SGW-63805
Revision 0

Hanford Site RCRA Groundwater Quarterly Report for October through December 2019

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

Contractor for the U.S. Department of Energy
under Contract 89303320DEM000030

P.O. Box 1464
Richland, Washington 99352

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Date Published
March 2021

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APPROVED
By Janis Aardal at 10:52 am, Apr 21, 2021

Release Approval | Date

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Terms

RCRA	*Resource Conservation and Recovery Act of 1976*
WMA	waste management area

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1 Introduction

This report provides quarterly determinations of the concentration, rate of migration, and extent of dangerous waste constituents in groundwater at six single-shell tank Waste Management Areas (WMAs). The report is based on the requirements for interim status facilities, as defined by the *Resource Conservation and Recovery Act of 1976* (RCRA), with regulations promulgated by the Washington State Department of Ecology in the *Washington Administrative Code* and the *Code of Federal Regulations* by reference (WAC 173-303-400, "Dangerous Waste Regulations," "Interim Status Facility Standards"; 40 CFR 265, "Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities," Subpart F, "Ground-Water Monitoring"). Under 40 CFR 265.93(d)(7)(i), "Preparation, Evaluation, and Response," units monitored under groundwater quality assessment programs that have determined dangerous waste has entered the groundwater must determine the rate and extent of migration and the concentrations of the identified waste on a quarterly basis. This report presents results for October through December 2019.

The WMAs in this report (Figures 1 and 2) include the inactive single-shell tank farms at the Hanford Site that are part of an interim status dangerous waste management unit within Rev. 8c of WA7890008967, *Hanford Facility Resource Conservation and Recovery Act (RCRA) Permit, Dangerous Waste Portion for the Treatment, Storage, and Disposal of Dangerous Waste.* Groundwater monitoring plans for each WMA (Table 1) provide specific information on the monitoring networks and sampling programs. The WMAs and their associated dangerous waste constituents in groundwater are identified as follows:

- 200 East Area
  - WMA B-BX-BY – cyanide
  - WMA C – cyanide
- 200 West Area
  - WMA S-SX – chromium[1]
  - WMA T – chromium[1]
  - WMA TX-TY – chromium[1]
  - WMA U – chromium[1]

Other Hanford Site RCRA units monitored under assessment programs during the reporting quarter (216-A-29 Ditch, Nonradioactive Dangerous Waste Landfill, and WMA A-AX) are not included in this report because they were still in the "first determination" phase during the reporting quarter.

For each WMA, this report provides summary information of the well network, quarterly sample results of the associated dangerous waste constituent, a discussion of the extent of contamination, and an estimate of the rate and direction of contaminant migration. The rate of contaminant migration is assumed to equal the rate of groundwater flow because cyanide and hexavalent chromium (Cr(VI)) are highly mobile in groundwater.

[1] Total chromium is the dangerous waste constituent specified in the assessment plans, and hexavalent chromium is a supporting constituent. Although total chromium and hexavalent chromium are analyzed by different methods, dissolved chromium in Hanford Site groundwater is almost entirely hexavalent, so filtered total chromium data effectively represent hexavalent chromium concentrations. Both types of data were used to create the plume maps included in this report. Unfiltered samples may include particulate chromium, which is typically not hexavalent. This report lists the specific type of analytical data required by the groundwater monitoring plans.

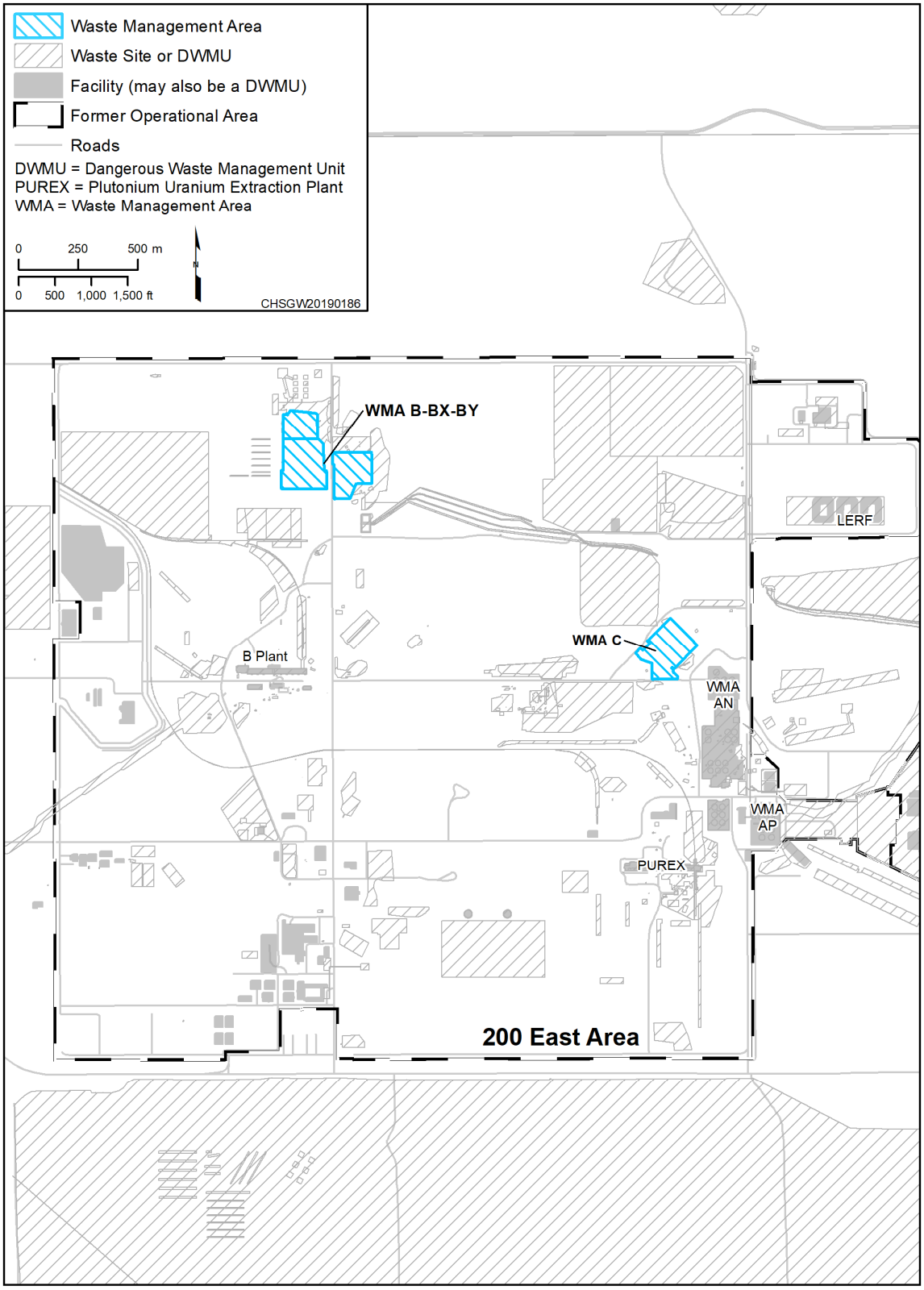


Figure 1. 200 East Area WMAs

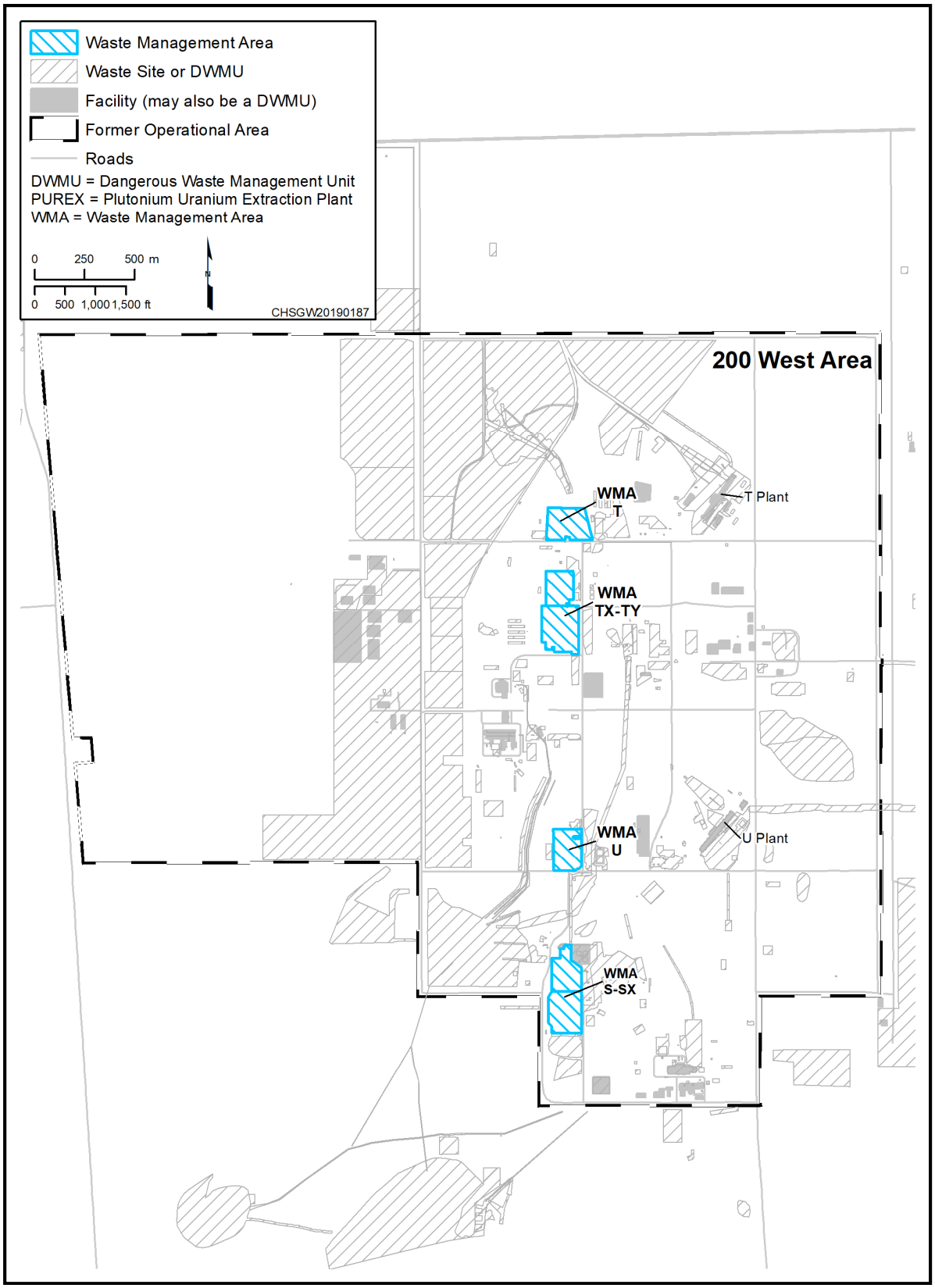


Figure 2. 200 West Area WMAs

Table 1. Groundwater Monitoring Plans and Engineering Evaluation Reports Associated with Single-Shell Tank WMAs

WMA	Groundwater Quality Assessment Monitoring Plan	Engineering Evaluation Report for Groundwater Monitoring
200 West Area		
WMA S-SX	DOE/RL-2009-73, Rev. 1	SGW-60577
WMA T	DOE/RL-2009-66, Rev. 2	SGW-60575
WMA TX-TY	DOE/RL-2009-67, Rev. 2	SGW-60576
WMA U	DOE/RL-2009-74, Rev. 2	SGW-60578
200 East Area		
WMA B-BX-BY	DOE/RL-2012-53, Rev. 1	SGW-60587
WMA C	DOE/RL-2009-77, Rev. 1	SGW-60588

Note: Complete reference citations are provided in Chapter 8.

WMA = waste management area

A suite of groundwater monitoring engineering evaluation reports (Table 1) was prepared to support the Part B (final status) permit application for the future Rev. 9 of WA7890008967. The engineering evaluation reports contain comprehensive background information as well as the geology, hydrogeology, and conceptual contaminant migration models.

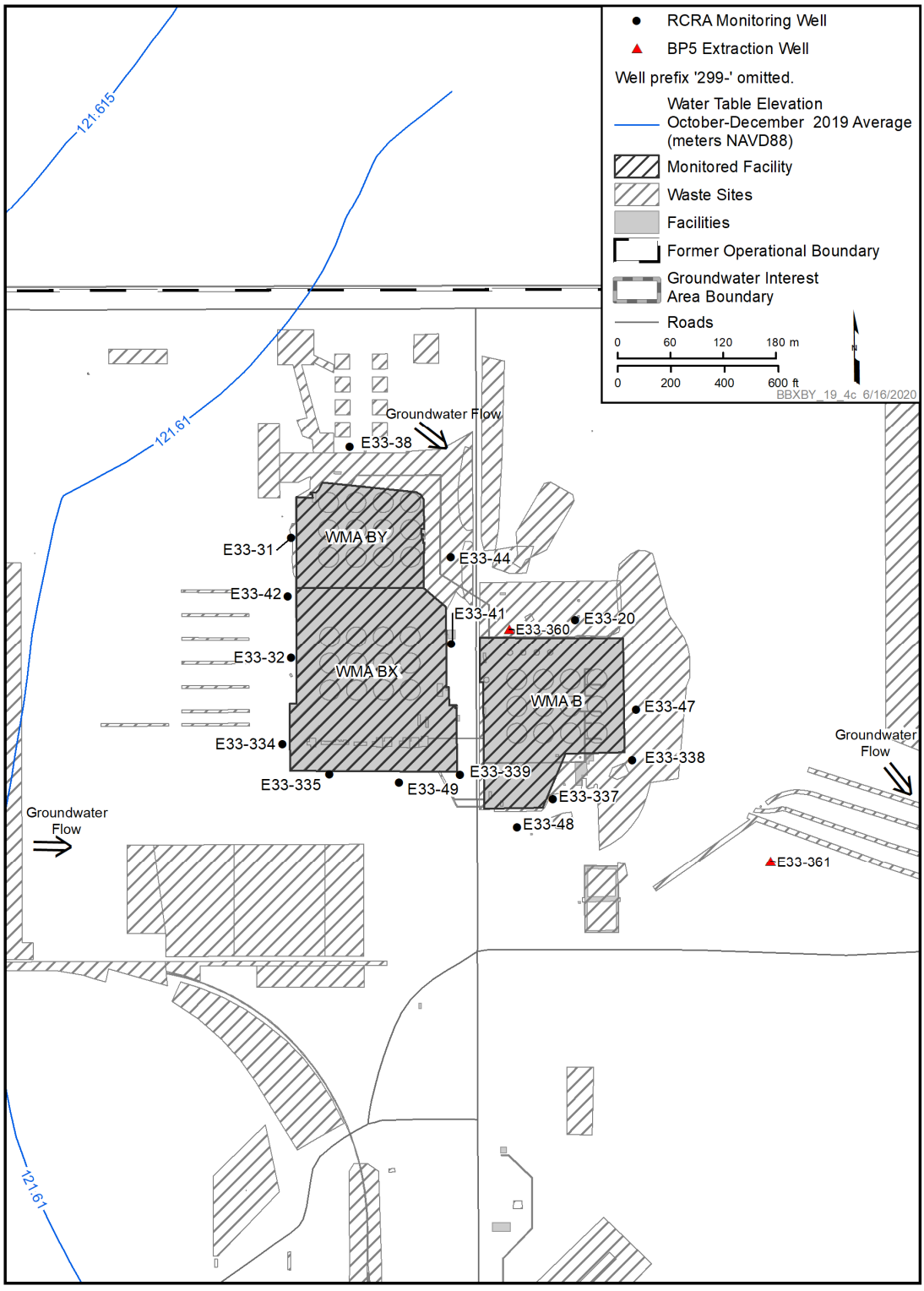
2 Waste Management Area B-BX-BY

WMA B-BX-BY, which includes the single-shell tanks and ancillary equipment of the 241-B, 241-BX, and 241-BY Tank Farms, is located in the north-central portion of the 200 East Area (Figure 1). Figure 3 presents the monitoring network with a water table map.

Previous releases from WMA B-BX-BY, along with the other waste sites, have contributed to groundwater contamination with the dangerous waste constituent cyanide. The WMA is monitored under DOE/RL-2012-53, *Interim Status Groundwater Quality Assessment Plan for the Single-Shell Tank Waste Management Area B-BX-BY*.

Evaluation of October through December 2019 water levels indicated that groundwater beneath WMA B-BX-BY flowed to the southeast at 0.17 m/d (0.56 ft/d) (ECF-HANFORD-20-0016, *Hydraulic Gradient and Average Linear Groundwater Velocity Calculations -- Quarter 4 Calendar Year 2019*). The impacts of extraction wells 299-E33-360 and 299-E33-361, which operate adjacent to WMA B-BX-BY (Figure 3), are not easily discerned from water-level data alone because the hydraulic gradient is so low (2×10^{-6} during the reporting quarter).

Table 2 lists October through December 2019 sampling results for cyanide at WMA B-BX-BY, and Figure 4 illustrates the most recent interpretation of the cyanide plume (2018). Extraction wells 299-E33-360 and 299-E33-361 limit migration of the plume.



Reference: ECF-200E-20-0014, *Groundwater Elevation Mapping for 200 East Area - Quarter 4 Calendar Year 2019*.

Figure 3. WMA B-BX-BY Monitoring Well Network and October-December 2019 Water Table

Table 2. WMA B-BX-BY Sample Results for October through December 2019

Well Name	Sample Date	Cyanide (Total) (µg/L)	Comment
299-E33-20[a,b]	11/8/2019	41.1	
299-E33-31[a]	11/8/2019	34.7	
299-E33-32[a]	11/8/2019	14.3	
299-E33-38	11/8/2019	888 D	
299-E33-41	11/13/2019	16.1	
299-E33-42[a]	11/12/2019	26.4	
299-E33-44	11/8/2019	832 D	
299-E33-47	11/8/2019	675 D	
299-E33-48	11/11/2019	2.12 B	
299-E33-49	11/11/2019	2.44 B	
299-E33-334[a]	11/11/2019	4.93 B	
299-E33-335	11/11/2019	2.78 B	
299-E33-337	11/11/2019	45.5	
299-E33-338	11/12/2019	5.54	
299-E33-339	11/12/2019	2.88 B	

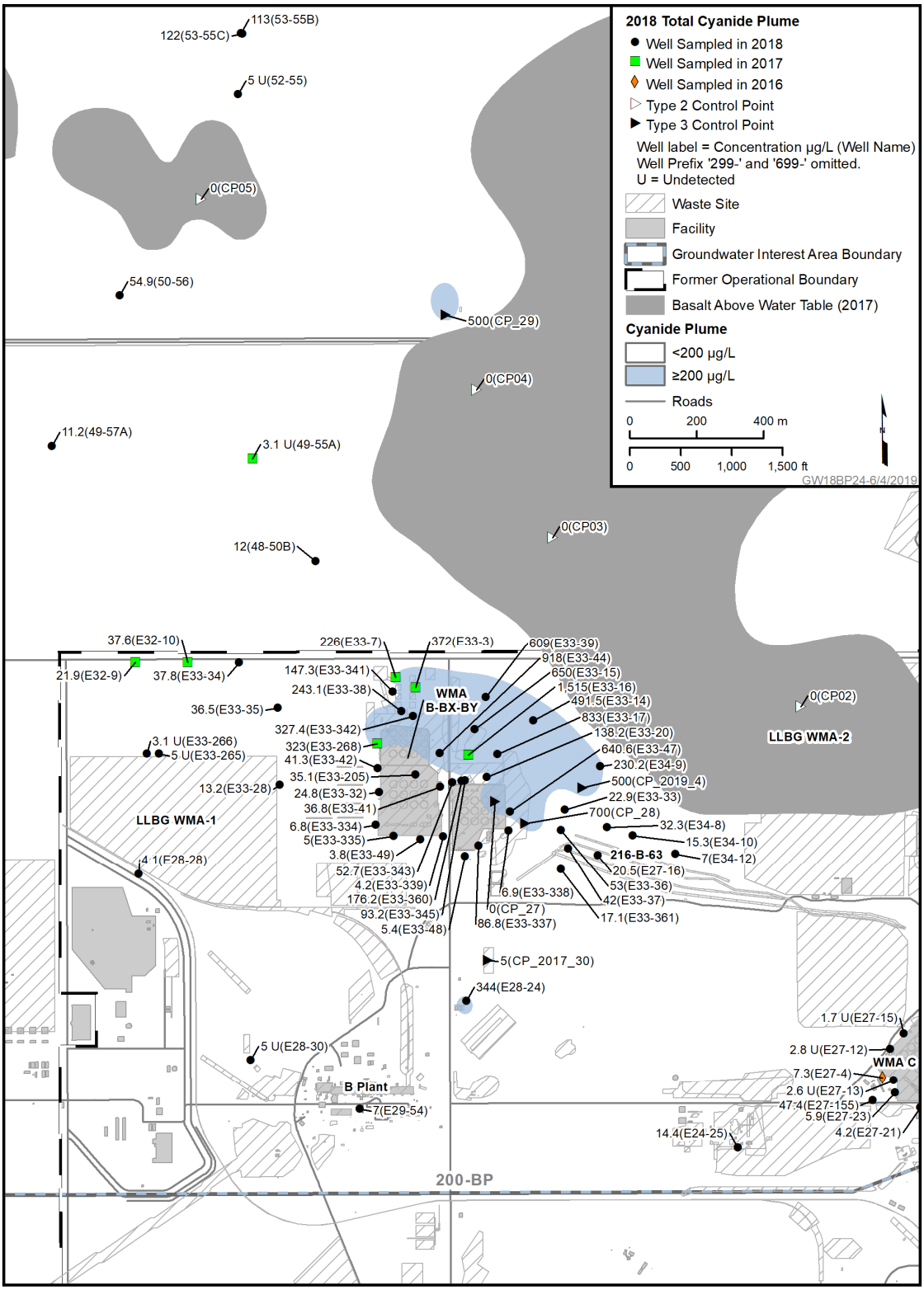
Note: Practical quantitation limit for cyanide by Methods 335.4, 9012, 9014, and 4500: 10.5 µg/L (ECF-HANFORD-18-0058, *Practical Quantitation Limits for Groundwater Environmental Samples*).

a. Upgradient well.

b. Well is not compliant with the construction standards in WAC 173-160, "Minimum Standards for Construction and Maintenance of Wells," and a replacement in kind well will be proposed.

B = detected at a value less than the required detection limit (e.g., practical quantitation limit) but greater than or equal to the method detection limit

D = reported at a secondary dilution factor

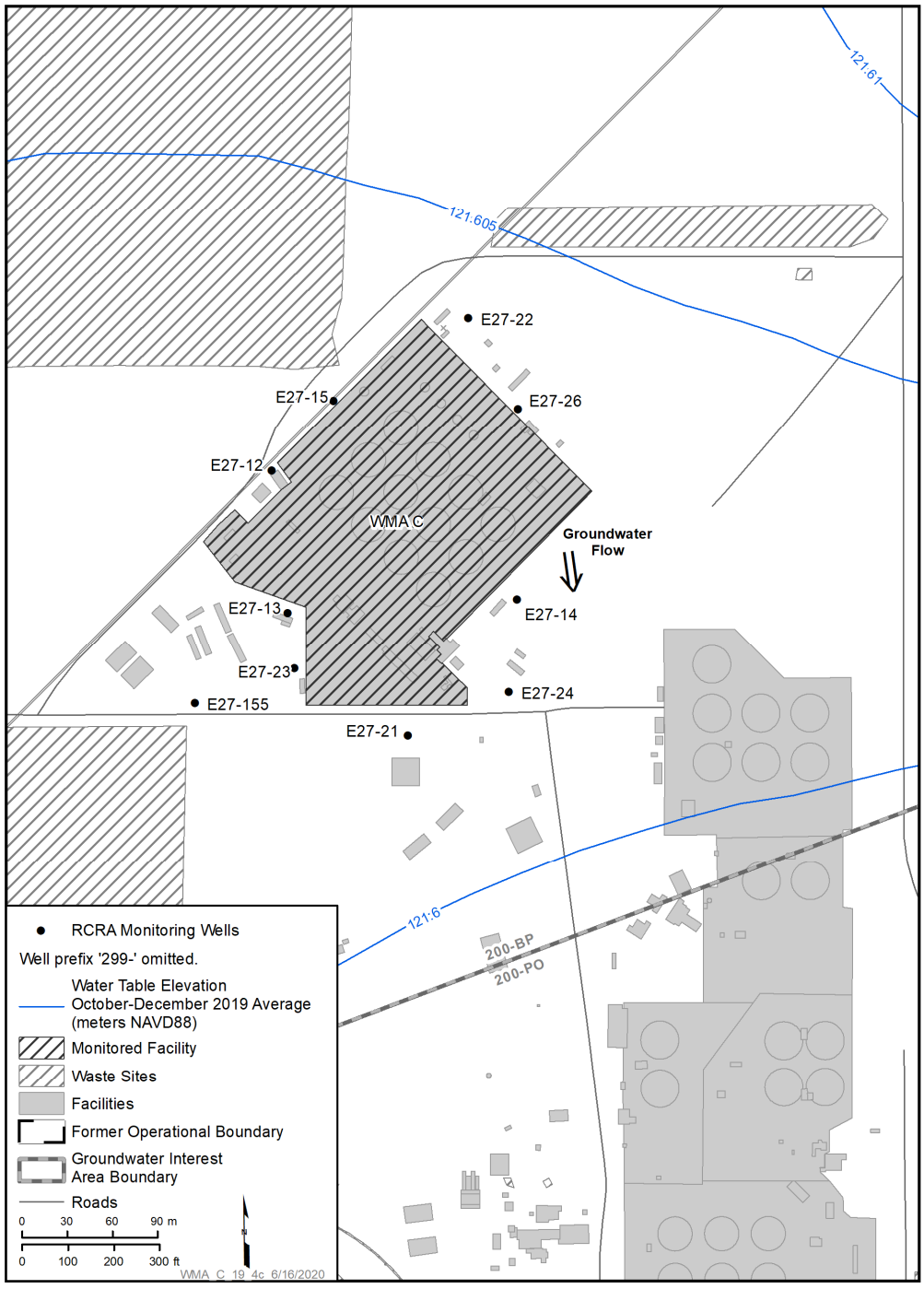


Source: DOE/RL-2018-66, *Hanford Site Groundwater Monitoring Report for 2018.*

Figure 4. Total Cyanide Plume Near WMA B-BX-BY, 2018

3 Waste Management Area C

WMA C, which includes the single-shell tanks and ancillary equipment of the 241-C Tank Farm, is located in the east-central portion of the 200 East Area (Figure 1). Figure 5 presents the monitoring network with a water table map.



Reference: ECF-200E-20-0014, *Groundwater Elevation Mapping for 200 East Area - Quarter 4 Calendar Year 2019.*

Figure 5. WMA C Monitoring Well Network and October-December 2019 Water Table

Previous releases from WMA C have contributed to groundwater contamination with the dangerous waste cyanide. The WMA is monitored under DOE/RL-2009-77, *Groundwater Quality Assessment Plan for the Single-Shell Tank Waste Management Area C*. Table 3 lists October through December 2019 sampling results for cyanide. A contaminant plume map is not provided because total cyanide concentrations are below levels used for contouring plumes in Chapter 9 of DOE/RL-2018-66, *Hanford Site Groundwater Monitoring Report for 2018.* The highest concentration was 52.1 µg/L in deep well 299-E27-155. It is likely the deep contamination originated at an upgradient source (Section 9.10 of DOE/RL-2018-66).

During October through December 2019, the average direction of groundwater flow beneath WMA C was south and the average velocity was 0.76 m/d (2.5 ft/d) (ECF-HANFORD-20-0016).

Table 3. WMA C Sample Results for October through December 2019

Well Name	Sample Date	Cyanide (Total) (µg/L)	Comment
299-E27-12*	12/6/2019	1.67 U	
299-E27-13	12/6/2019	1.67 U	
299-E27-14	12/10/2019	13.5	
299-E27-15*	12/9/2019	1.67 U	
299-E27-21	12/6/2019	1.67 U	
299-E27-22*	12/9/2019	2.35 B	
299-E27-23	12/10/2019	6.95	
299-E27-24	12/10/2019	19.2	
299-E27-26*	12/10/2019	13.0	
299-E27-155	12/9/2019	52.1	

Note: Practical quantitation limit for cyanide by Methods 335.4, 9012, 9014, and 4500: 10.5 µg/L (ECF-HANFORD-18-0058, *Practical Quantitation Limits for Groundwater Environmental Samples*).

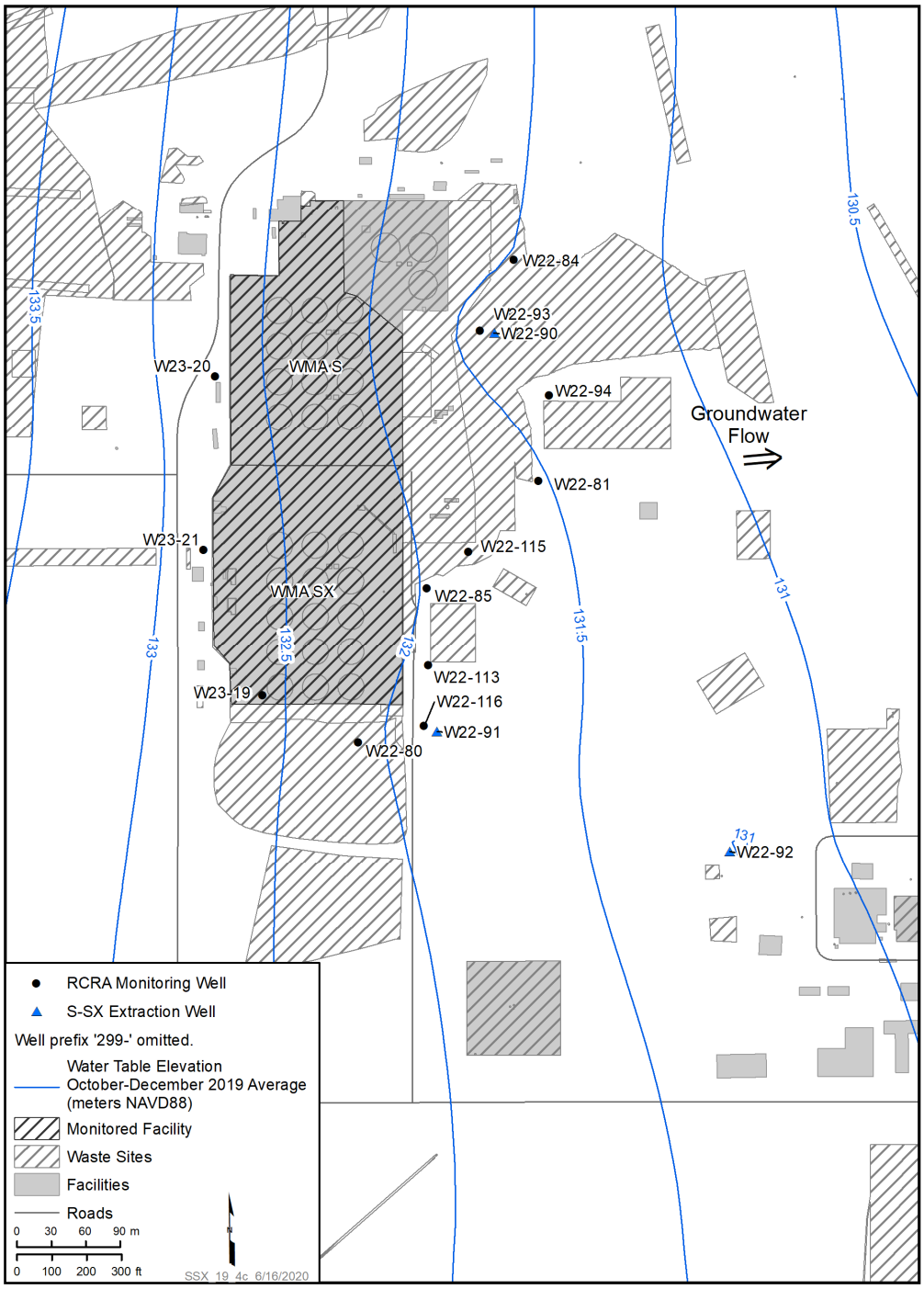
* Upgradient well.

B = detected at a value less than the required detection limit (e.g., practical quantitation limit) but greater than or equal to the method detection limit

U = undetected

4 Waste Management Area S-SX

WMA S-SX, which includes the single-shell tanks and ancillary equipment of the 241-S and 241-SX Tank Farms, is located in the southern portion of the 200 West Area (Figure 2). Figure 6 illustrates the monitoring well network and water table contours for the reporting quarter.



Reference: ECF-200W-20-0015, *Groundwater Elevation Mapping for 200 West Area - Quarter 4 Calendar Year 2019.*

Figure 6. WMA S-SX Monitoring Well Network and October-December 2019 Water Table

Previous releases from WMA S-SX have contributed to groundwater contamination with chromium. The WMA is monitored under DOE/RL-2009-73, *Interim Status Groundwater Quality Assessment Plan for the Single-Shell Tank Waste Management Area S-SX*.

Table 4 lists October through December 2019 sampling results for total chromium and Cr(VI). Two narrow Cr(VI) plumes with concentrations above 48 µg/L were defined based on 2018 data (Figure 7). Groundwater flow is influenced by extraction wells 299-W22-90 and 299-W22-91, located just east of WMA S-SX. Evaluation of October through December 2019 water levels indicated the average flow direction was to the east and the average velocity was 0.16 m/d (0.52 ft/d) (ECF-HANFORD-20-0016). Extraction wells 299-W22-90 and 299-W22-91 capture contaminated groundwater from these plumes (Figure 7), so the plumes did not expand during the reporting quarter.

Some of the Cr(VI) samples were analyzed outside the recommended 24-hour holding time (X and H flags in Table 4), but within 48 hours. The impact on data usability is insignificant. A limited study using Hanford Site groundwater samples in 2013 found that there was no discernible impact on Cr(VI) results analyzed up to 8 weeks after the sample date (Section 4.3.7.2 of DOE/RL-2010-96, *Remedial Investigation/Feasibility Study for the 100-BC-1, 100-BC-2, and 100-BC-5 Operable Units*).

Table 4. WMA S-SX Sample Results for October through December 2019

Well Name	Sample Date	Chromium (µg/L)[a]		Hexavalent Chromium (µg/L)[b]	Comment
		Unfiltered	Filtered		
299-W22-80	12/5/2019	51.8	5.0 B	6.06	
299-W22-81	12/4/2019	56.5	4.2 B	1.75 BXH	
299-W22-84	12/4/2019	3.8 B	3.9 B	5.81 XH	
299-W22-85	12/5/2019	4.1 B	3.4 B	4.88	
299-W22-93	12/4/2019	223	221	261 DXH	Duplicate sample
	12/4/2019	230	223	272 DXH	Duplicate sample
299-W22-94	12/4/2019	147	10.6	6.02 XH	
299-W22-113	12/5/2019	3.1 B	3.0 U	4.66	
299-W22-115	12/5/2019	2.4 B	2.4 B	4.64	
299-W22-116	12/6/2019	106	92.4	141 D	
299-W23-19	12/6/2019	211	200	240 D	Duplicate sample
	12/6/2019	208	204	247 D	Duplicate sample
299-W23-20[c]	12/4/2019	11.3	4.1 B	3.01 BXH	
299-W23-21[c]	12/6/2019	3.0 U	3.0 U	2.51 B	

Note: Practical quantitation limits for chromium by Method 6010: 10.5 µg/L; hexavalent chromium by Method 7196: 10.5 µg/L (ECF-HANFORD-18-0058, *Practical Quantitation Limits for Groundwater Environmental Samples*).

a. Chromium by Method 6010, as required by Table D-1 of DOE/RL-2009-73, *Interim Status Groundwater Quality Assessment Plan for the Single-Shell Tank Waste Management Area S-SX*. Chromium was also analyzed by Method 6020 during the reporting quarter.

b. Supporting constituent

c. Upgradient well

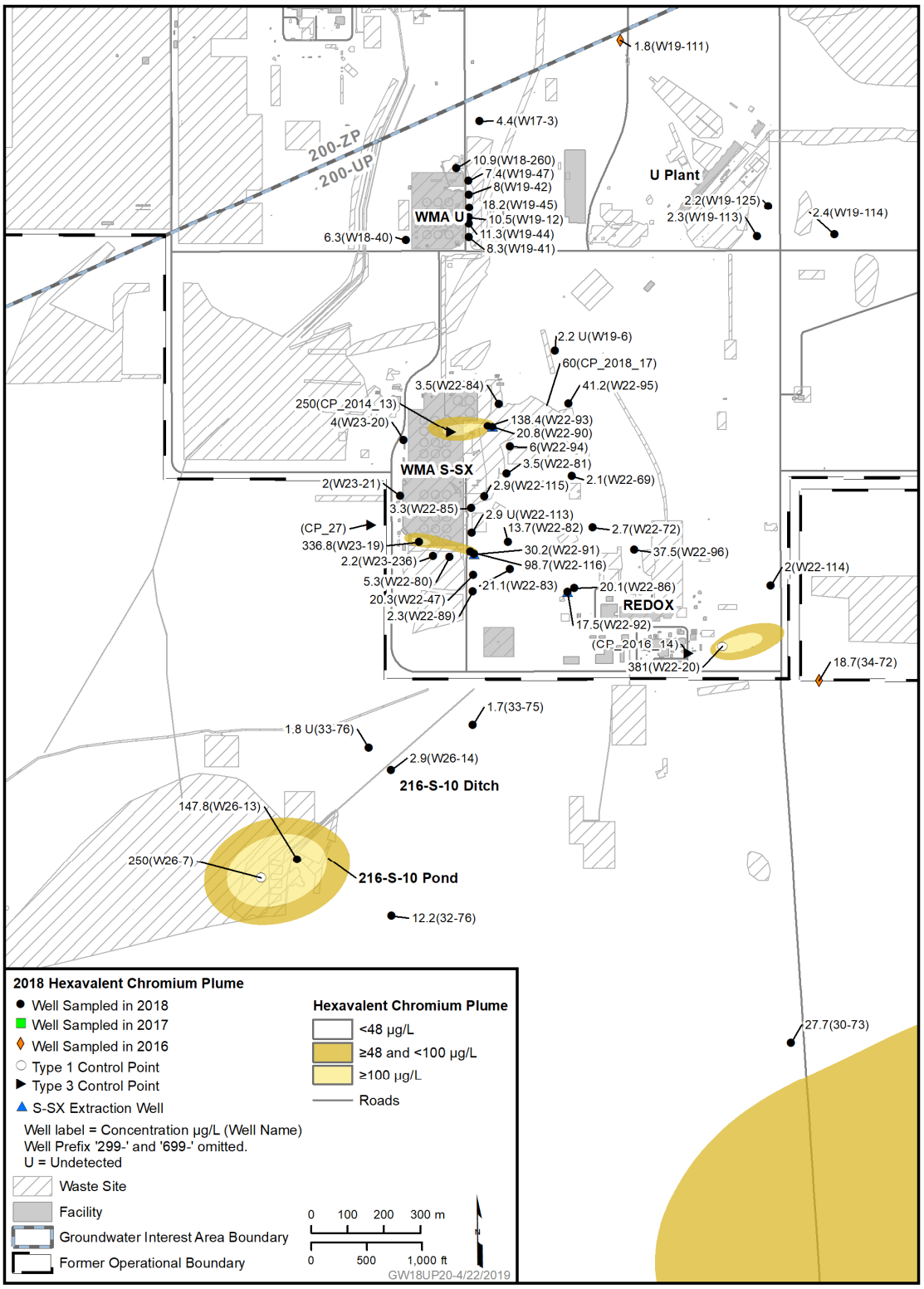
B = detected at a value less than the required detection limit (e.g., practical quantitation limit) but greater than or equal to the method detection limit

D = reported at a secondary dilution factor

H = laboratory holding time exceeded (see Chapter 4)

U = undetected

X = laboratory report noted the samples were analyzed beyond recommended holding time (see Chapter 4)

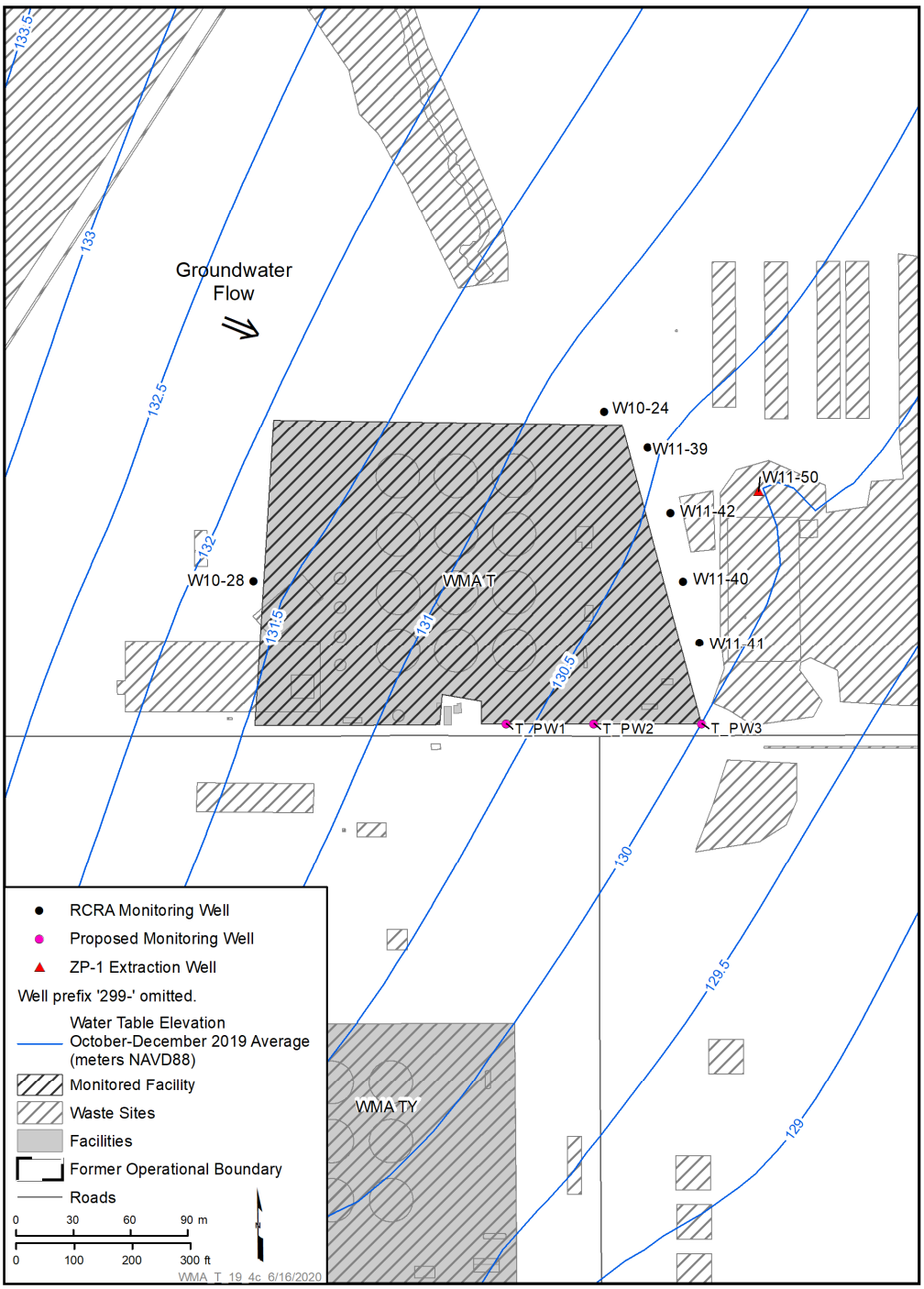


Source: DOE/RL-2018-66, *Hanford Site Groundwater Monitoring Report for 2018.*

Figure 7. Chromium Plumes Near WMA S-SX, 2018

5 Waste Management Area T

WMA T, which includes the single-shell tanks and ancillary equipment of the 241-T Tank Farm, is located in the northern portion of the 200 West Area (Figure 2). Figure 8 illustrates the monitoring well network and water table contours for the reporting quarter.



Reference: ECF-200W-20-0015, *Groundwater Elevation Mapping for 200 West Area - Quarter 4 Calendar Year 2019*.

Figure 8. WMA T Monitoring Well Network and October-December 2019 Water Table

Previous releases from WMA T have contributed to groundwater contamination with chromium. The WMA is monitored under DOE/RL-2009-66, *Interim Status Groundwater Quality Assessment Plan for the Single-Shell Tank Waste Management Area T*.

Evaluation of October through December 2019 water levels indicates that groundwater beneath WMA T flowed to the east-southeast at 0.24 m/d (0.79 ft/d) (ECF-HANFORD-20-0016). Flow is influenced by extraction well 299-W11-50 on the east side of WMA T.

Figure 9 presents the 2018 Cr(VI) plume in the vicinity of WMA T. Table 5 lists October through December 2019 quarterly sampling results for total chromium and Cr(VI). Concentrations have declined in WMA T network wells in response to groundwater remediation, and most were below the 48 µg/L contour level in network wells in 2018.

Two of the Cr(VI) samples were analyzed outside the recommended 24-hour holding time (X and H flags in Table 5), but within 48 hours. The impact on data usability is insignificant (Chapter 4). Four Cr(VI) results were flagged with Q because they were associated with out-of-limits field blank samples. The impact on the data is insignificant, based on comparison of Cr(VI) to filtered, total chromium.

Table 5. WMA T Sample Results for October through December 2019

Well Name	Sample Date	Chromium (µg/L)[a]		Hexavalent Chromium (µg/L)[b]	Comment
		Unfiltered	Filtered		
299-W10-24	11/6/2019	9.38 B	10.2	10.7 XHQ	
299-W10-28[c]	11/5/2019	88.5	72.7	75.1 XH	
299-W11-39	11/6/2019	100	36	26.7 Q	Duplicate sample
	11/6/2019	97	36	26.6 Q	Duplicate sample
299-W11-40	11/7/2019	34.3	33.9	35.3	
299-W11-41	11/6/2019	53.9	50.7	48.2	
299-W11-42	11/6/2019	28.1	27.3	22.3 Q	

Note: Practical quantitation limits for chromium by Method 6010: 10.5 µg/L; hexavalent chromium by Method 7196: 10.5 µg/L (ECF-HANFORD-18-0058, *Practical Quantitation Limits for Groundwater Environmental Samples*).

a. Chromium by Method 6010, as required by Table D-1 of DOE/RL-2009-66, *Interim Status Groundwater Quality Assessment Plan for the Single-Shell Tank Waste Management Area T*. Chromium was also analyzed by Method 6020 during the reporting quarter.

b. Supporting constituent

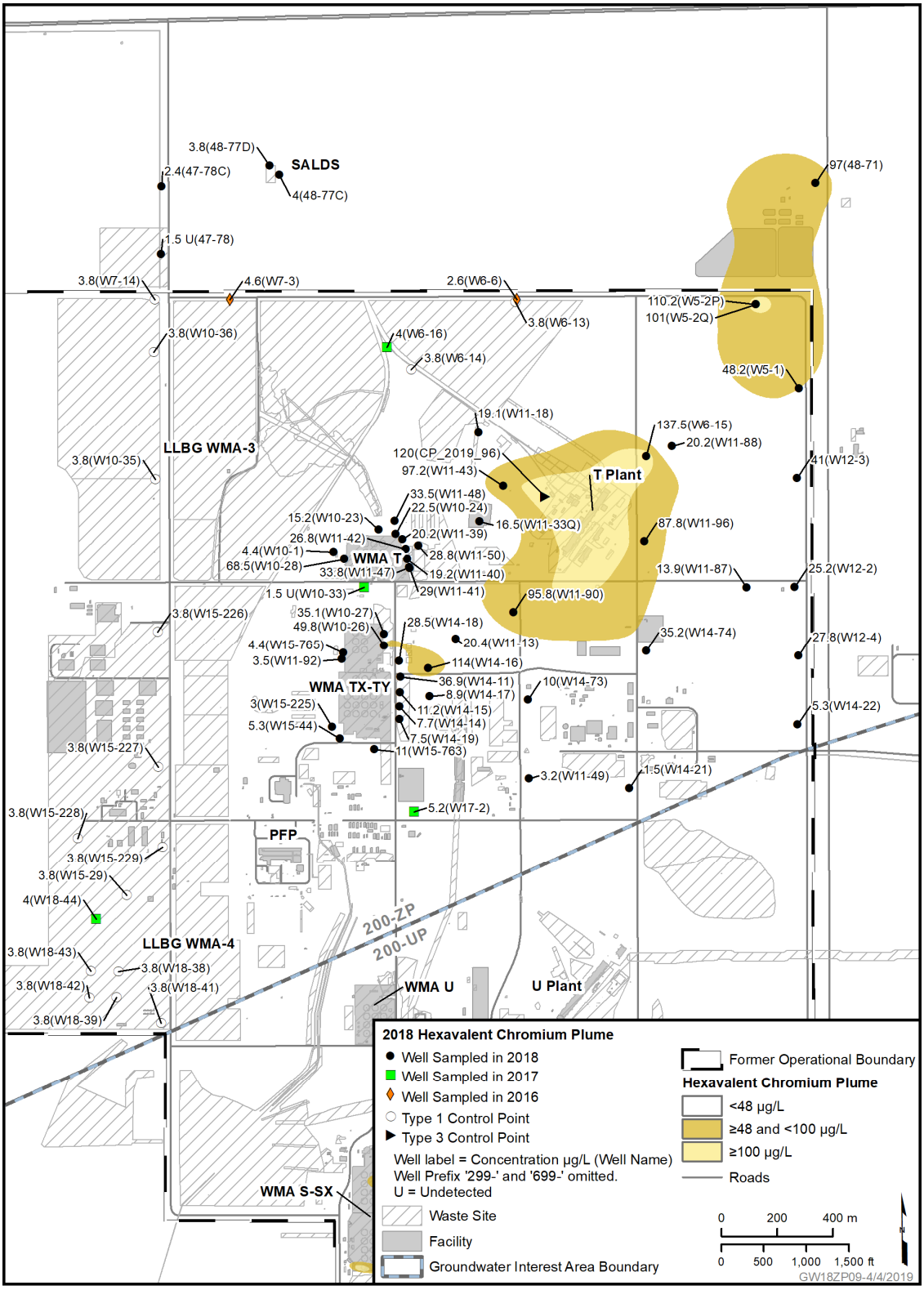
c. Upgradient well

B = detected at a value less than the required detection limit (e.g., practical quantitation limit) but greater than or equal to the method detection limit

H = laboratory holding time exceeded (see Chapter 4)

Q = associated with out-of-limit field blank sample

X = laboratory report noted the samples were analyzed beyond recommended holding time (see Chapter 4)

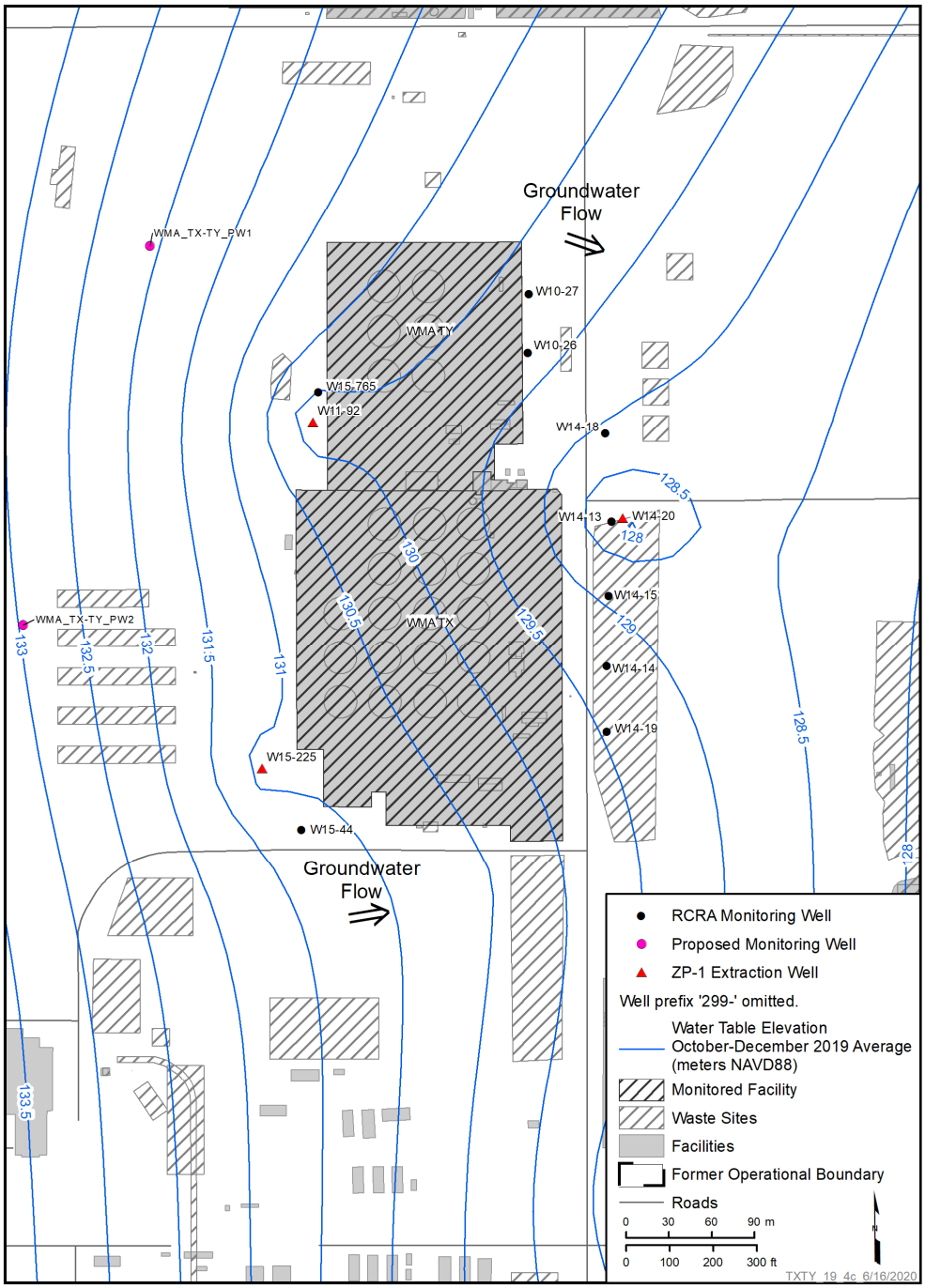


Source: DOE/RL-2018-66, *Hanford Site Groundwater Monitoring Report for 2018.*

Figure 9. Chromium Plumes near WMA T and TX-TY, 2018

6 Waste Management Area TX-TY

WMA TX-TY, which includes the single-shell tanks and ancillary equipment of the 241-TX and 241-TY Tank Farms, is located in the northern portion of the 200 West Area (Figure 2). Figure 10 illustrates the monitoring well network and water table contours for the reporting period.



Reference: ECF-200W-20-0015, *Groundwater Elevation Mapping for 200 West Area - Quarter 4 Calendar Year 2019.*

Figure 10. WMA TX-TY Monitoring Well Network and October-December 2019 Water Table

Previous releases from WMA TX-TY have contributed to groundwater contamination with chromium. The WMA is monitored under DOE/RL-2009-67, *Interim Status Groundwater Quality Assessment Plan for the Single-Shell Tank Waste Management Area TX-TY*).

Directions of groundwater flow beneath WMA TX-TY reflect the influence of extraction wells. During the reporting quarter, the direction of flow beneath the northern portion of WMA TX-TY was toward the southeast. Groundwater flow beneath the southern part of the WMA was to the east. The average flow rate was 0.31 m/d (1.0 ft/d) (ECF-HANFORD-20-0016).

Figure 9 shows the 2018 Cr(VI) plume in the vicinity of WMA TX-TY. Table 6 lists October through December 2019 sampling results for total chromium and Cr(VI). Groundwater extraction well 299-W14-20, located east of the plume, captures contaminated groundwater.

Two of the Cr(VI) samples were analyzed outside the recommended 24-hour holding time (X and H flags in Table 6), but within 48 hours. The impact on data usability is insignificant (Chapter 4).

Table 6. WMA TX-TY Sample Results for October through December 2019

Well Name	Sample Date	Chromium (µg/L)[a]		Hexavalent Chromium (µg/L)[b]	Comment
		Unfiltered	Filtered		
299-W10-26	11/15/2019	45.9	36.1	38	
299-W10-27	11/15/2019	25.2 D	21 D	21.1 XH	
299-W14-13	11/13/2019	21	7.3 B	7.46	
299-W14-14	11/14/2019	10.4	8.68 B	8.2	
299-W14-15	11/18/2019	10.5	11.1	2.64 BXH	
299-W14-18	11/14/2019	62.9	55.4	55.1	
299-W14-19	11/18/2019	7.8	8.2	6.65	
299-W15-44[c]	11/15/2019	19.4 D	9.7 BD	10.2	
299-W15-765[c]	11/15/2019	3.96 B	3.96 B	4.0	

Note: Practical quantitation limits for chromium by Method 6010 or 6020: 10.5 µg/L; hexavalent chromium by Method 7196: 10.5 µg/L (ECF-HANFORD-18-0058, *Practical Quantitation Limits for Groundwater Environmental Samples*).

a. Chromium by Method 6020. Table D-1 of DOE/RL-2009-67, *Interim Status Groundwater Quality Assessment Plan for the Single-Shell Tank Waste Management Area TX-TY*, lists Method 6010 for chromium, but Section A.3.1 allows the use of equivalent methods.

b. Supporting constituent

c. Upgradient well

B = detected at a value less than the required detection limit (e.g., practical quantitation limit) but greater than or equal to the method detection limit

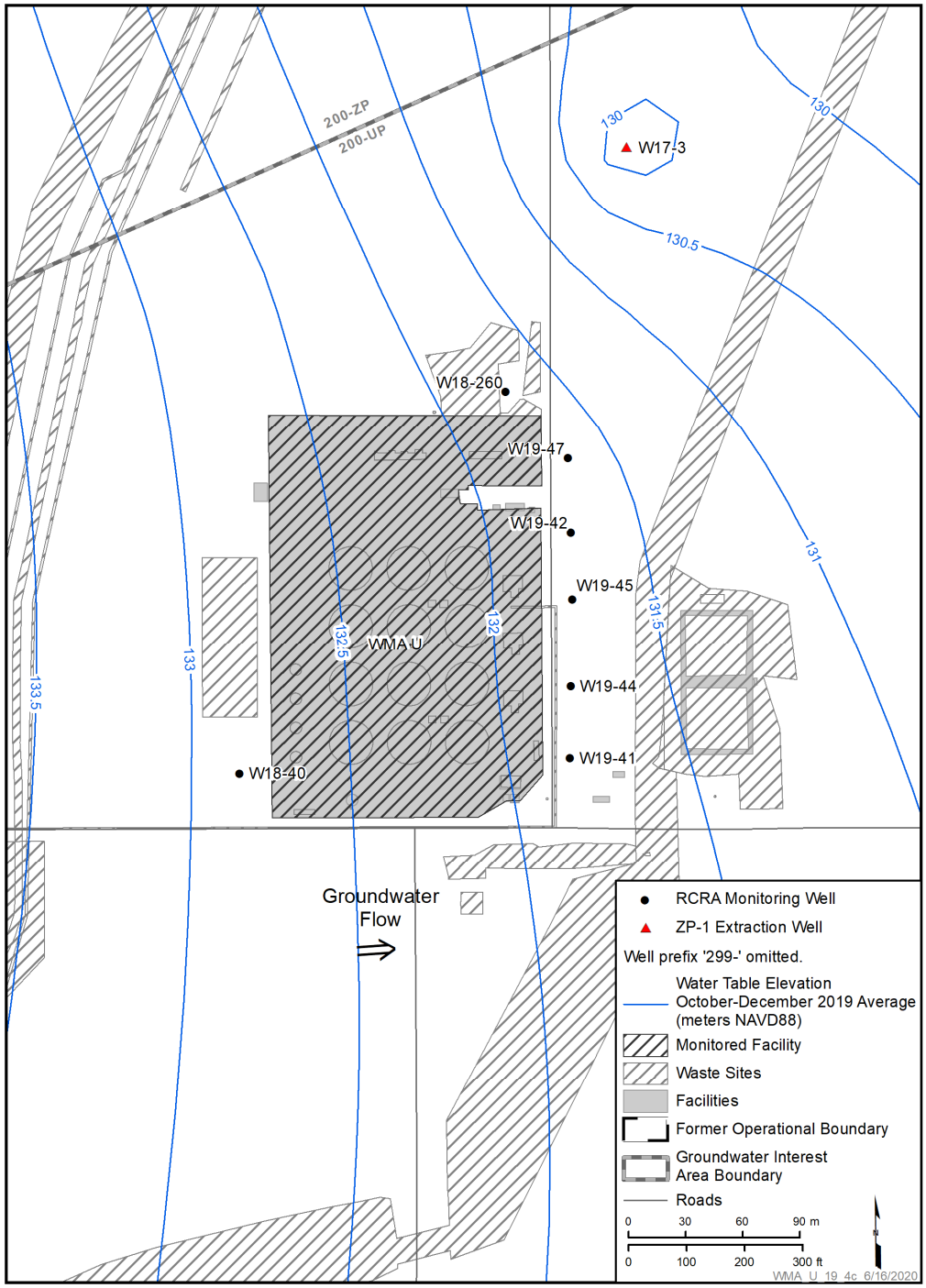
D = reported at a secondary dilution factor

H = laboratory holding time exceeded (see Chapter 4)

X = laboratory report noted the samples were analyzed beyond recommended holding time (see Chapter 4)

7 Waste Management Area U

WMA U, which includes the single-shell tanks and ancillary equipment of the U Tank Farm, is located in the south-central portion of the 200 West Area (Figure 2). Figure 11 illustrates the monitoring well network and water table contours for the reporting quarter.



Reference: ECF-200W-20-0015, *Groundwater Elevation Mapping for 200 West Area - Quarter 4 Calendar Year 2019*.

Figure 11. WMA U Monitoring Well Network and October-December 2019 Water Table

Previous releases from WMA U have contributed to groundwater contamination with chromium. The WMA is monitored under DOE/RL-2009-74, *Interim Status Groundwater Quality Assessment Plan for the Single-Shell Tank Waste Management Area U*.

Evaluation of October through December 2019 water levels indicates that groundwater beneath WMA U generally flowed to the east at 0.22 m/d (0.72 ft/d) (ECF-HANFORD-20-0016).

Table 7 lists October through December 2019 sampling results for chromium and Cr(VI). Five of the Cr(VI) samples were analyzed outside the recommended 24-hour holding time (X and H flags in Table 7), but within 48 hours. The impact on data usability is insignificant (Chapter 4).

A contaminant plume map is not provided because chromium concentrations are below levels used for contouring plumes in Chapter 11 of DOE/RL-2018-66.

Table 7. WMA U Sample Results for October through December 2019

Well Name	Sample Date	Chromium (µg/L)[a]		Hexavalent Chromium (µg/L)[b]	Comment
		Unfiltered	Filtered		
299-W18-40[c]	10/10/2019	6.3 B	5.4 B	6.72	
299-W18-260	10/10/2019	10.5	10.3	11	
299-W19-41	10/9/2019	32	8.6 B	7.3 HX	
299-W19-42	10/9/2019	12.8	10.4	10.1 HX	
299-W19-44	10/9/2019	12.7	11.1	9.24 HX	
299-W19-45	10/9/2019	18	17	17.2 HX	Duplicate sample
	10/9/2019	17	16	17.2 HX	Duplicate sample
299-W19-47	10/10/2019	10.6	11	11.6	

Note: Practical quantitation limits for chromium by Method 6010: 10.5 µg/L; hexavalent chromium by Method 7196: 10.5 µg/L (ECF-HANFORD-18-0058, *Practical Quantitation Limits for Groundwater Environmental Samples*).

a. Chromium by Method 6010, as required by Table D-1 of DOE/RL-2009-74, *Interim Status Groundwater Quality Assessment Plan for the Single-Shell Tank Waste Management Area U*. Chromium was also analyzed by Method 6020 during the reporting quarter.

b. Supporting constituent

c. Upgradient well

B = detected at a value less than the required detection limit (e.g., practical quantitation limit) but greater than or equal to the method detection limit

H = laboratory holding time exceeded (see Chapter 4)

X = laboratory report noted the samples were analyzed beyond recommended holding time (see Chapter 4)

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