200-BP

200-BP Overview

The 200-BP-5 operable unit addresses groundwater

and the associated contaminant plumes beneath the northern half of the 200 East Area and adjacent portions of the surrounding 600 Area. The main process separation facilities overlying the operable unit were B Plant and Semi Works; however, liquid waste from the other process separation facilities at Hanford were stored or disposed at sites overlying 200-BP-5. Nitrate, iodine-129, technetium-99 and uranium form extensive groundwater plumes in the operable unit. These contaminants have primary sources overlying the operable unit, except for iodine-129, which mainly migrated into 200-BP-5 from 200-PO-1 in the late 1980s and early 1990s. Other contaminants cyanide, tritium, strontium-90, cesium-137 and plutonium-239/240 are also present in groundwater, but to a more limited extent and are routinely sampled in selected wells. The most extensive contaminant plume areas were derived for 2003 through 2012.

DOE conducts groundwater monitoring in 200-BP-5 under CERCLA. DOE also monitors six RCRA sites within the operable unit: WMA B/BX/BY, WMA C, 216-B-63 Trench, LLWMA-1, LLWMA-2, and LERF. A third requirement for groundwater monitoring at 200-BP-5 is AEA monitoring associated with the active burial grounds (e.g., LLWMA-1 and LLWMA-2).

Within 200-BP-5, groundwater occurs as an unconfined aquifer and as semi-confined to confined aquifer beneath the Ringold lower mud unit and between basalt flows, respectively (Map BP.1). The unconfined aquifer is the primary aquifer impacted by past waste disposal operations. The unconfined aquifer occurs within Rattlesnake Ridge interbed, fractured basalt flow top areas, Ringold unit A, Ringold lower mud unit, Cold Creek unit, and Hanford formation (Figure BP.1).

Depths from land surface to the water table range from less than 1 meter to 105 meters, with the greatest depths occurring in the south portion of the operable unit. The thickness of the unconfined aquifer varies from less than a meter to more than 40 meters in the Gable Gap. Groundwater flow in 2012 within the unconfined aquifer was mainly southeast to south-southeast within the Gable Gap and north part of the 200 East Area.

Table BP.1 200-BP-5 at a Glance

B Plant Operations:	**1945–1952 (Plutonium separation)** **1967–1985 (Strontium and Cesium recovery)**		
2012 Groundwater Monitoring			
Contaminant	**Drinking Water Standard**	**Maximum Concentration[a]**	**Plume Area[b] (km^2)**
Nitrate	45 mg/L	1,570 mg/L (299-E33-15)	7.8
Iodine-129	1 pCi/L	7.45 pCi/L (299-W27-12)	3.9
Technetium-99	900 pCi/L	35,100 pCi/L (299-E33-18)	2.3
Uranium	30 µg/L	4,470 µg/L (299-E33-18)	0.6
Strontium-90	8 pCi/L	2,400 pCi/L (299-E28-25)	0.6
Cyanide	200 µg/L	1,100 µg/L (299-E33-15)	0.2
Tritium	20,000 pCi/L	35,000 pCi/L (699-42-40A)	0.2
Remediation			
B Complex perched aquifer pump-and-treat (treatability test): • Being performed by the 200-DV-1 Operable Unit • Test successful; ~ 324,000 liters pumped in 2012 Final action 200-BP-5 record of decision scheduled for 2016.			

a. Maximum concentration within the regional unconfined aquifer (i.e., excludes the perched aquifer beneath the B Complex).
b. Estimated area above listed drinking water standard.

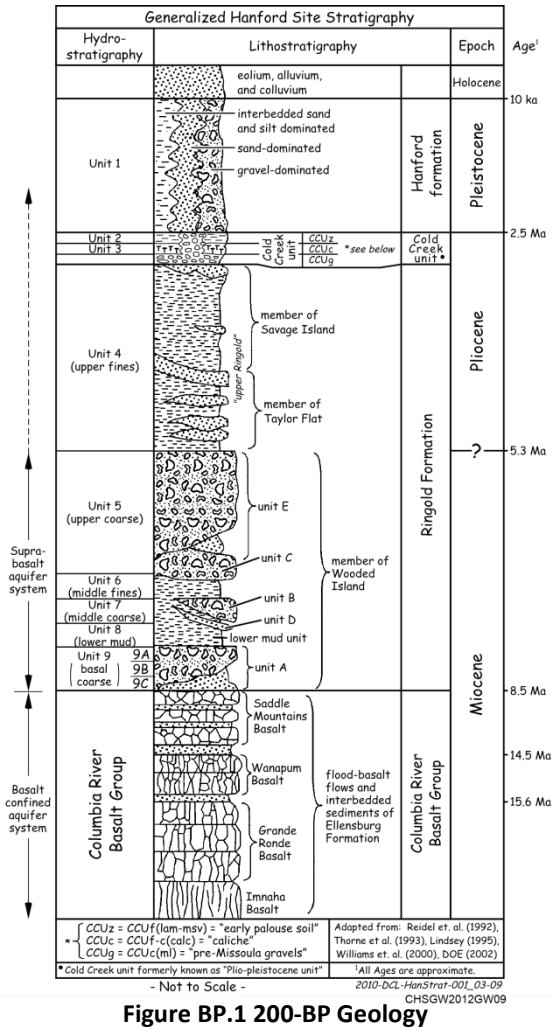
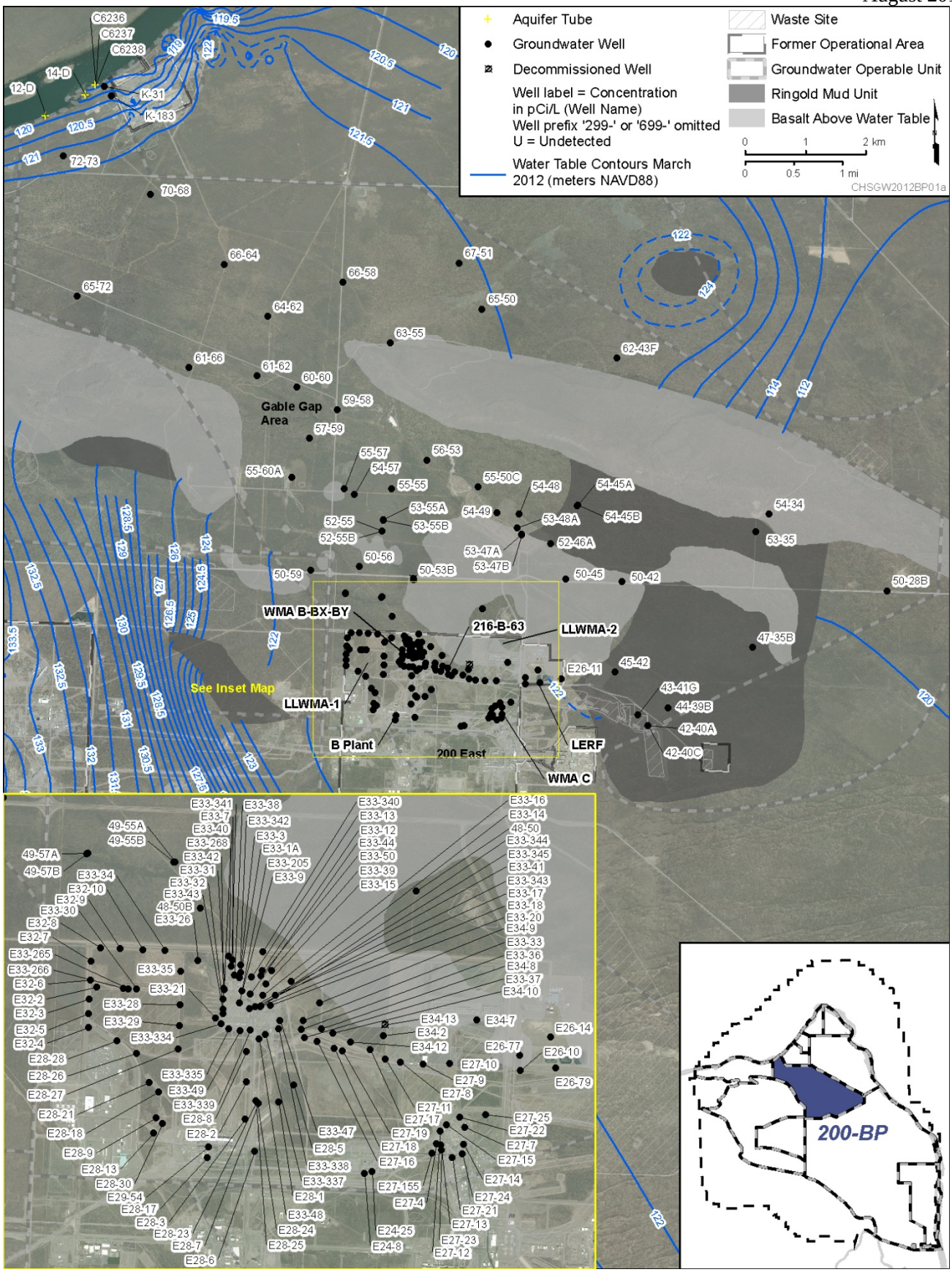


Figure BP.1 200-BP Geology



Map BP.1 200-BP Overview with Water Flow

200-BP CERCLA Activities

Groundwater monitoring under CERCLA is described in the Sampling and Analysis Plan (SAP) for the 200-BP-5 Groundwater operable unit (DOE/RL-2001-49 Rev. 1). This SAP identified ten contaminants of potential concern (COPCs): nitrate, iodine-129, technetium-99, uranium, cyanide, stronitum-90, tritium, cesium-137, plutonium-239/240 and cobalt-60. The groundwater monitoring network is shown in Map BP.2. A remedial investigation for the 200-BP-5 groundwater operable unit was initiated in 2006. Thirteen wells were installed in accordance with DOE/RL-2007-18, Rev. 1. The final well was installed in 2010. Three major findings resulted from the well installations:

- Elevated nitrate, tritium, and uranium were found below the upper portion of the aquifer near the 216-B-12 Cribs in remedial investigation wells 299-E28-30 and 299-E29-54.
- The contaminant flow model of technetium-99, north of the 200 east Area, was changed based on the remedial investigation wells 699-50-56 and 699-52-55.
- The conceptual contaminant transport associated with the 241-BX-102 Unplanned Release was verified by remedial investigation wells 299-E33-343, 299-E33-344, and 299-E33-345.

A draft remedial investigation report was initiated in 2010, but put in safe storage in 2011. In 2011, a treatability test was designed in accordance with DOE/RL-2010-74 Rev. 1 to evaluate the aquifer characteristics near sources of technetium-99 and uranium, but limited funding in 2012 impeded the completion. Changes in plume areas over time for major constituents in 200-BP are shown in Figure BP.2.

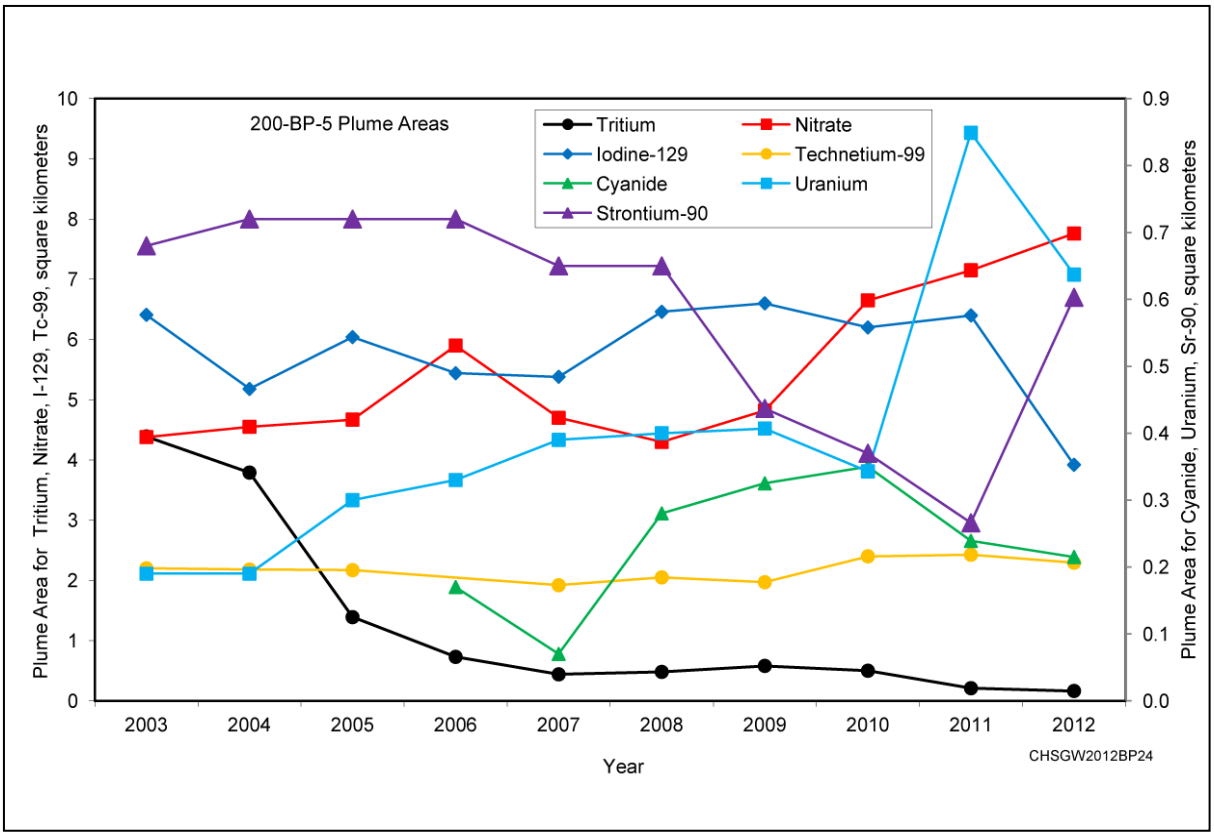
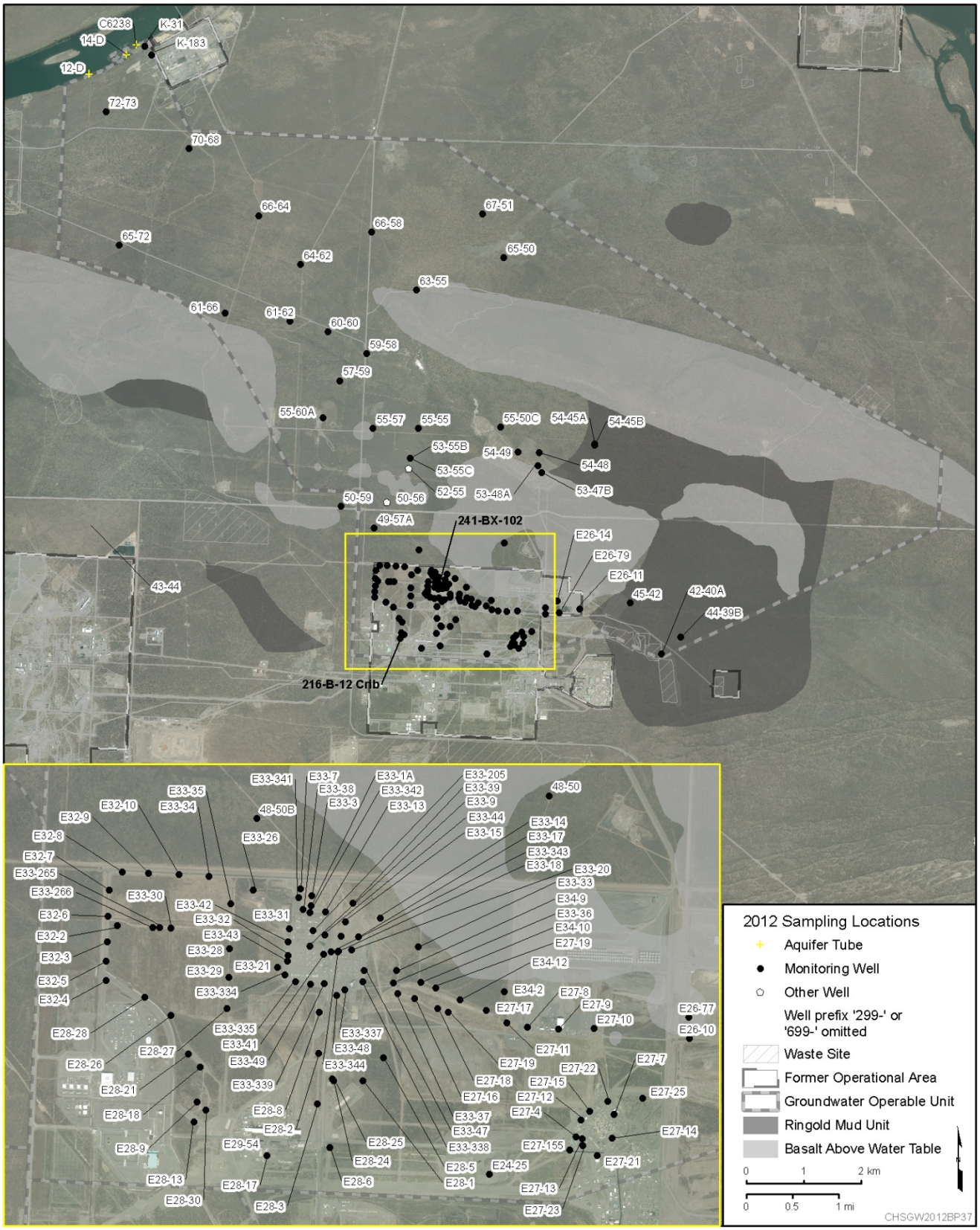


Figure BP.2 200-BP Plume Areas



Map BP.2 200-BP 2012 Sampling Locations

200-BP Nitrate

The most extensive plume in 2012 within 200-BP-5 was nitrate (Map BP.3). Nitrate sources have been identified as: BY Cribs, 216-B-7A&B Cribs, 216-B-8 Crib, 241-BX-102 unplanned release, releases with B tank farm, 216-B-12 Crib, 216-B-5 Injection Well, 216-B-2-2 Ditch, WMA C, and 216-A-29 pond.

BY Cribs. Nitrate inventories received at the BY Cribs in the past have migrated and continue to migrate through approximately 70 meters of vadose zone to groundwater. Well 299-E33-15, located approximately 350 meters southeast of the BY Cribs, had the maximum nitrate result, 1,570 mg/L in April 2012 (Figure BP.5). This is less than the historical maximum observed at well 299-E22-4 (i.e., 17,800 mg/L in 2008 before the well went dry). Past releases from this source are the prime reason for the plumes to the north and northwest of this site. Because of the southeast flow direction change in 2011 a concentrated plume from this source is now inferred to be migrating to the southeast as depicted in Figures BP.3 and BP.4 (Summer 2011 and Summer 2012, respectively).

B Tank Farm. The second highest nitrate concentration, 1540 mg/L, in the B Complex area was observed in well 299-E33-47 (Figure BP.5). The source of this isolated plume was determined to be associated with an unplanned release within the 241-B tank farm as discussed in DOE/RL-2012-53. The plume extent is shown in summer 2012 depiction. Contamination is increasing rapidly in this well even though the flow rate increased (Figure BP.5). Continued southeast migration of this plume is expected to extend beyond existing monitoring wells and additional wells are recommended to monitor the changing extent.

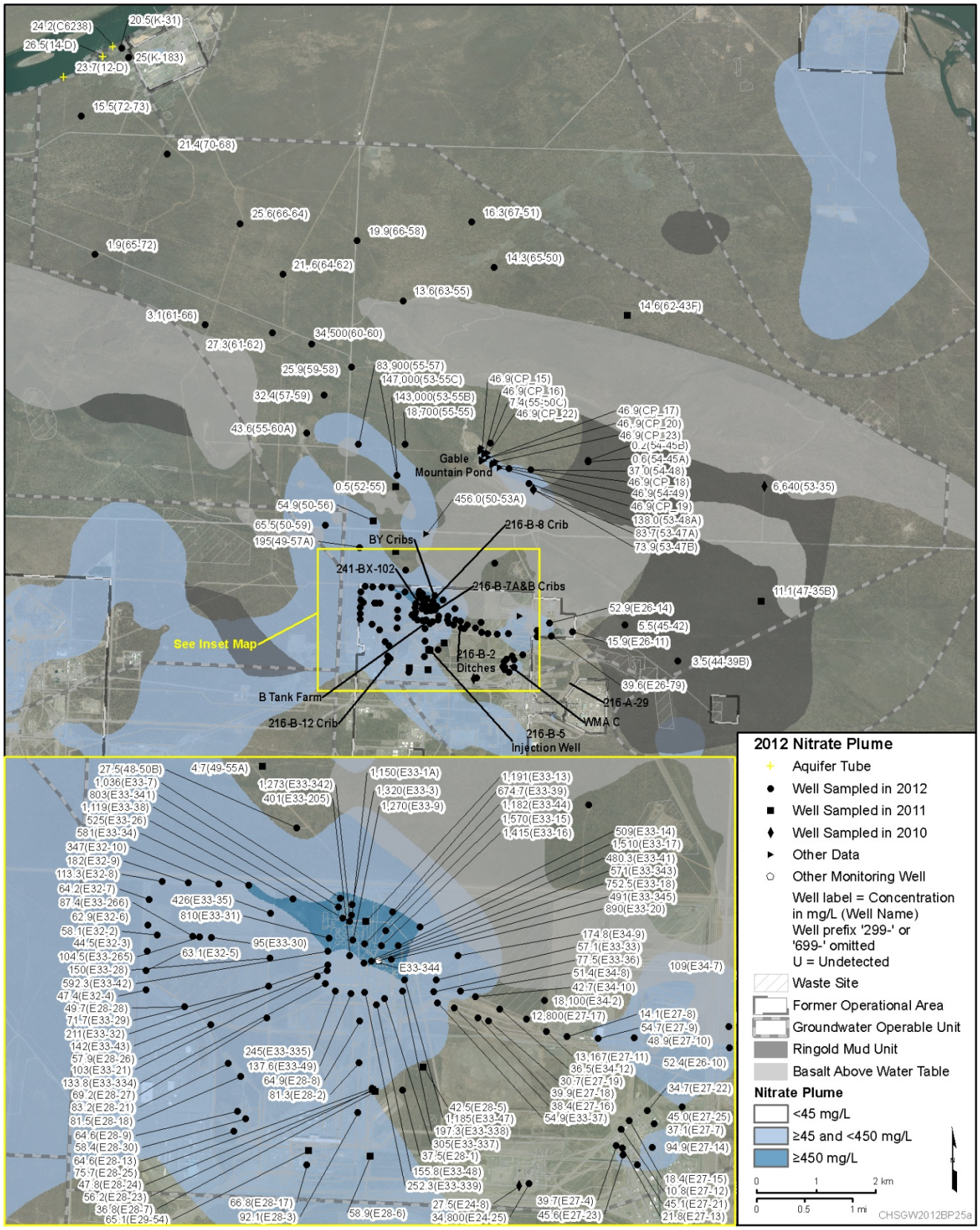
241-BX-102 Unplanned Release and 216-B-7A&B Cribs. Contaminated pore water within a perched water horizon, located approximately 3 meters above the unconfined aquifer is sourced from both the 241-BX-102 Unplanned Release and 216-B-7A&B Cribs. The perched horizon is monitored by well 299-E33-344. Nitrate at well 299-E33-344 has ranged between 326 to 810 mg/L since installation in 2007 (Figure BP.6). Estimated nitrate removed through extraction at 299-E33-344 is 180 kilograms through December 2012. Continued pumping at this well is planned for the foreseeable future.

216-B-12 Crib, B Plant, and 216-B-5 Injection Well. South of the 216-B-12 Crib nitrate concentrations increased slightly at well 299-E28-30, from 55.8 to 58.4 mg/L. Although the concentrations are only near the drinking water standard in the upper part of the aquifer at this well, greater nitrate concentrations were detected during RI depth discrete sampling in 2010. Concentrations at approximately 8 meters below the water table were nearly 900 mg/L. An estimate of the areal extent of the 450 mg/L boundary at approximately 8 meters below the top of the water table was provided in Figure 9-12 of DOE/RL-2011-01. To better assess the horizontal and vertical extent of the plume in this area, additional well installation is recommended. To the east nitrate increased from 67.7 mg/L in 2011 to 92.1 mg/L in 2012 at 299-E28-3.

216-B-2 Ditches. The nitrate concentrations, near the eastern portion of the 216-B-2 Ditches, in well 299-E27-10 have declined from 66.4 mg/L in February 2010 to 46.9 mg/L in October 2012. Nitrate concentrations also appear to be leveling off in wells 299-E26-10 to the east and 299-E27-9 to the west. To the south at well 299-E27-25, concentrations remain near the drinking water standard. It is expected that as concentrations decline at well 299-E27-10, the trend will follow at wells 299-E26-10, 299-E27-9, and 299-E27-25.

Waste Management Area C. Nitrate concentrations in five WMA C wells exceeded the drinking water standard in 2012. The greatest concentration (118 mg/L) was at well 299-E27-14, located on the southeast side of WMA C. The plume extends throughout the 15.5 meter thick aquifer. The nitrate concentration in the lower part of the aquifer has been stable, ranging between 68 and 72 mg/L.

Gable Mountain Pond (216-A-29). The highest nitrate concentration at the former Gable Mountain pond was 138 mg/L at well 699-53-48A. Over the previous 6 years, concentrations at this well have decreased from 210 mg/L. The aquifer at this well is approximately 2 meters thick as defined by the underlying basalt.



Map BP.3 200-BP 2012 Nitrate Plume

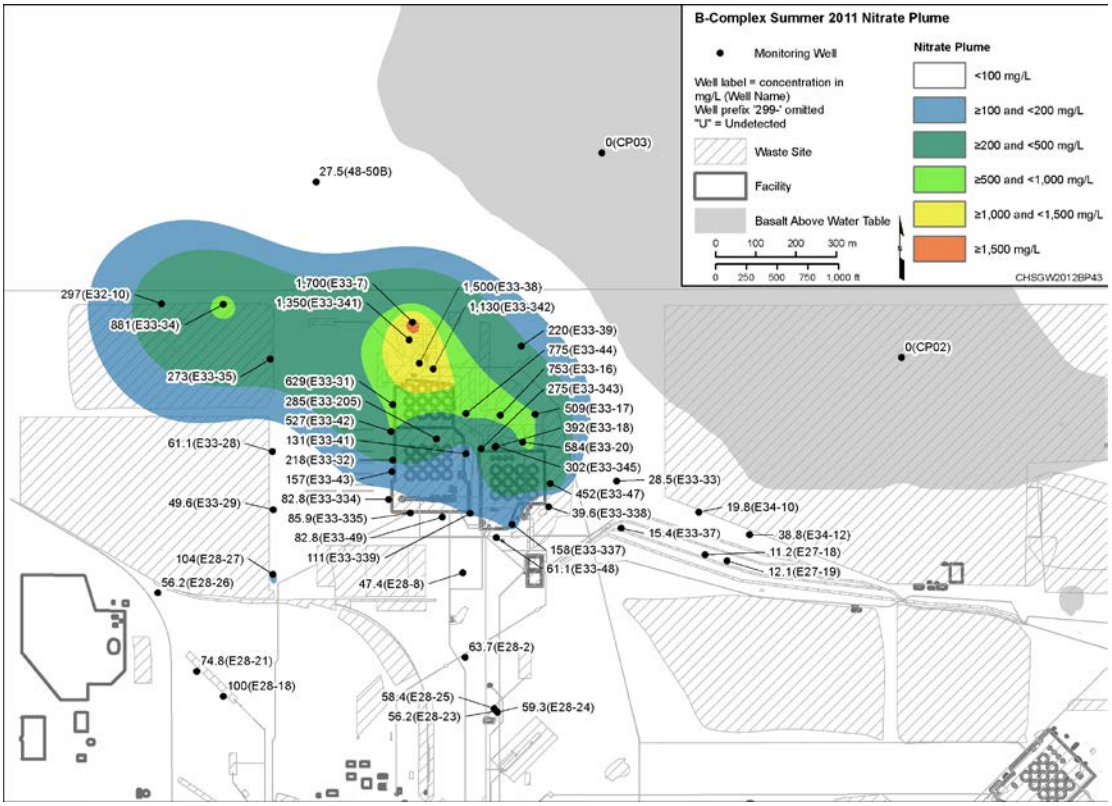


Figure BP.3 200-BP Nitrate Near BY Cribs, Summer 2011

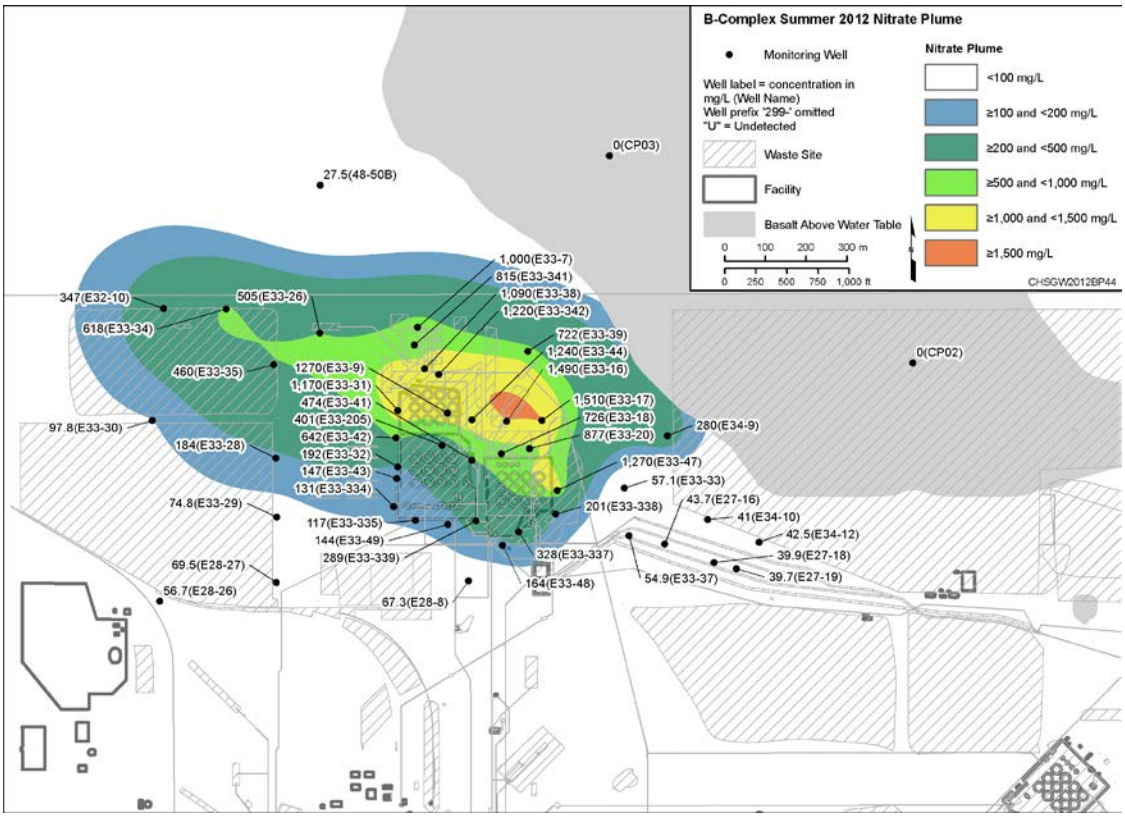


Figure BP.4 200-BP Nitrate Near BY Cribs, Summer 2012

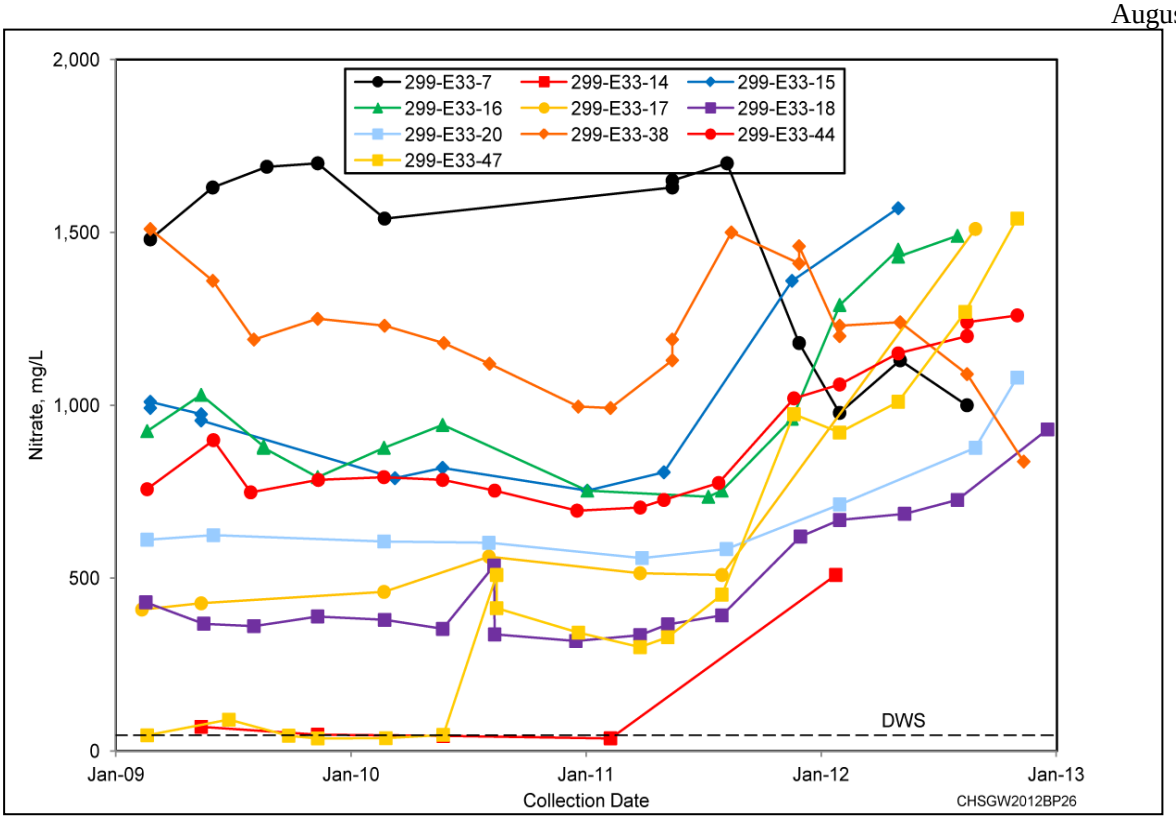


Figure BP.5 200-BP Nitrate Data for wells 299-E33-7, 299-E33-14, 299-E33-15, 299-E33-16, 299-E33-17, 299-E33-18, 299-E33-20, 299-E33-38, 299-E33-44, and 299-E33-47

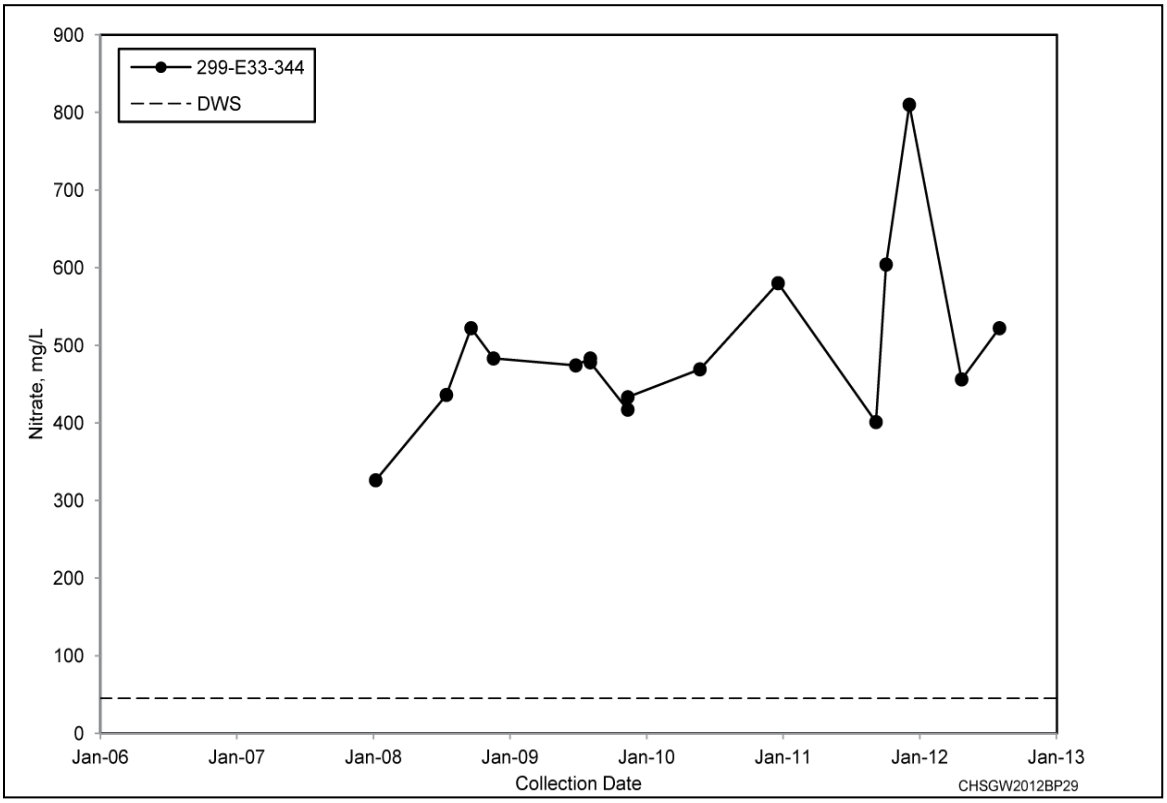


Figure BP.6 200-BP Nitrate Data for well 299-E33-344

200-BP Iodine-129

Three sources in the southeastern 200 East Area (216-A-10 Crib vicinity, 216-A-29 Ditch, and 216-B-3 Pond) were contributors to the widespread distribution of iodine-129 within the 200 East Area and Gable Gap (Map BP.4) . Other potential sources of iodine-129 to groundwater include the BY Cribs, 241-BX-102 unplanned release, and the 216-B-8 Crib. The plume area has remained steady until this year when it decreased. Two reasons for the decrease were identified as follows:

1) The iodine-129 plume northwest of 200 East Area is smaller. This change is driven by the decrease in iodine-129 in well 699-50-56 and the non-detect iodine-129 level (less than 0.26 pCi/L) in well 699-55-60A (Map BP.5).
2) The iodine-129 plume near B Pond was removed from the shallow unconfined aquifer because the contamination is considered to be within the Ringold mud unit and not in the upper aquifer.

Iodine-129 concentrations range from approximately 7 pCi/L near WMA C (299-W27-12) to approximately 1 pCi/L at wells in the Gable Gap. The northwest plume extent reflects the primary flow path in the late 1980s when discharges to Gable Mountain Pond were terminated.

Iodine-129 near B Pond

Seven wells were sampled and analyzed for iodine-129 near B Pond within 200-BP-5 in 2012. All of the results were less than 2010 or 2011 results by 0.1 to 3.03 pCi/L. The activity at well 699-43-45, downgradient of B Pond, decreased in activity the most, 9.98 pCi/L in 2011 to 6.95 pCi/L in 2012. Wells 699-42-42B and 699-43-41G were the only other wells which exceeded the drinking water standard. As a result, the drinking water standard contour at B Pond was decreased in areal extent.

Iodine-129 near Waste Management Area C

All of the wells at WMA C had iodine-129 levels exceeding the drinking water standard (see plume map), and are associated with a relatively large 200 East iodine-129 plume. The levels fluctuated in 2012, ranging from 1.3 to 7.45 pCi/L. Generally, lower concentrations of iodine-129 were detected in June sampling as compared to September. Concentrations of iodine-129 detected near WMA C have been relatively consistent over the past two decades.

Iodine-129 near Low-Level Waste Management Area 2

Elevated iodine-129 has been detected in the wells along the south side of LLWMA-2 since monitoring began in the early 1990s. The highest concentration was in well 299-E27-10 when sampling began, but has continued to decline and is currently near the drinking water standard. Only wells 299-E27-8, 299-E27-9, and 299-E27-10 continue to have activity levels greater than the drinking water standard south of the burial grounds. These wells define the northern and western extent of iodine-129 in this area.

Iodine-129 near the 216-B-5 Injection Well

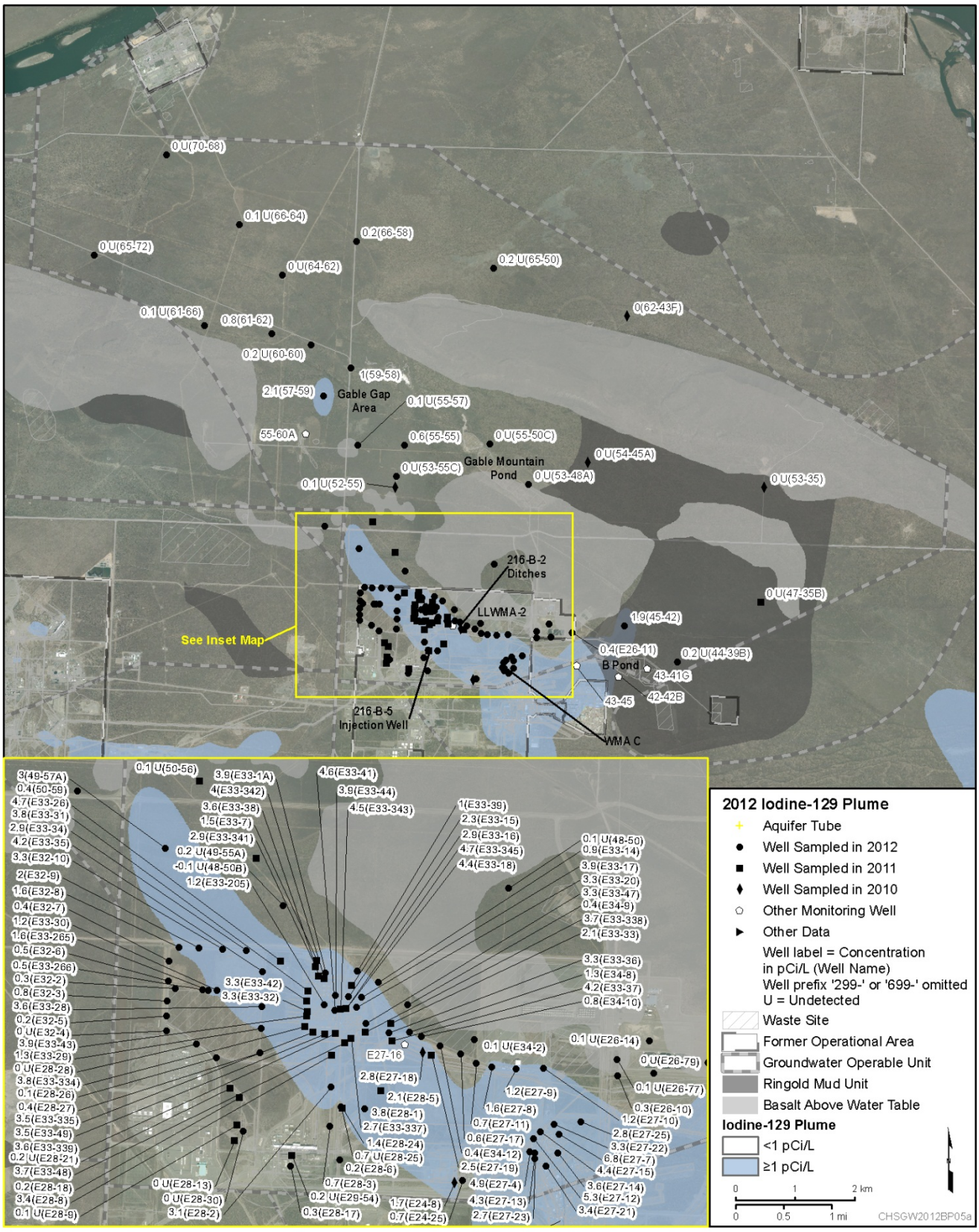
The spatial distribution of iodine-129 at wells near the 216-B-5 Injection Well indicates a source to the east of the site. The 1 pCi/L drinking water standard contour extends south of this waste site, between wells 299-E28-3 and 299-E28-24 (see plume map).

Iodine-129 near 216-B-2 Ditches

Elevated iodine-129 levels were detected in wells beneath the 216-B-2 Ditches as early as the 1990s. Past levels were greatest in well 299-E33-36, located north of the head end of the ditches. In 2012, iodine-129 concentrations in thirteen wells (i.e., 299-E33-36, E33-33, E33-37, E27-16, E27-18, E27-19, E33-47, E33-338, E33-337, and E33-48) in the vicinity of the 216-B-2 ditches were evaluated. Over the past three years, the iodine-129 concentration in these wells ranged between 1.84 and 4.76 pCi/L, with no clearly-discernible spatial distribution patterns.

Iodine-129 near B Complex to Gable Gap

The wells sampled in this area in 2012 did not show changes from 2011. In Gable Gap, the 1 pCi/L iodine-129 contour was contracted to wells 699-57-59 and 699-59-58 based on the change in groundwater flow that began in 2011.



Map BP.4 200-BP 2012 Iodine-129 Plume

200-BP Technetium-99

Technetium-99 sources have been identified at: BY Cribs, 216-B-7A&B Cribs, 216-B-8 Crib, 241-BX-102 unplanned release, releases with B tank farm, and WMA C. Estimated plume distribution is shown in Map BP.5.

BY Cribs. Technetium-99 in 200-BP groundwater is primarily from liquid waste associated with the BY Cribs, which received between approximately 14 and 25.5 Ci of technetium-99 (Appendix C of RPP-26744). Concentrations of technetium-99 increased between the mid-1990s and 2009 (Figure BP.7). During this time plumes primarily migrated north and northwest of this site (Map BP.5). Since 2009, concentrations have declined up to 17,000 pCi/L beneath the BY Cribs and now range between 20,000 to 28,000 pCi/L. The decrease is attributed to the observed change in groundwater flow direction to the southeast compared to northwesterly in previous years. Because of the southeast flow direction the technetium-99 plume is now inferred to be migrating to the southeast as depicted in Figures BP.8 and BP.9.

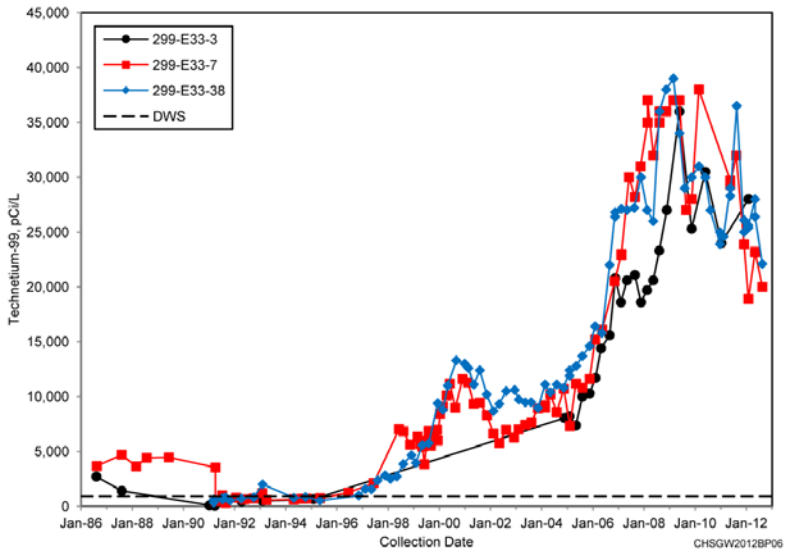


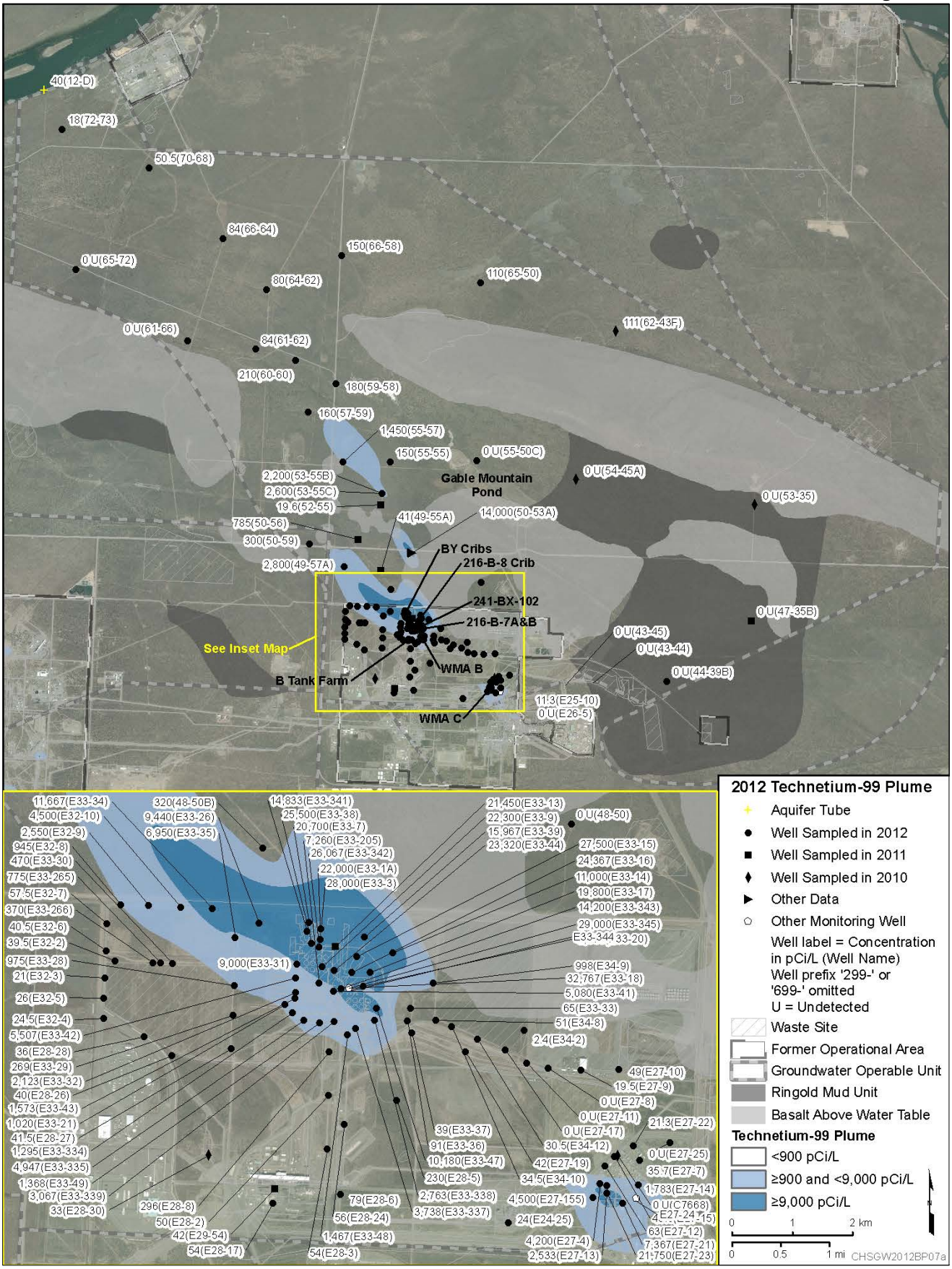
Figure BP.7 200-BP Technetium-99 Data for wells 299-E33-3, 299-E33-7, and 299-E33-38

241-BX-102 Unplanned Release and 216-B-7A&B Cribs. The highest technetium-99 activity in 200-BP-5 was located at well 299-E33-18, with a 2012 maximum of 35,100 pCi/L. The technetium-99 to nitrate ratio associated with this hotspot is different than the other plumes because of greater technetium-99 activity and lower nitrate concentration than beneath other source sites (Figure BP.10). This is consistent with the type of waste released, metal waste from the 241-BX-102 tank. By comparison, the technetium-99 to nitrate ratio in perched well 299-E33-344 is much lower because of the mixing with 216-B-7A&B waste. Estimated technetium-99 removed through extraction at 299-E33-344 is 7.95×10^{-3} curies through December 2012.

Two other small plumes of technetium-99, located along the south boundary of the 241-B and BX tank farms, at wells 299-E33-337 and 299-E33-339 may be related to the 241-BX-102 unplanned release; however, the technetium-99 to nitrate ratios at wells 299-E33-337 and 299-E33-339 is different from wells 299-E33-18 and 299-E33-343, which are considered sourced by the 241-BX-102 unplanned release (Figure BP.10). Other sources within the 241-B and BX tank farms are currently under assessment as discussed in DOE/RL-2012-53.

B Tank Farm. A new contaminant source was identified in 2012 at the 241-B tank farm, affecting two groundwater wells, 299-E33-47 and 299-E33-338 (Figure BP.9). Two observations at well 299-E33-47 differentiate this plume from the upgradient 241-BX-102 unplanned release: (1) the technetium-99 to nitrate ratio, and (2) the presence of cyanide. The source is considered to be associated with at tributyl phosphate waste release as discussed in DOE/RL-2012-53.

Waste Management Area C. Seven of the twelve WMA C monitoring wells had technetium-99 concentrations exceeding the 900 pCi/L drinking water standard (Figure BP.11). Activity is trending down in well 299-E27-23, which has had the greatest activity of all WMA C wells for the past 6 years. Activity is also decreasing at wells 299-E27-4 and 299-E27-155. The decline in the wells appears to be associated with the flow direction and rate change. Concentrations have been increasing in wells 299-E27-21 and 299-E27-24 since the flow direction change and the wells are now considered downgradient of the technetium-99 plume near well 299-E27-23. Well 299-E27-13, located just north of well 299-E27-23 also increased in technetium-99 activity between March and September 2012. The increase may be associated with the redirection of past migration towards well 299-E27-4. Finally, well 299-E27-14 continues to range between 1,500 and 2,600 pCi/L since 2006.



Map BP.5 200-BP 2012 Technetium-99 Plume

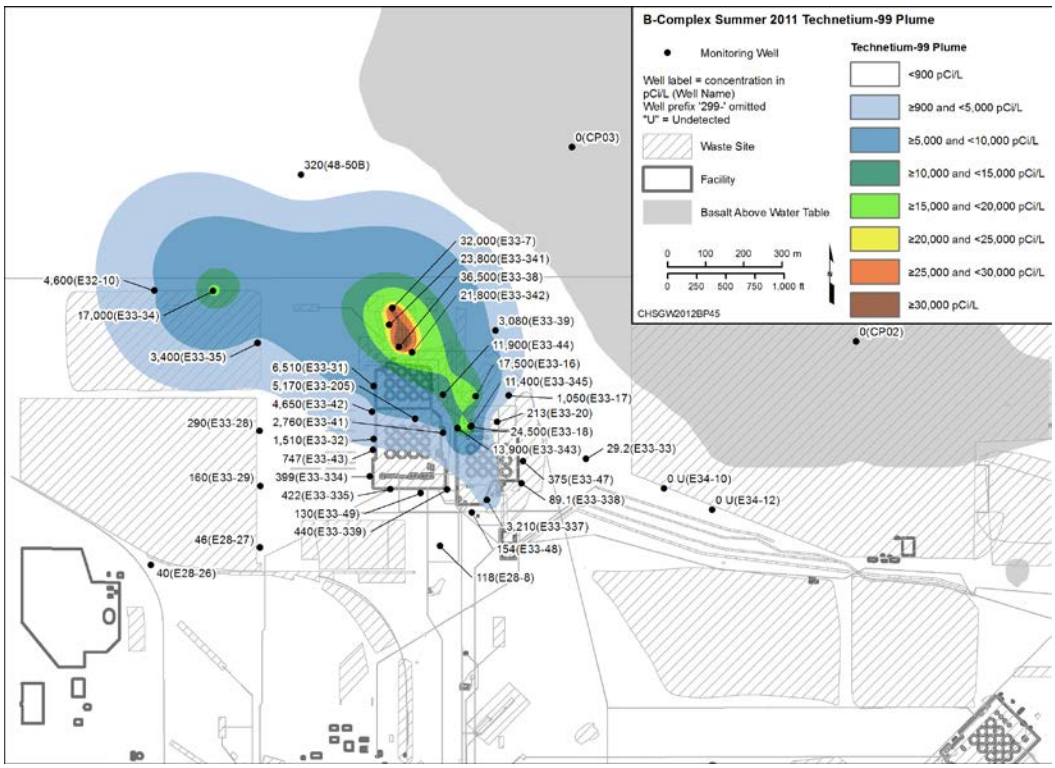


Figure BP.8 200-BP Technetium-99 near BY Cribs, August 2011

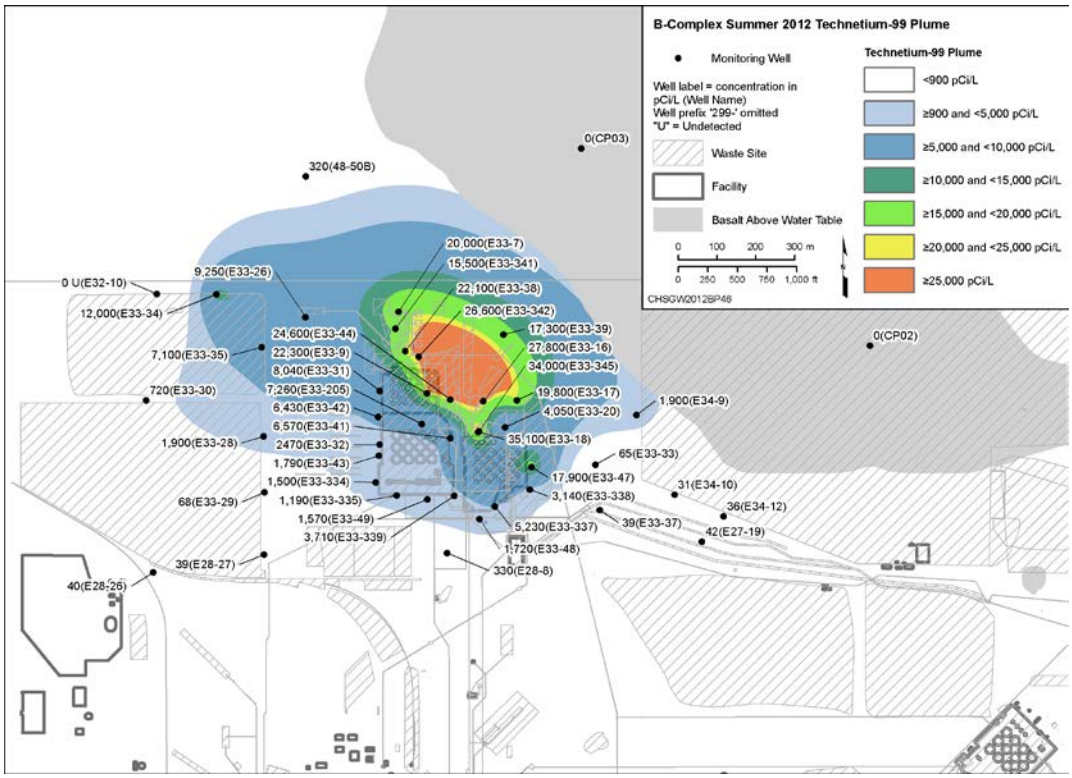


Figure BP.9 200-BP Technetium-99 near BY Cribs, August 2012

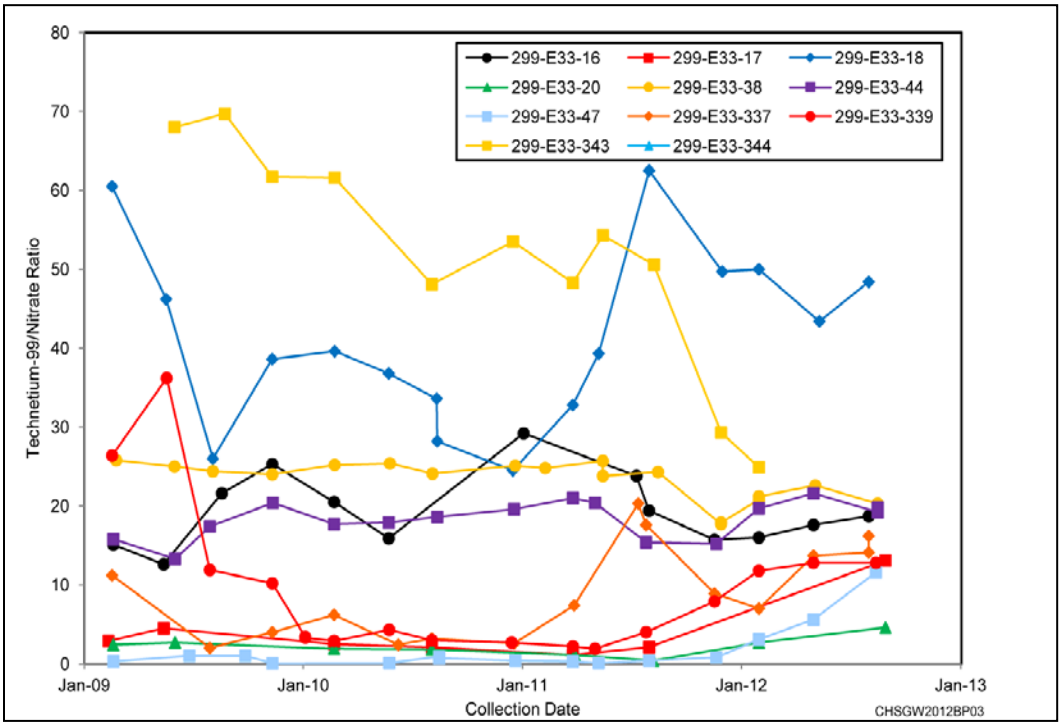


Figure BP.10 200-BP Technetium-99 Data for wells near 216-B-7A&B

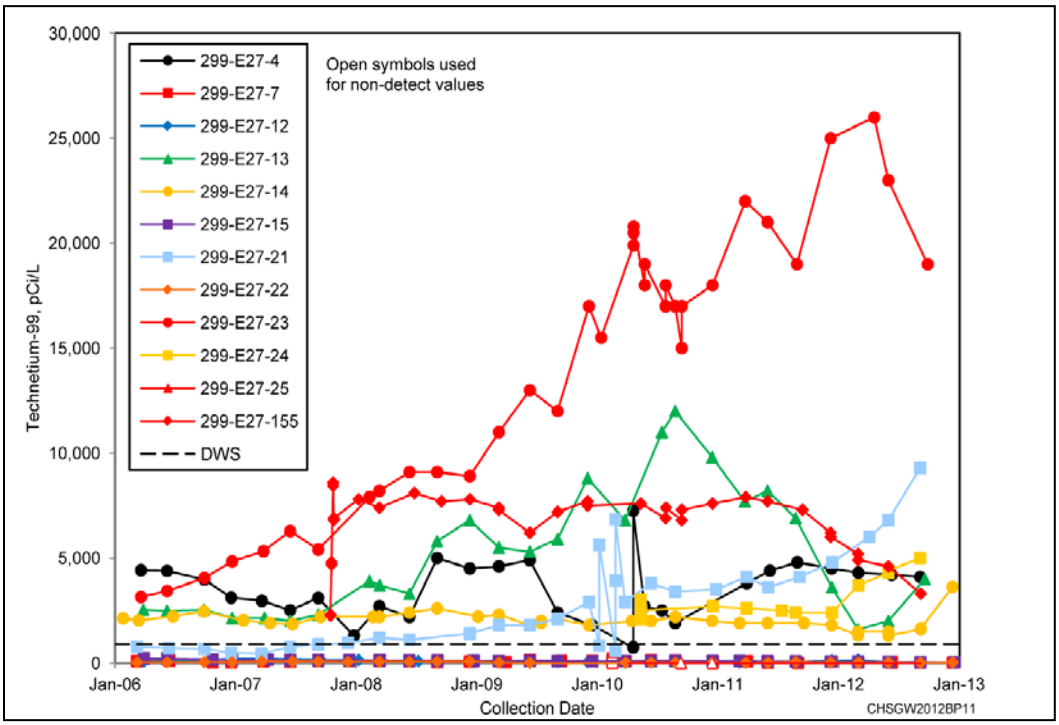


Figure BP.11 200-BP Technetium-99 Data for wells near BY Cribs

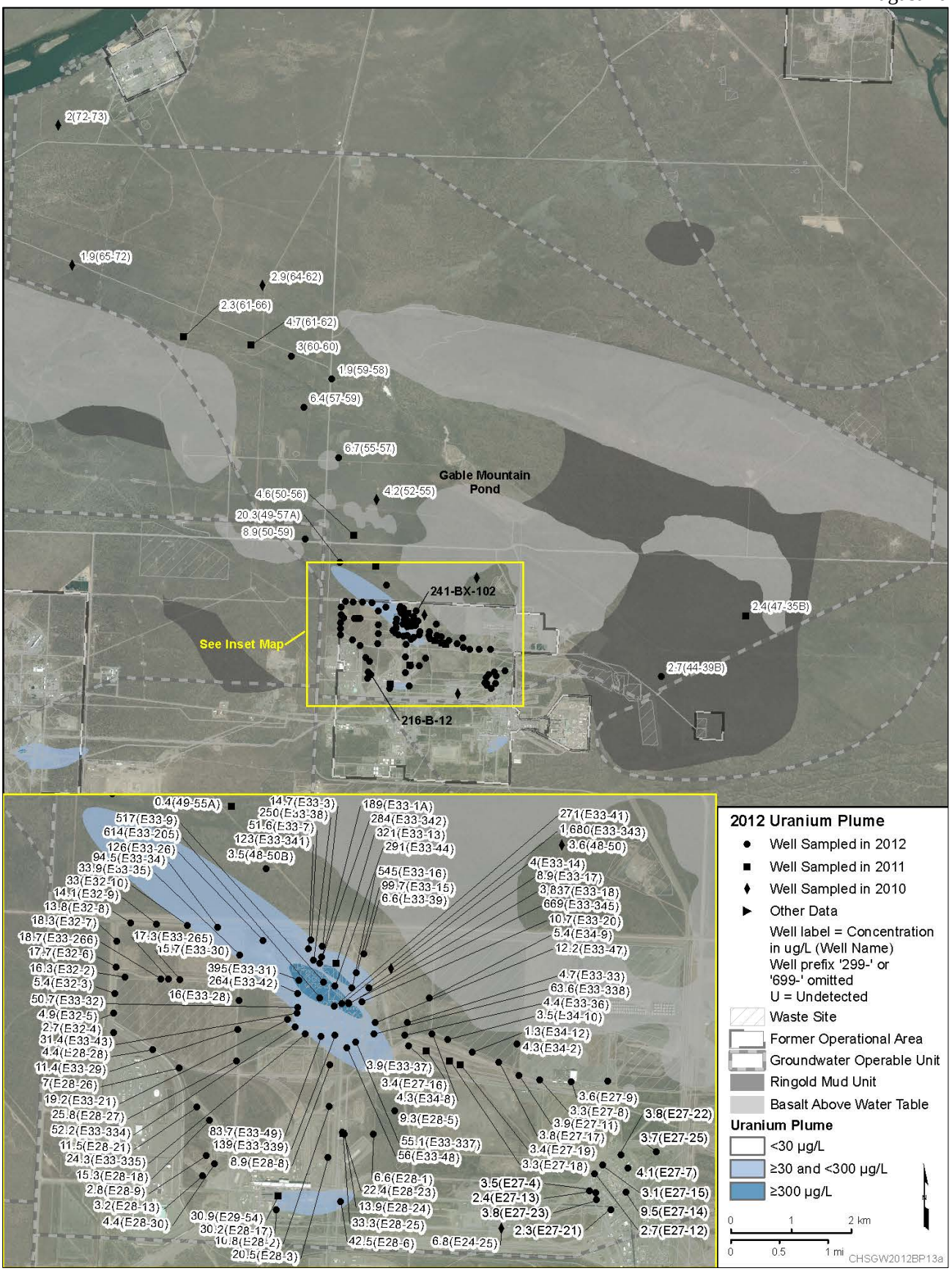
200-BP Uranium

Uranium found in 200-BP-5 groundwater primarily originated from large disposal inventories to the 216-B-12 Crib and the 241-BX-102 unplanned release (see Map BP.6). The uranium inventory disposed to these sites exceeded 10,000 kilograms, which is at least an order of magnitude greater than other waste sites within 200-BP.

216-BX-102 Unplanned Release. Rough order of magnitude calculations indicated that 1,050 kilograms of water-extractable uranium might reside in the Cold Creek silt-dominated unit approximately 3 meters above the aquifer (Figure BP.12). This estimate was based on sample results from three boreholes in an east-west orientation within the perched water zone. To address the groundwater impact associated with contaminant migration from the perching horizon, DOE initiated a perched water treatability test in 2011. Approximately 14 kg of uranium has been removed within this horizon.

Well 299-E33-18 had the greatest groundwater uranium concentration (4,470 µg/L) in the 200-BP-5 operable unit in 2012. This well is located 39 meters 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 (Figure BP.13). The maximum result at well 299-E33-343 was 5,500 µg/L in June 2009. The migration of the high-concentration portion of this plume is attributed to the groundwater flow direction change from the northwest to the southeast. The results of this flow change are seen by comparing the spatial distribution of the uranium plume from summer 2011 (Figure BP.14), when the flow change was initiated, and summer 2012 (Figure BP.15). Continued southeast migration of the uranium plume beneath the 241-B and BX tank farms will extend beyond existing monitoring wells in the near future and, therefore, additional wells are recommended along the proposed flow pathway.

216-B-12 Crib. The source of the uranium plume near well 299-E28-18 has been linked to the 216-B-12 Crib, as discussed further in DOE/RL-2011-01. The extent of the uranium plume in this area is difficult to evaluate because of the relatively low number of wells in this area, but is believed to be defined to the east by wells 299-E28-2, 299-E28-3, and 299-E28-25 (see Map BP.7). A south plume defined by wells 299-E28-6, 299-E28-17, and 299-E29-54 is also considered to be sourced by the 216-B-12 Crib. Another difficulty expressing the extent of uranium in this area is the depth at which concentrated uranium was found during Remedial Investigation drilling at wells 299-E28-30. The highest concentrations were detected approximately 8 meters below the water table. The wells in this area are not screened to that depth or are not screened in the interval where the highest concentrations were detected. Therefore, it is recommended that additional wells be installed and screened at depths to monitor the changing conditions of the plume near the 216-B-12 Crib and B Plant area.



Map BP.6 200-BP 2012 Uranium Plume

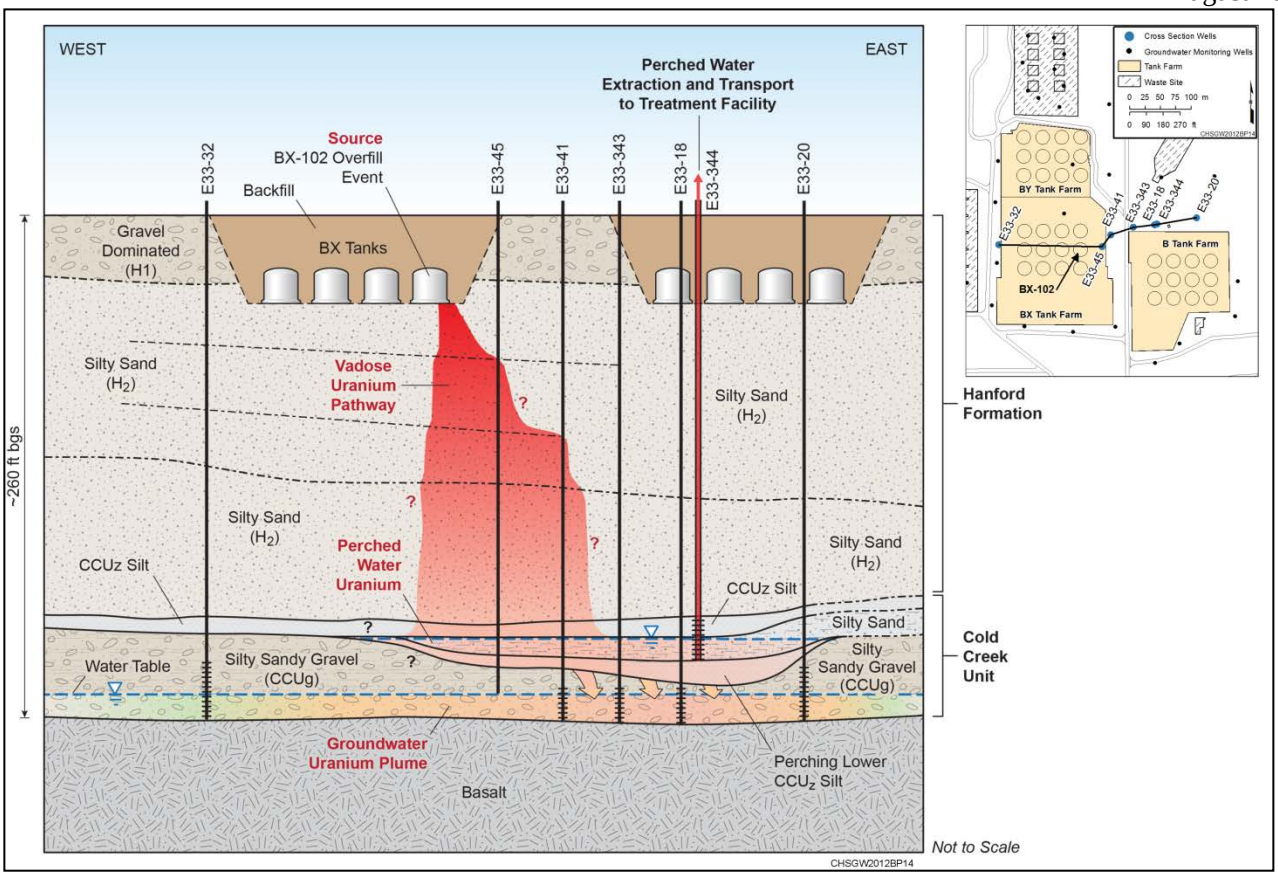


Figure BP.12 200-BP Uranium Conceptual Site Model for 216-BX-102 Unplanned Release

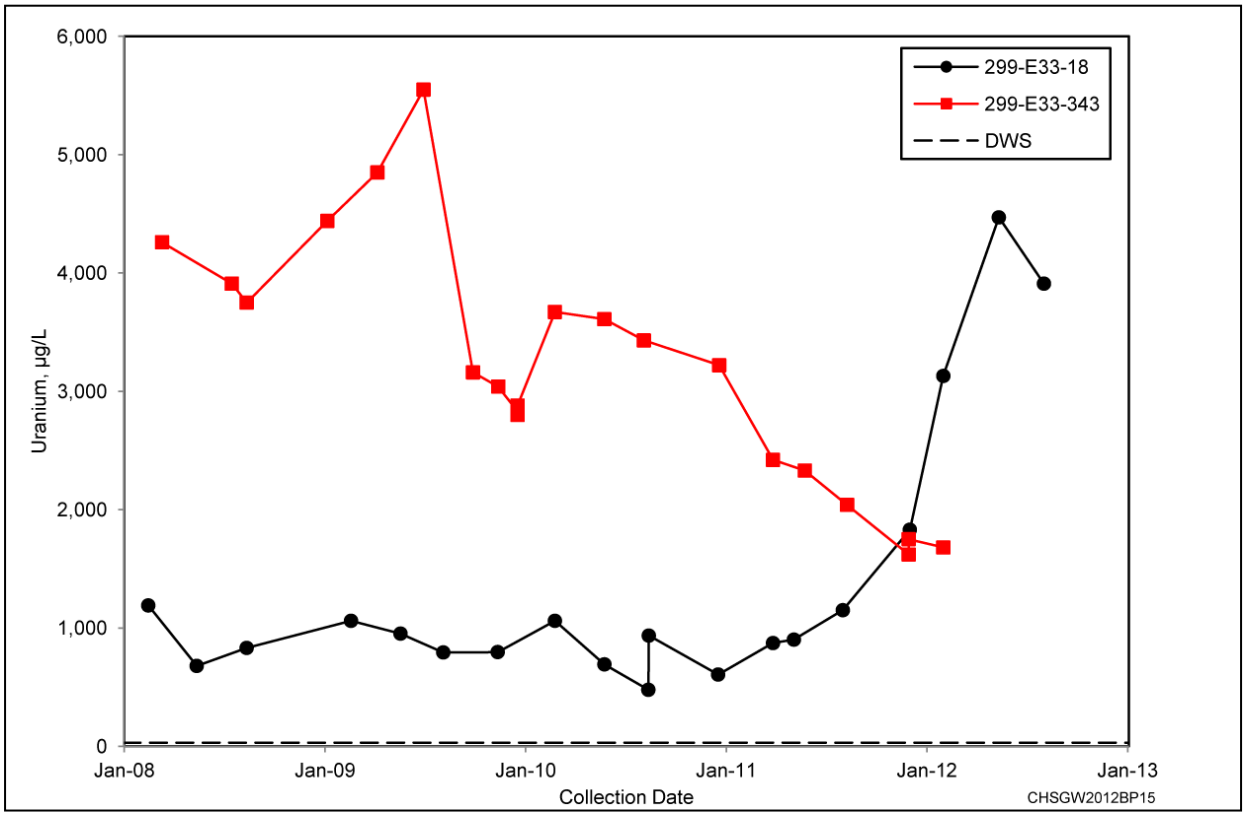


Figure BP.13 200-BP Uranium Data for wells 299-E33-18 and 299-E33-343

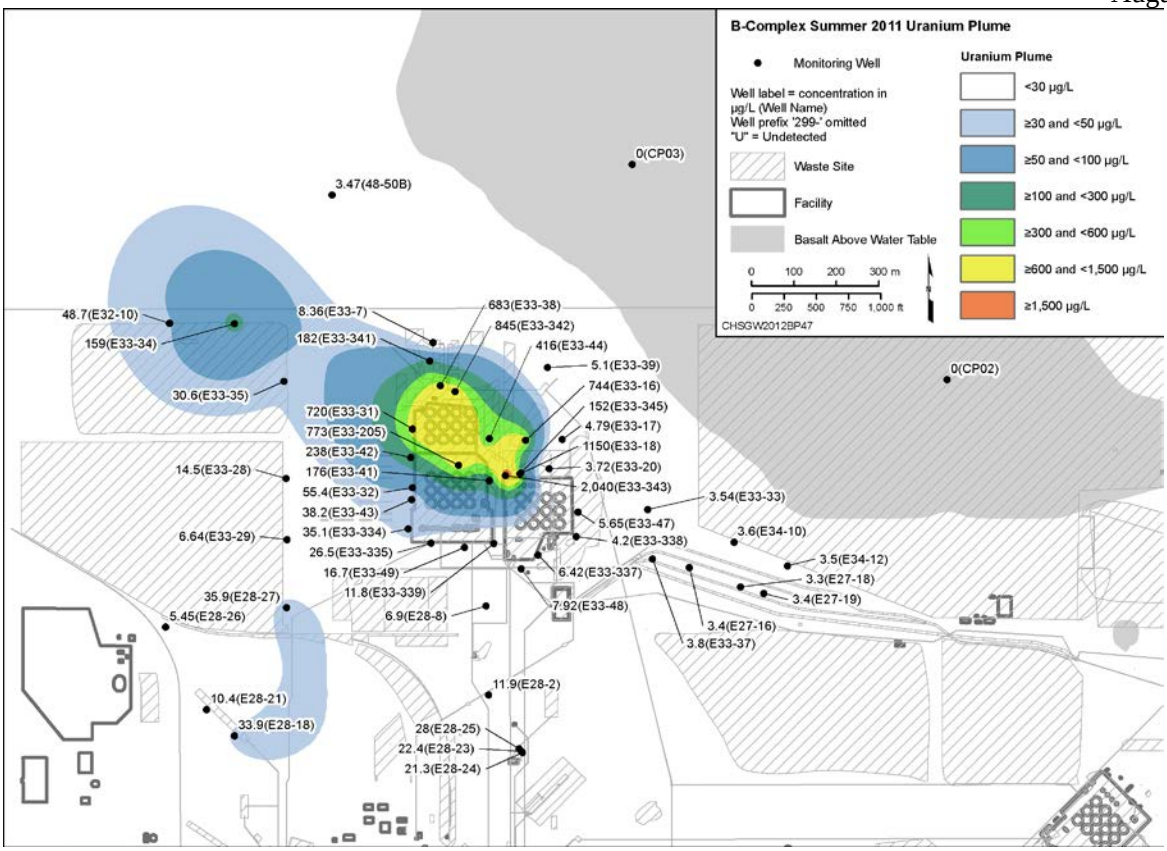


Figure BP.14 200-BP Uranium near WMA B-BX, Summer 2011

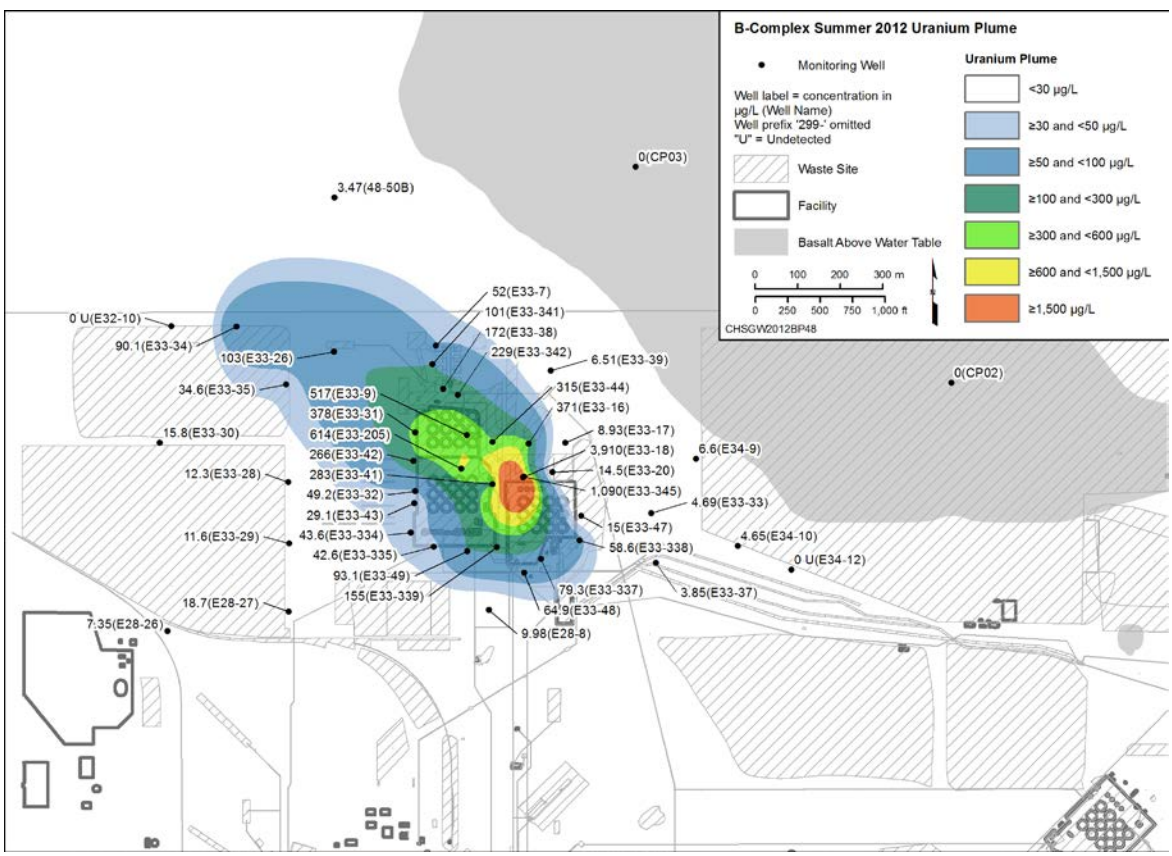


Figure BP.15 200-BP Uranium near WMA B-BX, Summer 2012

200-BP Strontium-90

Strontium-90 is only found at two locations, the former Gable Mountain Pond (inactive and dry since the mid to late 1980s) and the 216-B-5 Injection Well, within 200-BP (see Map BP.7). The reason these two locations have strontium-90 in the groundwater is because of the limited vadose zone exchange sites for sorption. At Gable Mountain Pond the vadose zone thickness is less than 12 meters, while the 216-B-5 Injection Well extends into the aquifer.

Gable Mountain Pond. The greatest historical strontium-90 activity reported at Gable Mountain Pond has been at well 699-53-47A (beneath the southeastern portion of the once active pond). The activity at this well has steadily decreased from 1,320 pCi/L in 1997 to 301 pCi/L the last time it was sampled in 2010 (Figure BP.16). A sample from this well was unsuccessful in 2012 because of limited water. A television survey of the well revealed approximately 0.46 meter of water. Another attempt to sample this well is scheduled in 2013. If the attempt is unsuccessful, this well will be a candidate for decommissioning.

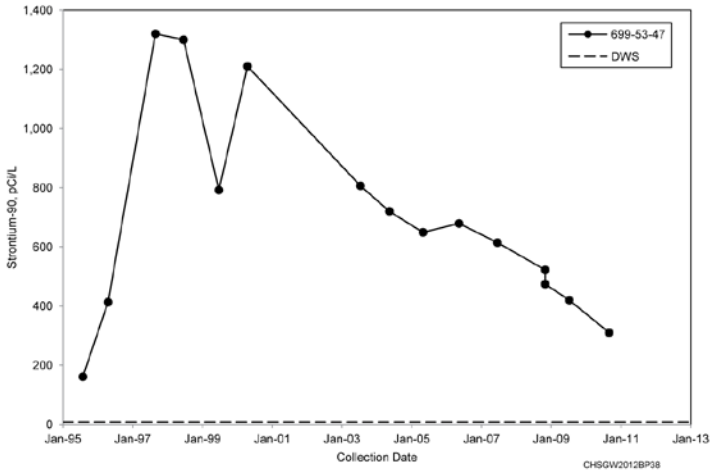


Figure BP.16 200-BP Strontium-90 Data for well 699-53-47A

Five other wells were sampled at Gable Mountain Pond in 2012. Those sampled were 699-53-47B, 699-53-48A, 699-54-48, 699-54-49, and 699-55-50C. Four of the wells had detectable levels of strontium-90, ranging from 21 to 250 pCi/L. Well 699-55-50C, located to northwest of Gable Mountain Pond contains no detectable strontium-90. The greatest activity of the four wells came from well 699-53-47B, located next to well 699-53-47A. Well 699-53-47B has also shown a decreasing trend in strontium-90 activity since 1998, most recently from 320 to 250 pCi/L between 2009 and 2012.

216-B-5 Injection Well. Strontium-90 has relatively low mobility in the subsurface, as mentioned above, and does not migrate significant distances within the aquifer. Confirmation of this has been seen by the significant number of less than detect results in wells northwest of the 216-B-5 Injection Well over the past two plus decades. Out of 210 samples collected between 1986 and 2012, strontium-90 was detected only 11 times. The detection results ranged between 0.372 and 2.2 pCi/L, which is below the 8 pCi/L drinking water standard. The lack of detections indicates strontium-90 from the 216-B-5 Injection Well is less mobile than modeled in DOE/RL-95-59.

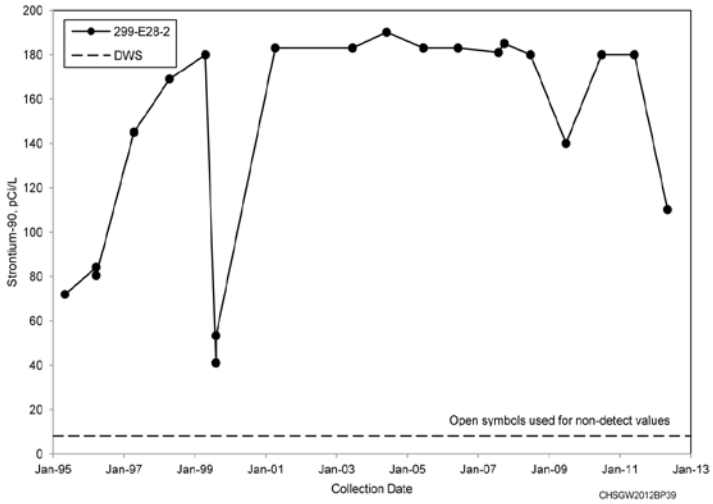
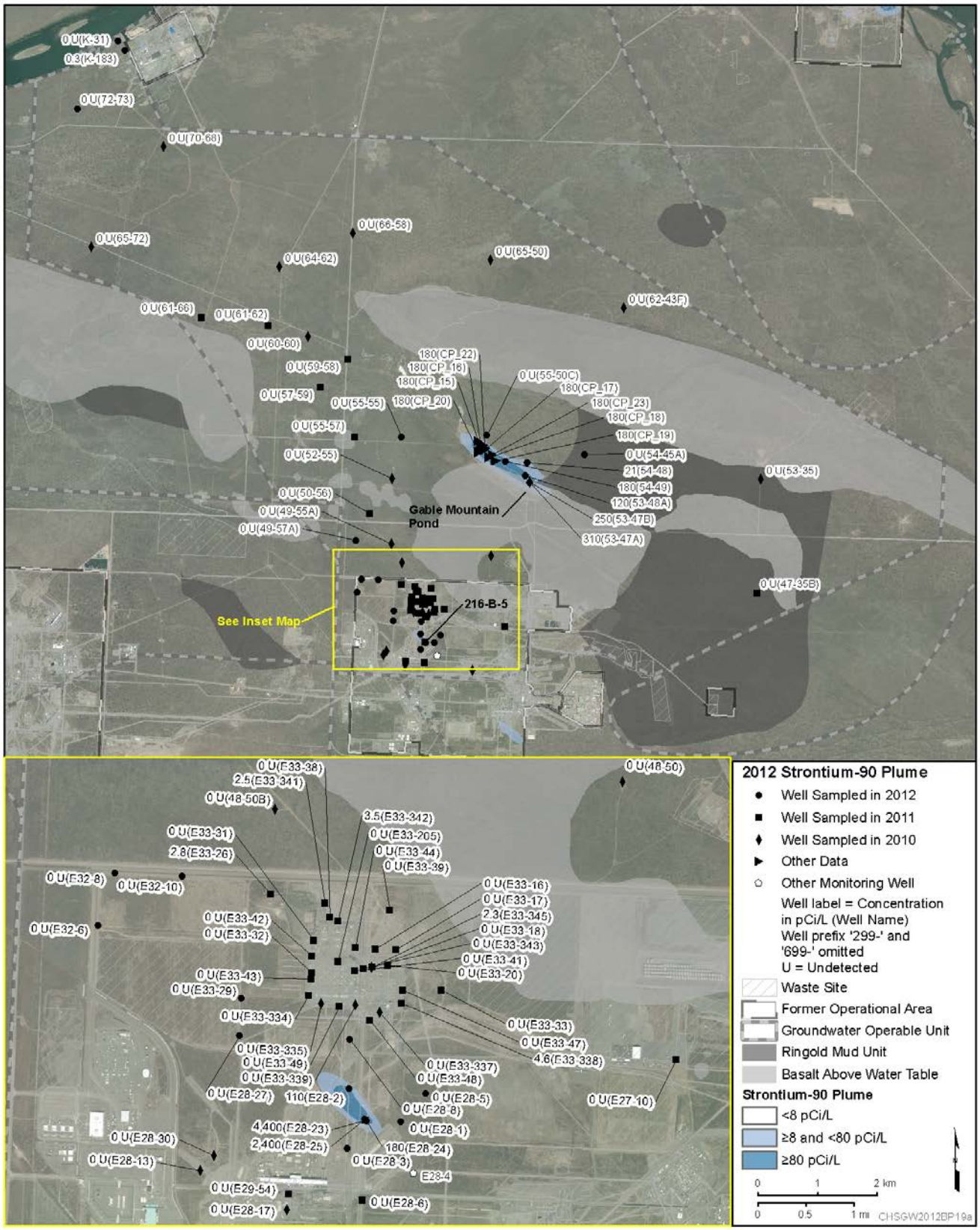


Figure BP.17 200-BP Strountium-90 Data for well 299-E28-2

As of 2012 only four wells exceeded the drinking water standard near the 216-B-5 Injection Well: 299-E28-2, 299-E28-23 through 299-E28-25. At well 299-E28-2, located approximately 150 meters northwest of the 216-B-5 Injection Well, the activity decreased from 180 to 110 pCi/L (Figure BP.17). At well 299-E28-24, located 5 meters southeast of the 216-B-5 Injection Well, the activity decreased from 350 to 180 pCi/L. At well 299-E28-25, located approximately 7 meters northwest of the 216-B-5 Injection Well, the activity increased from 2,200 to 2,400 pCi/L. Because of changing groundwater flow conditions in the 200 East Area the additional well sampled in 2011, 299-E28-1, east of the 216-B-5 Injection Well was retained to identify possible strontium-90 migration. Also, well 299-E28-4 was added to the schedule in 2013.



Map BP.7 200-BP 2012 Strontium-90 Plume

200-BP Cyanide

Cyanide found in 200-BP-5 groundwater originated from disposal of tributyl phosphate wastes scavenged for cesium-137. After scavenging was completed, the tank supernatant, including remaining dissolved ferrocyanide compounds, was discharged to the BY Cribs. Therefore, cyanide found in 200-BP-5 groundwater originated from disposal to the BY Cribs. In the late 1990s, cyanide concentrations began to increase in groundwater beneath the BY Cribs along with nitrate and technetium-99. Low concentrations of cyanide detected in the vicinity of WMA-C are attributed to historical releases of ferrocyanide-containing waste at that facility.

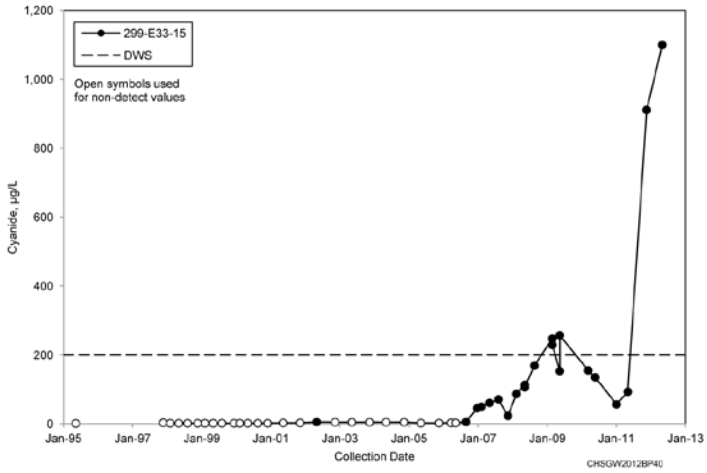


Figure BP.18 200-BP Cyanide Data for well 299-E33-15

BY Cribs

The distribution of cyanide above the 200 µg/L drinking water standard extends both northwest and southeast from the BY Cribs (see Map BP.9). The plume configuration has contracted from the northwest and expanded to the southeast since the flow reversed from northwest to the southeast in 2011, as seen with the other co-contaminants in the same area.

The maximum 2012 cyanide concentration in 200-BP-5 was from well 299-E33-15 (1,100 µg/L), located approximately 350 meters southeast of the BY Cribs. The 2012 maximum was 400 µg/L less than the value reported in 2011 (Figure BP.18), which was located beneath the BY Cribs. In five other wells (299-E33-14, 299-E33-16, 299-E33-17, 299-E33-39, and 299-E33-44) southeast of the BY Cribs, cyanide concentrations were detected above the drinking water standard for the first time in 2012.

One other well (299-E33-47), located southeast of the BY Cribs and east of the 241-B tank farm, also had cyanide concentrations exceeding the drinking water standard for the first time in 2012. Concentrations in this well were greater than upgradient wells to the north and northwest.

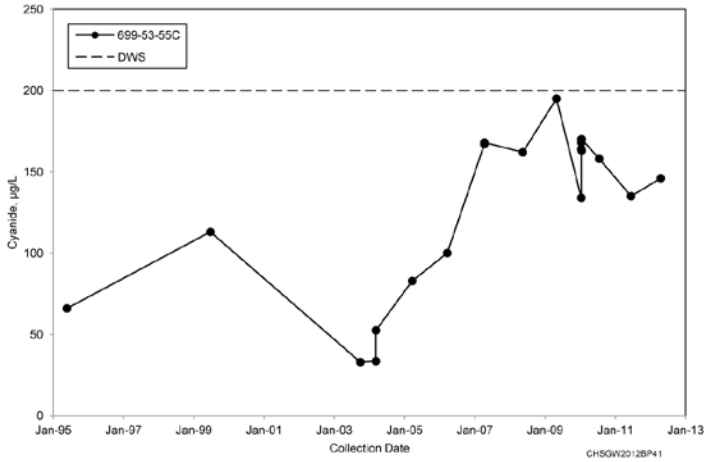
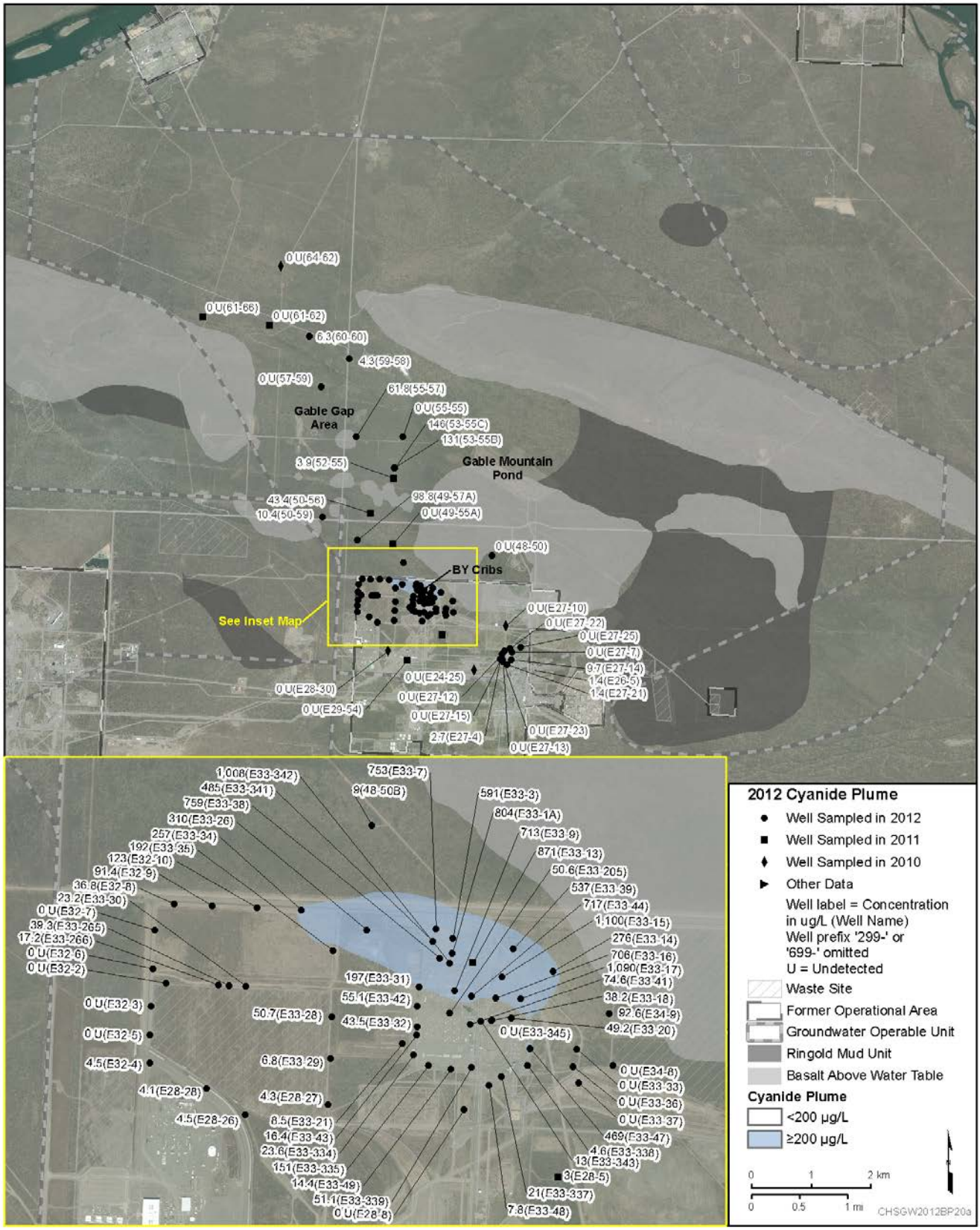


Figure BP.19 200-BP Cyanide Data for well 699-53-55C

Gable Gap

Cyanide concentrations to the north, near Gable Gap, have decreased in recent years. The greatest cyanide concentration associated with this plume is at well 699-53-55C. Concentrations have decreased at this well from 195 µg/L in 2009 to 146 µg/L in 2012 (Figure BP.19). Concentrations in other wells (699-53-55B and 699-55-57) have also decreased.



Map BP.8 200-BP 2012 Cyanide Plume

200-BP Tritium

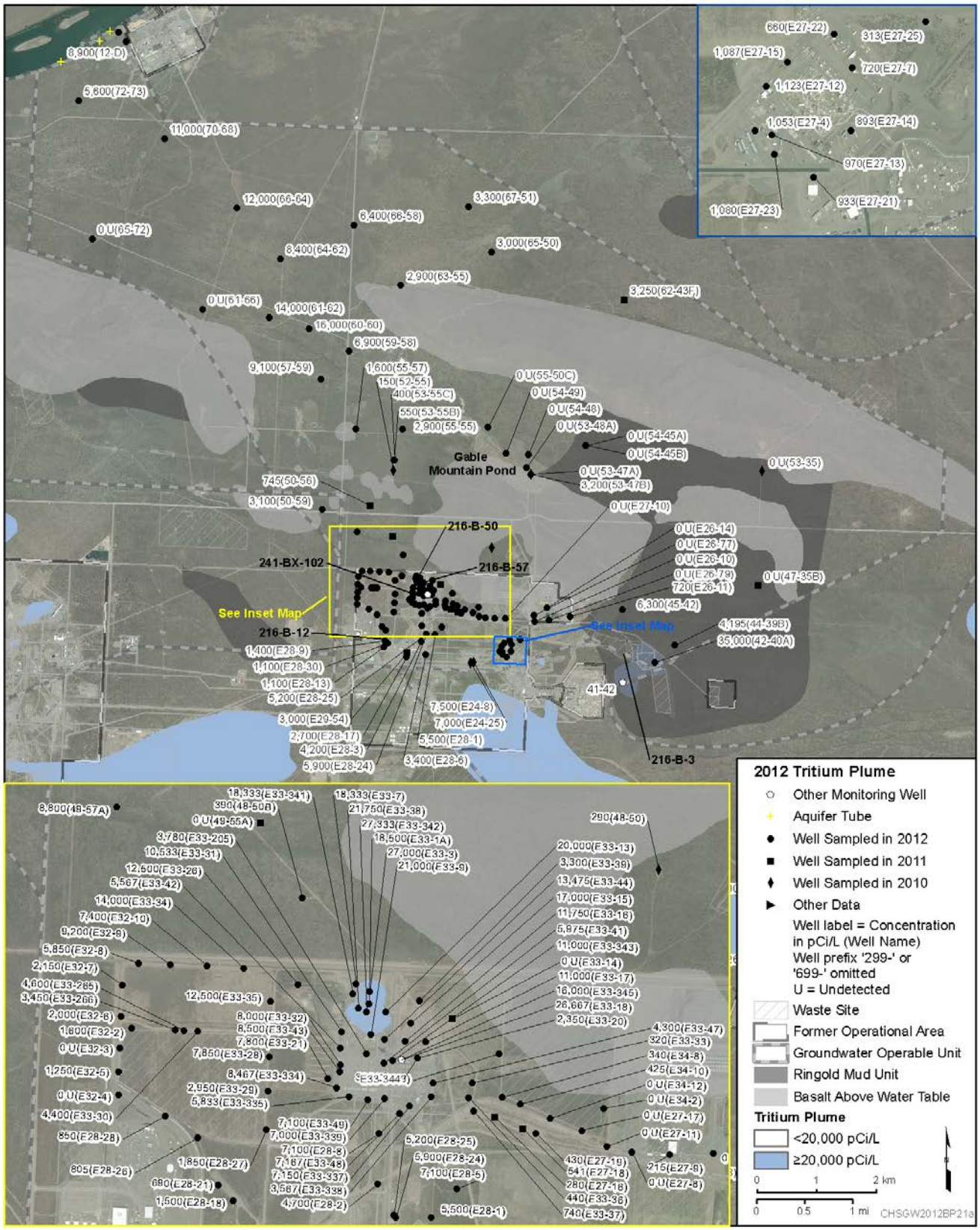
Over the past 9 years, the tritium plume size exceeding the drinking water standard in the upper part of the unconfined aquifer within 200-BP-5 has decreased significantly. The decline is attributed with radioactive decay, dispersion, and possibly diminishing levels of drainage from the vadose zone at certain sites. In 2012, tritium exceeding the drinking water standard was limited to 4 locations (see Map BP.9): beneath the 216-B-50 and 216-B-57 Cribs, beneath the 241-B tank farm, beneath the 216-B-12 and B Plant, and beneath the former 216-B-3 Pond. The greatest activity concentration measured in 2012 was beneath the former 216-B-3 Pond. Other locations may exhibit greater concentrations based on historical measurements (e.g., the vicinity of 216-B-12 Crib and B Plant), but substantial uncertainty remains in this area due to wells not being completed at the depth of highest concentration observed during the remedial investigation. Further discussion of the tritium activity at these sites is provided below.

216-B-50 and 216-B-57 Cribs. Tritium found in B Complex above the drinking water standard originated primarily from large inventories disposed to the 216-B-50 and 216-B-57 Cribs in the mid- to late 1960s to the early to mid-1970s. The 216-B-50 Crib received approximately 126.3 Ci and 216-B-57 Crib received approximately 194.6 Ci, which is over 100 Ci of tritium than most of the other site inventories in this area (Appendix C of RPP-26744, *Hanford Soil Inventory Model, Rev. 1: SIM Production Output Files*). These sources continue to drain into the aquifer today resulting in levels exceeding the drinking water standard. Because of the groundwater flow reversal in this area three wells exceeded the drinking water standard for the first time (299-E33-3, 299-E33-9, and 299-E33-38) (Map BP.10). The greatest 2012 tritium result was at well 299-E33-3 (31,000 pCi/L), which is now downgradient of the 216-B-50 Crib since the groundwater flow reversal. The other two wells, 299-E33-9 and 299-E33-38, had slightly less tritium activity and are now downgradient of the 216-B-57 Crib. As seen on the plume map, activity levels diminish farther to the southeast.

216-BX-102 Unplanned Release. The activity from this source is seen in well 299-E33-18 (see plume map). This well is located beneath a contaminated perched water horizon approximately 3 meters above the unconfined aquifer. The tritium activity at this well ranged between 25,000 and 28,000 pCi/L in 2012. Well 299-E33-344, screened within the perched horizon near well 299-E33-18, ranged in tritium activity from 22,000 to 29,000 pCi/L in 2012; however, activity in this well ranged between 41,300 and 43,500 pCi/L in 2011. This well has been used to remove perched water and associated contamination over the past 2 years. To date (end of December 2012), approximately 1.1×10^{-2} curies of tritium have been removed.

216-B-12 Crib. A deep zone of elevated tritium, not shown in the plume map, was discovered in 2010 during RI drilling of wells 299-E28-30 and 299-E29-54. Greater levels of tritium were found within the Ringold Unit A, approximately 8 meters or deeper below the water table. The source is likely the large inventory of tritium disposed to the 216-B-12 Crib in the 1950s when the crib received contaminated process condensate from U Plant operations. Alternatively, it may be from the 200-PO-1 sources. Since none of the wells in this location provides a means of determining the extent or changing conditions, it is recommended that additional wells be installed at depth to monitor the concentrated tritium plume. Note that near well 299-E28-30, tritium activity was 94,000 pCi/L at approximately 8 meters below the water table; near the bottom of the aquifer at well 299-E29-54, tritium activity of 150,000 pCi/L was observed.

216-B-3 Pond. East of the 200 East Area, significant inventories of tritium were discharged to the 216-B-3 Pond. Based on the 2012 tritium results, the highest tritium activity was at well 699-42-40A at 35,000 pCi/L. Contamination appears to extend to the southwest towards well 699-41-42 within the 200-PO-1 operable unit boundary.

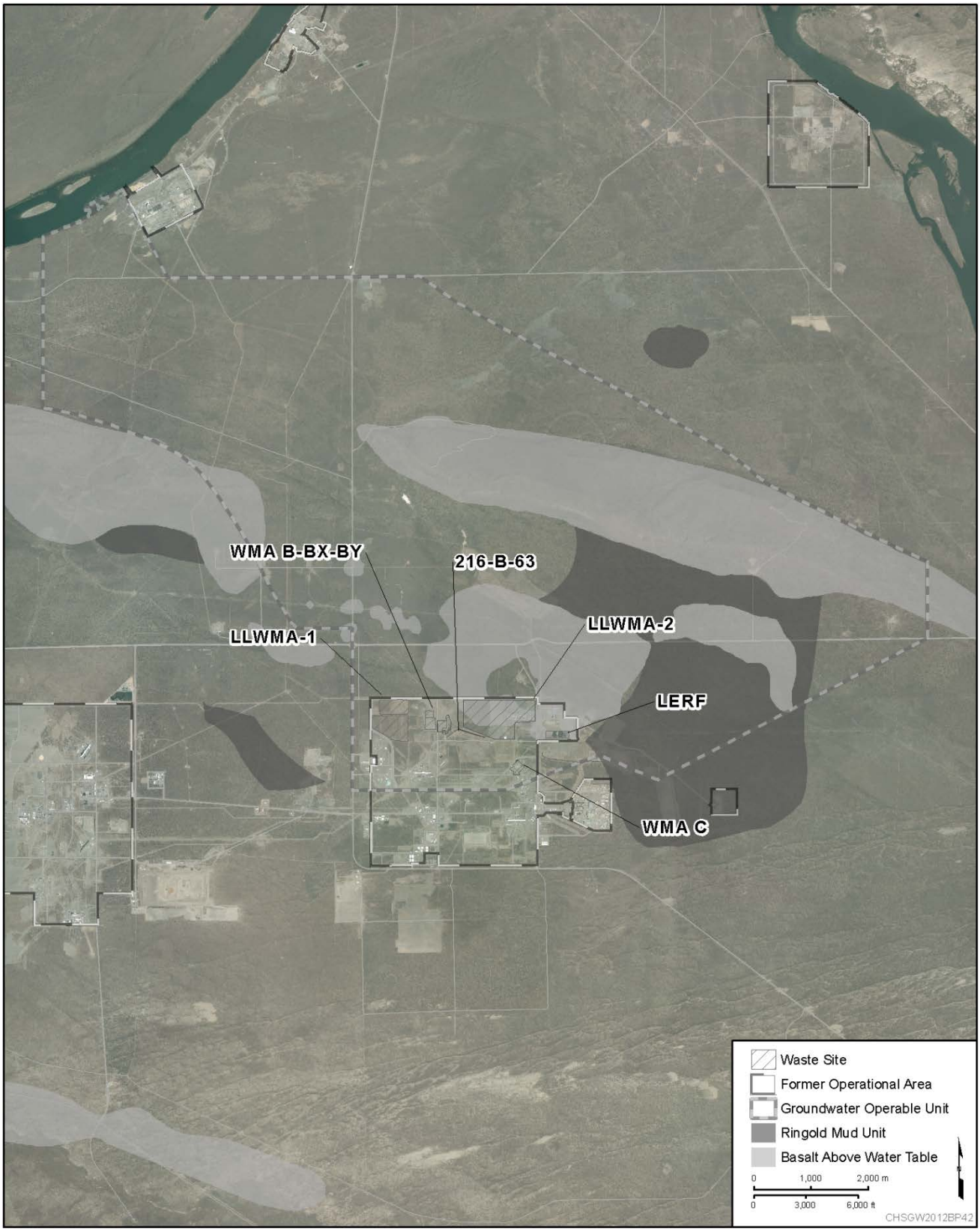


Map BP.9 200-BP 2012 Tritium Plume

200-BP RCRA – Introduction

This section describes the results of monitoring at individual units such as treatment, storage, and disposal units. These units are monitored under RCRA requirements for dangerous waste/dangerous waste constituents and under AEA for source, special nuclear, and byproduct materials. Data from unit-specific monitoring are also integrated into CERCLA groundwater investigations. Dangerous constituents and radionuclides are occasionally discussed jointly in this section to provide comprehensive interpretations of groundwater contamination. As previously discussed and pursuant to RCRA, the source, special nuclear, and byproduct material components of radioactive mixed waste are not regulated under RCRA but are instead regulated by DOE, acting pursuant to its AEA authority. Therefore, while this report may be used to satisfy RCRA reporting requirements, the inclusion of information on radionuclides in such a context is for information only and may not be used to create conditions or other restrictions set forth in any RCRA permit.

The 200-BP-5 Operable Unit contains six RCRA sites with groundwater monitoring requirements: (Map BP.11) WMA B-BX-BY, WMA C, 216-B-63 Trench, LERF, LLWMA-1, and LLWMA-2. The following discussion summarizes the results of statistical comparisons, assessment studies, and other developments for this reporting period. Groundwater data are available in the HEIS database and in the data files accompanying this report. SGW-55438 provides additional information (including well and constituent lists, maps, and statistical tables).



Map BP.10 200-BP RCRA Facility Locations

200-BP RCRA – WMA B-BX-BY

The WMA B-BX-BY is located in the north-northwest part of the 200 East Area. It includes the 241-B-BX-BY Tank Farms, which consists of 36 underground storage tanks ranging from 1,892,500-liter to 2,869,000-liter capacity. There are four additional 208,000-liter underground storage tanks in the 241-B-Tank Farm.

In 2012, continued assessment of the 241-B and BX tank farms was completed to determine if possible releases may account for the localized cyanide concentrations at well 299-E33-47. Documentation of this assessment is provided in DOE/RL-2012-53. The conclusion of the assessment was the dangerous waste constituent cyanide is associated with B tank farm. As of 2012, cyanide is the only dangerous waste/dangerous waste constituent identified within the groundwater associated with the 241-B-BX-BY Tank Farms. The extent of the cyanide is provided in Map BP.9. Other constituents, as discussed in DOE/RL-2012-53, are still being assessed and will be reported after a determination is made.

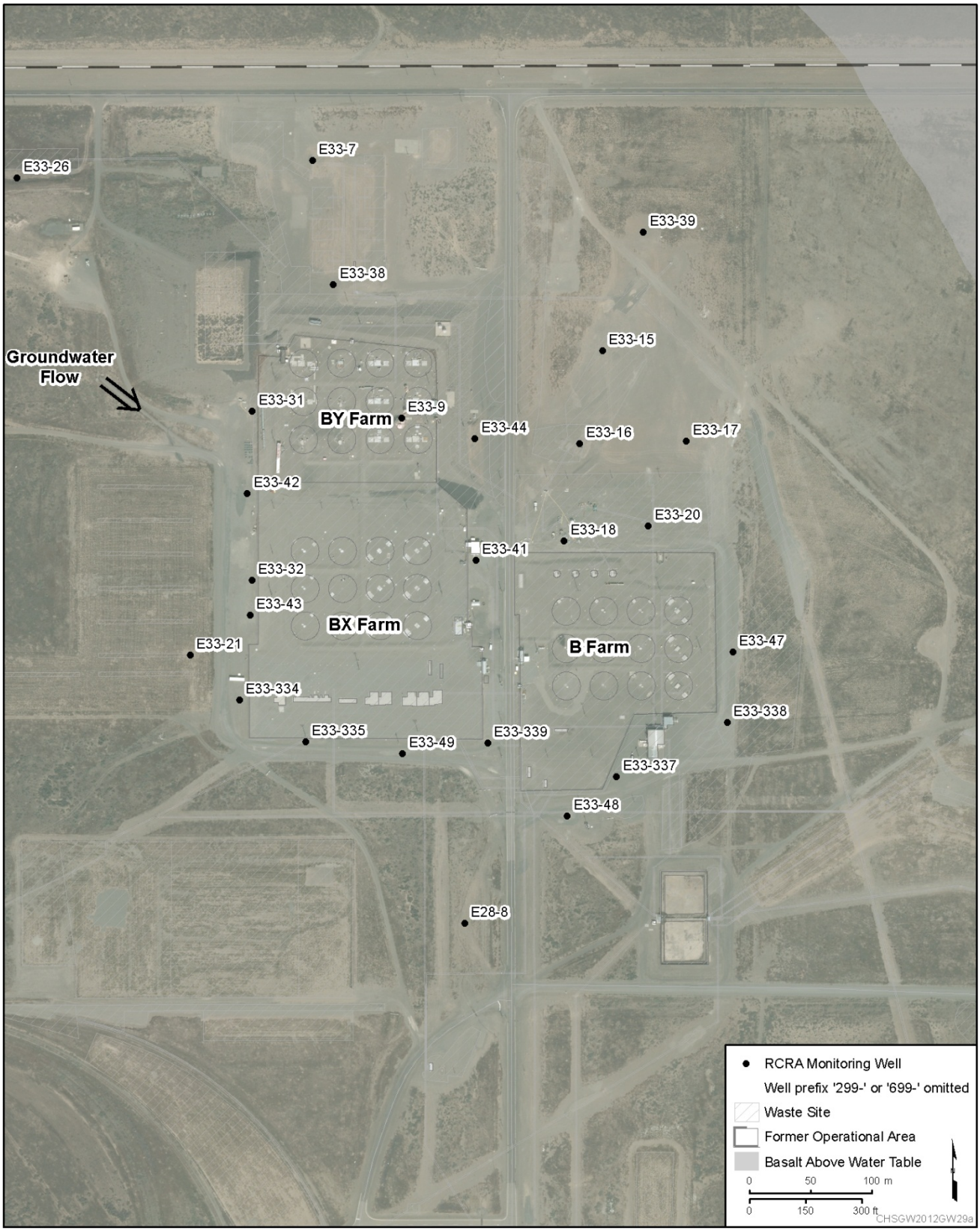
In accordance with 40 CFR 265.93[d](7) (as referenced by WAC 173-303-400), the WMA B-BX-BY well network (Map BP.11) was sampled quarterly in order to make continued determinations of the concentration and extent of dangerous waste/dangerous waste constituents in the groundwater. The former assessment plan (PNNL-13022) was replaced by DOE/RL-2012-53 in November 2012. One of the wells, 299-E33-26, was not sampled, as required by PNNL-13022, in 2012. The well appeared to be going dry and was therefore, surveyed with a remote television monitor within the well. After review of the available water in this well, it was removed from the revised network in the new plan (DOE/RL-2012-53). The main driver for the new assessment plan was the flow direction change in this area, from northwest to southeast. SGW-55438 includes a list of WMA B-BX-BY wells, constituents monitored, and whether the wells were sampled as scheduled.

The flow direction and rate have been reported as indeterminate to nearly stagnant over the past 5 years. This determination was based on the variability in the regional groundwater monitoring measurements from a regional low-gradient monitoring network of fourteen wells, located in the northwest quarter of 200 East Area, including three wells north of the 200 East Area. The use of this regionally corrected groundwater measurement network (survey to single benchmark, and deviation and barometrically corrected) has helped to define the variability of uncorrected measurements and determined flow direction and rate occasionally over the past 5 years. Since the flow direction change in August 2011, the flow direction has been determined to range from south to southeast with an average gradient (G) of 2.8×10^{-5} (i.e., a slope of 2.8 cm per kilometer) for this site.

The flow rate in 2012 was estimated by nitrate and technetium-99 plume movement from summer 2011 to summer 2012.. Based on the change in distance versus time, the average flow rate (V) at WMA B-BX-BY is ~ 0.5 m/day. This is consistent with a back calculated hydraulic conductivity of 1,765 m/day using the formula $V = (K*G)/n_e$ (Driscoll, 1986, *Groundwater and Wells*), where the effective porosity (n_e) is 0.1 and the average gradient (G) measurement from the low-gradient monitoring network is 2.8×10^{-5}. The hydraulic parameters used here were discussed in SGW-54508, *WMA C September 2012 Quarterly Groundwater Monitoring Report*, and are applicable for WMA B/BX/BY. These parameters are provided in SGW-55438.

The network well screens range from 0.99 to 6.12 meters into the aquifer. The least amount of water available for sampling is at well 299-E33-20. There have not been any previous issues with groundwater collection in this well. However, this well is not compliant with the *Washington Administrative Code*, and plans for replacing this and well 299-E33-18 have been proposed.

The presence of the dangerous waste constituent cyanide implies that WMA B-BX-BY has had an effect on groundwater. The 2012 monitoring network was sufficient to monitor the extent of cyanide considering the current flow direction and flow rate as shown on Map BP.11.. However, if cyanide concentrations continue to rise additional wells may be needed to the southeast to tract the extent of cyanide.



Map BP.11 200-BP RCRA WMA-B-BX-BY Monitoring Well Locations

200-BP RCRA – WMA C

The WMA C is located in the east central part of the 200 East Area. It includes the 241-C Tank Farm, which consists of 12 underground storage tanks with an approximate capacity of 1.9 million liters per tank. There are four additional underground storage tanks with an approximate capacity of 208,000 liters. As of 2012, cyanide is the only dangerous waste constituent determined as impacting groundwater from the 241-C Tank Farm. The concentrations are less than the 200 µg/L drinking water standard with a yearly maximum of 15.2 µg/L at well 299-E27-14. The maximum concentration was from the March sampling event, and concentrations decreased through the year.

In accordance with 40 CFR 265.93[d](7) (as referenced by WAC 173-303-400), the well network (Map BP.12) was sampled quarterly in order to make continued determinations of the concentration and extent of cyanide in the groundwater (DOE/RL-2009-77, *Groundwater Quality Assessment Plan for the Single-Shell Tank Waste Management Area C*). All of the wells were sampled quarterly, as required, during 2012. SGW-55438 includes a list of WMA-C wells and constituents monitored, and it indicates if the wells were sampled as scheduled.

Evaluation of flow direction and rate of groundwater flow at WMA C is difficult due to a very low hydraulic gradient (SGW-54508 and SGW-54675). Through the evaluation described in these documents, it was determined that WMA C will use the same gradient determinations as LLWMA-1 until a similar low-gradient network can be implemented at WMA C.

The use of the gradient measurements at LLWMA-1 and other hydraulic parameters discussed in SGW-54508 provided the means for deriving a range of flow rates at WMA C. Using the formula $V = (K*G)/n_e$ (Driscoll, 1986), where the effective porosity (n_e) is 0.1, the average gradient (G) measurement from the low-gradient monitoring network is 2.8×10^{-5}, and the hydraulic conductivity range is 100 to 2,100 m/day, the flow rate at WMA C ranges between 0.014 and 0.95 m/day. Based on other observed flow rates in the 200 East Area, as discussed in SGW-54675, a more representative WMA C average flow rate range is between 0.08 and 0.12 m/day.

A recent flow direction change in the northwest corner of the 200 East Area appears to be the driver for the changing flow direction at WMA C. Groundwater flow in the northwest corner of 200 East Area has changed from predominantly northwest to southeast. This flow direction change coincides with technetium-99 increases in Wells 299-E27-21 and 299-E27-24 at WMA C. These wells are located southeast of well 299-E27-23, where technetium-99 activity has exceeded 10 times the drinking water standard since 2008. Also coincident with the flow change are decreasing concentrations of other contaminants west of the 241-C tank farm, indicating a change in flow direction. These plus other observations discussed in SGW-54675 provide sufficient evidence for the determination of a southeast flow direction at WMA C.

The network well screens range from 1.61 to 13.47 meters into the aquifer. These wells all have adequate water columns in the screened interval for sampling through the next decade or more.

The presence of the dangerous waste constituent cyanide implies the 241-C Tank Farm is continuing to impact the groundwater. The current monitoring network was sufficient to determine the extent of contamination in 2012, as shown in Map BP.12.

Map BP.12 200-BP RCRA WMA C Monitoring Well Locations

200-BP RCRA – 216-B-63 Trench

The 216-B-63 Trench is located in the north central portion of the 200 East Area. The trench was constructed by 1970 as an emergency percolation trench for radioactively contaminated cooling water from B Plant. Through 1985, acidic and caustic treatments were completed to neutralize the waste. The actual corrosive portion of from the demineralizers was less than 1,890 liters per day, while the remainder of the 378,000 to 1,408,0000 liters per day was a combination of chemical sewer and cooling water. The corrosive waste discharges were regulated under RCRA and its implementing requirements WAC 173-303-400. Discharges to this trench ceased in 1992.

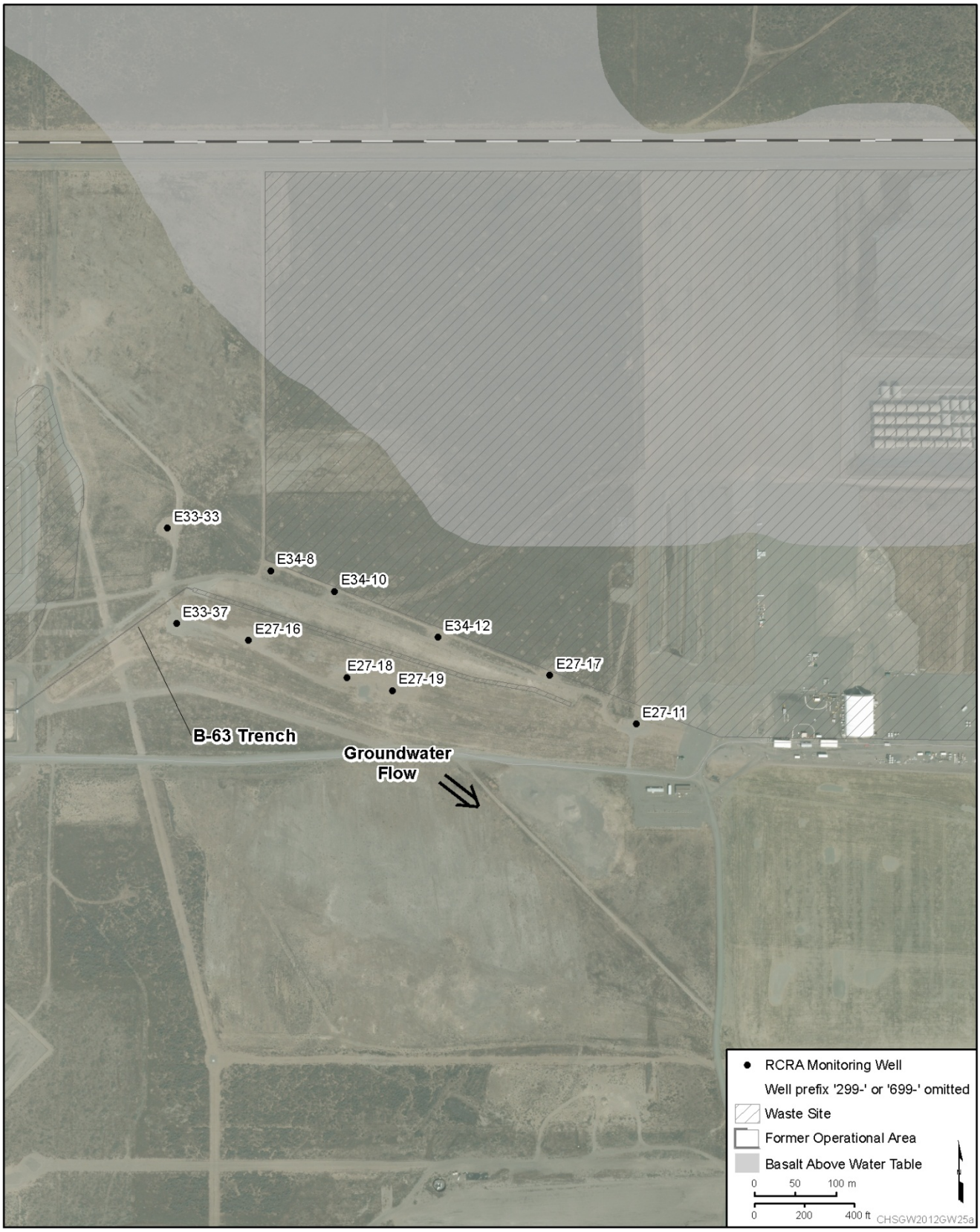
DOE monitors the groundwater semi-annually in accordance with 40 CFR 265.93(b) as referenced by WAC 173-303-400, as previously defined in Rev. 0 and currently defined in Rev. 1 of DOE/RL-2008-60, *Interim Status Groundwater Monitoring Plan for the 216-B-63 Trench*. To date, there has been no evidence of a release of dangerous waste to groundwater below this site.

All of the wells (Map MP.13) were sampled semiannually, as required, during 2012. Because of the 2011 flow direction change, as described in the introduction of Section 3.4, DOE/RL-2008-60 was revised in 2012. SGW-55438 includes a list of 216-B-63 Trench wells and the constituents monitored, and it indicates if the wells were sampled as scheduled. SGW-55438 also provides the indicator parameter comparison values for 2012. No exceedances of indicator parameter critical means occurred during 2012 (Table 3-37 in SGW-55438).

The revised monitoring network, as defined in DOE/RL-2008-60, Rev. 1 (released October 2012), consists of three upgradient and three downgradient wells (see insert figure). The definition of upgradient and downgradient is based on a southeast flow direction.

The network well screens range from 1.32 to 3.18 meters into the aquifer. These water table wells all have adequate water columns in the screened interval for sampling through the next decade and beyond.

While the alignment of the revised well network allows for statistical measures for determining whether the 216-B-63 Trench is impacting groundwater under stationary conditions over time, contaminant plumes are migrating towards this site from the northwest, which is anticipated to affect both the upgradient and downgradient wells. An increasing trend in specific conductance is expected by these plumes and may require other statistical tests not specifically provide for in the RCRA regulations (e.g., 40 CFR 265.93(b) and (c) to determine if the site has impacted the groundwater while this plume migrates beneath this site.



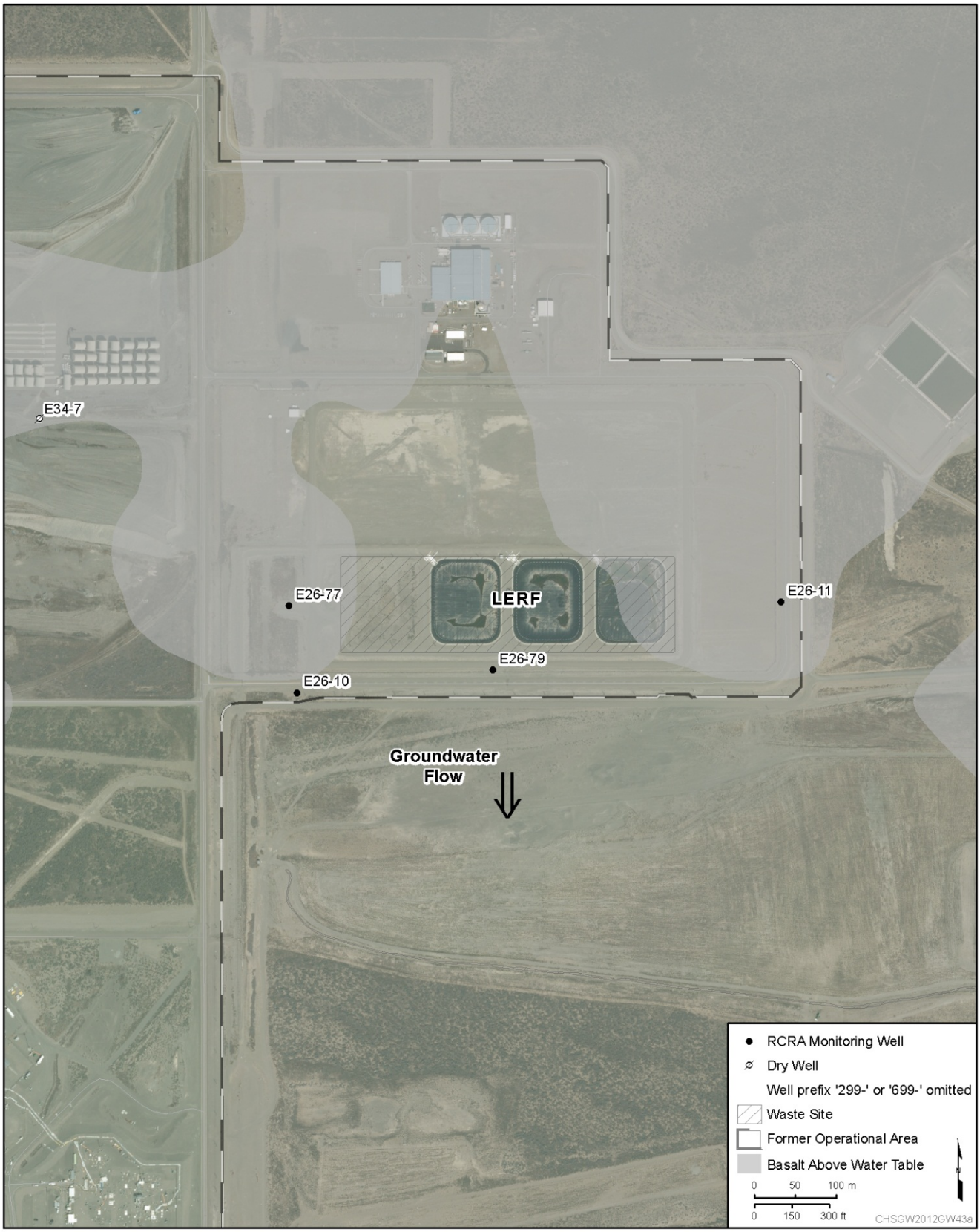
Map BP.13 200-BP RCRA 216-B-63 Monitoring Well Locations

200-BP RCRA – LERF

Located on the eastern boundary of the 200 East Area, the LERF consists of three lined surface impoundment basins. Construction of the complex was completed in 1991. The basins are arranged side by side, with an 18.2 meter separation between each basin. The dimensions of each basin (cell) are 100.5 meters by 82.2 meters, with a maximum fluid depth of 6.7 meters. The LERF is a RCRA-regulated unit under RCW 70.105 ("Hazardous Waste Management") and is subject to groundwater monitoring requirements pursuant to WAC 173-303-645. Analyses of samples collected during the reporting period indicate that all constituents in the permit were either undetected or below drinking water standards, except for nitrate. Sulfate is also elevated. The elevated concentrations appear to mimic the increases seen to the west of LERF.

In accordance with the RCRA final status permit conditions as stated in *Liquid Effluent Retention Facility Final-Status Groundwater Monitoring Plan,* (PNNL-11620) all the wells were sampled semiannually. Table 3-23 in SGW-55438 includes a list of LERF wells, the constituents monitored, and indicates if the wells were sampled as scheduled.

The current groundwater monitoring network consists of one upgradient well and three downgradient wells (Map BP.14). The definition of upgradient and downgradient is based on a south-southwest flow direction derived from statistical analysis of wells corrected gyroscopically and barometrically, and surveyed to a common datum (DOE/RL-2011-118). Although the network is monitored statistically it appears inconsistent with plume migration in the area from the west. The elevated nitrate and sulfate plumes are considered migrating from the west because of greater contaminant concentrations in wells to the west and earlier increases of these contaminants. While migration through the vadose zone may be possible for some of the wells (such as 299-E26-10 and 299-E26-77) it seems too distant for well 299-E26-14. All the monitoring wells are compliant with WAC 173-160.



Map BP.14 200-BP RCRA LERF Monitoring Well Locations

200-BP RCRA – LLWMA-1

The LLWMA-1 is located in the northwest corner of the 200 East Area. It includes the 218-E-10 Burial Ground, which consists of 14 unlined trenches. The 218-E-10 Burial Ground received low-level radiological waste and low-level mixed wastes beginning in 1955. The dangerous chemicals in the low-level mixed waste portions of 218-E-10 Burial Ground are regulated under RCRA and its implementing requirements WAC 173-303-400. DOE monitors the groundwater in accordance with 40 CFR 265.93(b), as defined in DOE/RL-2009-75, *Interim Status Groundwater Monitoring Plan for the LLBG WMA-1*. The monitoring network (Map BP.15) is defined as Low-Level Waste Management Area-1 (LLWMA-1). Previously, there has been no evidence of contaminant effects from the 218-E-10 Burial Ground site within the groundwater.

In 2012, TOC was confirmed to exceed the critical mean in well 299-E33-265. As a result, a draft *First Determination RCRA Groundwater Quality Assessment Plan For Low-Level Burial Grounds Low-Level Waste Management Area-1*, DOE/RL-2012-35 was submitted to Ecology in May, 2012. During 2012, all groundwater samples required by the monitoring plan were collected as scheduled (Tables 3-25 through 3-28 in SGW-55438). The tables also include a list of LLWMA-1 wells, constituents monitored, and indicates if the wells were sampled as scheduled. Based on this plan quarterly assessment sampling was completed in July and October, 2012. The laboratory results indicated no presence of dangerous waste/dangerous waste constituents; however, the TOC values remained elevated at this well. Because there were no dangerous waste/dangerous waste constituents found during the assessment based on the evaluation process provided in DOE/RL-2012-35 the site returned to interim detection monitoring in 2013. Currently, the most likely reason for the elevated TOC is an upgradient source of nature organic material near the well. Note that the elevated TOC at this well was coincident with a flow reversal. In addition, wells 299-E33-30 and 299-E33-266, located to 58 meters to the east and 37 meters to the west, respectively, have not shown any significant increase in TOC. The range of TOC in the adjacent wells was from 120 to 250 µg/L during 2012. The range of TOC at well 299-E33-265 in 2012 was from 1470 to 2660 µg/L.

The current detection monitoring plan, DOE/RL-2009-75, was reinstated at the completion of the assessment. This monitoring plan is designed for a northwest flow direction and will be updated for the current southeast flow direction in 2013. The network well screens range from 1.72 to 3.36 meters into the aquifer. These groundwater wells all have adequate water columns in the screened interval available for sampling for the next decade or more.

Specific conductance in downgradient well 299-E33-34 and upgradient well 299-E33-35 exceeded the critical mean in 2012 (Table 3-29 in SGW-55438). DOE initially reported an exceedance of specific conductance in well 299-E33-34 to Ecology in 1999. The elevated specific conductance levels are influenced by the migration of BY Cribs plumes. Thus, the elevated specific conductance is not a cause for a change to the interim status indicator evaluation monitoring.

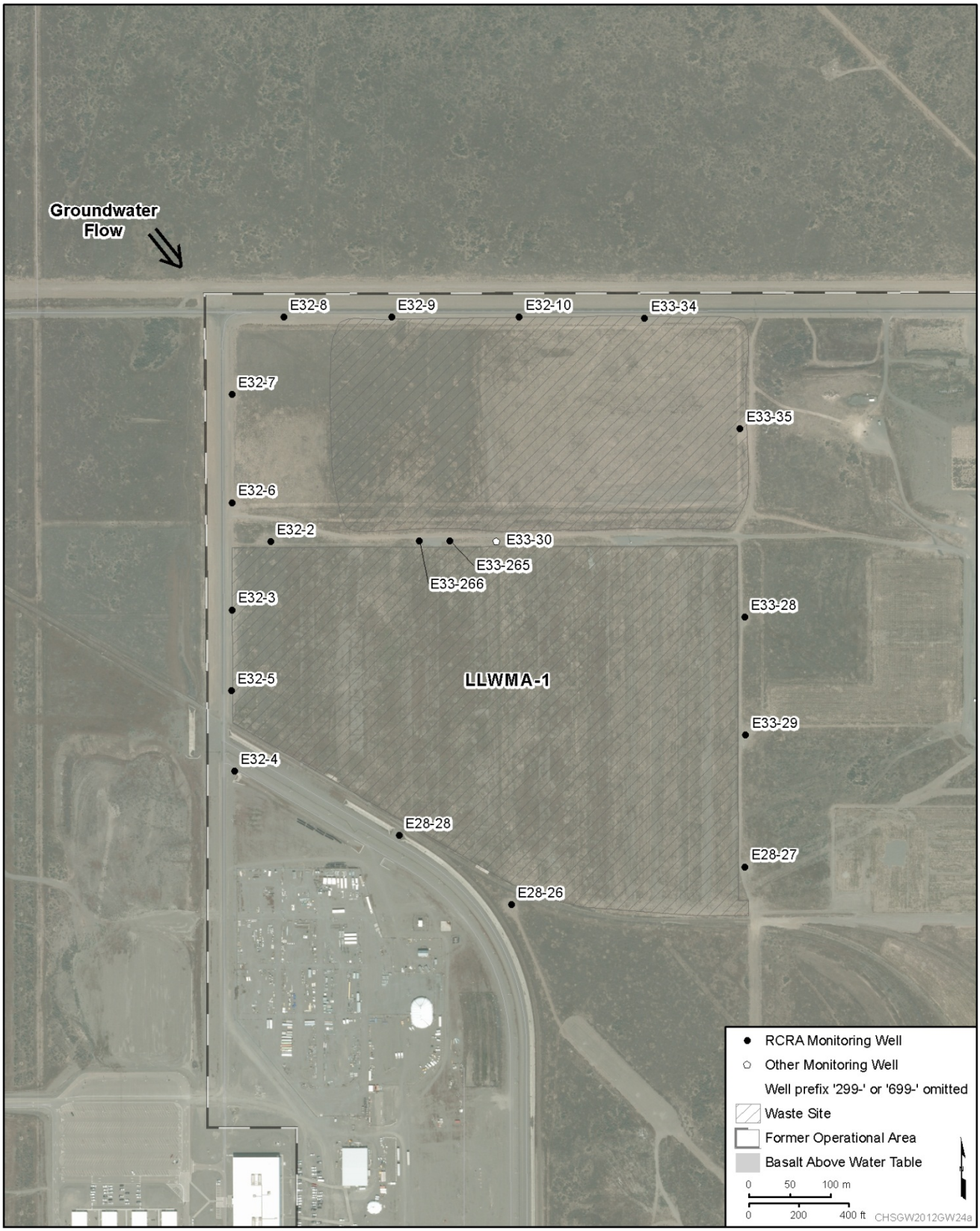
Performance assessment monitoring of radionuclides at LLWMA-1 (in accordance with AEA authority) is designed to complement RCRA detection monitoring and specifically at monitoring radionuclides not regulated under RCRA. The current monitoring plan (DOE/RL-2000-72) requires iodine-129, technetium-99, tritium, and uranium for assessing the groundwater. Based on observations at the LLWMA-1 wells and other 200-BP-5 monitoring wells, the 218-E-10 Burial Ground did not impact the groundwater. Results for each of these constituents are discussed below and can be found on the site map in the respective sections above.

Technetium-99 concentrations exceed the drinking water standards in wells monitoring the northeast portion of the WMA. The technetium-99 groundwater concentrations in the northeast wells (299-E32-10 and 299-E33-34) is primarily associated with the technetium-99 plume migrating from the BY Cribs. Technetium-99 detected in wells 299-E32-8, 299-E32-9, 299-E33-28, 299-E33-29, 299-E33-30, and 299-E33-35 is associated with either the 241-BX-102 unplanned release or a combination of the 241-BX-102 unplanned release and the BY Cribs. Technetium-99 from the B Complex is discussed further in the. 200-BP technetium-99 section.

Elevated iodine-129 activities found predominantly in the northeast portion of the WMA is from sources to the east-southeast, as discussed in 200-BP iodine-129 section. The highest level was in well 299-E33-35 (4.43 pCi/L). Levels decrease across the WMA to the southwest.

In 2012, uranium concentrations exceed the drinking water standards in wells 299-E33-34, 299-E-33-10, monitoring the northwest corner of the WMA (wells 299-E32-10, 299-E33-34, 299-E33-35), and one well southeast of the WMA (well 299-E28-27) . The elevated concentrations to the northeast are associated with the 241-BX-102 unplanned release. The highest concentrations was in well 299-E33-34 at 159 µg/L. Uranium concentrations also exceed the drinking water standard at well 299-E28-27 (southeast corner of WMA). The source is the 216-B-12 Crib, as discussed in the 200-BP uranium section.

Tritium was not reported above the drinking water standard in any LLWMA-1 monitoring well in 2011. The highest activity continued to be in well 299-E33-34, which is the result of migration from the 216-B-57 and 216-B-50 Cribs (see 200-BP Tritium section).



Map BP.15 200-BP RCRA LLWMA-1 Monitoring Well Locations

200-BP RCRA – LLWMA-2

The LLWMA-2 is located in the northeast corner of the 200 East Area. It includes the 218-E-12 Burial Ground, which consists of 40 unlined trenches. The 218-E-12 Burial Ground received low-level radiological waste and low-level mixed wastes beginning in 1967. The dangerous chemicals in the low-level mixed waste portions of LLWMA-2 are regulated under RCRA and its implementing requirements WAC 173-303-400.

DOE monitors the groundwater in accordance with 40 CFR 265.93(b), as defined in DOE/RL-2009-76, *Interim Status Groundwater Monitoring Plan for the LLBG WMA-2*. The monitoring network (Map BP.16) is defined as Low-Level Waste Management Area-2 (LLWMA-2).To date there has been no evidence of contaminant effects from the 218-E-12 Burial Ground within the groundwater.

All of the wells were sampled semiannually, as required, during the reporting period (Table 3-30 in SGW-55438). Because of the 2011 flow direction change, as noted in the introduction of Section 3.4, DOE/RL-2009-76 will be revised as it was designed for west-southwest groundwater flow direction versus the current southeast flow direction. SGW-55438 includes a list of LLWMA-2 wells, constituents monitored, and indicates if the wells were sampled as scheduled. Table 3-31 in SGW-55438 provide the indicator parameter comparison values for 2012.

Note, the west portion of the 218-E-12 Burial Ground has never been used for waste disposal and the flow direction has shifted from indeterminate because of a flat groundwater gradient to southeast. Thus, contaminant plumes migrating towards this portion of the site from the northwest is anticipated to affect specific conductance in wells 299-E34-9, 299-E34-10, and 299-E34-12 in 2013.

The network well screens range from 1.24 to 2.78 meters into the aquifer. These wells all have adequate water columns in the screened interval available for sampling for the next decade or more.

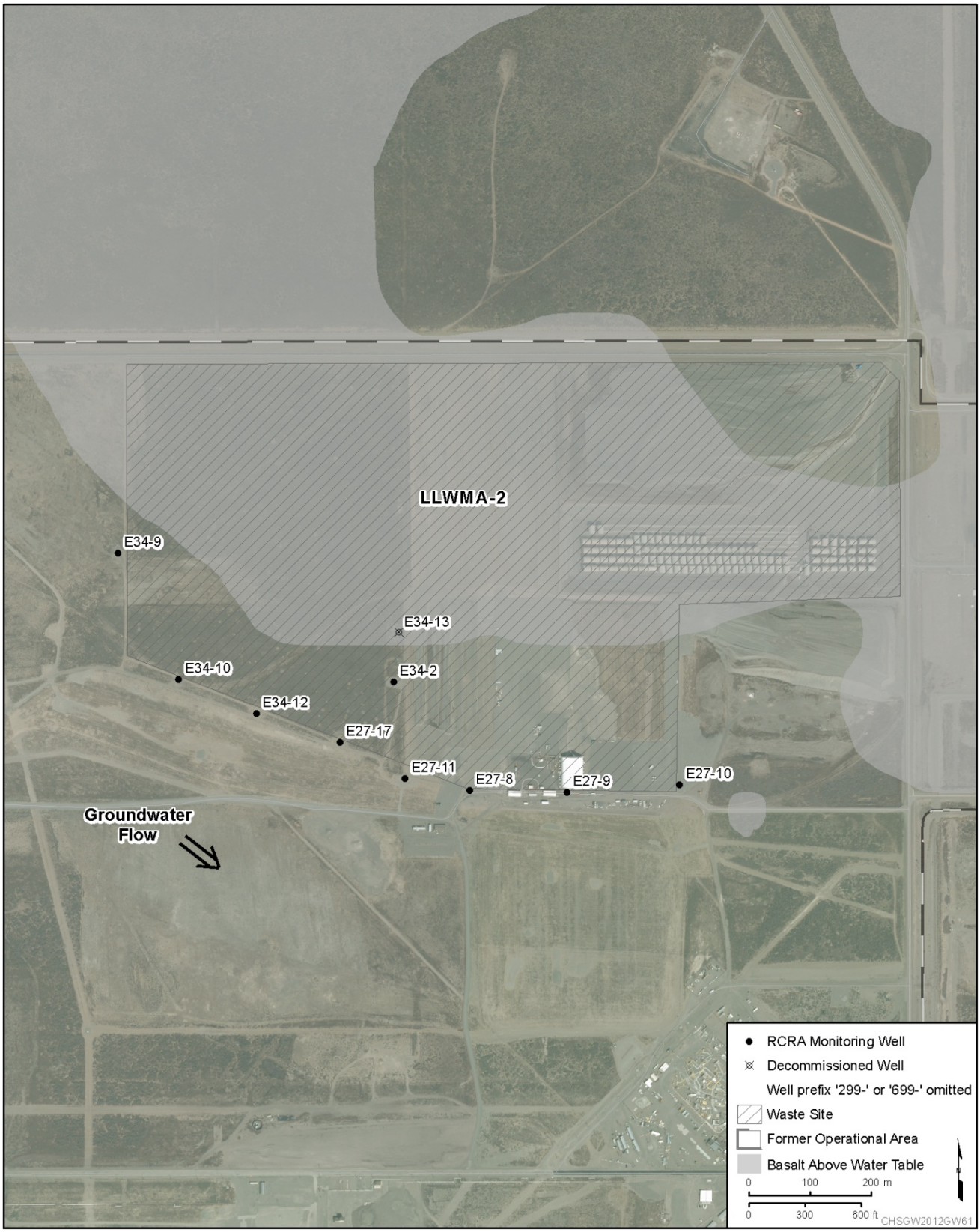
Performance assessment monitoring of radionuclides at LLWMA-2 (in accordance with AEA authority) is designed to complement RCRA detection monitoring and specifically at monitoring radionuclides not regulated under RCRA. The current monitoring plan (DOE/RL-2000-72) requires iodine-129, technetium-99, tritium, and uranium for assessing the groundwater. Based on observations at the LLWMA-2 wells and other 200-BP-5 monitoring wells, the 218-E-12 Burial Ground did not impact the groundwater. Results for each of these constituents can be found on the site map in the respective sections above.

Elevated iodine-129 has been detected in the wells along the south side of LLWMA-2 since monitoring began in the early 1990s. The highest level was in well 299-E27-10 when sampling began, but has continued to decline and is currently near the drinking water standard. Only the wells 299-E27-8, 299-E27-9, and 299-E27-10 continue to have activity levels above the drinking water standard south of the burial grounds. These wells define the northern and western extent of iodine-129 in this area.

During 2012, the highest average technetium-99 concentrations were at well 299-E34-9 (1,900 pCi/L) located on the west side of the LLWMA. This was the only detection in 2012 above the drinking water standard of 900 pCi/L. Concentrations in the April sampling event from this well was 96 pCi/L. Concentrations of technetium-99 in the other LLWMA-2 wells ranged from non-detect to 55 pCi/L.

Tritium concentrations have also decreased over the past two decades, with maximum concentrations currently below 1,000 pCi/L (650 pCi/L at well 299-E34-9 in April 2012). The tritium is associated with past migration from sources to the south-southeast, as discussed in 200-BP tritium section.

Uranium concentrations at LLWMA-2 were less than 7 µg/L, which is below background levels (DOE/RL-96-61).



Map BP.16 2000-BP RCRA LLWMA-2 Monitoring Well Locations

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