/L	9,040	—	5,250	
Sodium, unfiltered	µg/L	166,000	—	1,050	
Sodium, filtered	µg/L	168,000	—	1,050	
Specific conductance	µS/cm	2,981	—	—	
Sulfate	mg/L	62	250 [d]	1.05	
Temperature	°C	26.2	—	—	
Turbidity	NTU	130	—	—	

Note: Maximum is based on the required assessment sample results for this RCRA unit with concentrations above the PQL. Appendix A presents the full data set for 2020.

a. Water quality standards are provided for information only and are not used to determine RCRA groundwater monitoring exceedances.

b. Standardized PQL used in analytical requirements.

c. 40 CFR 141, Subpart G, “National Primary Drinking Water Regulations,” “Maximum Contaminant Levels and Maximum Residual Disinfectant Levels.”

d. 40 CFR 143.3, “National Secondary Drinking Water Regulations,” “Secondary Maximum Contaminant Levels.”

e. Individual risk-based concentration levels as derived from WAC 173-340-720, “Model Toxics Control Act—Cleanup,” “Groundwater Cleanup Standards,” as calculated in ECF-100NPL-10-0462, *Calculation of Standard Method B Groundwater Cleanup Levels for Potable Groundwater for the 100 Areas and 300 Area Remedial Investigation/Feasibility Study Reports.*

Table 3-10. WMA T Sampling Summary for 2020

Constituent	Units	Maximum	Water Quality Standard[a]	PQL[b]	Comments

f. The federal drinking water standard for nitrate is 10 mg/L expressed as nitrogen (40 CFR 141, Subpart G). This equates to 45 mg/L when expressed as NO_3.

— = no comparison value or PQL

NTU = nephelometric turbidity unit

PQL = practical quantitation limit

RCRA = *Resource Conservation and Recovery Act of 1976*

3.6 Waste Management Area TX-TY

WMA TX-TY (Figure 3-6), which includes the TX and TY Tank Farms, is located in the northern portion of the 200 West Area. The WMA contains 24 underground SSTs constructed in 1947 and 1948 for the TX Tank Farm and in 1951 and 1952 for the TY Tank Farm. Each tank has a capacity of 2.84 million L (750,000 gal). In addition to the tanks, six diversion boxes and ancillary pumps, valves, and pipes are included in the Hanford RCRA Permit Part A form for the SSTs in the TX-TY Tank Farms system.

The tanks in WMA TX-TY began receiving waste in 1949, with the tanks in both farms used to support the bismuth phosphate process and the uranium recovery program. Some of the tanks also received waste from REDOX and PUREX Plant operations. Detailed information for WMA TX-TY is provided in DOE/RL-2009-67, *Interim Status Groundwater Quality Assessment Plan for the Single-Shell Tank Waste Management Area TX-TY*. Most of the drainable liquid in the tanks has been removed, and the tanks have been interim stabilized. As an interim corrective action, berms were constructed around the tank farms in 2001 to stop run-on of natural precipitation, water lines were pressure tested and repaired, and lines no longer needed were cut and capped. Interim surface barriers were placed over the tanks in the TY Tank Farm in 2011 to inhibit precipitation infiltration.

WMA TX-TY is monitored under an interim status assessment program due to elevated specific conductance in two downgradient wells in 1993. The dangerous waste constituent chromium was monitored under the WMA TX-TY RCRA assessment program during the reporting period. In the first and second quarters of 2020, sampling was performed in accordance with DOE/RL-2009-67. In the third and fourth quarters of 2020, groundwater monitoring was performed in accordance with DOE/RL-2019-74. The new plan expanded the groundwater quality assessment constituents and removed fluoride and aluminum as supporting constituents. This assessment plan implements the monitoring network recommended in SGW-60576, *Engineering Evaluation Report for Single-Shell Tank Waste Management Area TX-TY Groundwater Monitoring* (Table 3-11). Two new upgradient wells are proposed for installation, and existing wells 299-W15-44 and 299-W15-765 are being monitored until the proposed new wells are installed.

Because of planned increases in groundwater extraction at the 200 West P&T, updated water-level predictions (SGW-63743) indicate that eight of the wells will have <0.9 m (3 ft) of water within the next 10 years (Table 3-11). The need for replacement wells is being evaluated; new wells at the Hanford Site are negotiated annually by the Tri-Parties under Tri-Party Agreement Milestone M-24-00 (Ecology et al., 1989b). The wells in the WMA TX-TY monitoring network are screened across the uppermost portion of the unconfined aquifer, which includes Ringold unit E.

The 200 West P&T extraction wells on the east, west, and south sides of the WMA alter the groundwater flow direction and hydraulic gradients (Figure 3-6). Based on 2020 water-level data, the overall flow direction is toward the east, but local directions vary from southeast (northern portion of the WMA) to east-northeast (southern portion of the WMA). The hydraulic gradient averaged 8.9×10^{-3} m/m, and the average linear velocity was estimated at 0.48 m/d (1.6 ft/d) (Table 1-2).

Quarterly sampling was completed as required in 2020, except a water-level measurement could not be collected at well 299-W14-15 due to an obstruction in the well during the November 2020 sampling event. In January 2021, well maintenance removed the obstruction from the well and the water level was measured. DOE subsequently notified Ecology of the missed water-level measurement.

Total chromium concentrations were below the 100 µg/L DWS in all of the filtered samples in 2020. Total chromium and Cr(VI) were above the 48 µg/L MTCA standard for Cr(VI) (WAC 173-340) in downgradient wells 299-W14-13 and 299-W14-18. The 2020 maximum Cr(VI) concentration was 82.4 µg/L in well 299-W14-13 in June 2020. The filtered total chromium result was 77 µg/L, indicating that the dissolved chromium is hexavalent. The maximum total chromium concentration in an unfiltered sample in 2020 was 156 µg/L in upgradient well 299-W15-44, which is an order of magnitude higher than the Cr(VI) concentration. The source of dissolved chromium was past leaks from tanks and pipelines at WMA TX-TY (Section 2.1 in SGW-60576).

Iron, manganese, and nickel were detected above the PQL and/or respective DWS in both upgradient and downgradient wells in the WMA TX-TY monitoring network in 2020 (Table 3-12). These metals (as well as chromium) occur naturally in groundwater and are associated with stainless-steel alloys typically found in Hanford Site well components (e.g., casings, screens, and pumps). However, none of the wells are exhibiting concentrations or ratios to iron reflective of the stainless-steel alloys typically used in Hanford Site monitoring wells, and concentrations are not increasing (Section 1.5). Therefore, these metals do not indicate a degree of well corrosion that warrants well maintenance.

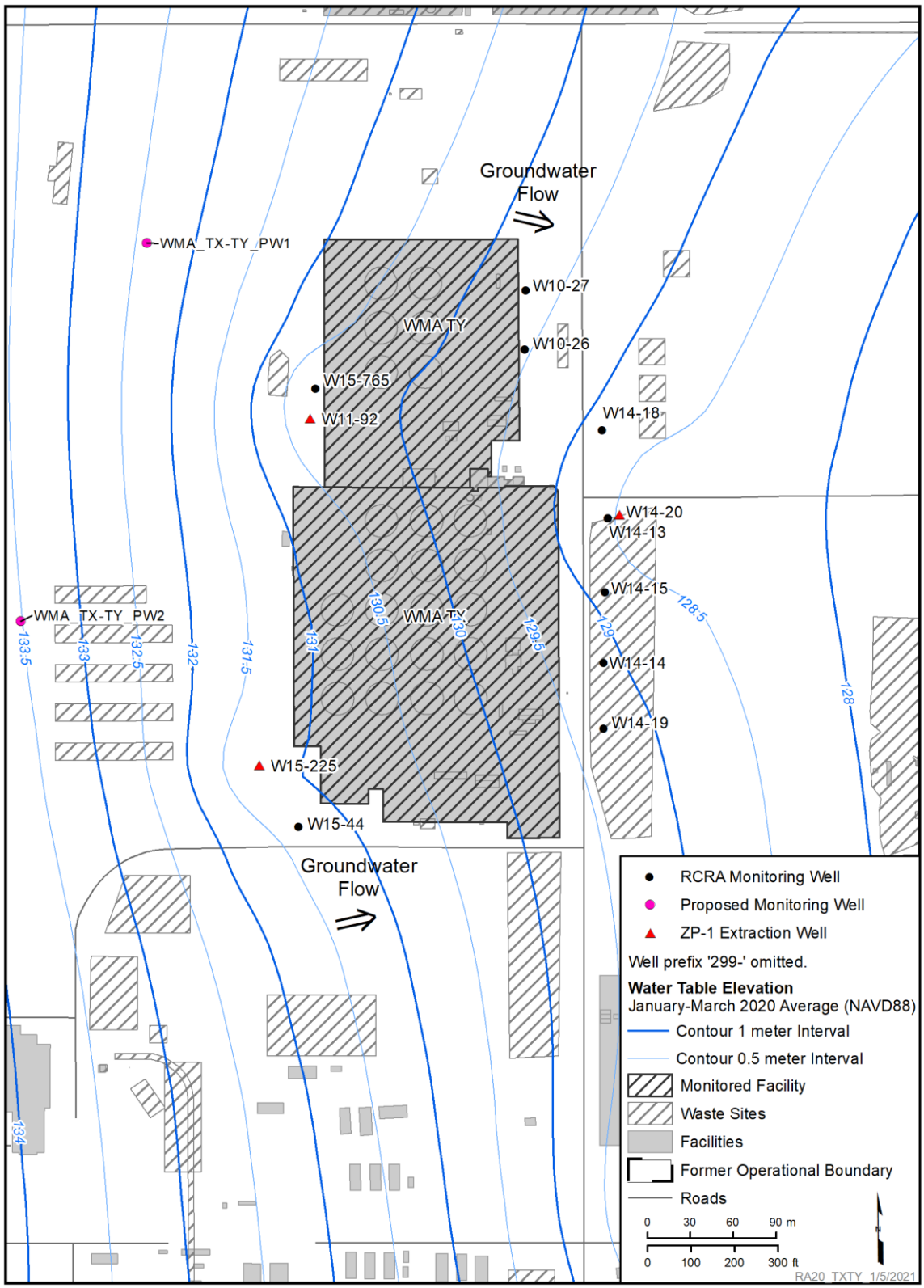
Table 3-12 summarizes 2020 sampling results. The following dangerous waste constituents were detected at concentrations above PQLs:

- Barium, mercury, and zinc were detected in upgradient and downgradient network wells in the WMA TX-TY network in 2020, indicating a potential source upgradient of the WMA. Additionally, these constituents occur naturally in groundwater, and the concentrations observed at WMA TX-TY are less than their respective DWS (Table 3-12).
- Cobalt was detected above the PQL (5.25 µg/L) in downgradient well 299-W14-18 in both filtered and unfiltered samples. However, cobalt is not considered a potential constituent of concern at WMA TX-TY based upon known process history, and it is not listed waste codes on the unit's Hanford RCRA Permit Part A application.
- Carbon tetrachloride was observed in all of the network wells above the primary DWS of 5 µg/L. Although carbon tetrachloride is listed in the dangerous wastes identified from the SST system Hanford RCRA Permit Part A application, upgradient well values indicate that the detections at WMA TX-TY for 2020 are sourced from a regional contaminant plume. Carbon tetrachloride is present in the unconfined aquifer beneath most of the 200 West Area. The carbon tetrachloride is believed to be from pre-1973 waste from the Plutonium Finishing Plant and not from WMA TX-TY (Section 4.4 and Figure 4-3 in SGW-60576).
- Cyanide was analyzed in the third and fourth quarters of 2020 under the new RCRA assessment plan (DOE/RL-2019-74) and monthly throughout 2020 for CERCLA requirements. Total cyanide concentrations were >200 µg/L in wells 299-W10-26 and 299-W14-18 (Figure 3-7). The highest free cyanide concentration was 17.9 µg/L in a non-RCRA sample from well 299-W10-26 (less than the 200 µg/L primary DWS but greater than MTCA Method B cleanup level of 4.8 µg/L [WAC 173-340]). In 2020, a statistical evaluation of cyanide sample results from WMA TX-TY monitoring wells was performed (ECF-200ZP1-20-0024, *Calculation of Temporal Trends and Confidence Limits for Chromium and Cyanide in Groundwater at Waste Management Area TX-TY*). This statistical evaluation identified that the concentrations of free cyanide at wells 299-W10-26 and 299-W14-18 were above the MTCA Method B groundwater cleanup level of 4.8 µg/L (Table 11 in ECF-200ZP1-20-0024). Four SSTs in WMA TX-TY (241-TX-118, 241-TY-101, 241-TY-103, and 241-TY-104) received ferrocyanide waste from the ferrocyanide scavenging process used in

the 1950s (Table 1 in HNF-SA-3126-FP, *Resolution of the Hanford Site Ferrocyanide Safety Issue*). The 241-TY-103 and 241-TY-104 SSTs are assumed leakers, with estimated leak volumes of 13,600 and 5,300 L (3,600 and 1,400 gal), respectively (Table 4-2 in HNF-EP-0182, Rev. 394, *Waste Tank Summary Report for Month Ending October 31, 2020*). Due to the presence of ferrocyanide in tanks that are assumed to have leaked and statistically significant concentrations of free cyanide above the MTCA cleanup value in monitoring wells located downgradient of the TY Tank Farm, the presence of cyanide in groundwater is considered attributable to WMA TX-TY. In accordance with Section 3.5 in DOE/RL-2019-74, a quarterly report for 2020 will provide information on this determination and DOE/RL-2019-74 will be updated to add cyanide as a site-specific sampling constituent.

During 2020, aluminum (not a dangerous waste constituent) was detected above the DWS (50 µg/L) and PQL (105 µg/L) in unfiltered samples from four downgradient wells (Table 3-12). The maximum concentration observed in 2020 was 3,700 µg/L at downgradient well 299-W14-13 in February. This detection is not consistent with 2019 data. Aluminum was removed from the WMA TX-TY monitoring constituents with the implementation of the current assessment plan (DOE/RL-2019-74).

During 2020, nitrate (not a dangerous waste constituent) concentrations remained above the 45 mg/L DWS in all upgradient and downgradient network wells. The maximum concentration was 788 mg/L in well 299-W14-18, which is an increase from 553 mg/L in 2019. Most of the nitrate contamination is attributed to Plutonium Finishing Plant operations, as well as past-practice disposal to cribs and trenches in the area.



Reference: ECF-HANFORD-20-0078, *Preparation of the Hanford Site Water Table Map for January to March 2020*.

Figure 3-6. Waste Management Area TX-TY

Table 3-11. WMA TX-TY Groundwater Monitoring Network

Well Name	Location	Year Installed	Head Date	Hydraulic Head		Elevation Screen Top		Elevation Screen Bottom		Water Column		Sample Frequency	Sampled Months; Comments
				m	ft	m	ft	m	ft	m	ft		
299-W10-26[a]	DG	1998	11/16/2020	129.43	424.63	138.5	454.5	127.8	419.4	1.6	5.3	Q	2, 6, 8, 11
299-W10-27[a]	DG	2001	11/16/2020	130.48	428.09	137.5	451.2	126.9	416.2	3.6	11.8	Q	2, 6, 8, 11
299-W14-13[a]	DG	1998	11/18/2020	128.14	420.41	138.3	453.8	127.6	418.7	0.5	1.7	Q	2, 6, 8, 11
299-W14-14[a]	DG	1998	11/17/2020	129.23	423.97	138.5	454.3	127.8	419.3	1.4	4.6	Q	2, 6, 8, 11
299-W14-15[a]	DG	2000	8/12/2020[b]	129.36	424.40	137.6	451.5	127.0	416.6	2.4	7.8	Q	2, 6, 8, 11
299-W14-18[a]	DG	2000	11/17/2020	128.82	422.65	137.8	452.1	127.1	417.1	1.7	5.5	Q	2, 6, 8, 11
299-W14-19[a]	DG	2002	11/17/2020	129.28	424.13	136.8	448.7	126.1	413.7	3.2	10.4	Q	2, 6, 8, 11
299-W15-44	UG	2002	11/16/2020	131.00	429.79	138.3	453.6	127.6	418.6	3.4	11.2	Q	2, 6, 8, 11
299-W15-765[a]	UG	2001	11/17/2020	129.81	425.87	137.4	450.9	126.8	415.9	3.0	9.9	Q	2, 6, 8, 11
WMA_TX-TY_PW1 (D0020)	UG	Proposed	—	—	—	—	—	—	—	—	—	Q	None
WMA_TX-TY_PW2 (D0021)	UG	Proposed	—	—	—	—	—	—	—	—	—	Q	None

Note: Requirements are from Table 2-1 in DOE/RL-2009-67, *Interim Status Groundwater Quality Assessment Plan for the Single-Shell Tank Waste Management Area TX-TY*; and Table 2-8 in DOE/RL-2019-74, *Interim Status Groundwater Quality Assessment Plan for the Single-Shell Tank System*.

a. Wells have or are predicted to have <0.9 m (3 ft) water in the screened interval within the next 10 years, which may limit sampling in the future if the water table continues to decline.

b. Water level was not measured in November 2020 due to an obstruction in the well.

— = no information (not yet installed)
DG = downgradient
Q = quarterly
UG = upgradient
WMA = waste management area

Table 3-12. WMA TX-TY Sampling Summary for 2020

Constituent	Units	Maximum	Water Quality Standard[a]	PQL[b]	Comments
Dangerous Waste Constituents					**Wells Above PQL or Water Quality Standard**
Barium, unfiltered	µg/L	230	2,000[c]	5.25	All wells above PQL
Barium, filtered	µg/L	220	2,000[c]	5.25	All wells above PQL
Carbon tetrachloride	µg/L	190	5.0[c]	3.0	All wells above PQL and water quality standard
Chromium, unfiltered	µg/L	156	100[c]	10.5	Above water quality standard: 299-W15-44; all wells except 299-W15-765 above PQL
Chromium, filtered	µg/L	77	100[c]	10.5	Above PQL: 299-W10-26, 299-W10-27, 299-W14-13, 299-W14-14, 299-W14-18, 299-W15-44
Cobalt, unfiltered	µg/L	14	—	5.25	Above PQL: 299-W14-18
Cobalt, filtered	µg/L	14	—	5.25	Same as unfiltered
Cyanide, free[d]	µg/L	17.9	4.8[e]	4.0	Above PQL and water quality standard: 299-W10-26, 299-W14-18
Cyanide, total[d]	µg/L	2,930	—	15.75	Above PQL: 299-W10-26, 299-W14-18
Mercury, unfiltered	µg/L	0.64	2.0[c]	0.5	Above PQL: 299-W10-26
Mercury, filtered	µg/L	0.61	2.0[c]	0.5	Same as unfiltered
Nickel, unfiltered	µg/L	38	—	21	Above PQL: 299-W14-13
Zinc, unfiltered	µg/L	200	5,000[f]	21	Above PQL: 299-W10-26, 299-W14-13, 299-W14-14, 299-W14-18
Other Constituents					**Wells Above Water Quality Standard**
Alkalinity	mg/L	134	—	5.25	
Aluminum, unfiltered	µg/L	3,700	50 – 200[f]	105	Above water quality standard: 299-W10-26, 299-W10-27, 299-W14-13, 299-W14-18
Calcium, unfiltered	µg/L	220,000	—	1,050	
Calcium, filtered	µg/L	220,000	—	1,050	
Chloride	mg/L	45.7	250[f]	0.4	
Dissolved oxygen	mg/L	10.49	—	—	

Table 3-12. WMA TX-TY Sampling Summary for 2020

Constituent	Units	Maximum	Water Quality Standard[a]	PQL[b]	Comments
Fluoride	mg/L	1.79	4.0[c]	0.525	
Hexavalent chromium	µg/L	82.4	48[e]	10.5	Above water quality standard: 299-W14-13, 299-W14-18
Iron, unfiltered	µg/L	11,000	300[f]	105	Above water quality standard: 299-W10-26, 299-W10-27, 299-W14-13, 299-W14-18, 299-W14-19, 299-W15-44
Iron, filtered	µg/L	870	300[f]	105	Above water quality standard: 299-W10-26, 299-W14-18, 299-W14-19
Magnesium, unfiltered	µg/L	74,000	—	1,050	
Magnesium, filtered	µg/L	74,000	—	1,050	
Manganese, unfiltered	µg/L	220	50[f]	10.5	Above water quality standard: 299-W14-13
Molybdenum, unfiltered	µg/L	8.7	—	5.25	
Molybdenum, filtered	µg/L	8.89	—	5.25	
Nitrate	mg/L	788	45[g]	0.525	All wells above water quality standard
pH measurement	unitless	8.22	6.5 – 8.5[f]	—	
Potassium, unfiltered	µg/L	14,000	—	5,250	
Potassium, filtered	µg/L	14,000	—	5,250	
Sodium, unfiltered	µg/L	98,000	—	1,050	
Sodium, filtered	µg/L	97,000	—	1,050	
Specific conductance	µS/cm	2171	—	—	
Sulfate	mg/L	77.2	250[f]	1.05	
Temperature	°C	21	—	—	
Turbidity	NTU	254	—	—	

Note: Maximum is based on the required assessment sample results for this RCRA unit with concentrations above the PQL. Appendix A presents the full data set for 2020.

a. Water quality standards are provided for information only and are not used to determine RCRA groundwater monitoring exceedances.

b. Standardized PQL used in analytical requirements.

c. 40 CFR 141, Subpart G, “National Primary Drinking Water Regulations,” “Maximum Contaminant Levels and Maximum Residual Disinfectant Levels.”

Table 3-12. WMA TX-TY Sampling Summary for 2020

Constituent	Units	Maximum	Water Quality Standard[a]	PQL[b]	Comments

d. Ranges for cyanide and free cyanide include all 2020 samples, including those not required for RCRA.

e. Individual risk based concentration levels as derived from WAC 173-340-720, "Groundwater Cleanup Standards," as calculated in ECF-100NPL-10-0462, *Calculation of Standard Method B Groundwater Cleanup Levels for Potable Groundwater for the 100 Areas and 300 Area Remedial Investigation/Feasibility Study Reports*.

f. 40 CFR 143.3, "National Secondary Drinking Water Regulations," "Secondary Maximum Contaminant Levels."

g. The federal drinking water standard for nitrate is 10 mg/L expressed as nitrogen (40 CFR 141, Subpart G). This equates to 45 mg/L when expressed as NO_3.

— = no comparison value or PQL

NTU = nephelometric turbidity unit

PQL = practical quantitation limit

RCRA = *Resource Conservation and Recovery Act of 1976*

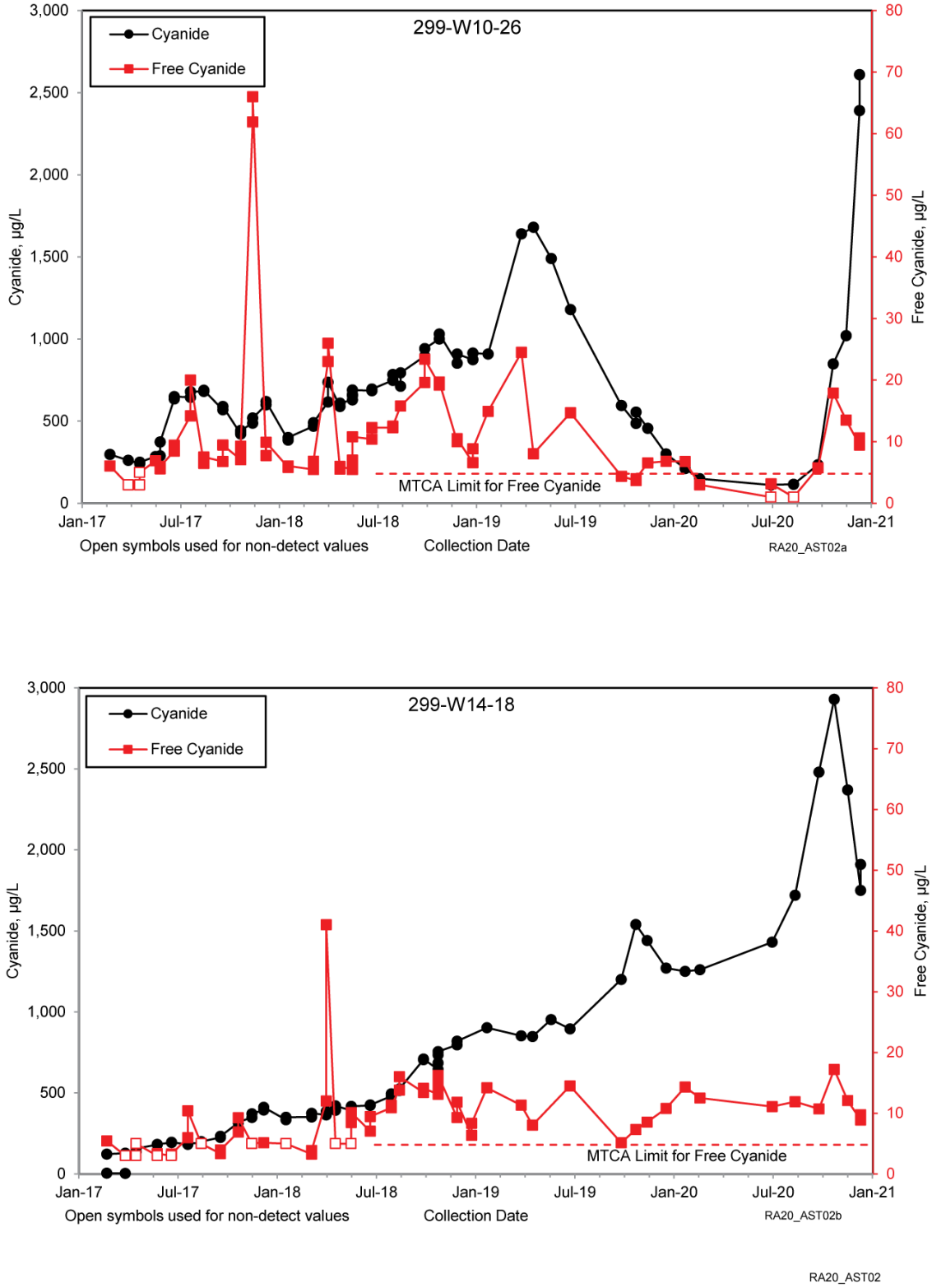


Figure 3-7. Total and Free Cyanide in Wells 299-W10-26 and 299-W14-18 at WMA TX-TY

3.7 Waste Management Area U

WMA U (Figure 3-8) contains 16 underground SSTs constructed between 1943 and 1944. Twelve SSTs have 2 million L (535,000 gal) capacities, and four SSTs have 210,000 L (55,000 gal) capacities (Section 1.2 in RPP-35485, *Field Investigation Report for Waste Management Area U*). The WMA also has a variety of ancillary equipment, including six diversion boxes; the 271UR control house; the 244UR process vault; the 244U double-contained receiver tank; and waste transfer lines, pits, and junction boxes.

WMA U received waste from the bismuth phosphate process between 1946 and 1948 and from the REDOX process between 1954 and 1957 (WHC-MR-0132). In 1952, some waste was retrieved and pumped to the 242T evaporator, and between 1952 and 1957, the metal waste stored in nine of the 2 million L (535,000 gal) capacity tanks was transferred to U Plant for uranium recovery. To minimize the probability and severity of future leaks, most of the drainable liquid in each tank has been removed and transferred to double-shell tanks.

WMA U was placed into assessment monitoring status in 2000 when specific conductance in downgradient monitoring wells exceeded upgradient levels. An assessment of that finding in 2000 determined that the WMA had affected groundwater quality based on elevated nitrate and possibly chromium in downgradient wells (Chapter 6.0 in PNNL-13282, *Groundwater Quality Assessment Plan for Waste Management Area U: First Determination*). However, these contaminants were below their respective DWSs, and the affected area was limited to the southeastern corner of the WMA.

For the first and second quarters of 2020, WMA U was monitored under DOE/RL-2009-74, *Interim Status Groundwater Quality Assessment Plan for the Single-Shell Tank Waste Management Area U*. The plan implemented the monitoring network recommended in SGW-60578, *Engineering Evaluation Report for Single-Shell Tank Waste Management Area U Groundwater Monitoring*, including a proposed new well (Table 3-13). For the third and fourth quarters of 2020, WMA U monitoring was performed in compliance with a new assessment plan, DOE/RL-2019-74. In comparison to the previous plan, the new plan expanded the groundwater quality assessment constituents and added dissolved oxygen as a field measurement.

All of the WMA U wells are expected to have sufficient water for continued sampling through at least 2030 (SGW-63743). The wells are screened across the uppermost portion of the unconfined aquifer, which includes Ringold unit E.

Groundwater flow beneath WMA U is affected by the 200 West P&T. In 2020, the hydraulic gradient sloped to the east-northeast with a magnitude of 6.9×10^{-3} m/m, and the estimated average linear velocity was 0.38 m/d (1.2 ft/d) (Table 1-2).

Quarterly sampling continued in 2020, and Table 3-14 summarizes the sampling results. WMA U is the source of groundwater contamination with dissolved chromium on the downgradient (east) side of the tank farm (Chapter 6.0 in PNNL-13282). In 2020, all wells except downgradient well 299-W19-47 detected filtered chromium above the PQL (10.5 µg/L) but below the DWS (100 µg/L). The concentration of filtered total chromium was 32.1 µg/L in downgradient well 299-W19-44, compared to 20.1 µg/L in upgradient well 299-W18-40.

Where total chromium concentrations in unfiltered samples are higher than in filtered samples, it may indicate stainless-steel well corrosion. The highest chromium concentration in an unfiltered sample was 79.7 µg/L in well 299-W19-44 in August 2020. The filtered chromium result from this well in August was 32.1 µg/L. Iron and manganese were detected above the PQL and/or respective DWS in both

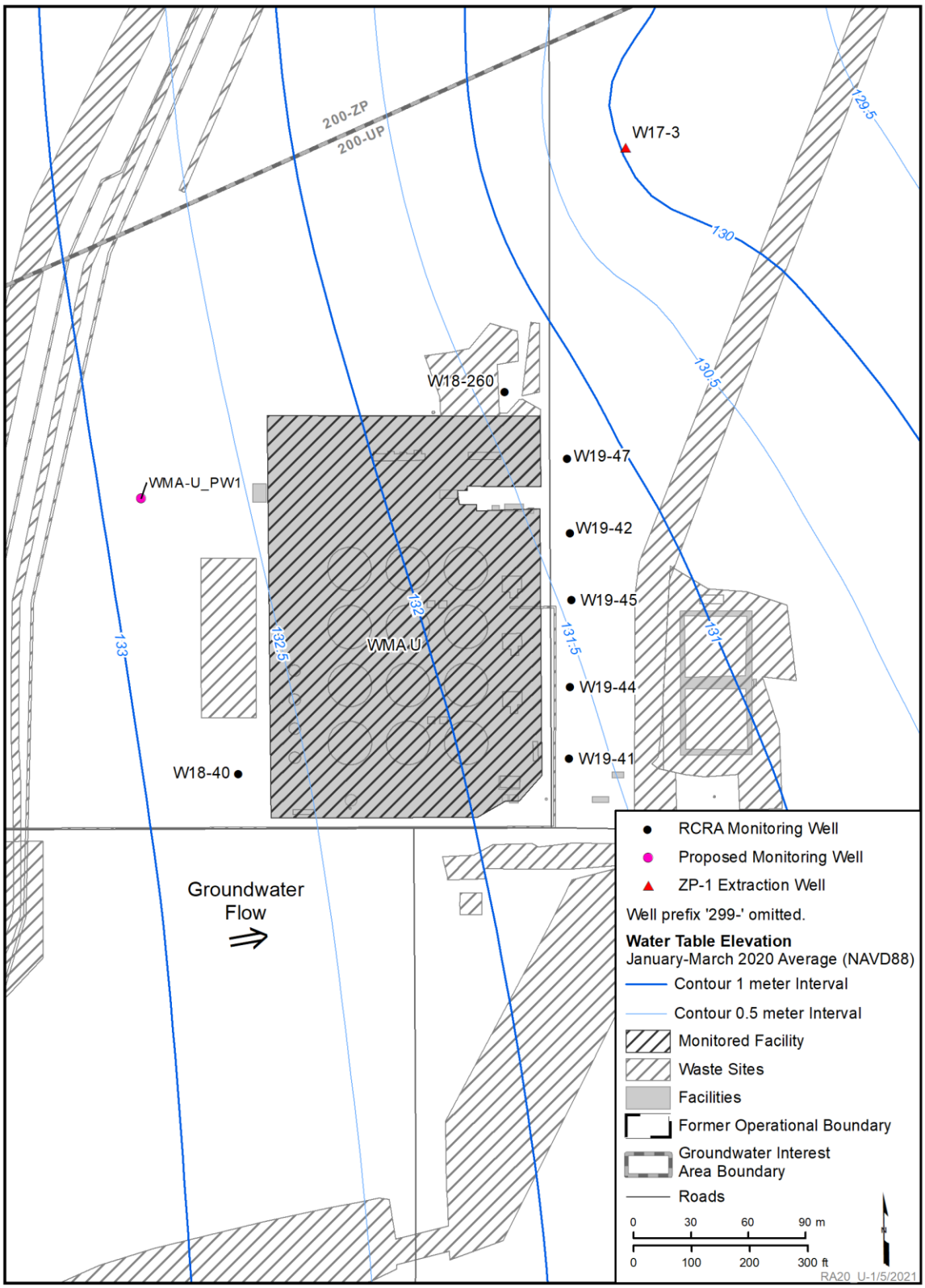
upgradient and downgradient wells in the WMA U monitoring network in 2020 (Table 3-14). These metals (included with chromium and nickel) are naturally occurring in groundwater and are constituents associated with stainless-steel alloys typically found in Hanford Site well components (e.g., casings, screens, and pumps). However, none of the wells are exhibiting concentrations or ratios to iron reflective of the stainless-steel alloys typically used in Hanford Site monitoring wells, and concentrations are not increasing (Section 1.5). Therefore, these metals do not indicate a degree of well corrosion that warrants well maintenance.

The following dangerous waste constituents were detected at levels above PQLs in 2020:

- Barium was observed above the PQL (5.25 μg/L) in all network wells, and zinc was observed above the PQL (21 μg/L) in downgradient wells 299-W18-40, 299-W19-44, and 299-W19-45. These constituents occur naturally in groundwater, and the concentrations observed at WMA U are less than their respective DWS (Table 3-14). Additionally, all barium concentrations are below the Hanford Site background value of 105 μg/L (DOE/RL-96-61).
- Carbon tetrachloride was detected above the PQL (3.0 μg/L) and DWS (5.0 μg/L) in all of the WMA U upgradient and downgradient monitoring wells. Although carbon tetrachloride is listed in the dangerous wastes identified from the SST system Hanford RCRA Permit Part A application, upgradient well values indicate that detections at WMA U in 2020 are sourced from a regional contaminant plume, and carbon tetrachloride is present in the unconfined aquifer beneath most of the 200 West Area (Section 2.4 and Figure D-1 in SGW-60578).

Concentrations of nitrate (not a dangerous waste constituent) exceeded the 45 mg/L DWS in all wells, including the upgradient well. WMA U is within a regional nitrate plume, but because nitrate in downgradient wells is higher than in the upgradient well, it is likely that WMA U is also a source of nitrate to the groundwater.

In 2020, pH was measured above the upper DWS (pH of 8.5 pH) at downgradient well 299-W19-44. The observed concentrations were not out of trend and were lower than pH values at this well for 2019.



Reference: ECF-HANFORD-20-0078, *Preparation of the Hanford Site Water Table Map for January to March 2020*.

Figure 3-8. Waste Management Area U

Table 3-13. WMA U Groundwater Monitoring Network

Well Name	Location	Year Installed	Head Date	Hydraulic Head		Elevation Screen Top		Elevation Screen Bottom		Water Column		Sample Frequency	Sampled Months; Comments*
				m	ft	m	ft	m	ft	m	ft		
299-W18-260	DG	2014	10/14/2020	131.862	432.62	132.0	433.0	122.8	403.0	9.0	29.6	Q	1, 6, 8, 10
299-W18-40	UG	2001	10/12/2020	133.032	436.46	136.2	446.9	125.5	411.9	7.5	24.6	Q	1, 6, 8, 10
299-W19-41	DG	1998	10/12/2020	131.887	432.70	138.7	455.1	128.0	420.0	3.9	12.7	Q	1, 6, 8, 10
299-W19-42	DG	1998	10/14/2020	131.859	432.61	138.4	454.0	127.7	418.9	4.2	13.7	Q	1, 6, 8, 10
299-W19-44	DG	2001	10/12/2020	131.822	432.49	136.4	447.7	125.8	412.7	6.0	19.8	Q	1, 6, 8, 10
299-W19-45	DG	2001	10/12/2020	131.842	432.55	137.3	450.6	126.7	415.7	5.1	16.8	Q	1, 6, 8, 10
299-W19-47	DG	2004	10/14/2020	131.866	432.63	136.3	447.3	125.7	412.3	6.2	20.3	Q	1, 6, 8, 10
WMA-U_PW1 (D0016)	UG	Proposed	—	—	—	—	—	—	—	—	—	Q	Not yet installed

Note: Requirements are from Table 2-1 in DOE/RL-2009-74, *Interim Status Groundwater Quality Assessment Plan for the Single-Shell Tank Waste Management Area U*; and Table 2-9 in DOE/RL-2019-74, *Interim Status Groundwater Quality Assessment Plan for the Single-Shell Tank System*.

*Sampling scheduled for April and July were delayed until June and August due to the COVID-19 pandemic.

— = no information (not yet installed)
DG = downgradient
Q = quarterly
UG = upgradient
WMA = waste management area

Table 3-14. WMA U Sampling Summary for 2020

Constituent	Units	Maximum	Water Quality Standard[a]	PQL[b]	Comments
Dangerous Waste Constituents					**Wells Above PQL or Water Quality Standard**
Barium, unfiltered	µg/L	82.2	2,000[c]	5.25	All wells above PQL
Barium, filtered	µg/L	74	2,000[c]	5.25	All wells above PQL
Carbon tetrachloride	µg/L	86	5.0[c]	3.0	All wells above PQL and water quality standard
Chromium, unfiltered	µg/L	79.7	100[c]	10.5	All wells above PQL
Chromium, filtered	µg/L	32.1	100[c]	10.5	All wells except 299-W19-47 above PQL
Zinc, unfiltered	µg/L	60.2	5,000[d]	21	Above PQL: 299-W18-40, 299-W19-44, 299-W19-45
Other Constituents					**Wells Above Water Quality Standard**
Alkalinity	mg/L	113	—	5.25	
Calcium, unfiltered	µg/L	54,000	—	1,050	
Calcium, filtered	µg/L	61,300	—	1,050	
Chloride	mg/L	33.6	250[d]	0.4	
Dissolved oxygen	mg/L	11.88	—	—	
Hexavalent chromium	µg/L	22	48[e]	10.5	
Iron, unfiltered	µg/L	2090	300[d]	105	Above water quality standard: 299-W18-260, 299-W19-42, 299-W19-44, 299-W19-45
Iron, filtered	µg/L	145	300[d]	105	Outlier excluded
Magnesium, unfiltered	µg/L	17,900	—	1,050	
Magnesium, filtered	µg/L	17,900	—	1,050	
Manganese, unfiltered	µg/L	55.9	50[d]	10.5	Above water quality standard 299-W19-44
Molybdenum, unfiltered	µg/L	8.5	—	5.25	
Molybdenum, filtered	µg/L	8.7	—	5.25	
Nitrate	mg/L	144	45[f]	0.525	All wells above water quality standard

Table 3-14. WMA U Sampling Summary for 2020

Constituent	Units	Maximum	Water Quality Standard[a]	PQL[b]	Comments
pH measurement	unitless	8.72	6.5 – 8.5[d]	—	Above water quality standard: 299-W19-44
Potassium, unfiltered	µg/L	5,900	—	5,250	
Potassium, filtered	µg/L	5,600	—	5,250	
Sodium, unfiltered	µg/L	26,000	—	1,050	
Sodium, filtered	µg/L	26,500	—	1,050	
Specific conductance	µS/cm	568	—	—	
Sulfate	mg/L	53.8	250[d]	1.05	
Temperature	°C	27.5	—	—	
Turbidity	NTU	4.95	—	—	

Note: Maximum is based on the required assessment sample results for this RCRA unit with concentrations above the PQL. Appendix A presents the full data set for 2020.

a. Water quality standards are provided for information only and are not used to determine RCRA groundwater monitoring exceedances.

b. Standardized PQL used in analytical requirements.

c. 40 CFR 141, Subpart G, "National Primary Drinking Water Regulations," "Maximum Contaminant Levels and Maximum Residual Disinfectant Levels."

d. 40 CFR 143.3, "National Secondary Drinking Water Regulations," "Secondary Maximum Contaminant Levels."

e. Individual risk-based concentration levels as derived from WAC 173-340-720, "Model Toxics Control Act—Cleanup," "Groundwater Cleanup Standards," as calculated in ECF-100NPL-10-0462, *Calculation of Standard Method B Groundwater Cleanup Levels for Potable Groundwater for the 100 Areas and 300 Area Remedial Investigation/ Feasibility Study Reports.*

f. The federal drinking water standard for nitrate is 10 mg/L expressed as nitrogen (40 CFR 141, Subpart G). This equates to 45 mg/L when expressed as NO_3.

— = no comparison value

NTU = nephelometric turbidity unit

PQL = practical quantitation limit

RCRA = *Resource Conservation and Recovery Act of 1976*

4 Corrective Action Monitoring

Two RCRA units that affected groundwater quality are monitored under final status corrective action programs. Remediation of groundwater contaminated by these units and other waste sites within the OUs is in progress under the CERCLA program.

4.1 183-H Solar Evaporation Basins

The 183-H Solar Evaporation Basins (116-H-6 waste site) (Figures 1-1 and 4-1) consisted of four basins in the 100-H Area. The basins were originally part of the larger 183H water treatment facility, which had 12 additional basins. Following decommissioning of the water treatment facility, the four remaining basins were used to evaporate various liquid waste streams, including neutralized spent acid etch solutions from the 300 Area fuel fabrication facilities. The waste solutions contained various contaminants, including chromium, uranium, and nitrate. The basins were used for waste evaporation from July 1973 until November 1985 and were demolished in 1995. The contaminated soil was removed to a depth of 4.6 m (15 ft) below Basin 1 in 1996 (DOE/RL-97-48, *183-H Solar Evaporation Basins Postclosure Plan*).

Groundwater protection was demonstrated through modeling, and Ecology approved a modified RCRA closure in May 1997 (Soper, 1997, "Acceptance of "Closure Certification for the 183-H Solar Evaporation Basins (T-1-4)," 96-EAP-246"). Clean closure of the site was not achieved because fluoride and nitrate levels in soil below the 4.6 m (15 ft) deep excavation exceeded the MTCA Method B cleanup levels (WAC 173-340) for groundwater protection. Therefore, the 183-H Solar Evaporation Basins were closed in place under the modified closure provisions of the Hanford RCRA Permit with specified measures for post-closure care. Ongoing groundwater monitoring results suggest that the vadose zone beneath the 183-H Basins is a continuing source of contamination to groundwater.

Groundwater monitoring to meet RCRA requirements is conducted in accordance with the Hanford RCRA Permit (WA7890008967, Part VI, Post-Closure Unit 2 (PCU-2), Chapter 3.0, "Groundwater Monitoring" [modification date of May 24, 2017]) (hereinafter referred to as the PCU-2 groundwater monitoring plan). The plan monitors total chromium (collected as a filtered sample) and nitrate as dangerous waste constituents identified for corrective action monitoring. Corrective action was deferred to the CERCLA program for the 100-HR-3 OU (Executive Summary of the PCU-2 groundwater monitoring plan). CERCLA remediation includes groundwater P&T for Cr(VI) and monitored natural attenuation for nitrate. Projections indicate CERCLA cleanup levels will be reached in 2032 for Cr(VI) and in 2026 for nitrate (Section 6.5 of EPA, et al., 2018, *Record of Decision Hanford 100 Area Superfund Site 100-DR-1, 100-DR-2, 100-HR-1, 100-HR-2, and 100-HR-3 Operable Units*). RCRA monitoring for total chromium (filtered) and nitrate will continue at least until the end of the RCRA compliance period (2022) and may extend beyond the compliance period until the concentration limits are not exceeded for three consecutive years (Section 3.2.4 of the PCU-2 groundwater monitoring plan).

The unconfined aquifer is very thin below the former 183-H Solar Evaporation Basins, and most of the wells are screened across the entire aquifer. In a typical year, the saturated aquifer thickness varies from <1 m (3 ft) in the fall during low river stage to 3 m (10 ft) in the spring and early summer during high river stage. Groundwater flow direction and gradients vary due to the influence of the nearby extraction and injection wells and river stage. Therefore, groundwater velocity was not calculated for the 183-H Solar Evaporation Basins in this report.

The 183-H Solar Evaporation Basins monitoring wells (Table 4-1) are scheduled for semiannual sampling for total chromium (filtered), nitrate, and field parameters. The RCRA sampling event scheduled for December 2020 was unsuccessful for well 199-H4-84 because the river stage was low and the well was dry. Well 199-H4-8 was sampled with a bailer in December because of low water levels.

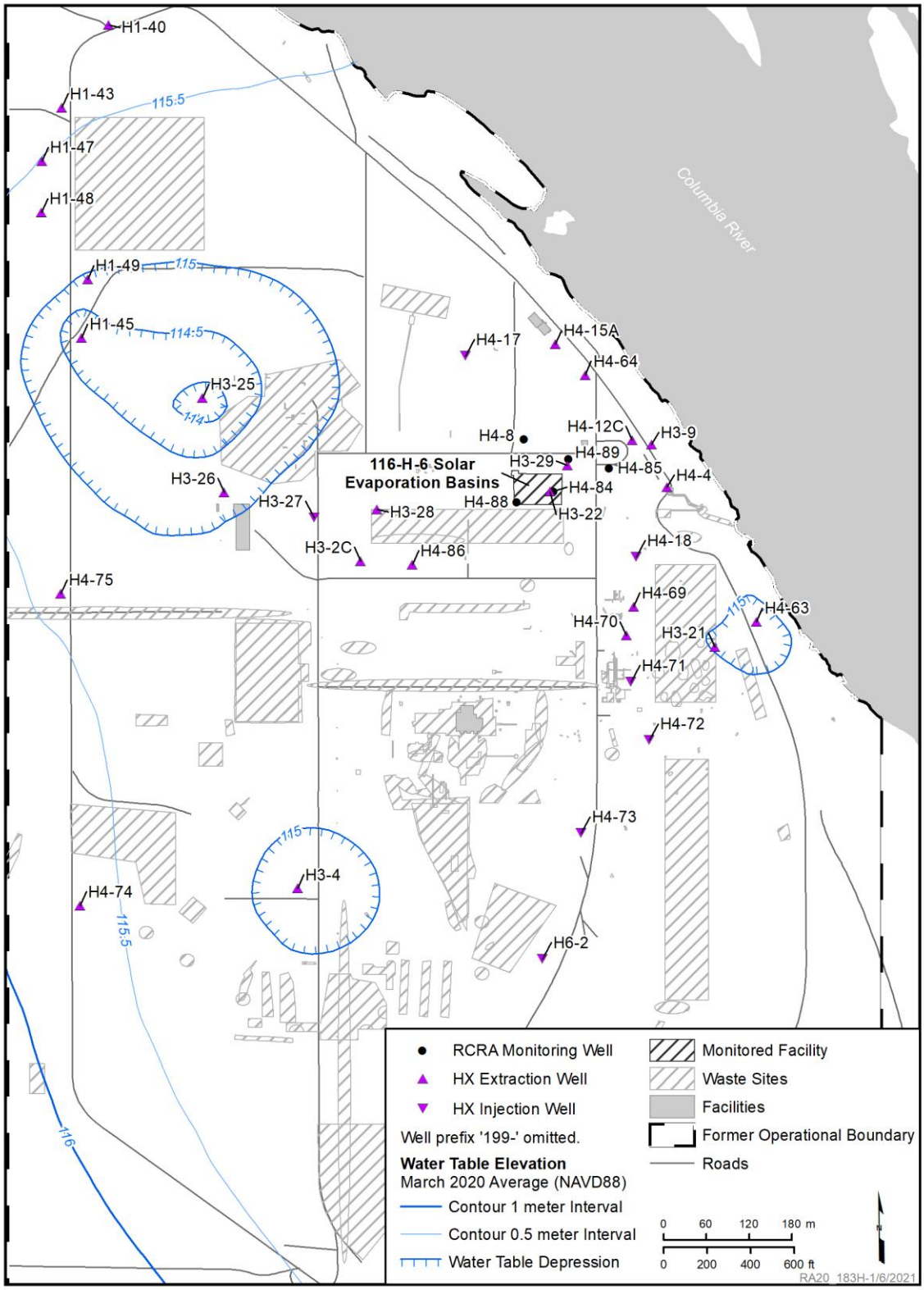
Table 4-2 summarizes the 2020 monitoring results for the 183-H Solar Evaporation Basins. The total chromium (filtered) result exceeded the Hanford RCRA Permit concentration limit of 48 µg/L in well 199-H4-84 in June (220 µg/L). However, that result was subsequently flagged as a suspected error because it is much higher than the Cr(VI) result (72.5 µg/L). Nitrate exceeded the permit concentration limit of 45 mg/L in wells 199-H4-84, 199-H4-88, and 199-H4-89 in June. The December chromium and nitrate results did not exceed a permit concentration limit.

Contaminant concentrations in wells 199-H4-84 and 199-H4-88 (located within the footprint of the former basins) generally rise with the water table in response to changes in river stage. These increased concentrations occur when contamination remains in the lower vadose zone and the water table rises high enough to encounter the periodically rewetted zone, releasing the contaminants into the water column.

The objective of the corrective action monitoring program is to evaluate the effectiveness of the correction action. A statistical evaluation is conducted for wells when eight independent samples are available for the upper confidence limit (UCL) of the mean (or 95% UCL) calculation. When sample results in the data set are less than the concentration limit, a nonstatistical or visual analysis of the data is conducted. In these cases, each result in the data set (8 to 10 samples) must be less than the concentration limit. In addition, the PQL for each sample in the data set must not exceed the concentration limit established in the Hanford RCRA Permit.

The statistical evaluation for the first half of 2020 was reported in SGW-65236, *Post-Closure Corrective Action Groundwater Monitoring Report for the 183-H Solar Evaporation Basins: January – June 2020* (Table 4-3). The 95% UCL values exceeded the concentration limit for nitrate at wells 199-H4-84 and 199-H4-88 and for chromium at well 199-H4-84. However, the chromium UCL for well 199-H4-84 will be recalculated because the June 2020 data point is a suspected error. Wells 199-H4-84 and 199-H4-88 are located within the footprint of the former 183-H Solar Evaporation Basins.

Not all of the data from the December 29, 2020, sampling event were received in time to complete a statistical evaluation for July through December before this annual report was prepared. Results of that statistical evaluation will be published in an upcoming semiannual report, along with revised results for the January through June 2020 UCL for well 199-H4-84.



Reference: ECF-HANFORD-20-0078, *Preparation of the Hanford Site Water Table Map for January to March 2020*.

Figure 4-1. 183-H Solar Evaporation Basins (116-H-6 Waste Site)

Table 4-1. 183-H Groundwater Monitoring Network

Well Name	Year Installed	Head Date	Hydraulic Head		Elevation Screen Top		Elevation Screen Bottom		Water Column		Sample Frequency	Comments; Sampling Exceptions
			m	ft	m	ft	m	ft	m	ft		
199-H4-8	1986	12/29/2020	114.33	375.09	117.0	383.9	114.0	373.9	0.4	1.2	S	Sampled with a bailer in December
199-H4-84	2011	6/17/2020	116.05	380.74	117.2	384.4	114.1	374.4	1.9	6.3	S	Well dry in December
199-H4-85	2013	12/29/2020	114.75	376.47	119.7	392.6	113.6	372.7	1.1	3.7	S	
199-H4-88	2016	12/29/2020	114.52	375.71	119.3	391.5	113.2	371.5	1.3	4.2	S	
199-H4-89	2016	6/17/2020	116.36	378.24	118.6	389.2	114.1	374.2	1.3	4.2	S	

Note: Requirements are from the Hanford RCRA Permit (WA7890008967, *Hanford Facility Resource Conservation and Recovery Act (RCRA) Permit, Dangerous Waste Portion for the Treatment, Storage, and Disposal of Dangerous Waste*, Revision 8c [modification date of May 24, 2017], Part VI, Post-Closure Unit 2 (PCU-2), Chapter 3.0, "Groundwater Monitoring Plan").

RCRA = *Resource Conservation and Recovery Act of 1976*

S = semiannual

Table 4-2. 183-H Solar Evaporation Basins Sampling Results for 2020

Well	Sample Date	Chromium (Filtered) (µg/L)	Nitrate (mg/L)	Dissolved Oxygen (mg/L)	pH	Specific Conductance (µS/cm)	Temperature (ºC)	Turbidity (NTU)	Comments
Permit Concentration Limit		**48**	**45**	—	—	—	—	—	
199-H4-8	6/16/2020	4.0 UD	20.5	8.5	7.64	436	19.2	1.7	
	12/29/2020	4.2 B	14.8	8.8	7.82	432	17.9	9.0	Well nearly dry; bailed samples
199-H4-84	6/17/2020	220 Y	142.0 D	9.4	7.50	1,157	18.8	2.0	Well dry in December
199-H4-85	6/17/2020	3.0 U	4.0	10.3	7.55	180	18.2	1.7	
	12/29/2020	3.6 B	2.8	7.0	7.06	149	12.2	0.8	
199-H4-88	6/17/2020	8.7 B	88.5 D	8.9	7.27	834	18.3	0.3	
	12/29/2020	6.6	39.8	8.1	7.33	617	15.5	0.95	
199-H4-89	6/17/2020	3.0 U	50.5 D	7.6	7.20	715	19.0	2.4	
	12/29/2020	4.9 BD	18.7	7.0	7.24	585	16.4	1.8	

Notes:

This table contains sample results collected specifically for this RCRA unit. Appendix A presents the full data set for 2020.

Yellow-highlighted cells indicated concentrations greater than the listed concentration limit.

B = below the quantitation limit

D = reported at a secondary dilution factor

NTU = nephelometric turbidity unit

RCRA = *Resource Conservation and Recovery Act of 1976*

U = below the detection limit

Y = suspected error (see text discussion)

Table 4-3. Statistical Evaluation of 183-H Solar Evaporation Basins Dangerous Waste Constituents, January to June 2020

Well	Semiannual Period	Chromium (Filtered) (Permit Concentration Limit 48 µg/L)	Nitrate (Permit Concentration Limit 45 mg/L)
		95% UCL	95% UCL
199-H4-8	January – June	N/A[a]	N/A[a]
199-H4-84	January – June	185.7[b]	92.78
199-H4-85	January – June	N/A[a]	N/A[a]
199-H4-88	January – June	N/A[a]	73.65
199-H4-89	January – June	N/A[a]	41.56

Source: SGW-65236, *Post-Closure Corrective Action Groundwater Monitoring Report for the 183-H Solar Evaporation Basins: January – June 2020*.

Notes:

The statistical evaluation for the second half of 2020 (samples collected on December 29, 2020) was not completed when this report was prepared and will be published in an upcoming semiannual report.

Yellow-highlighted cells indicate that the UCL exceeded a concentration limit identified in the Hanford RCRA Permit (WA7890008967, *Hanford Facility Resource Conservation and Recovery Act (RCRA) Permit, Dangerous Waste Portion for the Treatment, Storage, and Disposal of Dangerous Waste*, Revision 8c, as amended, Part VI, Post-Closure Unit 2 (PCU-2), Chapter 3.0, "Groundwater Monitoring").

a. None of the results in the data set exceeded the concentration limit; therefore, no UCL was calculated.

b. The June 2020 chromium result for well 199-H4-84 was flagged as a suspected error after statistical evaluations were performed. This UCL will be revised.

N/A = not applicable

RCRA = *Resource Conservation and Recovery Act of 1976*

UCL = upper confidence limit

4.2 300 Area Process Trenches

The 300 Area Process Trenches (316-5 waste site) (Figures 1-1 and 4-2) received mixed waste effluent discharges from fuel fabrication and nuclear research laboratories in the 300 Area Industrial Complex from 1975 to 1987, followed by continued discharge of cooling water with small quantities of nonhazardous maintenance and process waste until December 1994. A comprehensive description, including a history of operations, is provided in Section 3.1.1 of the final status groundwater monitoring plan for the 300 Area Process Trenches in the PCU-1 groundwater monitoring plan in the Hanford RCRA Permit. The PCU-1 groundwater monitoring plan was incorporated into Part VI of the Hanford RCRA Permit, Revision 8c, on May 24, 2017.[2] RCRA monitoring includes the dangerous waste constituents *cis*-1,2-dichloroethene (*cis*-1,2-DCE) and trichloroethene (TCE).

DOE remediated the 300 Area Process Trenches in 1991 under a CERCLA expedited response action by excavating contaminated soil and transporting the excavated soil to the north end of the trenches (Section 2.4 in DOE/RL-92-32, *Expedited Response Action Assessment for 316-5 Process Trenches*). Additional removal actions were performed in 1997 and 1998, followed by backfilling and surface restoration in 2004 (Chapter 3 in DOE/RL-2004-74, *300-FF-1 Operable Unit Remedial Action Report*).

[2] Minor formatting modifications were made to the groundwater monitoring plan on March 15, 2018.

The 300 Area Process Trenches were closed in 1998 under a modified closure with requirements for continued corrective action groundwater monitoring. Corrective action was deferred to the CERCLA program for the 300-FF-5 OU (Executive Summary of the PCU-1 groundwater monitoring plan in the Hanford RCRA Permit). CERCLA remediation includes monitored natural attenuation of *cis*-1,2-DCE and TCE. In 2020, EPA agreed that CERCLA monitoring for TCE can be discontinued because concentrations have attained the cleanup level in all CERCLA network wells (TPA-CN-0883, *DOE/RL-2014-42, Tri-Party Agreement Change Notice Form: 300-FF-5 Operable Unit Remedy Implementation Sampling and Analysis Plan, Rev. 0*). RCRA monitoring for TCE will continue through the RCRA compliance period (2022). If TCE concentrations remain below the concentration limit for 3 years before the end of the compliance period, then RCRA TCE monitoring will be discontinued (Section 3.2.4 of the PCU-1 groundwater monitoring plan). RCRA monitoring will continue for *cis*-1,2-DCE until concentrations have not exceeded the concentration limit for three consecutive years.

The RCRA post-closure groundwater monitoring under the WAC 173-303-645 corrective action program uses wells at four locations: one upgradient (northwest) and three downgradient (east, southeast, and south) of the former 300 Area Process Trenches (Figure 4-2; Table 4-4). The most distant downgradient location is about 200 m (660 ft) to the southeast, along the dominant groundwater flow path from the trenches. Two wells are located at each of the four locations. Well names ending in “A” are screened near the water table, and well names ending in “B” are screened in the lower portion of the unconfined aquifer.

The water table near the former trenches is not declining and is directly affected by the Columbia River stage. Dry well conditions are unlikely in the future (Section 3.2.5 in the PCU-1 groundwater monitoring plan in the Hanford RCRA Permit). Groundwater flows generally toward the south-southeast beneath the former trenches. In March 2020, the gradient sloped to the southeast at 4.7×10^{-4}, and the estimated average linear velocity was 25 m/d (81 ft/d) (Table 1-2).

The sampling schedule for the monitoring wells is designed to accommodate two sampling events each year, with collection scheduled during high river stage (typically May through June) and low river stage (typically September through November). This annual report for 2020 includes *cis*-1,2-DCE, TCE, and field parameter results for samples collected in June and September. In 2020, sampling was performed as planned (Table 4-5).

The Hanford RCRA Permit concentration limits for *cis*-1,2-DCE and TCE are 16 µg/L and 4 µg/L, respectively, consistent with the cleanup levels in the CERCLA Record of Decision (EPA and DOE, 2013, *Hanford Site 300 Area Record of Decision for 300-FF-2 and 300-FF-5, and Record of Decision Amendment for 300-FF-1*). DOE reports the results of 300 Area Process Trenches groundwater monitoring semiannually (SGW-65168, *Post-Closure Corrective Action Groundwater Monitoring Report for the 300 Area Process Trenches: January – June 2020*; and SGW-65804, *Post-Closure Corrective Action Groundwater Monitoring Report for the 300 Area Process Trenches: July – December 2020*).

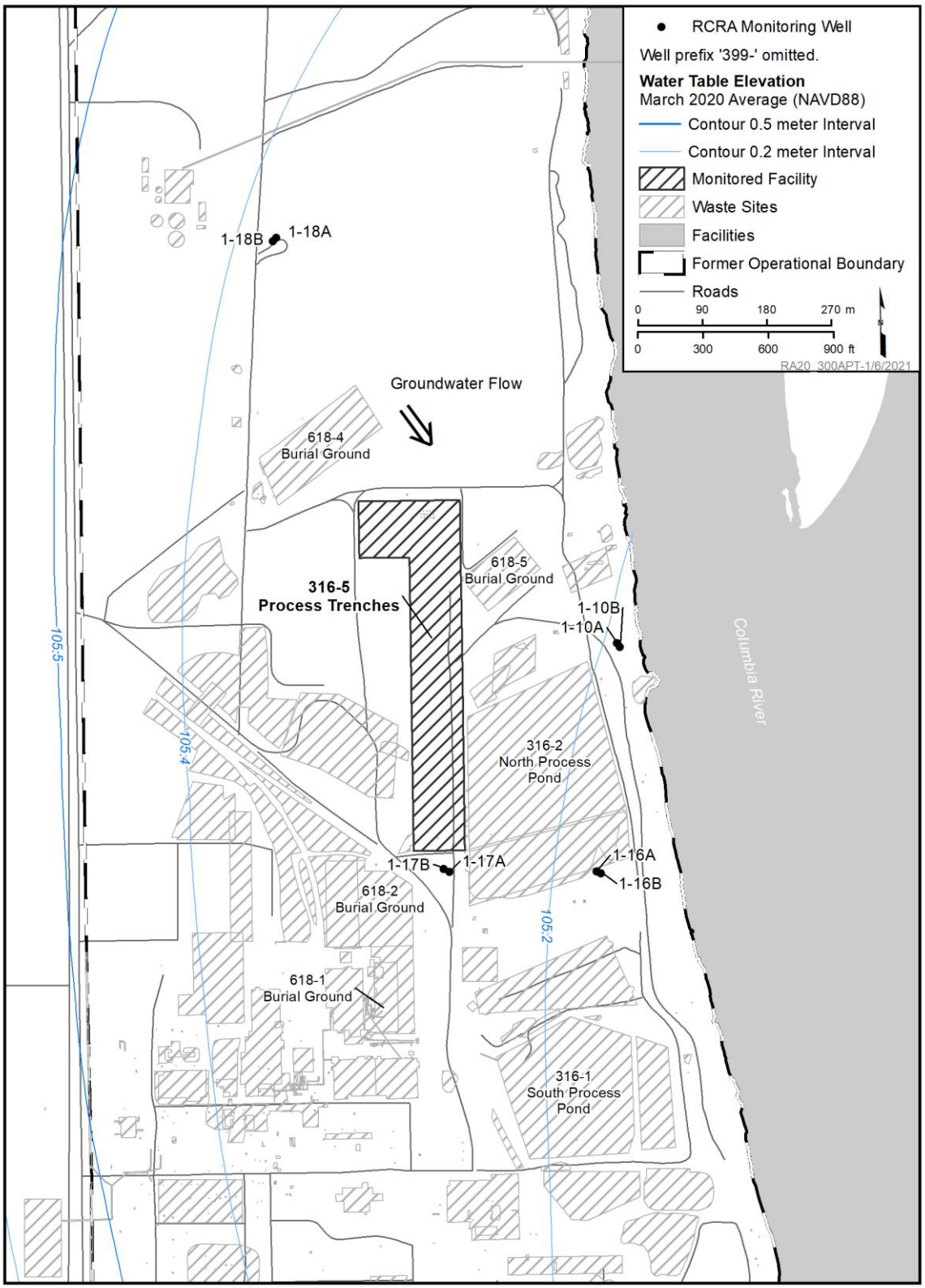
During 2020, TCE concentrations were below the Hanford RCRA Permit concentration limit (4 µg/L) and were mostly below the analytical detection limit (Table 4-5). Low-level detections of TCE in well 399-1-16B, with a maximum of 1.7 µg/L, may be from the former 300 Area Process Trenches or the former 316-2 North Process Pond (Appendix F of DOE/RL-2010-99, *Remedial Investigation/Feasibility Study for the 300-FF-1, 300-FF-2, and 300-FF-5 Operable Units*).

In samples from well 399-1-16B, *cis*-1,2-DCE continued to exceed the Hanford RCRA Permit concentration limit (16 µg/L), with concentrations ranging from 148 to 150 µg/L. Lower levels of *cis*-1,2-DCE were detected in well 399-1-17B, with a maximum of 0.89 µg/L. Numerical modeling indicates that the source of *cis*-1,2-DCE is probably not the 300 Area Process Trenches, and it resulted

from degradation of TCE and PCE that were historically disposed in the process ponds (Appendix F of DOE/RL-2010-99).

In accordance with Section 3.3.2 of the PCU-1 groundwater monitoring plan in the Hanford RCRA Permit, a statistical evaluation was performed to compare the dangerous waste constituent results to the Hanford RCRA Permit concentration limits. The evaluation applies to results at individual point-of-compliance (downgradient) wells. The 95% UCL on the mean is used for results that exceed concentration limits. A nonstatistical analysis is used for results that are less than concentration limits. In addition, the PQL for each sample in the data set must not exceed the concentration limit established in the Hanford RCRA Permit.

The statistical evaluation is conducted semiannually (SGW-65168; SGW-65804). The only 95% UCL that exceeded the Hanford RCRA Permit concentration limit in a downgradient well was for *cis*-1,2-DCE in well 399-1-16B, which is consistent with previous monitoring results (Table 4-6).



Reference: ECF-HANFORD-20-0078, *Preparation of the Hanford Site Water Table Map for January to March 2020*.

Figure 4-2. 300 Area Process Trenches (316-5 Waste Site)

Table 4-4. 300 Area Process Trenches Groundwater Monitoring Network

Well Name	Location	Year Installed	Head Date	Hydraulic Head		Elevation Screen Top		Elevation Screen Bottom		Water Column		Sample Frequency	Comments
				m	ft	m	ft	m	ft	m	ft		
399-1-10A	DG	1986	9/3/2020	105.16	345.00	106.9	350.8	102.3	335.8	2.8	9.2	S	
399-1-10B	DG deep	1991	9/3/2020	105.09	344.80	82.7	271.3	79.6	261.3	25.5	83.5	S	
399-1-16A	DG	1986	9/3/2020	105.14	344.93	107.0	351.0	102.4	336.0	2.7	8.9	S	
399-1-16B	DG deep	1987	9/3/2020	105.16	345.01	84.8	278.4	81.8	268.4	23.4	76.6	S	
399-1-17A	DG	1986	9/3/2020	105.25	345.31	107.7	353.5	103.2	338.5	2.1	6.8	S	
399-1-17B	DG deep	1986	9/3/2020	105.26	345.35	85.0	278.8	81.9	268.8	23.3	76.5	S	
399-1-18A	UG	1986	9/3/2020	105.65	346.62	107.3	352.1	102.8	337.1	2.9	9.5	S	
399-1-18B	UG deep	1987	9/3/2020	105.69	346.75	86.0	282.1	82.9	272.1	22.8	74.7	S	

Note: Requirements are from the Hanford RCRA Permit (WA7890008967, *Hanford Facility Resource Conservation and Recovery Act (RCRA) Permit, Dangerous Waste Portion for the Treatment, Storage, and Disposal of Dangerous Waste*, Revision 8c, as amended, Part VI, Post-Closure Unit 1 (PCU-1), Chapter 3.0, "Groundwater Monitoring Plan").

DG = downgradient
RCRA = *Resource Conservation and Recovery Act of 1976*
S = semiannual
UG = upgradient

Table 4-5. 300 Area Process Trenches RCRA Sampling Results for 2020

Well Name	RCRA Sample Date	*cis*-1,2-DCE (µg/L)	TCE (µg/L)	pH	Specific Conductance (µS/cm)	Temperature (°C)	Turbidity (NTU)
Permit Concentration Limit		**16**	**4.0**	—	—	—	—
399-1-10A	6/18/2020	0.333 U	0.333 U	7.78	195.3	14.5	0.54
		0.333 U	0.333 U				
399-1-10A	9/3/2020	0.333 U	0.333 U	7.75	422	17.7	0.57
399-1-10B	6/18/2020	0.39 U	0.50 U	7.33	298	15.6	0.51
399-1-10B	9/3/2020	0.39 U	0.50 U	7.55	306	16.8	0.64
399-1-16A	6/22/2020	0.23 U	0.31 U	7.77	204.8	15.5	0.67
399-1-16A	9/3/2020	0.333 U	0.333 U	7.69	409	16.2	0.20
399-1-16B	6/22/2020	150 D	1.7	8.15	316	16.5	2.31
399-1-16B	9/3/2020	148 D	1.6 J	8.19	322	16.1	0.39
399-1-17A	6/18/2020	0.333 U	0.333 U	7.64	376	17.5	0.70
399-1-17A	9/3/2020	0.333 U	0.333 U	7.67	523	17.1	0.21
		0.333 U	0.333 U				
399-1-17B	6/18/2020	0.89 J	0.50 U	7.67	350	17.5	4.32
399-1-17B	9/3/2020	0.70 J	0.50 U	7.66	347	17.2	0.74
399-1-18A	6/18/2020	0.39 U	0.50 U	7.98	478	17.3	0.36
399-1-18A	9/3/2020	0.333 U	0.333 U	7.99	489	18.3	0.59
399-1-18B	6/18/2020	0.333 U	0.333 U	7.5	357	17.5	0.53
399-1-18B	9/3/2020	0.39 U	0.50 U	7.53	362	18.2	0.93

Notes:

Sample results collected for this RCRA unit. Appendix A presents the full data set for 2020.

Yellow-highlighted cells indicate exceedances of the concentration limit defined in the Hanford RCRA Permit (WA7890008967, *Hanford Facility Resource Conservation and Recovery Act (RCRA) Permit, Dangerous Waste Portion for the Treatment, Storage, and Disposal of Dangerous Waste*, Revision 8c, as amended, Part VI, Post-Closure Unit 1 (PCU-1), Chapter 3.0, "Groundwater Monitoring Plan").

Table 4-5. 300 Area Process Trenches RCRA Sampling Results for 2020

Well Name	RCRA Sample Date	*cis*-1,2-DCE (µg/L)	TCE (µg/L)	pH	Specific Conductance (µS/cm)	Temperature (°C)	Turbidity (NTU)

cis-1,2-DCE = *cis*-1,2-dichloroethene
D = analyte was reported at a secondary dilution factor
J = estimated value; result is below the quantitation limit
NTU = nephelometric turbidity unit
RCRA = *Resource Conservation and Recovery Act of 1976*
TCE = trichloroethene
U = result is below the method detection limit

Table 4-6. Statistical Evaluation of 300 Area Process Trenches Dangerous Waste Constituents for 2020

Well	Semiannual Period	*cis*-1,2 Dichloroethene (Permit Concentration Limit = 16 µg/L)	Trichloroethene (Permit Concentration Limit = 4 µg/L)
		95% UCL	95% UCL
399-1-10A	January – June	N/A*	N/A*
399-1-10A	July – December	N/A*	N/A*
399-1-10B	January – June	N/A*	N/A*
399-1-10B	July – December	N/A*	N/A*
399-1-16A	January – June	N/A*	N/A*
399-1-16A	July – December	N/A*	N/A*
399-1-16B	January – June	171.6	N/A*
399-1-16B	July – December	156.0	N/A*
399-1-17A	January – June	N/A*	N/A*
399-1-17A	July – December	N/A*	N/A*
399-1-17B	January – June	N/A*	N/A*
399-1-17B	July – December	N/A*	N/A*

Sources:

SGW-65168, *Post-Closure Corrective Action Groundwater Monitoring Report for the 300 Area Process Trenches: January – June 2020*.

SGW-65804, *Post-Closure Corrective Action Groundwater Monitoring Report for the 300 Area Process Trenches: July – December 2020*.

Note: Yellow-highlighted cells indicate that the 95% UCL exceeded concentration limits defined in Hanford RCRA Permit (WA7890008967, *Hanford Facility Resource Conservation and Recovery Act (RCRA) Permit, Dangerous Waste Portion for the Treatment, Storage, and Disposal of Dangerous Waste*, Revision 8c, as amended, Part VI, Post-Closure Unit 1 (PCU-1), Chapter 3.0, "Groundwater Monitoring Plan").

*None of the results in the data set exceeded the concentration limit; therefore, the UCL was not calculated.

N/A = not applicable

UCL = upper confidence limit

RCRA = *Resource Conservation and Recovery Act of 1976*

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5 References

18-NWP-062, 2018, "Request for Removal of 218-E-12B Trench 94 from the Hanford Facility Resource Conservation and Recovery Act/ Dangerous Waste Permit Application Part A Form for the Low-Level Burial Grounds Operating Unit Group, letter 16-AMRP-0032, dated November 20, 2015" (letter to Joe Franco, U.S. Department of Energy, Richland Operations Office from Alexandra K. Smith), Washington State Department of Ecology, Richland, Washington, April 20. Available at: https://pdw.hanford.gov/document/0065881H.

19-NWP-197, 2019, "Approval of Request for Integrated Disposal Facility Groundwater Sample Activities" (letter to William F. Hamel, U.S. Department of Energy, Richland Operations Office from Alexandra K. Smith), Washington State Department of Ecology, Richland, Washington, December 17. Available at: https://pdw.hanford.gov/document/AR-03388.

40 CFR 141, "National Primary Drinking Water Regulations," *Code of Federal Regulations*. Available at: https://www.ecfr.gov/cgi-bin/text-idx?SID=86e507a2388a33ef5e85286bec95f2c8&mc=true&node=pt40.25.141&rgn=div5.

Subpart G, "Maximum Contaminant Levels and Maximum Residual Disinfectant Levels."

40 CFR 143.3, "National Secondary Drinking Water Regulations," "Secondary Maximum Contaminant Levels," *Code of Federal Regulations*. Available at: https://www.ecfr.gov/cgi-bin/text-idx?SID=49dc1c93cd5e85e125ae2348881d4ed5&mc=true&node=se40.25.143_13&rgn=div8.

40 CFR 265, "Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities," *Code of Federal Regulations*. Available at: http://www.ecfr.gov/cgi-bin/text-idx?SID=821b3a92b47bf77af198c434f81d5504&mc=true&node=pt40.26.265&rgn=div5.

265.92, "Sampling and Analysis."

265.93, "Preparation, Evaluation, and Response."

265.94, "Recordkeeping and Reporting."

Subpart F, "Ground-Water Monitoring."

Atomic Energy Act of 1954, Pub. L. 83-703 as amended, 42 USC 2011 et seq., 68 Stat. 919. Available at: https://www.govinfo.gov/content/pkg/STATUTE-68/pdf/STATUTE-68-Pg919.pdf#page=30.

Comprehensive Environmental Response, Compensation, and Liability Act of 1980, Pub. L. 107-377, as amended, 42 USC 9601, et seq., December 31, 2002. Available at: https://www.csu.edu/cerc/researchreports/documents/CERCLASummary1980.pdf.

Section 120, "Federal Facilities."

CP-47631, 2018, *Model Package Report: Central Plateau Groundwater Model, Version 8.4.5*, Rev. 4, CH2M HILL Plateau Remediation Company, Richland, Washington. Available at: https://pdw.hanford.gov/document/0066449H.

CP-57037, 2020, *Model Package Report: Plateau to River Groundwater Transport Model Version 8.3*, Rev. 2, CH2M HILL Plateau Remediation Company, Richland, Washington. Available at: https://pdw.hanford.gov/document/AR-03674.

DOE/RL-92-32, 1992, *Expedited Response Action Assessment for 316-5 Process Trenches*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://pdw.hanford.gov/document/D196105947.

DOE/RL-96-61, 1997, *Hanford Site Background: Part 3, Groundwater Background*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://pdw.hanford.gov/document/D197226378.

DOE/RL-97-48, 1997, *183-H Solar Evaporation Basins Postclosure Plan*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://pdw.hanford.gov/document/D197226569.

DOE/RL-2004-74, 2005, *300-FF-1 Operable Unit Remedial Action Report*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://pdw.hanford.gov/document/DA01233219.

DOE/RL-2008-58, 2020, *Interim Status Groundwater Monitoring Plan for the 216-A-29 Ditch*, Rev. 1, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: https://pdw.hanford.gov/document/AR-03968.

DOE/RL-2008-59, 2017, *Interim Status Groundwater Monitoring Plan for the 216-B-3 Pond*, Rev. 2, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://pdw.hanford.gov/document/0066771H.

Modified by:

RCRA-CN-01_DOE/RL-2008-59_R2, 2019, *RCRA Interim Status Change Number 1: Interim Status Groundwater Monitoring Plan for the 216-B-3 Pond*, dated September 17, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: https://pdw.hanford.gov/document/AR-03418.

RCRA-CN-02_DOE/RL-2008-59_R2, 2020, *Interim Status Change Number 2: Interim Status Groundwater Monitoring Plan for the 216-B-3 Pond*, dated June 8, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: https://pdw.hanford.gov/document/AR-03878.

RCRA-CN-03_DOE/RL-2008-59_R2, 2020, *Interim Status Change Number 3: Interim Status Groundwater Monitoring Plan for the 216-B-3 Pond*, dated October 15, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: https://pdw.hanford.gov/document/AR-04311.

DOE/RL-2008-60, 2012, *Interim Status Groundwater Monitoring Plan for the 216-B-63 Trench*, Rev. 1, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://pdw.hanford.gov/document/0091409.

Modified by:

RCRA-CN-01_DOE/RL-2008-60_R1, 2020, *Interim Status Change Number 1: Interim Status Groundwater Monitoring Plan for the 216-B-63 Trench*, dated June 8, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: https://pdw.hanford.gov/document/AR-03873.

DOE/RL-2008-61, 2017, *Interim Status Groundwater Monitoring Plan for the 216-S-10 Pond and Ditch*, Rev. 1, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: https://pdw.hanford.gov/document/0069130H.

Modified by:

RCRA-CN-01_DOE/RL-2008-61_R1, 2020, *Interim Status Change Number 1: Interim Status Groundwater Monitoring Plan for the 216-S-10 Pond and Ditch*, dated June 8, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: https://pdw.hanford.gov/document/AR-03877.

DOE/RL-2009-66, 2019, *Interim Status Groundwater Quality Assessment Plan for the Single-Shell Tank Waste Management Area T*, Rev. 1, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: https://pdw.hanford.gov/document/0091408.

DOE/RL-2009-66, 2019, *Interim Status Groundwater Quality Assessment Plan for the Single-Shell Tank Waste Management Area T*, Rev. 2, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: https://pdw.hanford.gov/document/AR-03104.

DOE/RL-2009-67, 2019, *Interim Status Groundwater Quality Assessment Plan for the Single-Shell Tank Waste Management Area TX-TY*, Rev. 2, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: https://pdw.hanford.gov/document/AR-03104.

DOE/RL-2009-68, 2012, *Interim Status Groundwater Monitoring Plan for the LLBG WMA-3*, Rev. 2, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://pdw.hanford.gov/document/0091262.

DOE/RL-2009-69, 2012, *Interim Status Groundwater Monitoring Plan for the LLBG WMA-4*, Rev. 2, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://pdw.hanford.gov/document/0091410.

Modified by:

TPA-CN-718, 2016, *Tri-Party Agreement Change Notice Form: DOE/RL-2009-69, Interim Status Groundwater Monitoring Plan for the LLBG WMA-4, Revision 2*, dated May 12, U.S. Department of Energy, Richland Operations Office, and Washington State Department of Ecology, Richland, Washington. Available at: http://pdw.hanford.gov/document/0076959H.

RCRA-CN-01_DOE/RL-2009-69_R2, 2020, *Interim Status Change Number 1: Interim Status Groundwater Monitoring Plan for the LLBG WMA-4*, dated June 8, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: https://pdw.hanford.gov/document/AR-03875.

DOE/RL-2009-73, 2019, *Interim Status Groundwater Quality Assessment Plan for the Single-Shell Tank Waste Management Area S-SX*, Rev. 1, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: https://pdw.hanford.gov/document/AR-03104.

Modified by:

RCRA-CN-01_DOE/RL-2009-73_R1, 2020, *Interim Status Change Number 1: Interim Status Groundwater Quality Assessment Plan for the Single-Shell Tank Waste Management Area S-SX*, dated March 22, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: https://pdw.hanford.gov/document/AR-03738.

DOE/RL-2009-74, 2019, *Interim Status Groundwater Quality Assessment Plan for the Single-Shell Tank Waste Management Area U*, Rev. 2, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: https://pdw.hanford.gov/document/AR-03104.

DOE/RL-2009-75, 2015, *Interim Status Groundwater Monitoring Plan for the LLBG WMA-1*, Rev. 1, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://pdw.hanford.gov/document/0074656H.

Modified by:

RCRA-CN-01_DOE/RL-2009-75_R1, 2020, *Interim Status Change Number 1: Interim Status Groundwater Monitoring Plan for the LLBG WMA-1*, dated June 8, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: https://pdw.hanford.gov/document/AR-03876.

DOE/RL-2009-76, 2010, *Interim Status Groundwater Monitoring Plan for the LLBG WMA-2*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: https://pdw.hanford.gov/document/0084331.

Modified by:

RCRA-CN-01_DOE/RL-2009-76_R0, 2020, *Interim Status Change Number 1: Interim Status Groundwater Monitoring Plan for the LLBG WMA-2*, dated June 8, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: https://pdw.hanford.gov/document/AR-03866.

DOE/RL-2009-76, 2020, *Interim Status Groundwater Monitoring Plan for the LLBG WMA-2*, Rev. 1, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: https://pdw.hanford.gov/document/AR-05985.

DOE/RL-2009-77, 2010, *Groundwater Quality Assessment Plan for the Single-Shell Tank Waste Management Area C*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: https://pdw.hanford.gov/document/0084330.

DOE/RL-2009-77, 2019, *Interim Status Groundwater Quality Assessment Plan for the Single-Shell Tank Waste Management Area C*, Rev. 1, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: https://pdw.hanford.gov/document/AR-03381.

DOE/RL-2010-92, 2017, *Interim Status Groundwater Monitoring Plan for the 216-A-37-1 PUREX Plant Crib*, Rev. 3, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://pdw.hanford.gov/document/0066775H.

Modified by:

RCRA-CN-01_DOE/RL-2010-92_R3, 2020, *Interim Status Change Number 1: Interim Status Groundwater Monitoring Plan for the 216-A-37-1 PUREX Plant Crib*, dated June 8, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: https://pdw.hanford.gov/document/AR-03984.

RCRA-CN-02_DOE/RL-2010-92_R3, 2020, *Interim Status Change Number 2: Interim Status Groundwater Monitoring Plan for the 216-A-37-1 PUREX Plant Crib*, dated October 1, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: https://pdw.hanford.gov/document/AR-04312.

DOE/RL-2010-93, 2016, *Interim Status Groundwater Monitoring Plan for the 216-A-36B PUREX Plant Crib*, Rev. 2, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: https://pdw.hanford.gov/document/0073381H.

Modified by:

RCRA-CN-01_DOE/RL-2010-93_R2, 2020, *Interim Status Change Number 1: Interim Status Groundwater Monitoring Plan for the 216-A-36B PUREX Plant Crib*, dated June 8, U.S. Department of Energy, Richland Operations Office, Richland Operations Office, Richland, Washington. Available at: https://pdw.hanford.gov/document/AR-03864.

RCRA-CN-02_DOE/RL-2010-93_R2, 2020, *Interim Status Change Number 1: Interim Status Groundwater Monitoring Plan for the 216-A-36B PUREX Plant Crib*, dated October 1, U.S. Department of Energy, Richland Operations Office, Richland Operations Office, Richland, Washington. Available at: https://pdw.hanford.gov/document/AR-04313.

DOE/RL-2010-99, 2013, *Remedial Investigation/Feasibility Study for the 300-FF-1, 300-FF-2, and 300-FF-5 Operable Units*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at:
https://pdw.hanford.gov/document/0088359.
https://pdw.hanford.gov/document/0088307.
https://pdw.hanford.gov/document/0088306.
https://pdw.hanford.gov/document/0088305.

DOE/RL-2012-53, 2019, *Groundwater Quality Assessment Plan for the Single-Shell Tank Waste Management Area B-BX-BY*, Rev. 1, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: https://pdw.hanford.gov/document/AR-03104.

DOE/RL-2015-32, 2020, *Groundwater Monitoring Plan for the Nonradioactive Dangerous Waste Landfill*, Rev. 1, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: https://pdw.hanford.gov/document/AR-03861.

DOE/RL-2015-49, 2016, *Interim Status Groundwater Quality Assessment Plan for the Single-Shell Tank Waste Management Area A-AX*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://pdw.hanford.gov/document/0073187H.

Modified by:

RCRA-CN-01_DOE/RL-2015-49_R0, 2020, *Interim Status Change Number 1: Interim Status Groundwater Monitoring Plan for the Single-Shell Tank Waste Management Area A-AX*, dated February 13, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: https://pdw.hanford.gov/document/AR-03597.

DOE/RL-2016-23, 2017, *216-A-29 Ditch Interim Status Groundwater Quality Assessment Monitoring Plan*, Rev. 2, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://pdw.hanford.gov/document/0066773H.

DOE/RL-2016-66, *Hanford Site RCRA Groundwater Monitoring Report for 2016*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: https://pdw.hanford.gov/document/0072146H.

DOE/RL-2017-11, 2018, *Removal Action Work Plan for the 200-BP-5 Operable Unit Groundwater Extraction*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: https://pdw.hanford.gov/document/0065869H.

DOE/RL-2017-19, 2017, *Groundwater Quality Assessment Plan for the Nonradioactive Dangerous Waste Landfill, Hanford Site*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://pdw.hanford.gov/document/0072142H.

DOE/RL-2019-21, 2019, *Groundwater Assessment First Determination Report for Waste Management Area A-AX*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: https://pdw.hanford.gov/document/AR-03385.

DOE/RL-2019-22, 2019, *Groundwater Assessment First Determination Report for the Nonradioactive Dangerous Waste Landfill*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: https://pdw.hanford.gov/document/AR-03427.

DOE/RL-2019-27, 2019, *Groundwater Assessment First Determination Report for the 216-A-29 Ditch*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: https://pdw.hanford.gov/document/AR-03386.

DOE/RL-2019-29, 2019, *Groundwater Monitoring Plan for the Integrated Disposal Facility*, Rev. 1, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: https://pdw.hanford.gov/document/AR-03232.

DOE/RL-2019-32, 2019, *Interim Status Groundwater Quality Assessment Plan for the Low-Level Burial Grounds Waste Management Area-3*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: https://pdw.hanford.gov/document/AR-03280.

Modified by:

RCRA-CN-01_DOE/RL-2019-32_R0, 2020, *Interim Status Change Number 1: Interim Status Groundwater Quality Assessment Plan for the Low-Level Burial Grounds Waste Management Area-3*, dated August 5, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: https://pdw.hanford.gov/document/AR-04027.

DOE/RL-2019-44, 2020, *Interim Status Groundwater Monitoring Plan for the Single-Shell Tank Waste Management Area A-AX*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: https://pdw.hanford.gov/document/AR-03862.

DOE/RL-2019-66, 2020, *Hanford Site Groundwater Monitoring Report for 2019*, Rev. 0, U.S Department of Energy, Richland Operations Office, Richland, Washington. Available at: https://pdw.hanford.gov/document/AR-04023.

DOE/RL-2019-74, 2020, *Interim Status Groundwater Quality Assessment Plan for the Single-Shell Tank System*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: https://pdw.hanford.gov/document/AR-03908.

DOE/RL-2020-57, 2020, *Groundwater Quality Assessment Plan for the Nonradioactive Dangerous Waste Landfill*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: https://pdw.hanford.gov/document/AR-04330.

ECF-100NPL-10-0462, 2018, *Calculation of Standard Method B Groundwater Cleanup Levels for Potable Groundwater for the 100 Areas and 300 Area Remedial Investigation/Feasibility Study Reports*, Rev. 4, CH2M HILL Plateau Remediation Company, Richland, Washington. Available at: https://pdw.hanford.gov/document/0065284H.

ECF-200W-20-0065, *Groundwater Elevation Mapping for 200 West Area – Quarter 1 Calendar Year 2020*, Rev. 0 (pending), Central Plateau Cleanup Company, Richland, Washington.

ECF-200ZP1-20-0024, 2020, *Calculation of Temporal Trends and Confidence Limits for Chromium and Cyanide in Groundwater at Waste Management Area TX-TY*, Rev. 0, CH2M HILL Plateau Remediation Company, Richland, Washington. Available at: https://pdw.hanford.gov/document/AR-04204.

ECF-300FF5-11-0151, 2012, *Groundwater Flow and Uranium Transport Modeling in Support of the 300 Area FF-5 RI/FS*, Rev. 3, CH2M HILL Plateau Remediation Company, Richland, Washington. Available at: http://pdw.hanford.gov/document/0078650H.

ECF-HANFORD-13-0029, 2018, *Development of the Hanford South Geologic Framework Model, Hanford Site, Washington*, Rev. 5, CH2M HILL Plateau Remediation Company, Richland, Washington. Available at: https://pdw.hanford.gov/document/0072751H.

ECF-HANFORD-20-0007, 2020, *Calculation of Critical Means for Calendar Year 2020 RCRA Groundwater Monitoring*, Rev. 0, CH2M HILL Plateau Remediation Company, Richland, Washington. Available at: https://pdw.hanford.gov/document/AR-03565.

ECF-HANFORD-20-0066, *Hydraulic Gradient and Average Linear Groundwater Velocity Calculations – Quarter 1 Calendar Year 2020*, Rev. 0 (pending), CH2M HILL Plateau Remediation Company, Richland, Washington.

ECF-HANFORD-20-0070, 2020, *Open Interval Elevations for Central Plateau Groundwater Monitoring Wells*, Rev. 0, CH2M HILL Plateau Remediation Company, Richland, Washington. Available at: https://pdw.hanford.gov/document/AR-04499.

ECF-HANFORD-20-0078, *Preparation of the Hanford Site Water Table Map for January to March 2020*, Rev. 0 (pending), CH2M HILL Plateau Remediation Company, Richland, Washington.

EPA, Ecology, and DOE, 2018, *Record of Decision Hanford 100 Area Superfund Site 100-DR-1, 100-DR-2, 100-HR-1, 100-HR-2, and 100-HR-3 Operable Units*, U.S. Environmental Protection Agency, Washington State Department of Ecology, and U.S. Department of Energy, Olympia, Washington. Available at: https://pdw.hanford.gov/document/0065047H.

Ecology, EPA, and DOE, 1989a, *Hanford Federal Facility Agreement and Consent Order*, 2 vols., as amended, Washington State Department of Ecology, U.S. Environmental Protection Agency, and U.S. Department of Energy, Olympia, Washington. Available at: http://www.hanford.gov/?page=81.

Ecology, EPA, and DOE, 1989b, *Hanford Federal Facility Agreement and Consent Order Action Plan*, as amended, Washington State Department of Ecology, U.S. Environmental Protection Agency, and U.S. Department of Energy, Olympia, Washington. Available at: https://www.hanford.gov/?page=82.

Ecology Publication No. 97-407, 2014, *Chemical Test Methods For Designating Dangerous Waste, WAC 173-303-090 & -100*, Washington State Department of Ecology, Olympia, Washington. Available at: https://fortress.wa.gov/ecy/publications/publications/97407.pdf.

EPA and DOE, 2013, *Hanford Site 300 Area Record of Decision for 300-FF-2 and 300-FF-5, and Record of Decision Amendment for 300-FF-1*, U.S. Environmental Protection Agency and U.S. Department of Energy, Richland, Washington. Available at: http://pdw.hanford.gov/document/0087180.

H-2-59129, 1966, *Crib 216-A36B, Plan Profiles & Details*, U.S. Atomic Energy Commission, Richland, Washington. Available at: https://pdw.hanford.gov/document/0065123H.

HNF-EP-0182, 2017, *Waste Tank Summary Report for Month Ending November 30, 2017*, Rev. 359, Washington River Protection Solutions, Richland, Washington. Available at: http://pdw.hanford.gov/document/0067188H.

HNF-EP-0182,2020, *Waste Tank Summary Report for Month Ending October 31, 2020*, Rev. 394, Washington River Protection Solutions, Richland, Washington. Available at: https://pdw.hanford.gov/document/AR-05644.

HNF-SA-3126-FP, 1997, *Resolution of the Hanford Site Ferrocyanide Safety Issue*, DE&S Hanford, Inc., Pacific Northwest National Laboratory, and Babad Technical Services, Richland, Washington. Available at: https://pdw.hanford.gov/document/0071666H.

PNNL-11810, 1998, *Results of Phase I Groundwater Quality Assessment for Single-Shell Tank Waste Management Areas S-SX at the Hanford Site*, Pacific Northwest National Laboratory, Richland, Washington. Available at: http://pdw.hanford.gov/document/D198175192.

PNNL-13282, 2000, *Groundwater Quality Assessment Plan for Waste Management Area U: First Determination*, Pacific Northwest National Laboratory, Richland, Washington. Available at: http://pdw.hanford.gov/document/D2760779.

PNNL-15479, 2005, *Groundwater Monitoring Plan for the Hanford Site 216-B-3 Pond RCRA Facility*, Pacific Northwest National Laboratory, Richland, Washington. Available at: https://pdw.hanford.gov/document/DA01649608.

PNNL-15670, 2006, *Hanford Site Groundwater Monitoring For Fiscal Year 2005*, Pacific Northwest National Laboratory, Richland, Washington. Available at https://pdw.hanford.gov/document/0084078.

RCW 70.105, "Hazardous Waste Management," *Revised Code of Washington*, Olympia, Washington. Available at: http://apps.leg.wa.gov/rcw/default.aspx?cite=70.105.

Resource Conservation and Recovery Act of 1976, 42 USC 6901, et seq. Available at: https://elr.info/sites/default/files/docs/statutes/full/rcra.pdf.

RHO-CD-798, 1979, *Current Status of the 200 Area Ponds*, Rockwell Hanford Operations, Richland, Washington. Available at: http://pdw.hanford.gov/document/0072752H.

RPP-7218, 2000, *Preliminary Inventory Estimates for Single-Shell Tank Leaks in T, TX, and TY Tank Farms*, Rev. 0, CH2M HILL Hanford Group, Inc., Richland, Washington. Available at: http://pdw.hanford.gov/document/0069094H.

RPP-7884, 2002, *Field Investigation Report for Waste Management Area S-SX*, Rev. 0, CH2M HILL Hanford Group, Inc., Richland, Washington. Available at: http://pdw.hanford.gov/document/D8974033. http://pdw.hanford.gov/document/D8974041. http://pdw.hanford.gov/document/D8974046. http://pdw.hanford.gov/document/D8974049.

RPP-26744, 2005, *Hanford Soil Inventory, Rev. 1*, Rev. 0, CH2M HILL Hanford Group, Inc., Richland, Washington. Available at: http://pdw.hanford.gov/document/0081114H.

RPP-35485, 2007, *Field Investigation Report for Waste Management Area U*, Rev. 0, CH2M HILL Hanford Group, Richland, Washington. Available at: http://pdw.hanford.gov/document/0080440H.

RPP-ENV-37956, 2014, *Hanford 241-A/AX Farm Leak Inventory Assessment Report*, Rev. 2, Washington River Protection Solutions, Richland, Washington. Available at: http://pdw.hanford.gov/document/0075796H.

RPP-ENV-39658, 2010, *Hanford SX-Farm Leak Assessments Report*, Rev. 0, Washington River Protection Solutions, Richland, Washington. Available at: http://www.hanford.gov/files.cfm/RPP-ENV-39658_Rev_0.pdf.

RPP-RPT-48589, 2011, *Hanford 241-S Farm Leak Assessment Report*, Rev. 0, Washington River Protection Solutions, Richland, Washington. Available at: http://pdw.hanford.gov/document/0080435H.

SGW-41072, 2017, *Liquid Effluent Retention Facility Engineering Evaluation and Characterization Report*, Rev. 1, CH2M HILL Plateau Remediation Company, Richland, Washington. Available at: http://pdw.hanford.gov/document/0068831H.

SGW-59564, 2016, *Engineering Evaluation of the 200 West Pump and Treat Influence on Groundwater Monitoring for the Low-Level Burial Ground Trenches 31 and 34*, Rev. 0, CH2M HILL Plateau Remediation Company, Richland, Washington. Available at: https://pdw.hanford.gov/document/0075238H.

SGW-60575, 2018, *Engineering Evaluation Report for Single-Shell Tank Waste Management Area T Groundwater Monitoring*, Rev. 0, CH2M HILL Plateau Remediation Company, Richland, Washington. Available at: https://pdw.hanford.gov/document/0064669H.

SGW-60576, 2018, *Engineering Evaluation Report for Single-Shell Tank Waste Management Area TX-TY Groundwater Monitoring*, Rev. 0, CH2M HILL Plateau Remediation Company, Richland, Washington. Available at: https://pdw.hanford.gov/document/0064670H.

SGW-60577, 2018, *Engineering Evaluation Report for Single-Shell Tank Waste Management Area S-SX Groundwater Monitoring*, Rev. 0, CH2M HILL Plateau Remediation Company, Richland, Washington. Available at: https://pdw.hanford.gov/document/0064668H.

SGW-60578, 2018, *Engineering Evaluation Report for Single-Shell Tank Waste Management Area U Groundwater Monitoring*, Rev. 0, CH2M HILL Plateau Remediation Company, Richland, Washington. Available at: https://pdw.hanford.gov/document/0064667H.

SGW-60583, 2018, *Engineering Evaluation Report for Low-Level Burial Grounds Waste Management Area-3 Green Islands Groundwater Monitoring*, Rev. 0, CH2M HILL Plateau Remediation Company, Richland, Washington. Available at: https://pdw.hanford.gov/document/0063845H.

SGW-60584, 2018, *Engineering Evaluation Report for Low-Level Burial Grounds Waste Management Area-4 Green Islands Groundwater Monitoring*, Rev. 0, CH2M HILL Plateau Remediation Company, Richland, Washington. Available at: https://pdw.hanford.gov/document/0063844H.

SGW-60585, 2018, *Engineering Evaluation Report for the 216-S-10 Pond and Ditch Groundwater Monitoring*, Rev. 0, CH2M HILL Plateau Remediation Company, Richland, Washington. Available at: https://pdw.hanford.gov/document/0064675H.

SGW-60586, 2019, *Engineering Evaluation Report for Single-Shell Tank Waste Management Area A-AX Groundwater Monitoring*, Rev. 0, CH2M HILL Plateau Remediation Company, Richland, Washington. Available at: https://pdw.hanford.gov/document/AR-03246.

SGW-60587, 2019, *Engineering Evaluation Report for Single-Shell Tank Waste Management Area B-BX-BY Groundwater Monitoring*, Rev. 0, CH2M HILL Plateau Remediation Company, Richland, Washington. Available at: https://pdw.hanford.gov/document/AR-03211.

SGW-60588, 2019, *Engineering Evaluation Report for Single-Shell Tank Waste Management Area C Groundwater Monitoring*, Rev. 0, CH2M HILL Plateau Remediation Company, Richland, Washington. Available at: https://pdw.hanford.gov/document/AR-03247.

SGW-60589, 2019, *Engineering Evaluation Report for the Nonradioactive Dangerous Waste Landfill Groundwater Monitoring*, Rev. 0, CH2M HILL Plateau Remediation Company, Richland, Washington. Available at: https://pdw.hanford.gov/document/AR-03283.

SGW-60590, 2019, *Engineering Evaluation Report for Low-Level Burial Grounds Waste Management Area-1 Green Islands Groundwater Monitoring*, Rev. 0, CH2M HILL Plateau Remediation Company, Richland, Washington. Available at: https://pdw.hanford.gov/document/AR-03212.

SGW-60591, 2019, *Engineering Evaluation Report for the 216-B-3 Main Pond Groundwater Monitoring*, Rev. 0, CH2M HILL Plateau Remediation Company, Richland, Washington. Available at: https://pdw.hanford.gov/document/AR-02644.

SGW-60592, 2019, *Engineering Evaluation Report for the 216-A-29 Ditch Groundwater Monitoring*, Rev. 0, CH2M HILL Plateau Remediation Company, Richland, Washington. Available at: https://pdw.hanford.gov/document/AR-02644.

SGW-60593, 2019, *Engineering Evaluation Report for the 216-A-37-1 Crib Groundwater Monitoring*, Rev. 0, CH2M HILL Plateau Remediation Company, Richland, Washington. Available at: https://pdw.hanford.gov/document/AR-02644.

SGW-60594, 2019, *Engineering Evaluation Report for the 216-B-63 Trench Groundwater Monitoring*, Rev. 0, CH2M HILL Plateau Remediation Company, Richland, Washington. Available at: https://pdw.hanford.gov/document/AR-03266.

SGW-60595, 2019, *Engineering Evaluation Report for the 216-A-36B Crib Groundwater Monitoring*, Rev. 0, CH2M HILL Plateau Remediation Company, Richland, Washington. Available at: https://pdw.hanford.gov/document/AR-03213.

SGW-62007, 2019, *Engineering Evaluation Report for the Integrated Disposal Facility Groundwater Monitoring*, Rev. 0, CH2M HILL Plateau Remediation Company, Richland, Washington. Available at: https://pdw.hanford.gov/document/AR-01220.

SGW-63743, 2019, *Predicted Impact of Future Water-Level Declines on Groundwater Well Longevity Within the Central Plateau, Hanford Site*, Rev. 1, CH2M HILL Plateau Remediation Company, Richland, Washington.

SGW-65236, 2020, *Post-Closure Corrective Action Groundwater Monitoring Report for the 183-H Solar Evaporation Basins: January – June 2020*, Rev. 0, CH2M HILL Plateau Remediation Company, Richland, Washington. Available at: https://pdw.hanford.gov/document/AR-04228.

SGW-65168, 2020, *Post-Closure Corrective Action Groundwater Monitoring Report for the 300 Area Process Trenches: January – June 2020*, Rev. 0, CH2M HILL Plateau Remediation Company, Richland, Washington. Available at: https://pdw.hanford.gov/document/AR-04227.

SGW-65804, *Post-Closure Corrective Action Groundwater Monitoring Report for the 300 Area Process Trenches: July – December 2020*, Rev. 0 (pending), CH2M HILL Plateau Remediation Company, Richland, Washington.

Soper, Wayne W., 1997, "Acceptance of "Closure Certification for the 183-H Solar Evaporation Basins (T-1-4)," 96-EAP-246" (letter to J. Wagner, U.S. Department of Energy, Richland Operations Office, and M. Little, Bechtel Hanford Inc.), Washington State Department of Ecology, Kennewick, Washington, May 13. Available at: http://pdw.hanford.gov/document/0080812H.

TPA-CN-0883, 2020, *DOE/RL-2014-42, Tri-Party Agreement Change Notice Form: 300-FF-5 Operable Unit Remedy Implementation Sampling and Analysis Plan, Rev. 0*, dated April 9, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: https://pdw.hanford.gov/document/AR-03682.

WA7890008967, *Hanford Facility Resource Conservation and Recovery Act (RCRA) Permit, Dangerous Waste Portion for the Treatment, Storage, and Disposal of Dangerous Waste*, Revision 8c, as amended, Washington State Department of Ecology, Richland, Washington. Available at: https://fortress.wa.gov/ecy/nwp/permitting/hdwp/rev/8c/.

WAC 173-160, "Minimum Standards for Construction and Maintenance of Wells," *Washington Administrative Code*, Olympia, Washington. Available at: http://apps.leg.wa.gov/WAC/default.aspx?cite=173-160.

WAC 173-303, "Dangerous Waste Regulations," *Washington Administrative Code*, Olympia, Washington. Available at: http://apps.leg.wa.gov/wac/default.aspx?cite=173-303.

303-040, "Definitions."

303-400, "Interim Status Facility Standards."

303-645, "Releases from Regulated Units."

303-806, "Final Facility Permits."

WAC 173-340, "Model Toxics Control Act—Cleanup," *Washington Administrative Code*, Olympia, Washington. Available at: http://apps.leg.wa.gov/WAC/default.aspx?cite=173-340.

340-705, "Use of Method B."

340-720, "Groundwater Cleanup Standards."

WHC-EP-0287, 1989, *Waste Stream Characterization Report*, 4 vols., Westinghouse Hanford Company, Richland, Washington. Available at:
http://pdw.hanford.gov/document/D195064218.
http://pdw.hanford.gov/document/D195064321.
http://pdw.hanford.gov/document/D195064332.
http://pdw.hanford.gov/document/D195064333.

WHC-MR-0132, 1990, *A History of the 200 Area Tank Farms*, Westinghouse Hanford Company, Richland, Washington. Available at: http://pdw.hanford.gov/document/0081013H.

WHC-SD-EN-AP-045, 1991, *Ground Water Monitoring Plan for the 216-A-29 Ditch*, Rev. 0, Westinghouse Hanford Company, Richland, Washington. Available at:
http://pdw.hanford.gov/document/0080437H.

WRPS-55779-FP, 2013, *Hanford Tank Waste to WIPP – Maximizing the Value of our National Repository Asset – 14230*, Rev. A, Washington River Protection Solutions, Richland, Washington. Available at: https://www.osti.gov/servlets/purl/1105036.

Appendix A

2020 Groundwater Data for Hanford Site RCRA Monitoring Wells

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A1 Monitoring Data for 2020

This appendix consists of a compilation of groundwater data, including laboratory analytical results, field measurements, and water-level measurements, collected at the *Resource Conservation and Recovery Act of 1976* (RCRA) dangerous waste management units discussed in this report. The data are organized by site. The data for each site are tabulated in two Microsoft® Excel files provided electronically with hardcopies of this report. For informational purposes, this appendix includes data from other groundwater monitoring programs. Only the well networks, constituents, and sampling events identified in the current RCRA monitoring plans are used for RCRA groundwater monitoring compliance.

Online users may find groundwater data via the Environmental Dashboard Application at https://ehs.hanford.gov/eda.

A2 Reference

Resource Conservation and Recovery Act of 1976, 42 USC 6901, et seq. Available at: https://elr.info/sites/default/files/docs/statutes/full/rcra.pdf.

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