DOE/RL-2015-26
Revision 0

Engineering Evaluation/Cost Analysis for the 200-BP-5 Operable Unit Groundwater Extraction

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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Executive Summary

This engineering evaluation/cost analysis (EE/CA) has been prepared to evaluate the implementation of a non-time-critical removal action (NTCRA) for groundwater contamination located in the 200-BP-5 Groundwater Operable Unit (OU) in the 200 East Area of the Hanford Site (Figure ES-1) in Richland, Washington.

This EE/CA identifies the scope of work for the NTCRA; presents removal action alternatives; analyzes those alternatives for effectiveness, implementability, and cost; and identifies a recommended alternative.

The overall objective of the NTCRA is to capture and remove uranium and technetium-99 groundwater contamination in the B Complex area of the 200-BP-5 OU. Contaminant concentrations in this area exceed federal and state drinking water standards (DWSs), have increasing trends, and have potential for further adverse effects on groundwater at the Hanford Site. Specific objectives of the NTCRA include the following:

- Capture and remove uranium and technetium-99 groundwater contaminant concentrations that exceed 10 times the DWS.
- Treat extracted 200-BP-5 OU groundwater at the 200 West Pump and Treat (P&T) Facility, using an aboveground pipeline to convey the groundwater.

The recommended alternative for this NTCRA is extraction of groundwater containing elevated levels of technetium-99 and uranium from the B Complex area of the 200-BP-5 OU (Figures ES-1 and ES-2). Extracted groundwater will be conveyed using an existing aboveground pipeline to the 200 West P&T Facility for treatment and injection. This alternative provides abatement of uranium and technetium-99 groundwater contamination, is protective of human health and the environment, meets NTCRA objectives, is cost effective, and is consistent with planned or existing remedial and removal actions on the Central Plateau.

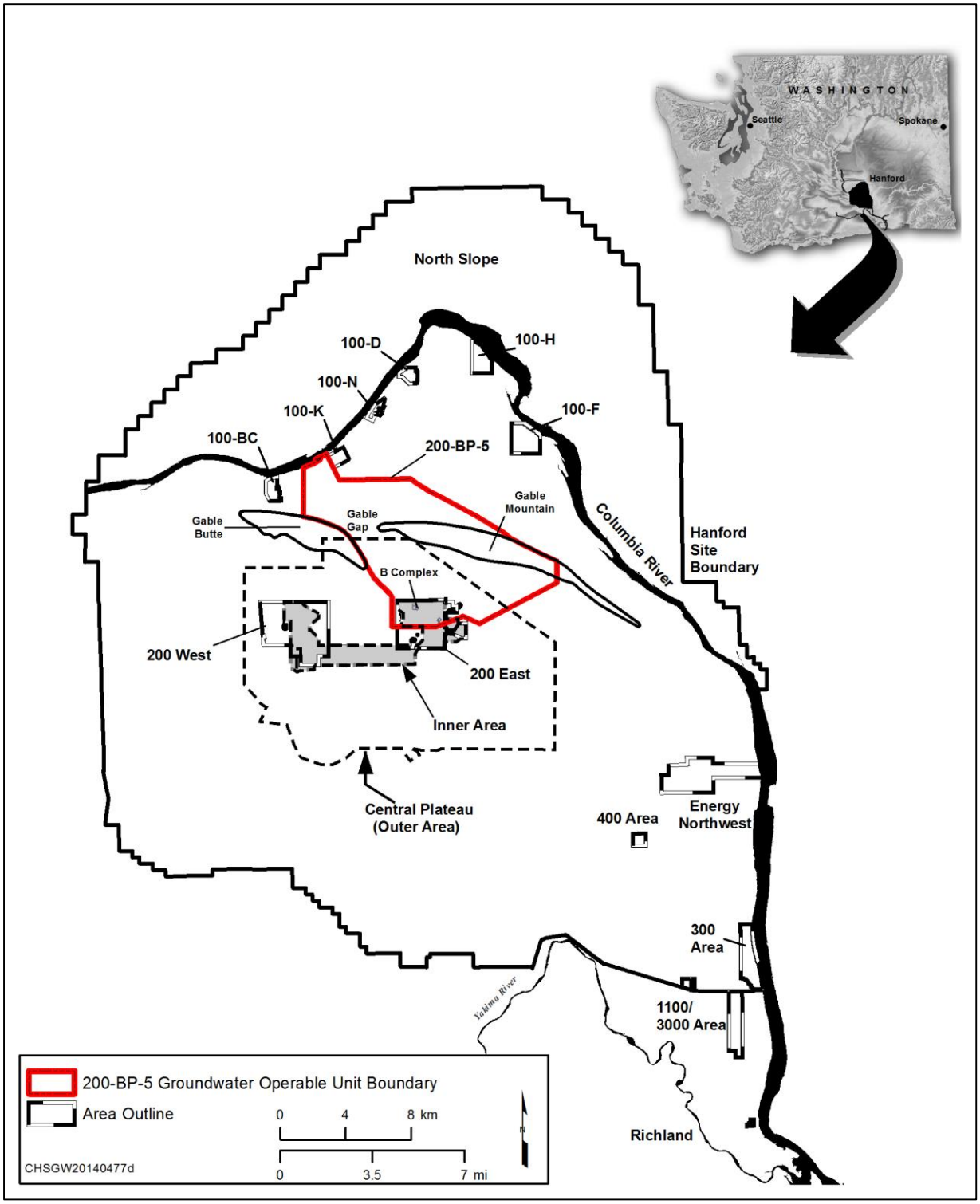

Figure ES-1. Location of the B Complex Area within the 200-BP-5 Groundwater OU

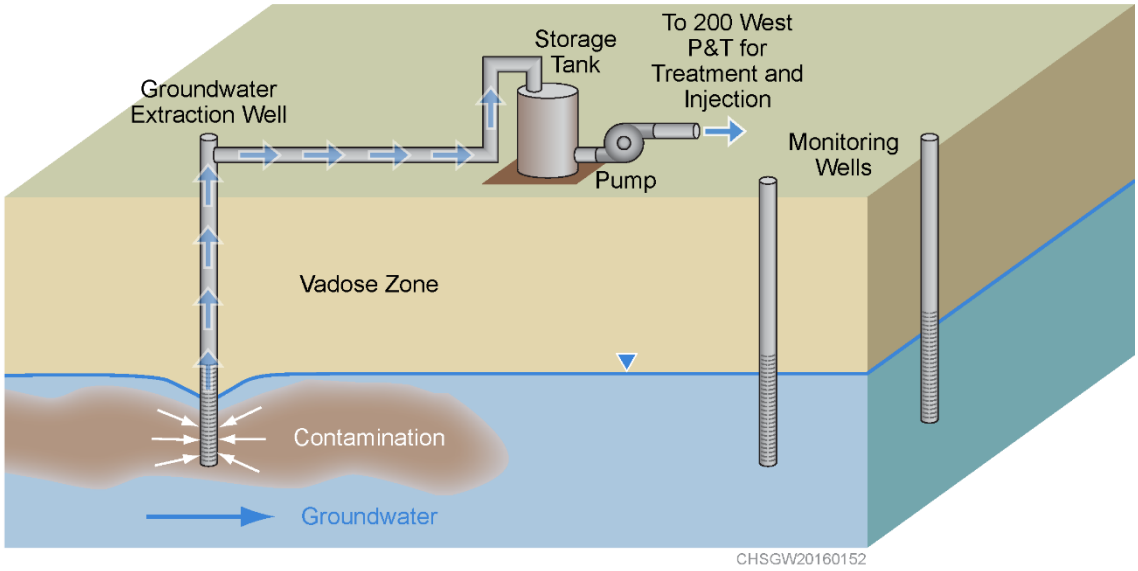

Figure ES-2. Conceptual Schematic of the Preferred Alternative

An aquifer test was performed for these plumes in late 2015 as a treatability test[1] to assess the pumping rate that can be sustained in the unconfined aquifer. The NTCRA described in this EE/CA will use information from the treatability test to design and implement groundwater extraction for the B Complex area. Results from implementing the selected removal action also will be used to support the 200-BP-5 OU remedial investigation/feasibility study process.

The U.S. Department of Energy, U.S. Environmental Protection Agency, and Washington State Department of Ecology (also referred to collectively as the Tri-Parties) will use this EE/CA as the basis for determining the best method to address the elevated levels of technetium-99 and uranium groundwater contamination in the vicinity of the B Complex. This EE/CA was prepared in accordance with the *Comprehensive Environmental Response, Compensation, and Liability Act of 1980*[2] to meet the intent of EPA 540-R-93-057[3].

[1] DOE/RL-2010-74, 2015, *Treatability Test Plan for the 200-BP-5 Groundwater Operable Unit*, Rev. 2, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://pdw.hanford.gov/arpir/index.cfm/viewDoc?accession=0081243H.

[2] *Comprehensive Environmental Response, Compensation, and Liability Act of 1980*, 42 USC 9601, et seq. Pub. L. 107-377, December 31, 2002. Available at: http://epw.senate.gov/cercla.pdf.

[3] EPA 540-R-93-057, *Guidance on Conducting Non-Time-Critical Removal Actions Under CERCLA*, OSWER Directive 9360.0-32, Office of Emergency and Remedial Response, U.S. Environmental Protection Agency, Washington, D.C. Available at: http://nepis.epa.gov/Exe/ZyNET.exe/9100SN02.TXT?ZyActionD=ZyDocument&Client.

Following public review and Tribal Nations input on this EE/CA, an action memorandum will be prepared to select and authorize the removal action. A remedial action work plan will then be prepared to describe how the NTCRA will be implemented.

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Terms

ARAR	applicable or relevant and appropriate requirement
CERCLA	*Comprehensive Environmental Response, Compensation, and Liability Act of 1980*
DOE	U.S. Department of Energy
DWS	drinking water standard
Ecology	Washington State Department of Ecology
EE/CA	engineering evaluation/cost analysis
EPA	U.S. Environmental Protection Agency
ERDF	Environmental Restoration Disposal Facility
FS	feasibility study
FY	fiscal year
gpm	gallons per minute
HHE	human health and the environment
IX	ion exchange
MCL	maximum contaminant level
N/A	not applicable
NCP	National Contingency Plan (40 CFR 300, "National Oil and Hazardous Substances Pollution Contingency Plan")
NPL	National Priorities List (40 CFR 300, Appendix B)
NTCRA	non-time-critical removal action
OU	operable unit
P&T	pump and treat
RAWP	removal action work plan
RI	remedial investigation
ROD	record of decision
TPA	Tri-Party Agreement
Tri-Parties	DOE, EPA, and Ecology
Tri-Party Agreement	*Hanford Federal Facility Agreement and Consent Order*
UPR	unplanned release

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1 Introduction

This engineering evaluation/cost analysis (EE/CA) has been prepared in accordance with 40 CFR 300.415(b)(4)(i), "National Oil and Hazardous Substances Pollution Contingency Plan," hereinafter called the National Contingency Plan (NCP), "Removal Action," to assist the U.S. Department of Energy (DOE) in initiating a non-time-critical removal action (NTCRA) for remediating contaminated groundwater in the 200-BP-5 Groundwater Operable Unit (OU) located at Hanford Site in Richland, Washington (Figure 1).

This EE/CA evaluates the implementation of an NTCRA to extract and treat contaminated groundwater in the 200-BP-5 OU. The extracted groundwater will be from contaminant plumes near the B-BX-BY Tank Farms (B Complex) containing elevated levels of technetium-99 and uranium (Figure 2). The contaminant concentrations show increasing trends and have the potential for further adverse effects on groundwater at the Hanford Site. An aquifer test was performed for these plumes in late 2015 as a treatability test (DOE/RL-2010-74, *Treatability Test Plan for the 200-BP-5 Groundwater Operable Unit*) to assess the pumping rate that can be sustained in the unconfined aquifer. The NTCRA described in this EE/CA will use information from the treatability test to design and implement groundwater extraction for the 200-BP-5 OU. Results from implementing the selected removal action also will be used to support the 200-BP-5 OU remedial investigation (RI)/feasibility study (FS) process.

1.1 Purpose and Scope

This EE/CA identifies the scope of work for the NTCRA; presents removal action alternatives; analyzes those alternatives for effectiveness, implementability, and cost; and identifies a recommended alternative. DOE, the U.S. Environmental Protection Agency (EPA), and the Washington State Department of Ecology (Ecology) (also referred to collectively as the Tri-Parties) will use this EE/CA as the basis for determining the best method to address the elevated levels of technetium-99 and uranium groundwater contamination near the B Complex. Data from this activity will be further evaluated through the RI/FS process.

The overall objective of the NTCRA is to capture and remove uranium and technetium-99 groundwater contamination in the B Complex area. Specific objectives include the following:

- Capture and remove uranium and technetium-99 groundwater contaminant concentrations that exceed 10 times the drinking water standards (DWSs).
- Treat extracted 200-BP-5 OU groundwater at the 200 West Pump and Treat (P&T) Facility, using an aboveground pipeline to convey the groundwater.

The removal action will continue to be implemented until one or more of the following occurs:

- Uranium and technetium-99 concentrations near the B Complex are below 10 times their respective DWSs.
- Tri-Parties agree to terminate the removal action.
- Action is superseded by a record of decision (ROD) for the 200-BP-5 OU.

This NTCRA will provide abatement of uranium and technetium-99 groundwater contamination by removing and treating contaminated groundwater near the B Complex area that currently exceeds federal and state DWSs.

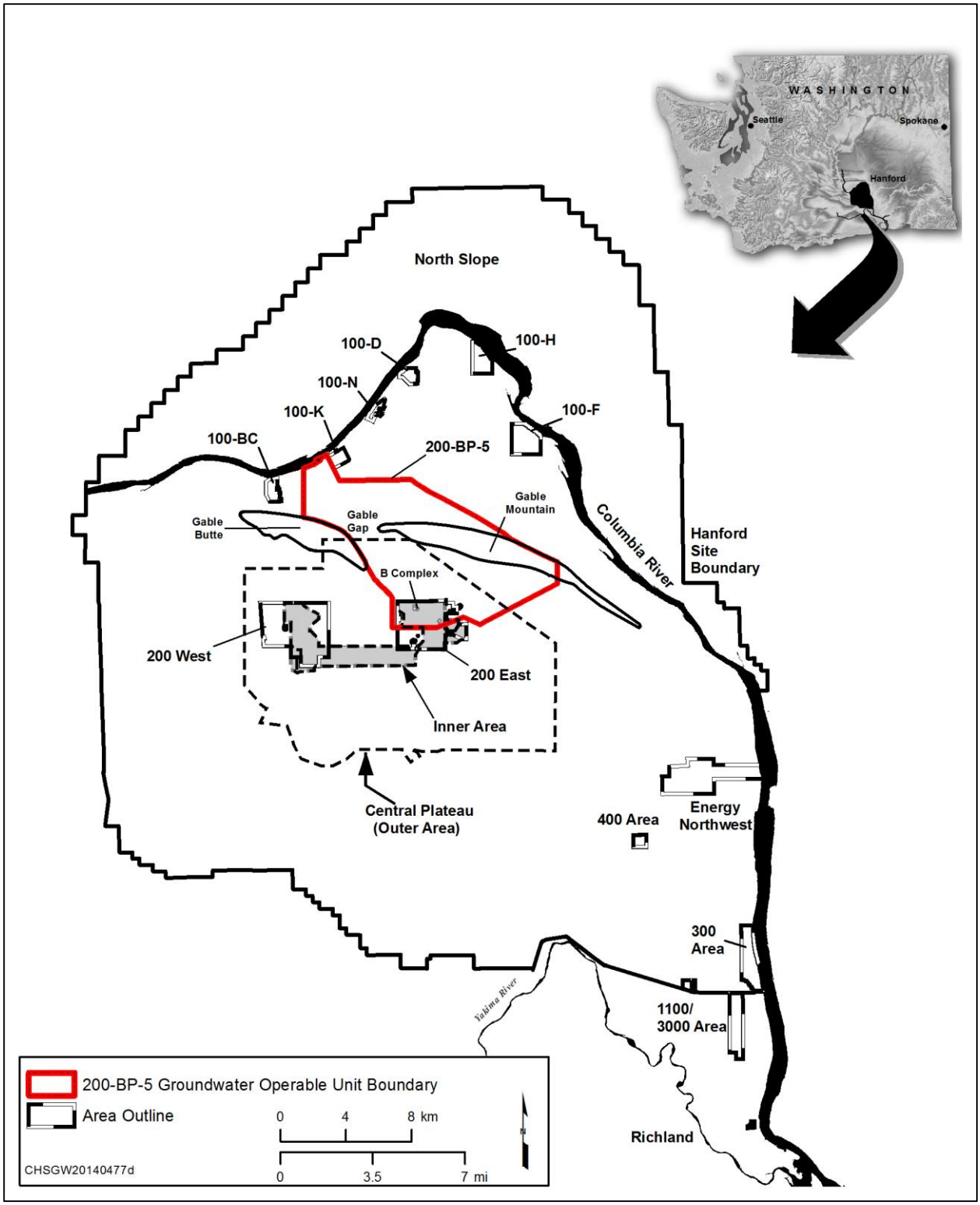


Figure 1. Location of the 200-BP-5 OU on the Hanford Site

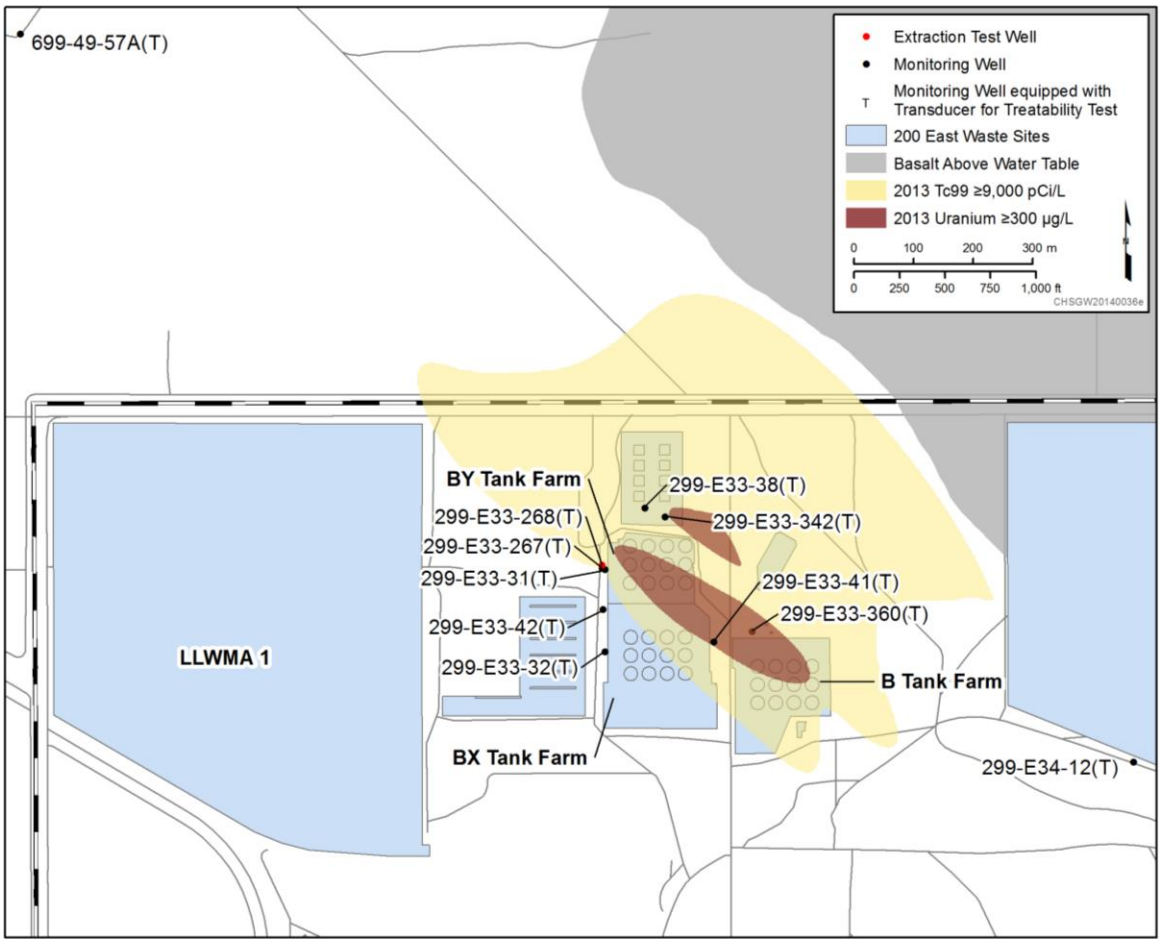


Figure 2. Location of the Extraction Well and Associated Groundwater Monitoring Wells for the Treatability Test Plan near Waste Management Area B-BX-BY

Extracted groundwater from the B Complex area will be treated using the 200 West P&T Facility. Treated 200-BP-5 groundwater will be returned to the Central Plateau aquifer. Co-contaminants associated with the B Complex groundwater including iodine-129, nitrate, tritium, and cyanide will also be removed prior to injection. Injected groundwater will meet DWSs.

Following public review and Tribal Nations input on this EE/CA, an action memorandum will be prepared to select and authorize the removal action. A removal action work plan (RAWP) will then be prepared to describe how the NTCRA will be implemented. The RAWP provides the plan and schedule for design, construction, operation, and monitoring activities necessary to successfully implement the removal action selected. This includes determining extraction well location(s) and pumping rates as part of the design effort to remove or reduce uranium and technetium-99 concentrations in this area. Pumping rates would consider aquifer properties, contaminant plume location, the treatment capacity of the 200 West P&T Facility, and flow rates required to prevent freezing during winter months. Results of the 200-BP-5 treatability test will also be used to support the design of the removal action.

Groundwater extraction under the 200-BP-5 treatability test would continue to be performed as an initial step to the removal action until the RAWP is completed. This initial step may include continued extraction from well 299-E33-268 and expansion to other existing or new wells near the B Complex.

1.2 Site Description and Background

The Hanford Site encompasses 1,517 km^2 (586 mi^2) in southeastern Washington State. The area is located just north of the confluence of the Columbia, Yakima, and Snake Rivers. Figure 1 shows the location of the Hanford Site. The Hanford Site was selected for plutonium production in 1942 as part of the Manhattan Project, primarily because of the availability of water from the Columbia River and access to power from the Bonneville and Grand Coulee Dams. The remote location and weather conditions of the area, which allowed for nearly year-round construction, also contributed to the selection. Between 1943 and 1964, nine plutonium production reactors were built along the Columbia River in six areas: 100-BC (two reactors), 100-K (two reactors), 100-N, 100-D (two reactors), 100-H, and 100-F. From 1944 to 1989, fuel processing, isotope recovery operations, and associated waste management activities occurred within the Central Plateau 200 East Area (B Plant and Plutonium-Uranium Extraction Plant) and 200 West Area (T Plant, Reduction-Oxidation Plant, U Plant, and Plutonium Finishing Plant). Each chemical processing facility generated multiple waste streams and used multiple sites for waste management and disposal.

In 1989, EPA placed the 100, 200, 300, and 1100 Areas of the Hanford Site on the National Priorities List (NPL) (40 CFR 300, Appendix B), pursuant to the *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* (CERCLA). The 200 Area NPL (40 CFR 300, Appendix B) site contains the 200 East and 200 West Areas, which include waste management facilities, interim storage and staging of irradiated fuel, inactive fuel reprocessing facilities, and waste sites located just north of the Central Plateau and southwest of Gable Mountain (sometimes referred to as the 200 North Area, as shown in Figure 1-1 of DOE/RL-2009-17, *Sampling and Analysis Plan for the 212-N, 212-P, and 212-R Buildings*). The 200 Area was the center of activity for plutonium processing at the Hanford Site starting in the mid-1940s. Liquid wastes are considered the most significant type of discharge to the environment in terms of volume and numbers of constituents. Detailed information on the historical operations and waste generation mechanisms is provided in Section 1.2 of DOE/RL-2001-54, *Central Plateau Ecological Evaluation.*

The 200-BP-5 Groundwater OU extends from the 200 East Area northwest through Gable Gap and along the eastern flank of Gable Mountain to the Columbia River (Figure 1). The 200-BP-5 OU addresses groundwater and the associated contaminant plumes beneath the northern half of the 200 East Area and adjacent portions of the surrounding 600 Area. This area includes associated cribs, trenches, tanks farms, and unplanned releases (UPRs), which are identified as sources of contamination associated with groundwater within the 200-BP-5 OU. During 200-BP-5 OU groundwater sampling, concentrations of uranium and technetium-99 were detected at more than 10 times the DWSs in groundwater at the B Complex.

1.3 Previous Investigations and Removal Actions

In 2009, the Tri-Parties agreed to an amendment to the 200-BP-5 RI/FS Work Plan (DOE/RL-2007-18, *Remedial Investigation/Feasibility Study Work Plan for the 200-BP-5 Groundwater Operable Unit*) as modified by Tri-Party Agreement (TPA) (Ecology et al., 1989a, *Hanford Federal Facility Agreement and Consent Order*) Milestone M-015-82. The amendment and associated TPA milestone consisted of a treatability test to evaluate if a 189 L/min (50 gallons per minute [gpm]) P&T system could be sustained in the aquifer beneath the B Complex to contain and reduce uranium and technetium-99 groundwater contamination. The treatability test was started in September 2015 and is described in DOE/RL-2010-74.

A draft RI report (DOE/RL-2009-127, *Remedial Investigation Report for the 200-BP-5 Groundwater Operable Unit*, Draft A) was prepared in 2015 to document completion of RI activities for the 200-BP-5 OU, to assess contaminant fate and transport, and to evaluate potential risks to human health and

the environment (HHE). The RI activities described in the 200-BP-5 RI/FS Work Plan (DOE/RL-2007-18) included drilling and construction of new wells, soil sampling, groundwater sampling during drilling of new wells (including seven wells near the B Complex area), hydrologic testing, geophysical investigations, and groundwater monitoring of existing and new wells. This NTCRA will support the FS for the 200-BP-5 OU by providing information on pumping rates that could be maintained in the aquifer beneath the B Complex area, and contaminant mass of technetium-99 and uranium, as well as other co-contaminants (nitrate, cyanide, tritium, and iodine-129) that could be removed from groundwater.

Perched water (saturated soils above the groundwater table), contaminated primarily with uranium, nitrate, and technetium-99, occurs beneath the B Complex area in a sand lens about 67 m (220 ft) below ground surface and approximately 4.6 m (15 ft) above the unconfined aquifer. The perched water was identified during drilling associated with the 200-BP-5 RI (DOE/RL-2009-127). Contamination within the perched water zone is contributing to groundwater contamination in the underlying unconfined aquifer in the B Complex area. The perched water removal action was transitioned to an NTCRA in 2015 (DOE/RL 2014-34, *Action Memorandum for 200-DV-1 Operable Unit Perched Water Pumping/Pore Water Extraction*).

Routine groundwater monitoring of the 200-BP-OU is performed under DOE/RL-2001-49, *Groundwater Sampling and Analysis Plan for the 200-BP-5 Operable Unit* (modified by TPA-CN-578). Groundwater monitoring is evaluated annually and reported in annual reports (e.g., DOE/RL-2015-07, *Hanford Site Groundwater Monitoring Report for 2014*). Groundwater monitoring includes wells in the B Complex and near the 200-DV-1 OU perched water extraction.

2 Regulatory Overview

The President of the United States is given authority by CERCLA Section 104, “Response Authorities,” when there is a threat to public health or welfare of the United States or the environment, to take any appropriate removal action to abate, prevent, minimize, stabilize, mitigate, or eliminate the release or threat of release of contaminants into the environment. This authority is delegated to DOE, as the CERCLA lead agency, through Executive Order 12580, *Superfund Implementation*. Expedited response actions are addressed by the TPA Action Plan (Ecology et al., 1989b, *Hanford Federal Facility Agreement and Consent Order Action Plan*), Section 7.2.4, which cites and is consistent with Executive Order 12580. This NTCRA is prepared to meet the intent of EPA 540-R-93-057, *Guidance on Conducting Non-Time-Critical Removal Actions Under CERCLA*.

This EE/CA was prepared in accordance with CERCLA, NCP (40 CFR 300.415), and EPA 540-R-93-057 to evaluate alternative removal actions for the NTCRA in the B Complex area. After the public and Tribal Nations have had an opportunity to comment on the alternatives and the recommended approach presented in this document, the Tri-Parties will review those comments. After public comments are considered, DOE will issue an action memorandum with Ecology concurrence to select and authorize the removal action. Documents prepared to support the NTCRA, EE/CA, and action memorandum will be placed in the TPA (Ecology et al., 1989a) Administrative Record for the 200-BP-5 OU.

The 200 Area is listed on the NCP (40 CFR 300), Appendix B, “National Priorities List” (NPL); consequently, the 200-BP-5 OU is subject to cleanup action under CERCLA. Cleanup activities are performed in accordance with the NCP (40 CFR 300) and TPA (Ecology et al. 1989a). Appendix C of the TPA Action Plan (Ecology et al., 1989b) identifies the 200-BP-5 OU as potentially needing remedial action. The actions proposed in this EE/CA for groundwater will, to the extent practicable, contribute to the efficient performance of anticipated long-term remedial action(s) as required by the NCP (40 CFR 300.415(d)). Information from this activity will contribute to the CERCLA FS process for the 200-BP-5 OU. A final action decision for the B Complex area groundwater will be addressed after completion of the 200-BP-5 OU RI/FS process through issuance of a ROD.

2.1 Public and Tribal Nations Involvement

Public and Tribal Nations involvement activities conducted pursuant to this EE/CA will be performed according to DOE et al., 2012, *Hanford Federal Facility Agreement and Consent Order Hanford Public Involvement Plan*, public participation requirements established in the NCP (40 CFR 300.415(n)), EPA 540-R-93-057, and applicable DOE policies. The EE/CA will undergo a 30-day public comment period. As the agency implementing this action, DOE will consider comments received from the public and Tribal Nations and confer with EPA and Ecology on issuance of the action memorandum. The action memorandum will identify the selected alternative for remediation of groundwater in the B Complex as evaluated in this EE/CA.

3 Source, Nature, and Extent of Contamination

The following sections discuss the source, nature, and extent of groundwater contamination within the B Complex (Figure 3) for the target contaminants (uranium and technetium-99) and provide information on other contaminants of interest (nitrate, iodine-129, tritium, and cyanide).

3.1 B Complex Area Technetium-99

Within the B Complex, major sources of technetium-99 groundwater contamination include the BY Cribs, 216-B-7A&B Cribs, 241-BX-102 UPR, and B Tank Farm (Waste Management Area B) (Figure 3).

3.1.1 BY Cribs

Technetium-99 in 200-BP-5 OU groundwater is primarily from liquid waste disposed to the BY Cribs, which received approximately 14 to 25.5 Ci of technetium-99 (Appendix C of RPP-26744, *Hanford Soil Inventory Model, Rev. 1*). Waste discharged to the BY Cribs (Figure 3) included liquids from uranium recovery and process removal, and liquid wastes from the removal of the primary long-lived fission products of cesium-137 and strontium-90. Some of the waste associated with process removal of cesium-137 and strontium-90 generated at 221-U (U Plant) was transferred to the BY Tank Farm (Waste Management Area BY). After settling, resultant supernatant was sent to the BY Cribs for disposal. Additional details are provided in PNNL-19277, *Conceptual Models for Migration of Key Groundwater Contaminants Through the Vadose Zone and Into the Unconfined Aquifer Below the B-Complex*, and DOE/RL-2011-102, *Remedial Investigation/Feasibility Study and RCRA Facility Investigation/Corrective Measures Study Work Plan for the 200-DV-1 Operable Unit*. Groundwater concentrations of technetium-99 increased between the mid-1990s and 2009. During this time, plumes primarily migrated north and northwest of the BY Cribs, consistent with the groundwater flow direction. Since 2009, concentrations have declined beneath the BY Cribs and now range between 20,000 and 28,000 pCi/L. The decrease is attributed to the observed change in groundwater flow direction since 2011. The change in flow direction from the northwest (prior to 2011) to the southeast (since 2011) is primarily attributed to ongoing water table declines in the 200 East Area as a continued response to the cessation of large liquid discharges within the Central Plateau in the late 1980s. Additional details regarding the change in groundwater flow direction are provided in DOE/RL-2013-22, *Hanford Site Groundwater Monitoring Report for 2012*; DOE/RL-2014-32, *Hanford Site Groundwater Monitoring Report for 2013*; and SGW-58828, *Water Table Maps for the Hanford Site 200 East Area, 2013 and 2014*. Because of the change in flow direction, the technetium-99 plume is migrating to the southeast, as depicted in Figures 4 and 5.

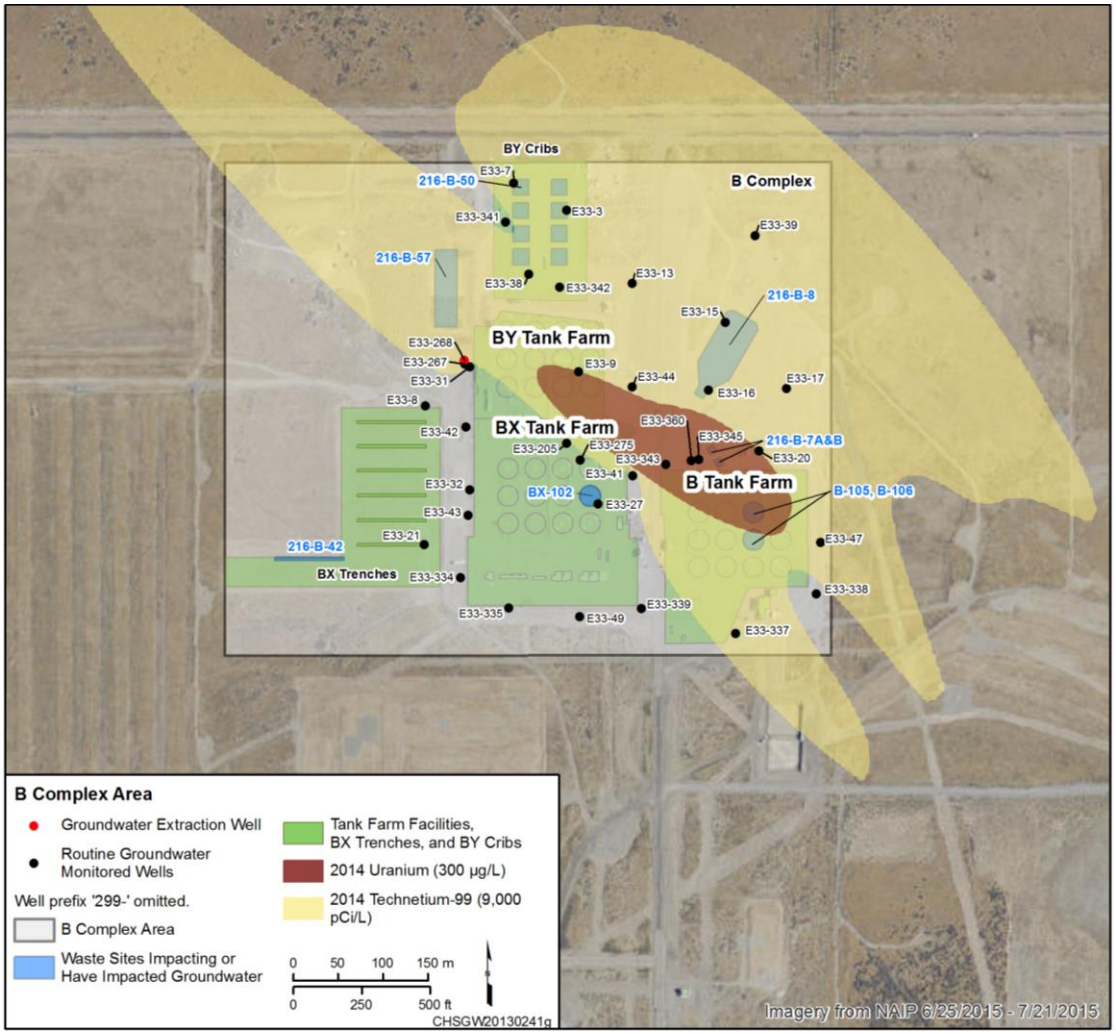


Figure 3. Map of the B Complex Area

3.1.2 241-BX-102 Unplanned Release and 216-B-7A&B Cribs

The highest technetium-99 concentration in 200-BP-5 groundwater was 35,100 pCi/L in well 299-E33-18 in 2012. The technetium-99 to nitrate ratio associated with this location is different from the other plumes because of greater technetium-99 activity and lower nitrate concentration than beneath other source sites. This is consistent with the type of waste released (i.e., metal waste from Tank 241-BX-102). The technetium-99 to nitrate ratio in perched well 299-E33-344 is much lower because of mixing with 216-B-7A&B waste. Two other small plumes of technetium-99, located along the south boundary of the 241-B and 241-BX Tank Farms at wells 299-E33-337 and 299-E33-339, may be related to the 241-BX-102 UPR. However, technetium-99 to nitrate ratios at wells 299-E33-337 and 299-E33-339 are different from those at wells 299-E33-18 and 299-E33-343, which are linked to the 241-BX-102 UPR source. Other sources within the 241-B and BX Tank Farms are currently under assessment, as discussed in DOE/RL-2012-53, *Groundwater Quality Assessment Plan for the Single-Shell Tank Waste Management Area B-BX-BY*.

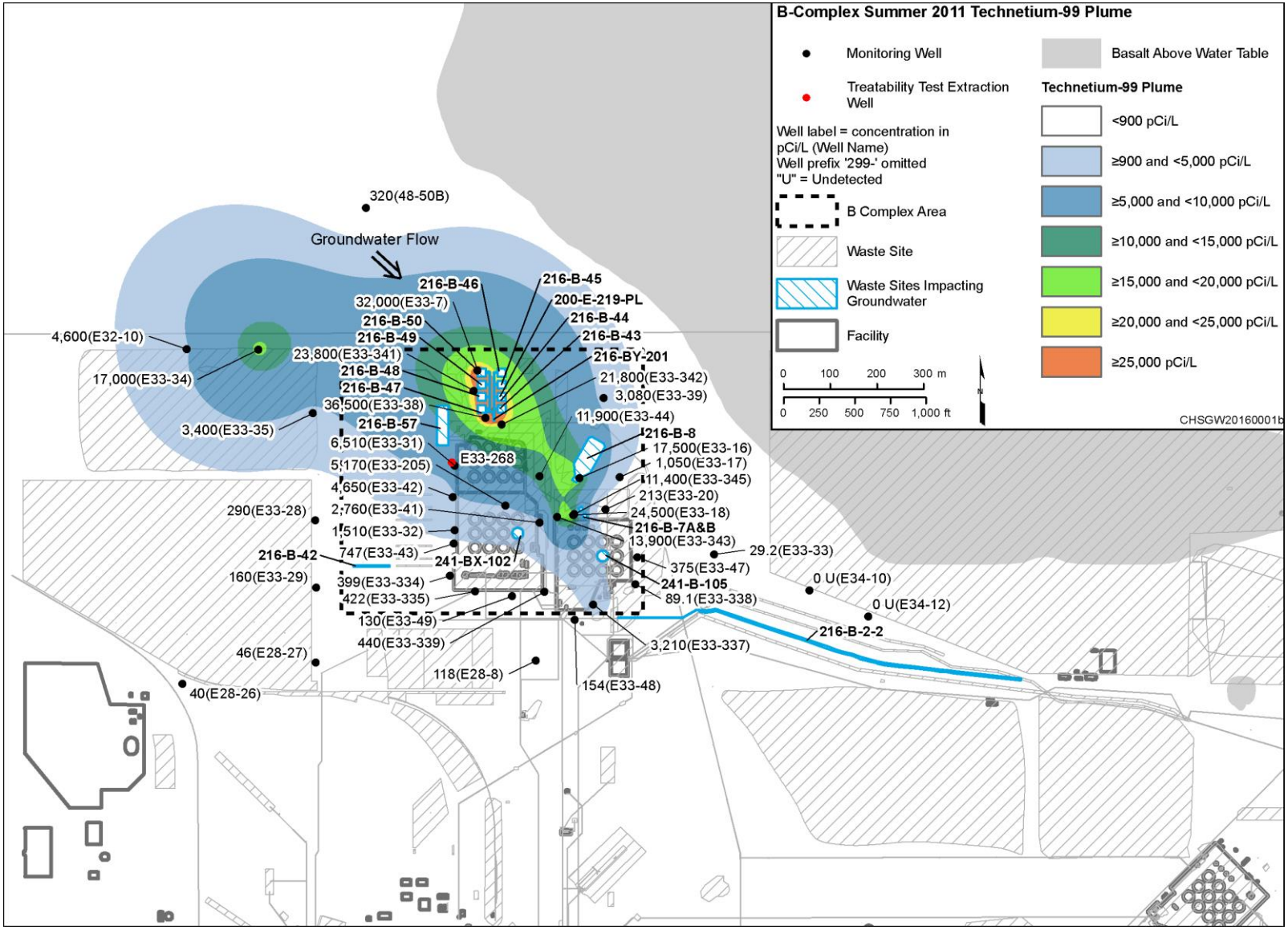


Figure 4. Technetium-99 Groundwater Plume near B Complex (Summer 2011)

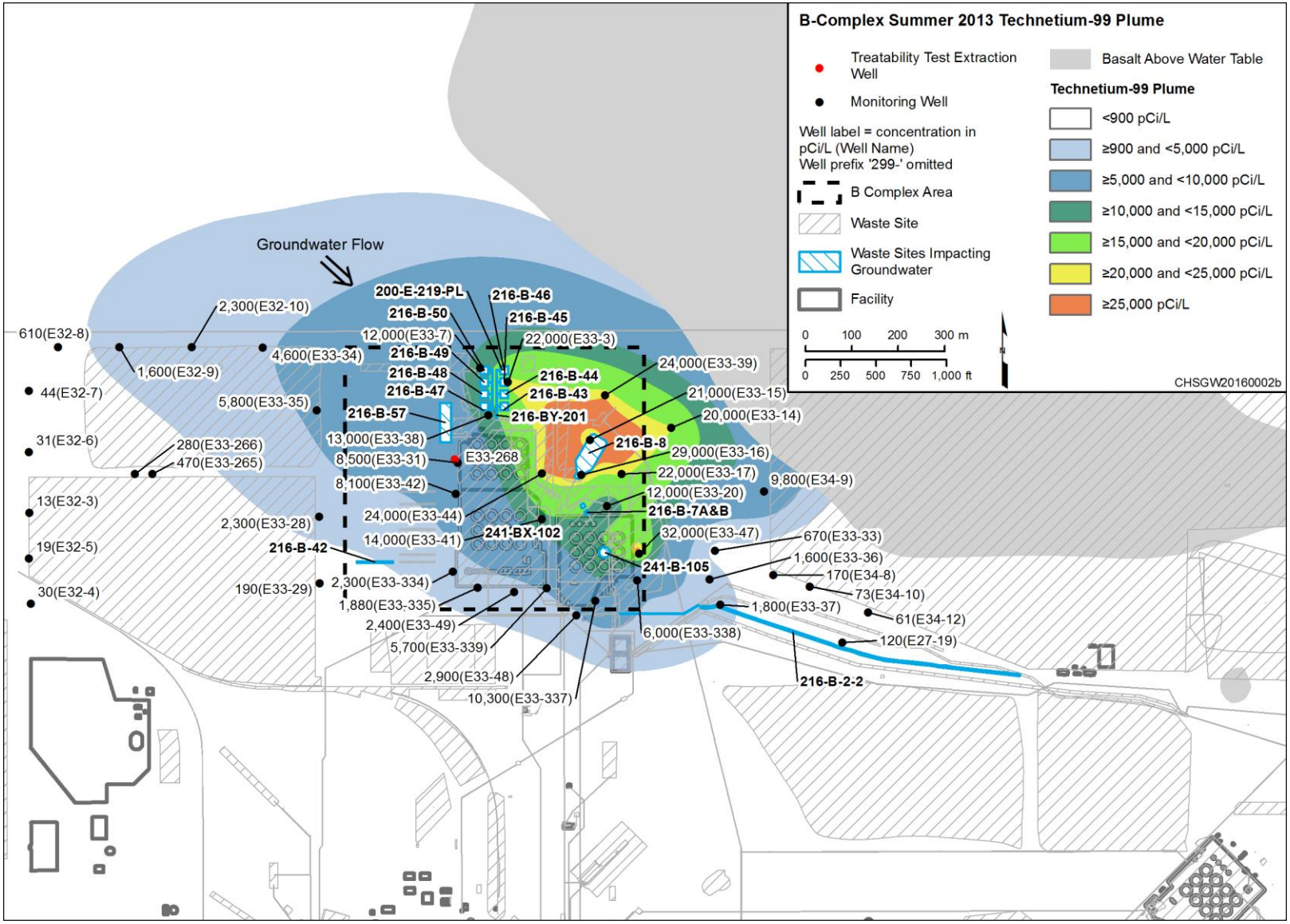


Figure 5. Technetium-99 Groundwater Plume near B Complex (Summer 2013)

3.1.3 B Tank Farm

A new contaminant source was identified in 2012 at the B Tank Farm. Technetium-99 concentrations in groundwater up to 32,000 pCi/L have been detected associated with this source. Two observations of the groundwater concentrations from this newly identified source differentiate this plume from the upgradient 241-BX-102 UPR (discussed in Section 3.1.2): (1) the technetium-99 to nitrate ratio, and (2) the increased presence of cyanide. The source is considered to be associated with a tributyl phosphate/scavenged waste release as discussed in DOE/RL-2012-53.

3.2 B Complex Area Uranium

Uranium found in the B Complex groundwater primarily originated from the 241-BX-102 UPR. The uranium inventory disposed to this site exceeded 10,000 kg (22,000 lb), which is at least an order of magnitude greater than other waste sites overlying this area.

Rough-order-of-magnitude calculations indicated that 1,050 kg (2,310 lb) of water-extractable uranium might reside at a perched water interval approximately 3 m (10 ft) above the aquifer. This estimate was based on sample results from three boreholes that characterize the perched water zone. Well 299-E33-18 had the greatest groundwater uranium concentration (4,470 µg/L) in the B Complex area in 2012. This well is located 39 m (128 ft) east of well 299-E33-343, which had the greatest groundwater uranium results from 2008 (when it was drilled as part of the 200-BP-5 RI) to 2011. The maximum result at well 299-E33-343 was 5,500 µg/L in June 2009. Migration of the high-concentration portion of this plume is attributed to the groundwater flow direction change from the northwest to the southeast. Results of this flow change are seen by comparing the spatial distribution of the uranium plume from summer 2011 (Figure 6), when the flow change was initiated, and summer 2013 (Figure 7).

3.3 Other Contaminants of Interest for the B Complex Area

Uranium and technetium-99 are the groundwater target contaminants that are the focus for this NTCRA for the B Complex area. Additional collocated contaminants of interest that exceed maximum contaminant levels in the B Complex area include nitrate, iodine-129, tritium, and cyanide. Table 1 provides a summary of the average, maximum, and minimum concentrations for B Complex area contaminants. Treatment concentration goals for the 200 West P&T Facility are provided in Table D-3 of DOE/RL-2009-124, *200 West Pump and Treat Operations and Maintenance Plan*.

Table 1. B Complex Area Groundwater Contaminant Concentrations

B Complex Area Groundwater Concentration Data from 42 Wells (2012 and 2013)					
	Average	**Maximum**	**Minimum**	**MCL**	**Units**
Technetium-99	10,038	34,000	28	900	pCi/L
Uranium	131	1,680	2.1	30	µg/L
Nitrate (NO_3)	554	1,680	1.9	45*	mg/L
Iodine-129	2.3	4.7	Nondetect	1	pCi/L
Cyanide	292	1,520	Nondetect	200	µg/L
Tritium	9,787	31,000	Nondetect	20,000	pCi/L

* 45 mg/L (expressed as the NO_3 ion) is an equivalent concentration to the federal drinking water standard for nitrate of 10 mg/L (expressed as NO_3-N). To convert nitrate as the NO_3 ion, the NO_3-N drinking water standard value is multiplied by 4.43.

MCL = maximum contaminant level

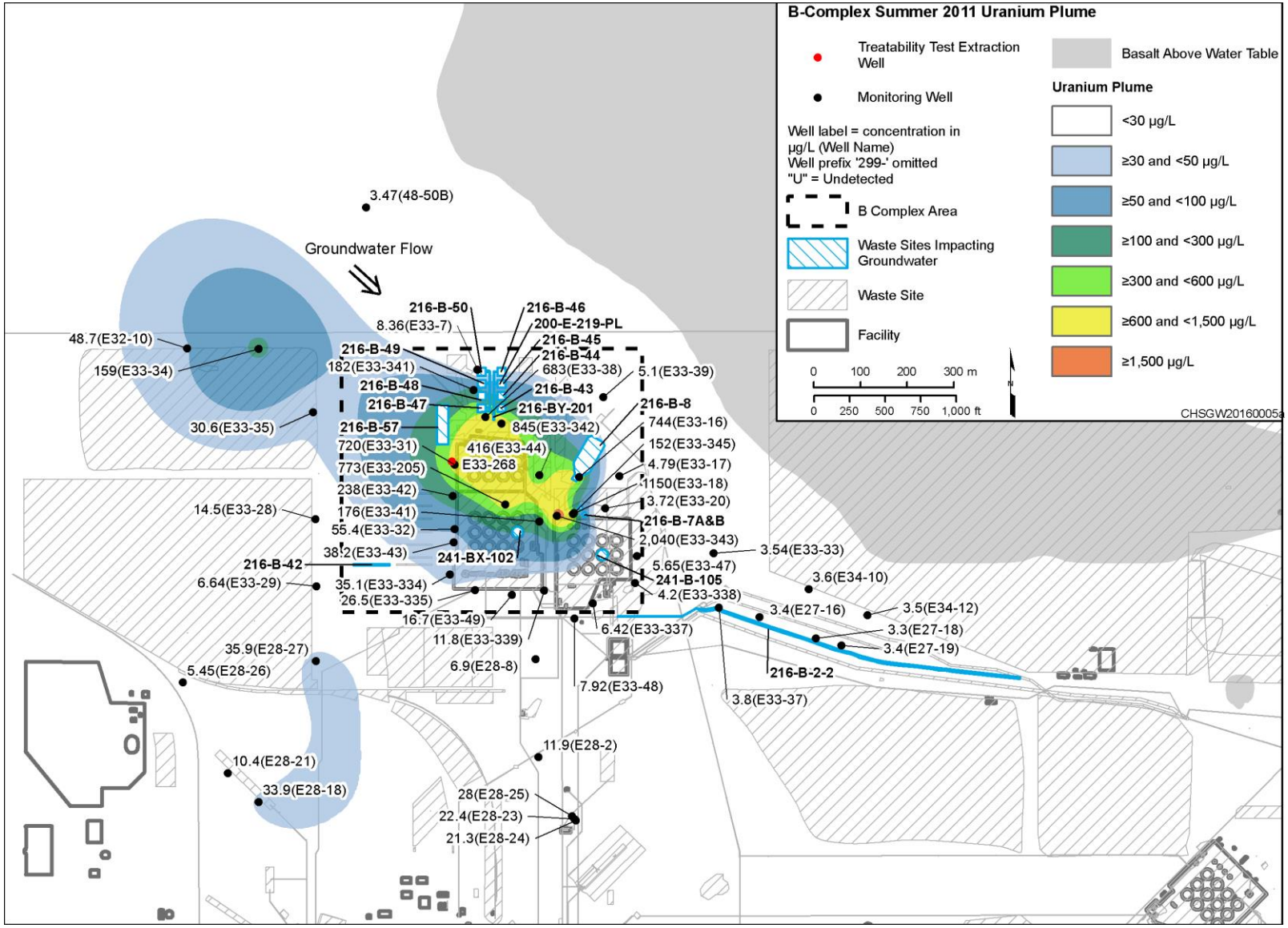


Figure 6. Uranium Groundwater Plume near B Complex (Summer 2011)

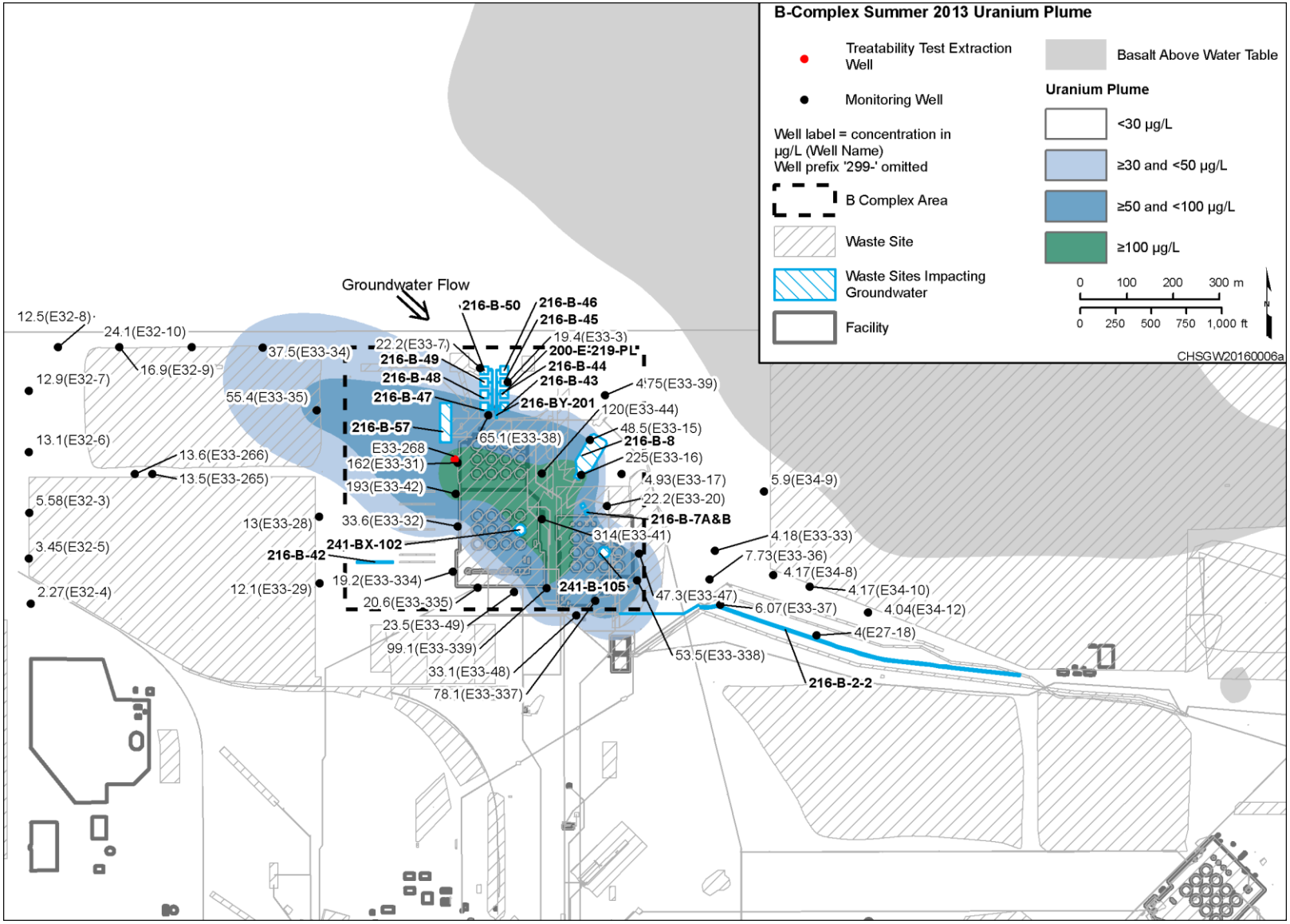


Figure 7. Uranium Groundwater Plume near B Complex (Summer 2013)

4 Applicable or Relevant and Appropriate Requirements

CERCLA Section 121, "Cleanup Standards," requires the responsible CERCLA implementing agency to ensure that the substantive standards of applicable laws will be incorporated into the design and operation of the agency's long-term remedial actions and into its more immediate removal actions. DOE is the implementing agency for this NTCRA. In accordance with the NCP (40 CFR 300.415(d)), removal actions will, to the extent practicable, contribute to the efficient performance of any anticipated long-term remedial action with respect to the release concerned. Three factors are applied to determine whether compliance with applicable or relevant and appropriate requirements (ARARs) is practicable in a particular removal action situation: exigencies of the situation, scope of the removal action to be taken, and effect of ARAR attainment on the statutory limits for removal action duration and cost. Appendix A provides ARARs for the identified alternatives.

5 Identification of Alternatives

The removal action for groundwater must be protective of HHE and must meet NTCRA objectives. Based on these considerations, the removal action alternatives are discussed in detail in the following sections.

5.1 Alternative 1: No Action

This alternative assumes that no extraction of groundwater would be conducted from the B Complex area as an NTCRA. Implementation of any remedial actions would not proceed until completion of the RI/FS, proposed plan, and ROD for the 200-BP-5 OU. As a result, Alternative 1 would delay remedial actions for the B Complex area groundwater plumes, thereby allowing the plumes to migrate farther from the sources; would not contribute to abatement (e.g., would not remove mass) of the uranium, technetium-99, and other co-contaminants (nitrate, iodine-129, tritium, and cyanide); and would not provide information to support the 200-BP-5 OU CERCLA decisions. Initial risks of Alternative 1 are minimal, but risks over time are anticipated to increase. This alternative does not meet NTCRA objectives and is used as a baseline for comparison only.

5.2 Alternative 2: B Complex Area Groundwater Extraction

Alternative 2 consists of extraction of groundwater in the B Complex area up to a total of 567 L/min (150 gpm), treatment at the 200 West P&T, and injection in the 200 West Area. A simplified illustration of Alternative 2 is provided in Figure 8.

Alternative 2 will use extraction well 299-E33-268 (Figure 9) in the treatability test and possibly one or two other existing wells (e.g., 299-E33-360) that can be converted to extraction wells. The estimated flow rates of extracted groundwater are 284 to 567 L/min (75 to 150 gpm). Connection of additional wells will be documented in the RAWP. The RAWP may also evaluate returning treated water to the 200 East Area. Extracted groundwater will be conveyed to the 200 West P&T via the aboveground pipeline system installed for the treatability test. Figure 10 provides a process flow diagram for the extraction and treatment of groundwater at the 200 West P&T. Extraction and treatment of groundwater under this proposed NTCRA is consistent with and would not impede planned or existing remedial actions on the Central Plateau. Extraction and treatment of groundwater under this NTCRA will support the 200-BP-5 RI/FS process.

The 200 West P&T was constructed in 2012 and designed for cleanup of the 200-ZP-1 Groundwater OU located in the 200 West Area. The 200 West P&T is designed to capture and treat contaminated groundwater to reduce the mass of carbon tetrachloride, total chromium (trivalent and hexavalent), nitrate, trichloroethene, iodine-129, and technetium-99. The system design also includes treatment of groundwater from the 200-UP-l OU, including removal of uranium. The treatment capacity of the system is 9,450 L/min (2,500 gpm) of extracted groundwater. From a volume perspective, the flow rate from the

B Complex area extracted groundwater can be accommodated by the 200 West P&T. The treatability test (DOE/RL-2010-74), signed by the Tri-Parties, described transferring water from the 200-BP-5 OU to the 200 West P&T and injection into the 200 West Area, and DOE/RL-2009-124 was modified in 2015 for treatment of the 200-BP-5 OU groundwater at the 200 West P&T. Section 6.2 of this document evaluates the capability of the 200 West P&T to meet treatment requirements for injection water that includes groundwater extracted from the 200-BP-5 OU. Large-scale hydraulic impacts from injection of additional water within the 200 West Area from the 200-BP-5 OU are not expected. Groundwater level (hydraulic) monitoring is conducted in the 200 West Area to monitor impacts of injection from the 200 West P&T.

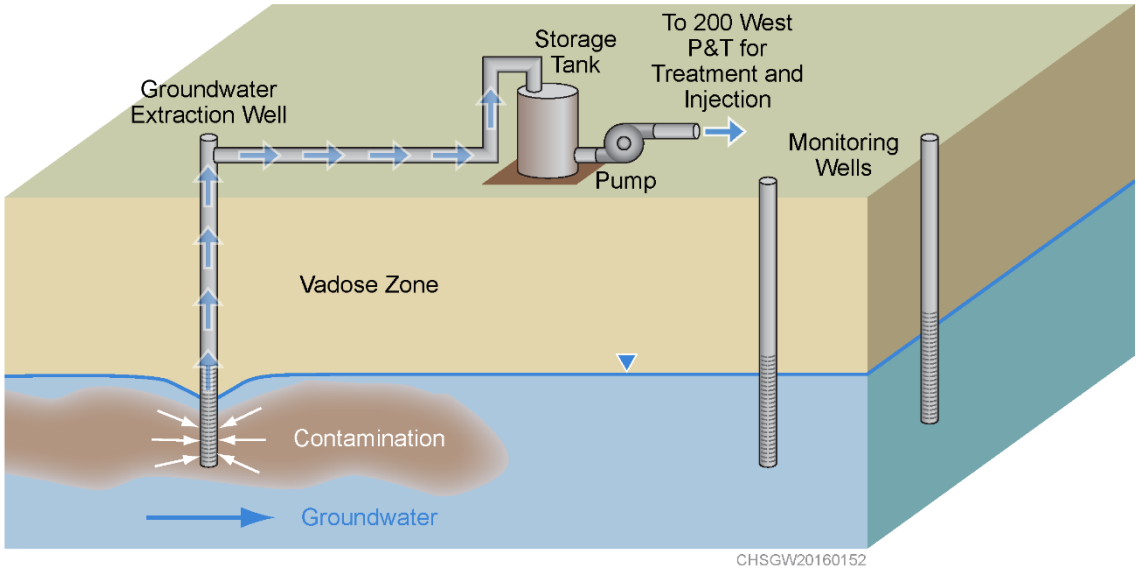


Figure 8. Conceptual Schematic of Alternative 2

Extraction well 299-E33-268 was installed on the west side of the BY Tank Farm (Figure 9). Selection of this location was based on capture zone numerical simulations (ECF-200BP5-10-0254, *Initial Evaluation of Extraction Well Location Alternatives with B-BX-BY Local-Scale Groundwater Model*), the saturated thickness (approximately 2.4 m [8 ft]) of the unconfined aquifer, proximity of existing wells for use as monitoring wells, and proximity of the uranium and technetium-99 plumes (Figure 11). Placing the well outside the tank farm boundary facilitated construction and overall operation because the land area in the B Complex is congested with industrial buildings interconnected by roads, railroads, subsurface pipelines, and electrical transmission lines. Other considerations were to locate the well clear of subsurface and overhead interferences and near a source of electrical power.

The 200-BP-5 OU treatability test was conducted in late 2015. During the 3-day constant rate test with an extraction rate of 473 L/min (125 gpm) from well 299-E33-268, drawdown of less than 10 cm (4 in.) was measured in the extraction well and observation wells. During the subsequent 27-day pumping test, approximately 17.3 million L (4.5 million gal) of water was extracted and 2.2 kg (4.8 lb) of uranium and 0.12 Ci of technetium-99 was removed from the well. Past treatability tests conducted for the 200-BP-5 OU in the mid-1990s yielded much lower extraction rates, ranging from 11 to 140 L/min (3 to 37 gpm). However, these tests were conducted in areas northwest and south of the B Complex (DOE/RL-95-59, *200-BP-5 Operable Unit Treatability Test Report*).

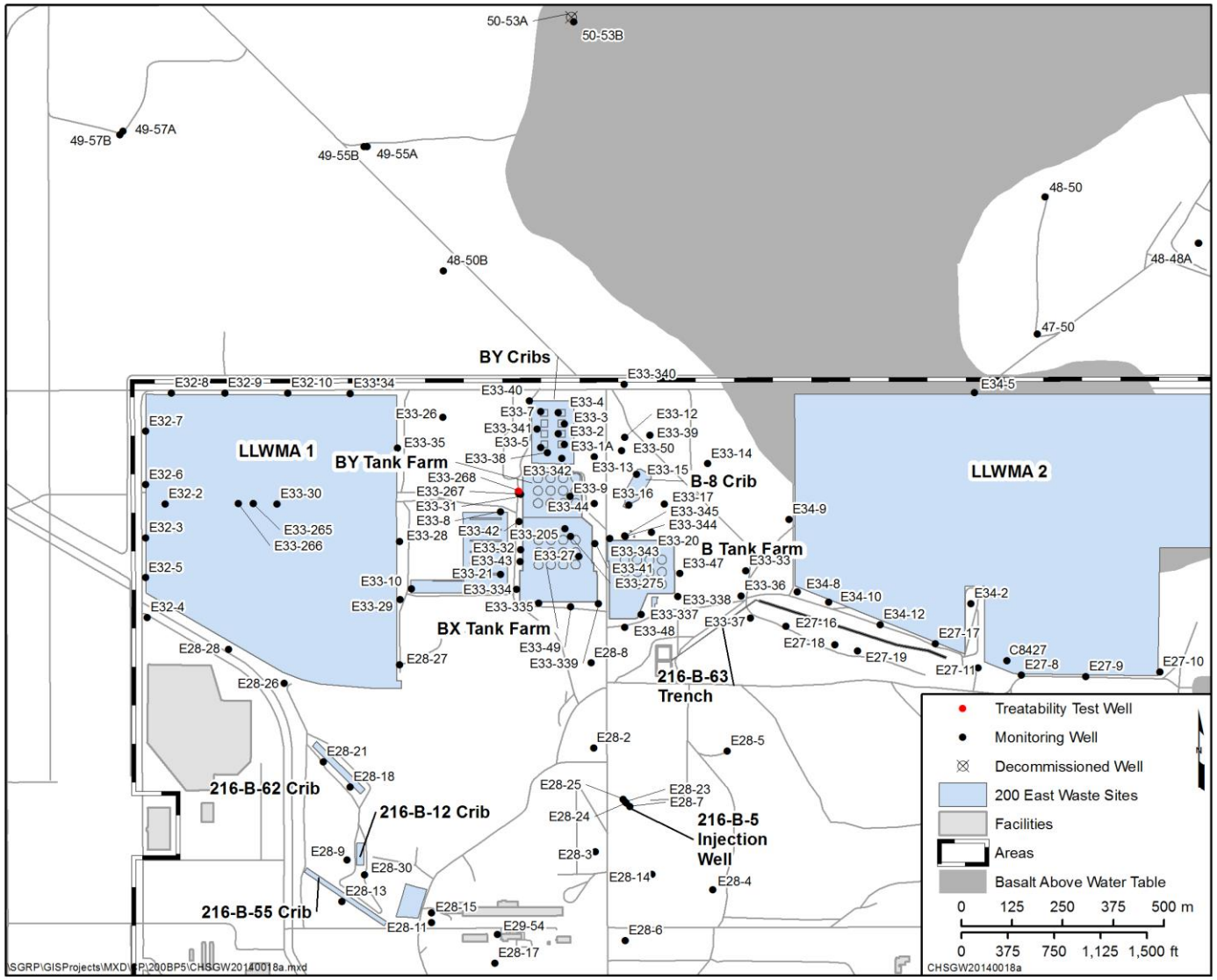


Figure 9. Location of Extraction Well 299-E33-268 (Red) within the B Complex Area and Other Groundwater Monitoring Wells

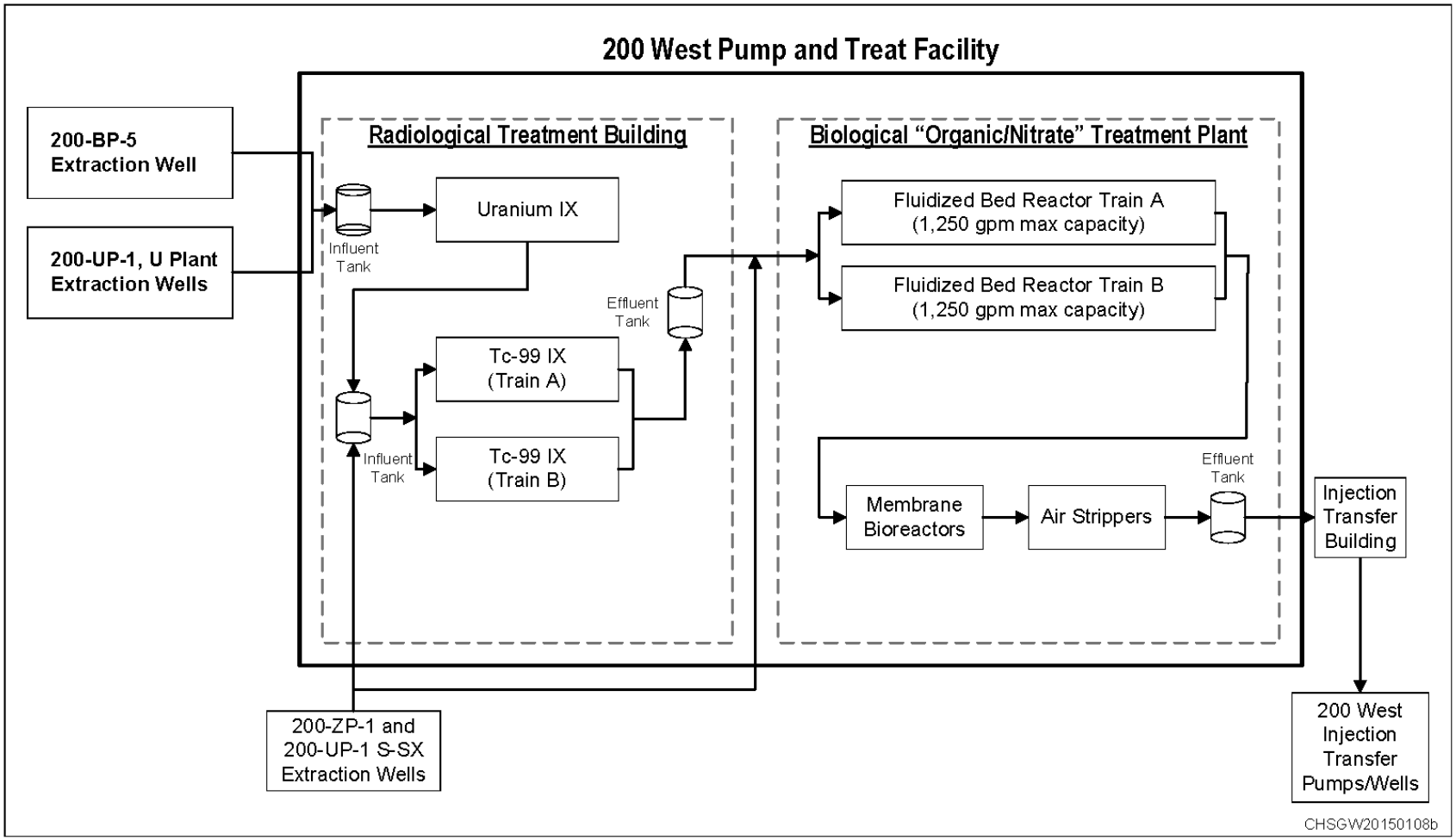
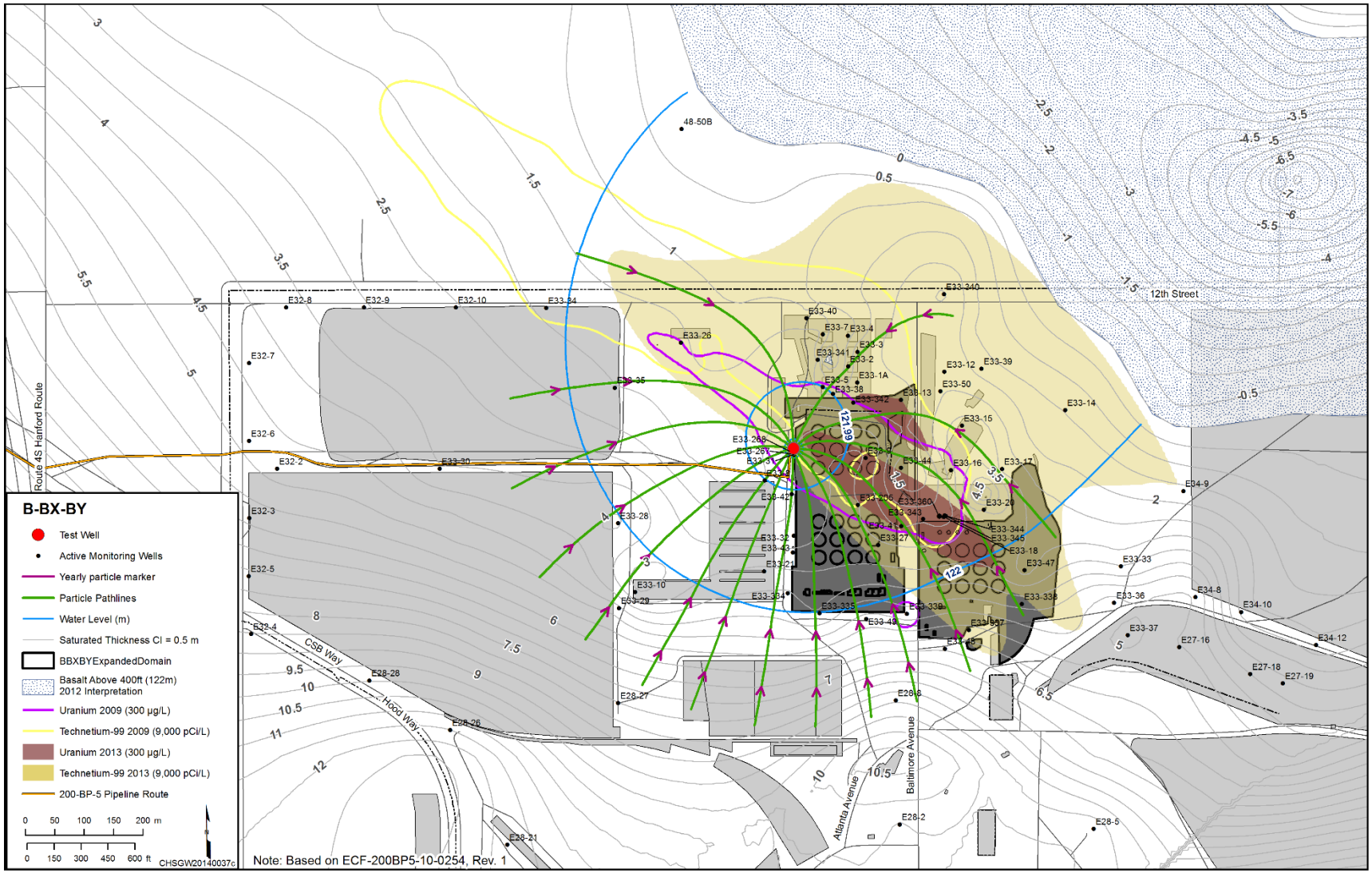


Figure 10. Process Flow Diagram for Extraction and Treatment of Groundwater at the 200 West P&T



Source: ECF-200BP5-10-0254, *Initial Evaluation of Extraction Well Location Alternatives with B-BX-BY Local-Scale Groundwater Model*.

Figure 11. Location of Aquifer Groundwater Extraction Test Well and the Inferred Capture Zone at 189 L/min (50 gpm)

6 Analysis of Removal Action Alternatives

As required by CERCLA and implemented through EPA 540-R-93-057, NTCRA alternatives identified in this chapter will be evaluated against three criteria: effectiveness, implementability, and cost.

Effectiveness includes two subcriteria: protectiveness and the ability to meet the NTCRA objectives. Implementability is evaluated based on technical feasibility; availability of equipment, personnel, services, and disposal facilities; and administrative feasibility. Costs are estimated, including capital costs, operations and maintenance costs, and net present worth costs.

6.1 Effectiveness of Removal Action Alternatives

The following subsections address the criteria for evaluating protectiveness and the ability to meet ARARs.

6.1.1 Overall Protection of Human Health and the Environment

Protection of HHE (a CERCLA threshold requirement) is a primary objective of a removal action. Protectiveness is a threshold criterion that must be met to recommend an alternative. This section addresses the protectiveness for the public and the environment for each of the alternatives being evaluated. This criterion was used to evaluate whether implementation of an alternative achieves adequate protection of risks to HHE through the likely exposure pathways.

Under Alternative 1, the No Action Alternative, no active actions would be taken to address potential threats to HHE posed by the target contaminants. Alternative 1 cannot meet NTCRA objectives and will not be protective of HHE; therefore, Alternative 1 will not be further considered.

Alternative 2 is protective of HHE and can achieve NTCRA objectives. The alternative protects HHE by reducing contaminated groundwater contamination, controlling groundwater contamination near the sources, and by removing uranium and technetium-99 mass from the groundwater. Alternative 2 is also protective of workers during implementation because Hanford Site workers are experienced in handling and processing extracted contaminated groundwater using the existing 200 West P&T Facility. Alternative 2 would provide abatement of the groundwater contamination in the B Complex by intercepting and removing contaminants until one or more of the following occurs:

- Uranium and technetium-99 concentrations near the B Complex are below 10 times their respective DWSs.
- Tri-Parties agree to terminate the removal action.
- Action is superseded by a ROD for the 200-BP-5 OU.

6.1.2 Overall Ability to Achieve ARARs

The alternatives were evaluated against the identified ARARs to determine whether they meet the requirements. ARARs are substantive environmental regulations that have been evaluated as potentially pertinent to the removal action. Removal actions are required to comply with ARARs to the extent practicable. This section presents the evaluation of the alternatives against the key ARARs addressed in this EE/CA. The ARARs will be documented in the CERCLA action memorandum.

Alternative 2 meets the ARARs as identified in Appendix A; Alternative 1, No Action, does not.

6.2 Implementability of Alternatives

This criterion addresses the technical and administrative feasibility of implementing the alternatives and the availability of required services and materials.

Alternative 1, No Action, is readily implementable since no further activities would be performed.

Alternative 2 will use the 200 West P&T for treatment of the extracted groundwater. The estimated flows of extracted groundwater are 284 to 567 L/min (75 to 150 gpm). These flow rates are within the design capacity for the 200 West P&T. The extracted groundwater will be transferred for treatment to the 200 West P&T by an aboveground pipeline (Figure 12), and injection into the 200 West Area groundwater. The pipeline follows existing roads near identified waste sites and does not cross currently identified waste sites. Contaminants identified in the 200-BP-5 OU groundwater above federal and state DWSs are provided in Table 1. The 200 West P&T is capable of treating or reducing the concentrations of uranium and technetium-99 to meet injection criteria. Alternative 2 is readily implementable.

The treated water will be conveyed through pipelines from the 200 West P&T to associated injection wells in the 200 West Area. Injection of treated groundwater in the 200 East Area may be evaluated in the RAWP for this alternative and will be evaluated as part of the FS for the 200-BP-5 OU. Injection of the treated groundwater to the aquifer at the 200 West P&T is allowed by CERCLA Section 104(d)(4), based on the following from the treatability test plan (DOE/RL-2010-74):

> *The preamble to the NCP states that when noncontiguous facilities are reasonably close to one another and wastes at these sites are compatible for a selected treatment or disposal approach, CERCLA Section 104(d)(4), "Response Authorities," allows the lead agency to treat these related facilities as one site for response purposes and, therefore, allows the lead agency to manage waste transferred between such noncontiguous facilities without having to obtain a permit. The 200-BP-5 OU extraction wells and the 200 West Groundwater Treatment Facility are reasonably close to one another, and the wastes are compatible for the selected disposal approach. Therefore, these sites are considered to be a single site for response purposes.*

Similarly, potentially contaminated solid wastes, not to include liquid wastes, generated from treatment of 200-BP-5 OU contaminated groundwater will be disposed at a secure, long-term management facility (i.e., Environmental Restoration Disposal Facility [ERDF]) per Section 104(d)(4) of CERCLA. For contaminated solid wastes generated in support of Alternative 2, ERDF would be the recommended disposal location for wastes meeting ERDF waste acceptance criteria (WCH-191, *Environmental Restoration Disposal Facility Waste Acceptance Criteria*).

Table 2 summarizes the changes in contaminant influent concentrations for the 200-BP-5 flow stream in comparison to the treatment capacity of the uranium, technetium-99, and other collocated contaminants (nitrate, iodine-129, tritium, and cyanide) in the 200 West P&T, assuming a 200-BP-5 OU flow rate of 567 L/min (150 gpm). The largest impacts to the 200 West P&T influent concentrations are from nitrate, iodine-129, and technetium-99. This table illustrates that contaminant concentrations from the additional 200-BP-5 OU flow are within the treatment capacities of the 200 West P&T, and injection of the treated water will meet 200 West P&T effluent requirements. Table 3 provides concentrations from the B Complex area used for 200 West P&T groundwater treatment calculations. Details regarding treatment processes associated with the 200 West P&T are provided in DOE/RL-2009-124.

6.3 Cost of Alternatives

Alternative 1 assumes no groundwater extraction or treatment as an NTCRA, so it has no associated cost.

Table 4 provides the cost estimate for Alternative 2 for the 3-year period from fiscal year (FY) 2016 through FY 2020. This time frame includes planning, design, and construction of the B Complex P&T extraction well system in FY 2016, removal action operations in FY 2017 through FY 2020, and remedy performance monitoring and reporting in FY 2017 through FY 2020. Annual costs are estimated at $2,000,000/yr for operations and $96,000/yr for remedy performance monitoring and reporting. The cross-site pipeline from well 299-E33-268 to the 200 West P&T Facility was completed as part of the 200-BP-5 treatability test. As a result, design and construction costs are limited to extending the pipeline from well 299-E33-268 to well 299-E33-360. Costs and schedule will be refined as the scope is defined in the action memorandum and as the design of the system progresses. Costs for the removal action will be updated, and an implementation schedule will be developed as part of the RAWP.

Figure 12. Diagram of Conveyance Pipeline from the 200-BP-5 OU Test Extraction Well Located in the 200 East Area to the 200 West Groundwater Treatment Facility

Table 2. Comparison of Contaminant Concentrations to be Treated at the Various 200 West Groundwater Treatment Train Systems versus the Current Treatment Train Contaminant Capacity

Contaminants of Concern (Unit of Concentration or Activity)	Uranium IX Treatment Train			Technetium-99 IX Treatment Train			Biological Treatment System		
	Influent Concentration without 200-BP-5 Flow[a]	Blended Influent Concentration with 200-BP-5 Flow[b]	Treatment Capacity of Train	Blended Influent Concentration without 200-BP-5 Flow[c]	Blended Influent Concentration with 200-BP-5 Flow[d]	Treatment Capacity of Train	Blended Influent Concentration without 200-BP-5 Flow[e]	Blended Influent Concentration with 200-BP-5 Flow[f]	Treatment Capacity of Train
Technetium-99 (pCi/L)	1,892	4,958	9,050	1,088	988	14,400	71	67	N/A
Iodine-129 (pCi/L)	0.90	2.21	N/A	0.38	0.99	N/A	0.21	0.40	N/A
Tritium (pCi/L)	401	3,609	N/A	4,377	4,867	N/A	2,213	2,495	N/A
Uranium (µg/L)	354	411	10,000[g]	2.7	2.8	N/A	1.7	1.8	N/A
Cyanide (µg/L)	0	46	N/A	0	19	N/A	0	6	25
Nitrate as NO_3 (µg/L)	291,225	490,695	N/A	188,275	289,440	N/A	111,565	147,028	199,350

a. Influent from planned 200-UP-1 uranium plume (U Plant area) extraction system flows at 567 L/min (150 gpm). Concentrations based on the average concentrations of uranium plume groundwater analyses from wells 299-W19-34A, -34B, -35, -36, -43, -48, and -101 over the period of January 1, 2009, through March 31, 2014. Influent from planned 200-DV-1 uranium plume (200 East Perched Water) extraction system flows at 2.16 L/min (0.57 gpm). Concentrations based on the average perched water uranium analyses from well 299-E33-344 over the period of October 1, 2011, through April 30, 2014. Technetium-99 and co-contaminant (iodine-129, tritium, cyanide, and nitrate) concentrations established by criteria used for uranium.

b. Assumes conditions in note a, plus a 200-BP-5 flow rate of 567 L/min (150 gpm). 200-BP-5 concentrations based on the average concentration of groundwater samples from well 299-E33-31 (adjacent to the planned extraction well) over a period of high concentrations. The time period of peak concentrations varied by contaminant as follows: technetium-99, Nov 19, 2007 through February 12, 2014; iodine-129, February 16, 2000 through November 18, 2011; tritium, November 19, 2007 through February 12, 2014; uranium, November 19, 2007 through October 1, 2013; cyanide, November 19, 2007 through February 12, 2014; and nitrate, November 19, 2007 through October 1, 2013 (see Table 3).

c. Assumes conditions in note a, plus expected technetium-99 removal across the uranium IX train. Water from uranium IX is blended with flow from existing 200-ZP-1 extraction system at 1,703 L/min (450 gpm). 200-ZP-1 water concentrations into the technetium-99 IX train are based on a flow-weighted mass balance using typical extraction well flows and concentrations as of November 18, 2014.

d. Assumes conditions in note b, plus expected technetium-99 removal across the uranium IX train. Effluent from uranium IX system is blended with flow from existing 200-ZP-1 extraction system at 1,230 L/min (325 gpm). 200-ZP-1 water concentrations into the technetium-99 IX train are based on a flow-weighted mass balance using typical extraction well flows and concentrations as of November 18, 2014. Water from 200-ZP-1 extraction wells does not contain significant concentrations of uranium that warrants treatment by the uranium IX treatment train and is fed directly to the technetium-99 IX treatment train.

e. Assumes conditions in note c. Effluent from technetium-99 IX system is blended with flow from existing 200-ZP-1 extraction system at 6,435 L/min (1,700 gpm). 200-ZP-1 water concentrations into the biological treatment process are based on average process sample concentrations as of November 18, 2014.

f. Assumes conditions in note d. Effluent from technetium-99 IX system is blended with flow from existing 200-ZP-1 extraction system at 6,340 L/min (1,675 gpm). 200-ZP-1 water concentrations into the biological treatment process are based on average process sample concentrations as of November 18, 2014.

g. Treatment capacity of uranium is estimated from studies at other sites and will be confirmed by careful monitoring. Concentrations are significantly less than the estimated capacity and are not expected to exceed treatment capacity.

IX = ion exchange

N/A = not applicable (indicates contaminant not treated by treatment train)

Table 3. 200-BP-5 Contaminant Concentrations for 200 West Groundwater Treatment Calculations*

Contaminant	Cyanide (µg/L)	Nitrate (µg/L)	Iodine-129 (pCi/L)	Technetium-99 (pCi/L)	Tritium (pCi/L)	Uranium (µg/L)
Concentrations	93	691,080	3.53	8,036	6,828	469

* Calculation details are provided in SGW-57790, *Characterization data for New Waste Streams (200-UP-1, ERDF Leachate, 200-BP-5 and Perched Water) for the 200 West Pump-and-Treat Facility*.

Table 4. Alternative 2, B Complex Groundwater Extraction Removal Action Cost Summary for Fiscal Years 2015 through 2020

Activity	FY 2016	FY 2017	FY 2018	FY 2019	FY 2020	Total Cost
Action Memorandum	$60,000	$ -	$ -	$ -	$ -	$60,000
Removal Action Work Plan	$365,000	$ -	$ -	$ -	$ -	$365,000
Remedial Design	$300,000	$ -	$ -	$ -	$ -	$300,000
Construction	$600,000	$ -	$ -	$ -	$ -	$600,000
Operations and Maintenance	$ -	$2,000,000	$2,000,000	$2,000,000	$2,000,000	$8,000,000
Remedy Performance Monitoring/Reporting	$ -	$96,000	$96,000	$96,000	$96,000	$384,000
Project Management	$132,500	$200,000	$200,000	$200,000	$200,000	$932,500
Totals	$1,457,500	$2,296,000	$2,296,000	$2,296,000	$2,296,000	$10,641,500

Note: This is a rough-order-of-magnitude estimate. The accuracy is expected to be within +50% and -30%.

Design and construction costs are limited to activities associated with extending the pipeline from well E33-268 to well E33-360.

FY = fiscal year

The cost associated with implementing Alternative 2, although higher than Alternative 1 (No Action), will be efficient and cost effective by using existing infrastructure and treatment facilities. Alternative 2 will not require construction and operation of a stand-alone treatment facility.

7 Comparative Analysis of Removal Action Alternatives

DOE compared the alternatives described in Chapters 5 and 6. Alternative 1 does not meet the NTCRA objectives, while Alternative 2 does. While Alternative 1 is not effective to reduce risk to HHE, Alternative 2 is effective by removal of contamination from the groundwater through pumping and treating the groundwater. Both Alternatives 1 and 2 are implementable. Alternative 2 is implementable by using existing wells, pumps, and pipelines already in use at the 200-BP-5 OU treatability test. While Alternative 1 costs less than Alternative 2, Alternative 2 costs are minimized to the extent practicable by use of the existing groundwater extraction system that was installed for the treatability test.

7.1 Recommended Alternative

The recommended removal action is Alternative 2: extraction of groundwater from the 200-BP-5 OU, treatment at the 200 West P&T, and injection into the Central Plateau aquifer. Alternative 1 (No Action) does not meet protectiveness criteria and is not considered further.

The recommended alternative, Alternative 2, provides abatement of uranium and technetium-99 groundwater contamination, is protective of HHE, meets the NTCRA objectives, is cost effective, and is consistent with planned or existing remedial and removal actions on the Central Plateau.

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Appendix A

Applicable or Relevant and Appropriate Requirements

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Terms

ARAR	applicable or relevant and appropriate requirement
OU	operable unit
TBC	to be considered

A1 Compliance with Applicable or Relevant and Appropriate Requirements

The applicable or relevant and appropriate requirements (ARARs) that potentially are pertinent to this removal action are listed in Table A-1 (federal ARARs), Table A-2 (state ARARs), and Table A-3 (to be considered [TBC] criteria). Onsite activities, such as this removal action, must comply with ARARs but only need to comply with the substantive parts of those requirements.

Table A-1. Identification of Federal ARARs

ARAR Citation	ARAR	Requirement	Rationale for Use
Other Federal ARARs			
Archeological and Historic Preservation Act of 1974 16 USC 469a-1 through 469a-2(d)	ARAR	Requires that the removal action at the 200-BP-5 Groundwater OU does not cause the loss of any archaeological or historic data. This act mandates preservation of the data and does not require protection of the actual historical sites.	Archeological and historic sites have been identified within the 200 Areas; therefore, the substantive requirements of this act are applicable to actions that might disturb these sites. This requirement is action specific.
National Historic Preservation Act of 1966 36 CFR 60, "National Register of Historic Places" 36 CFR 65, "National Historic Landmarks Program" 36 CFR 800, "Protection of Historic Properties"	ARAR	Requires federal agencies to consider the impacts of their undertaking on cultural properties through identification, evaluation, and mitigation processes.	Cultural and historic sites have been identified within the 200 Areas; therefore, the substantive requirements of this act are applicable to actions that might disturb these types of sites. This requirement is location specific.
Native American Graves Protection and Repatriation Act of 1990 25 USC 3001, et seq. 43 CFR 10, "Native American Graves Protection and Repatriation Regulations"	ARAR	Establishes federal agency responsibility for discovery of human remains, associated and unassociated funerary objects, sacred objects, and items of cultural patrimony.	Substantive requirements of this act are applicable if remains and sacred objects are found during remediation. This is a location-specific requirement.
Endangered Species Act of 1973 16 USC 1531 et seq., 16 USC 1536(c) 50 CFR 402, "Interagency Cooperation—Endangered Species Act of 1973, as Amended"	ARAR	Establishes requirements for actions by federal agencies that are likely to jeopardize the continued existence of listed species or result in the destruction or adverse modification of critical habitat. If remediation is within critical habitat or buffer zones surrounding threatened or endangered species, mitigation measures must be taken to protect the resource.	Substantive requirements of this act are applicable if threatened or endangered species are identified in areas where removal action will occur. This is a location-specific requirement.

Table A-1. Identification of Federal ARARs

ARAR Citation	ARAR	Requirement	Rationale for Use
Migratory Bird Treaty Act of 1918 16 USC 703-712, et seq.	ARAR	Protects all migratory bird species and prevents "take" of protected migratory birds, their young, or their eggs."	Remedial actions that require mitigation measures to deter nesting by migratory birds on, around, or within remedial action site and methods to identify and protect occupied bird nests. This requirement is location specific.

ARAR = applicable or relevant and appropriate requirement
OU = operable unit
TBC = to be considered

Table A-2. Identification of State ARARs

ARAR Citation	ARAR	Requirement	Rationale for Use
WAC 173-303, "Dangerous Waste Regulations"			
"Identifying Solid Waste" WAC 173-303-016	ARAR	Identifies those materials that are and are not solid wastes.	Substantive requirements of these regulations are applicable because they define which materials are subject to the designation regulations. Specifically, materials that are generated during the removal action would, if a solid waste, be subject to the requirements for solid wastes. This requirement is action specific.
"Recycling Processes Involving Solid Waste" WAC 173-303-017	ARAR	Identifies materials that are and are not solid wastes when recycled and includes provisions for exemption from WAC 173-303.	Substantive requirements of these regulations are applicable because they define which materials are subject to the designation regulations. Specifically, materials that are generated during the removal action, if a solid waste, would be subject to the requirements for solid wastes. This requirement is action specific.

Table A-2. Identification of State ARARs

ARAR Citation	ARAR	Requirement	Rationale for Use
"Designation of Dangerous Waste" WAC 173-303-070(3)	ARAR	Establishes whether a solid waste is, or is not, a dangerous waste or an extremely hazardous waste.	Substantive requirements of these regulations are applicable to materials generated during the removal action. Specifically, solid waste that is generated during this removal action, if a dangerous waste, would be subject to the dangerous waste requirements. This requirement is action specific.
"Excluded Categories of Waste" WAC 173-303-071	ARAR	Describes those categories of wastes that are excluded from the requirements of WAC 173-303 (excluding WAC 173-303-050, "Department of Ecology Cleanup Authority").	This regulation is applicable to the removal action in the 200-BP-5 Groundwater OU should wastes identified in WAC 173-303-071 be generated. This requirement is action specific.
"Requirements for Universal Waste" WAC 173-303-077	ARAR	Identifies those wastes exempted from regulation under WAC 173-303-140 and WAC 173-303-170 through 173-303-9906 (excluding WAC 173-303-960). These wastes are subject to regulation under WAC 173-303-573.	Substantive requirements of these regulations are applicable to universal waste generated during the removal action. Specifically, the substantive standards for management of universal waste are relevant and appropriate to the management of universal waste that will be generated during the removal action. This requirement is action specific.
"Recycled, Reclaimed, and Recovered Wastes" WAC 173-303-120 Specific subsections: WAC 173-303-120(3) WAC 173-303-120(5)	ARAR	These regulations define the requirements for recycling materials that are solid and dangerous waste. Specifically, WAC 173-303-120(3) provides for the management of certain recyclable materials, including spent refrigerants, antifreeze, and lead acid batteries. WAC 173-303-120(5) provides for the recycling of used oil.	Substantive requirements of these regulations are applicable to certain materials that might be generated during the removal action. Eligible recyclable materials can be recycled and/or conditionally excluded from certain dangerous waste requirements. This requirement is action specific.

Table A-2. Identification of State ARARs

ARAR Citation	ARAR	Requirement	Rationale for Use
"Land Disposal Restrictions" WAC 173-303-140(4)	ARAR	This regulation establishes state standards for land disposal of dangerous waste and incorporates, by reference, federal land disposal restrictions of 40 CFR 268, "Land Disposal Restrictions," that are relevant and appropriate to solid waste that is designated as dangerous or mixed waste in accordance with WAC 173-303-070(3).	The substantive requirements of this regulation are applicable to materials generated during the removal action. Specifically, dangerous/mixed waste that is generated during the removal action would be subject to the relevant and appropriate substantive land disposal restrictions. The offsite treatment, disposal, or management of such waste would be subject to all applicable substantive and procedural laws and regulations, including land disposal restriction requirements. This requirement is action specific.
"Requirements for Generators of Dangerous Waste" WAC 173-303-170	ARAR	Establishes the requirements for dangerous waste generators.	Substantive requirements of these regulations are applicable to materials generated during the removal action. Specifically, the substantive standards for management of dangerous/mixed waste are relevant and appropriate to the management of dangerous waste that will be generated during the removal action. For purposes of this removal action, WAC 173-303-170(3) includes the substantive provisions of WAC 173-303-200 by reference. WAC 173-303-200 further includes certain substantive standards from WAC 173-303-630 and WAC 173-303-630-640 by reference. This requirement is action specific.

ARAR = applicable or relevant and appropriate requirement

OU = operable unit

Table A-3. Identification of TBC Criteria

Criteria TBC	Rationale for Use
EPA et al., 2008, *Record of Decision, Hanford 200 Area 200-ZP-1 Superfund Site, Benton County, Washington*	Contaminated water extracted from the 200-BP-5 OU and added to the 200 West Pump and Treat Facility influent for treatment will attain the cleanup levels for treated effluent.
DOE/RL-2009-124, *200 West Pump and Treat Operations and Maintenance Plan*	Groundwater extracted from the 200-BP-5 OU will meet the design requirements that allow the addition of the groundwater to the 200 West Pump and Treat Facility influent for treatment.

OU = operable unit
TBC = to be considered

A2 References

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36 CFR 65, "National Historic Landmarks Program," *Code of Federal Regulations*. Available at: http://www.gpo.gov/fdsys/pkg/CFR-2010-title36-vol1/xml/CFR-2010-title36-vol1-part65.xml.

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303-017, "Recycling Processes Involving Solid Waste."

303-050, "Department of Ecology Cleanup Authority."

303-070, "Designation of Dangerous Waste."

303-071, "Excluded Categories of Waste."

303-077, "Requirements for Universal Waste."

303-120, "Recycled, Reclaimed, and Recovered Wastes."

303-140, "Land Disposal Restrictions."

303-170, "Requirements for Generators of Dangerous Waste."

303-200, "Accumulating Dangerous Waste On-Site."

303-573, "Standards for Universal Waste Management."

303-630, "Use and Management of Containers."

303-640, "Tank Systems."

303-960, "Special Powers and Authorities of the Department."

303-9906, "Special Waste Bill of Lading."