8 1100-EM

8.1 Overview

This chapter describes groundwater monitoring in the 1100-EM groundwater interest area and the Richland North Area (Figure 8-1). Within this region, the former 1100-EM-1 OU includes the inactive DOE Horn Rapids Landfill, which was used from the late 1940s to the 1970s for disposal of office and construction waste, asbestos, sewage sludge, fly ash, and reportedly numerous drums of unidentified organic liquids (DOE/RL-90-18). Following cleanup of 1100-EM-1 and related source OUs, DOE transferred ownership of a portion of the property to the Port of Benton. Some key facts about 1100-EM are provided in Table 8-1. Groundwater monitoring is described in DOE/RL-2012-59, *Surveillance Groundwater Monitoring on the Hanford Site*. Section 1.3 provides details about plume mapping, including descriptions of terms in figure legends (e.g., Type 1 Control Point).

The Richland North Area includes the City of Richland North Well Field and Recharge Ponds. The City of Richland pumps water from the Columbia River into the recharge ponds. The river water percolates to the groundwater, which is then pumped through surrounding wells for municipal use during peak demand periods (WHC-MR-0033). The Richland North Area also includes the AREVA NP, Inc. nuclear fuel production facility, which is southwest (upgradient) of the inactive DOE Horn Rapids Landfill.

Groundwater beneath 1100-EM and Richland North flows primarily west to east and discharges to the Columbia River (Figure 8-2). Groundwater flow from the west is diverted to the northeast and southeast around a recharge mound beneath Richland's recharge ponds. The unconfined aquifer is recharged by water from the Yakima River, by infiltration of agricultural irrigation, and by natural precipitation.

The thickness of the unconfined aquifer in this area is approximately 5.6 to 9 m (18 to 30 ft), with all but the upper few meters residing in the Ringold Formation unit E (Figure 8-3). A silt- and clay-dominated facies forms a local, laterally extensive upper aquitard up to 10 m (33 ft) thick.

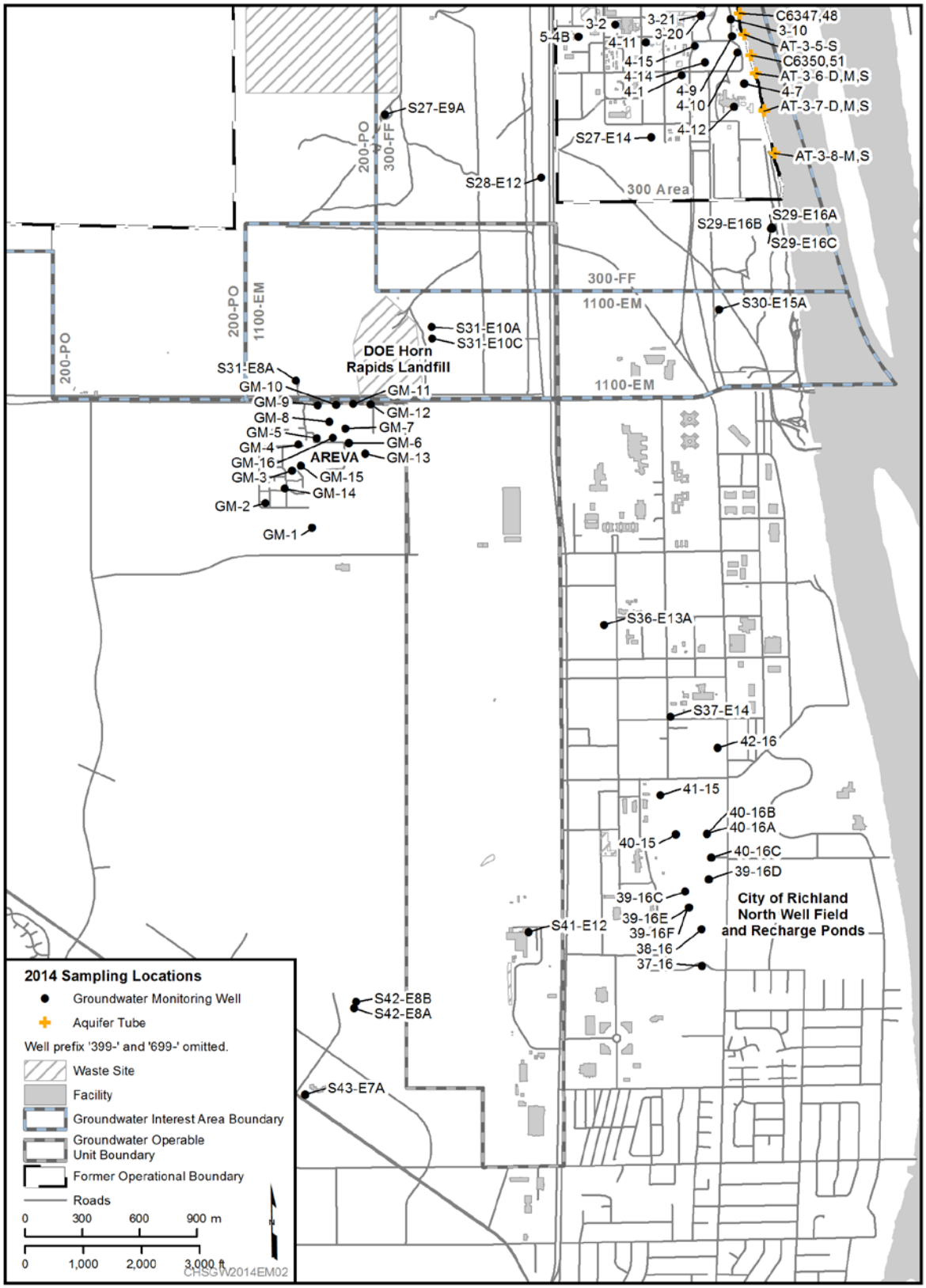

Figure 8-1. 1100-EM Sampling Locations, 2014

Table 8-1. 100-EM at a Glance

Operations included industrial and automotive activities (1954–1985), and a landfill (1950s–1970)			
2014 Groundwater Monitoring			
Contaminant	**Water Quality Criteria**	**Maximum Concentration**	**Plume Area[a] (km^2)**
Trichloroethene	5 µg/L[b]	0.71 µg/L (699-S31-E10A)	0
Nitrate	45 mg/L[c]	205 mg/L (699-S31-E10C)	Not calculated[d]
Uranium	30 µg/L[e]	28.4 µg/L (699-S31-E10A)	Not calculated[d]
Remediation			
Waste sites (final action): 100 percent complete[f] Groundwater (final action): MNA Final ROD: 1993			

a. Estimated area at a concentration greater than the DWS.

b. Cleanup level in ROD.

c. 45 mg/L as NO_3 is equivalent to the DWS of 10 mg/L as N.

d. Nitrate and uranium in 1100-EM are from offsite sources.

e. Drinking water standard

f. Sites with status of closed, interim closed, no action, not accepted, or rejected.

COCs = contaminants of concern
DWS = drinking water standard
MNA = monitored natural attenuation
ROD = Record of Decision

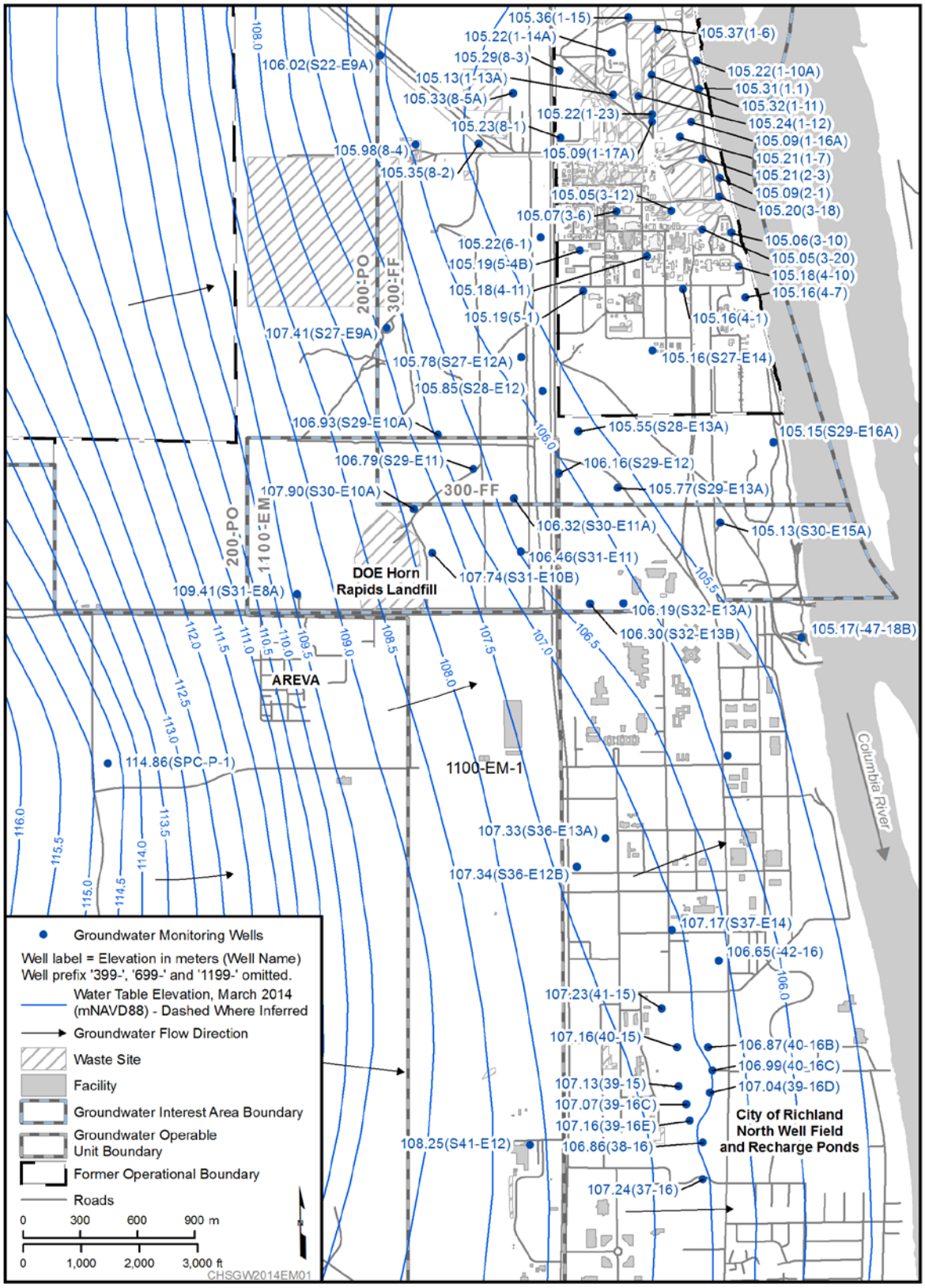

Figure 8-2. 1100-EM Water Table, 2014

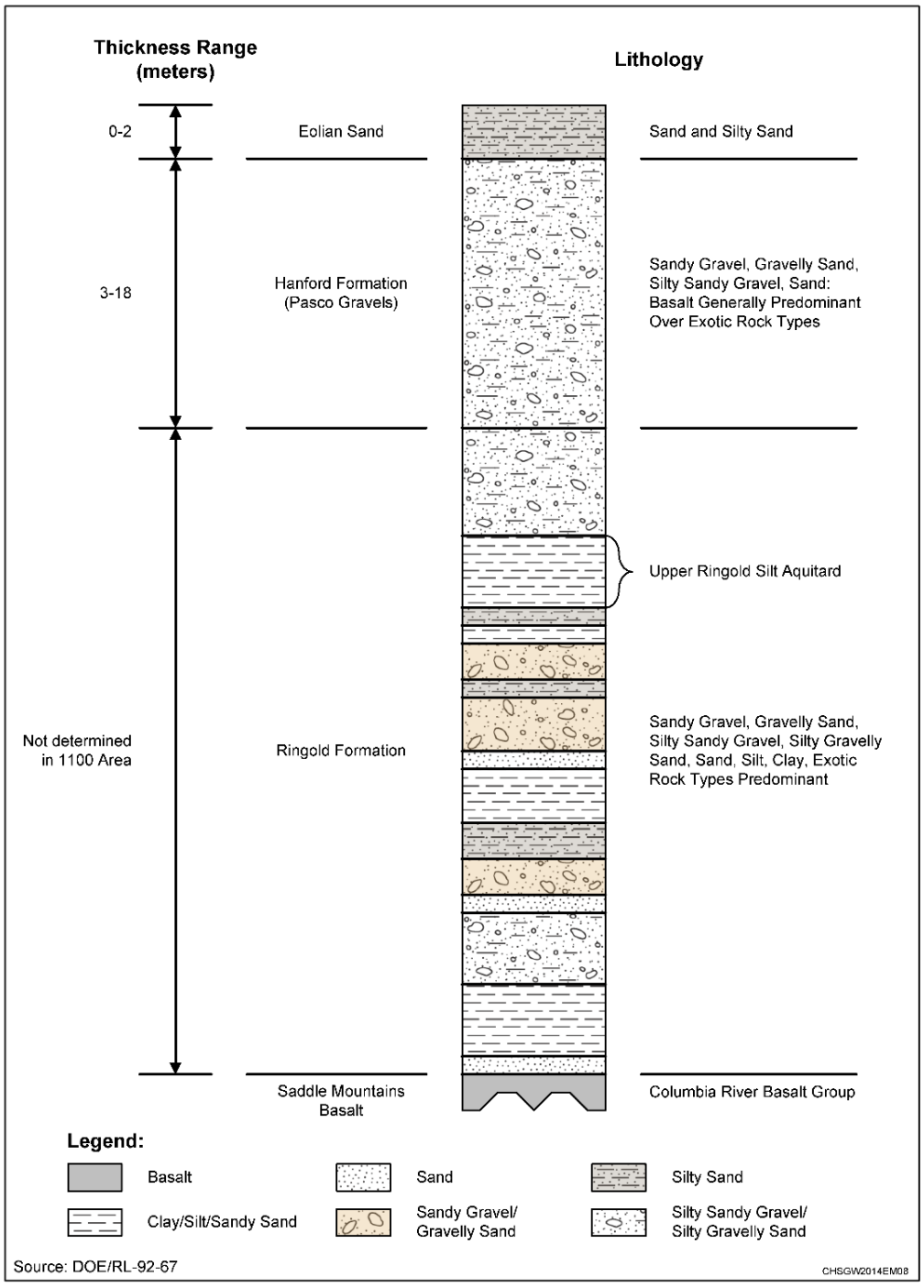

Figure 8-3. 1100-EM Lithology

8.2 CERCLA Activities

In 1993, EPA, Ecology, and DOE signed a ROD for the 1100 Area, which included the 1100-EM-1 Groundwater OU and two source OUs (1100-EM-2 and 1100-EM-3) (EPA/ROD/R10-93/063). The ROD had a groundwater component that relied on MNA for TCE, with a cleanup level of 5 µg/L.

In 2006, the second CERCLA 5-year review (DOE/RL-2006-20) concluded that remedies selected for the 1100-EM-1 OU had been completed. The RAOs established in the ROD had been achieved and are protective of human health and the environment. As a result, the 1100 Area was removed from the National Priorities List and DOE, EPA, and Ecology agreed to a change (reduction) in groundwater monitoring. Groundwater monitoring, described in TPA-CN-163, included the following to provide assurance that the remedial action goals had been achieved:

- Wells 699-S28-E12, 699-S31-E10A, and 699-S31-E10C
- Annual sampling for TCE, vinyl chloride, and 1,1-dichloroethene

Note that TPA-CN-163 also states that monitoring of nitrate and uranium near the DOE Horn Rapids Landfill would continue under the environmental monitoring activities performed to meet the AEA objectives, and monitoring associated with the 300-FF-5 OU will continue to evaluate TCE concentrations northeast of 1100-EM-1 near the river. Currently, monitoring of nitrate and uranium near the landfill, as well as tritium near the City of Richland's water supply wells, is described in DOE/RL-2012-59.

The third 5-year review (DOE/RL-2011-56) stated that the remedy remains protective of human health and the environment.

All three monitoring wells were sampled in January 2014 for the previous year, as discussed in last year's annual report. Two of the monitoring wells (699-S28-E12 and 699-S31-E10A) in the 1100-EM-1 network were sampled as scheduled in December 2014 (Table A-12 of Appendix A). The other well (699-S31-E10C) was delayed until February 2015 because of a broken pump.

8.3 Trichloroethene

Historically, TCE-contaminated groundwater was found upgradient and downgradient of the inactive DOE Horn Rapids Landfill. A review of available information indicated that TCE contamination moved into the Hanford Site's 1100 Area via groundwater. AREVA, a facility adjacent to the landfill, has investigated soil and groundwater contamination as an independent action in accordance with WAC 173-340, "Model Toxics Control Act—Cleanup." The past use of organic solvents at the AREVA lagoon area was the only documented record of TCE occurrence or use near the contaminant plume identified during the 1100-EM-1 RI/FS (DOE/RL-92-67). TCE was used to bond overlapping liner sections together during the installation, repair, and cleaning of lagoon liners at various times from 1978 through 1988. While the DOE Horn Rapids Landfill is thought to have received drummed waste solvents (DOE/RL-90-18), no evidence of a TCE source was revealed by soil vapor surveys, geophysical investigations, and trenching activities during the RI/FS (DOE/RL-92-67).

TCE concentrations in the three 1100-EM-1 CERCLA network wells continued to be near or below detection limits, with a maximum of 0.81 µg/L in December 2014. Concentrations have declined since the 1990s (Figure 8-4). Potential breakdown products of TCE (1,1-dichloroethene and vinyl chloride) remained below detection limits.

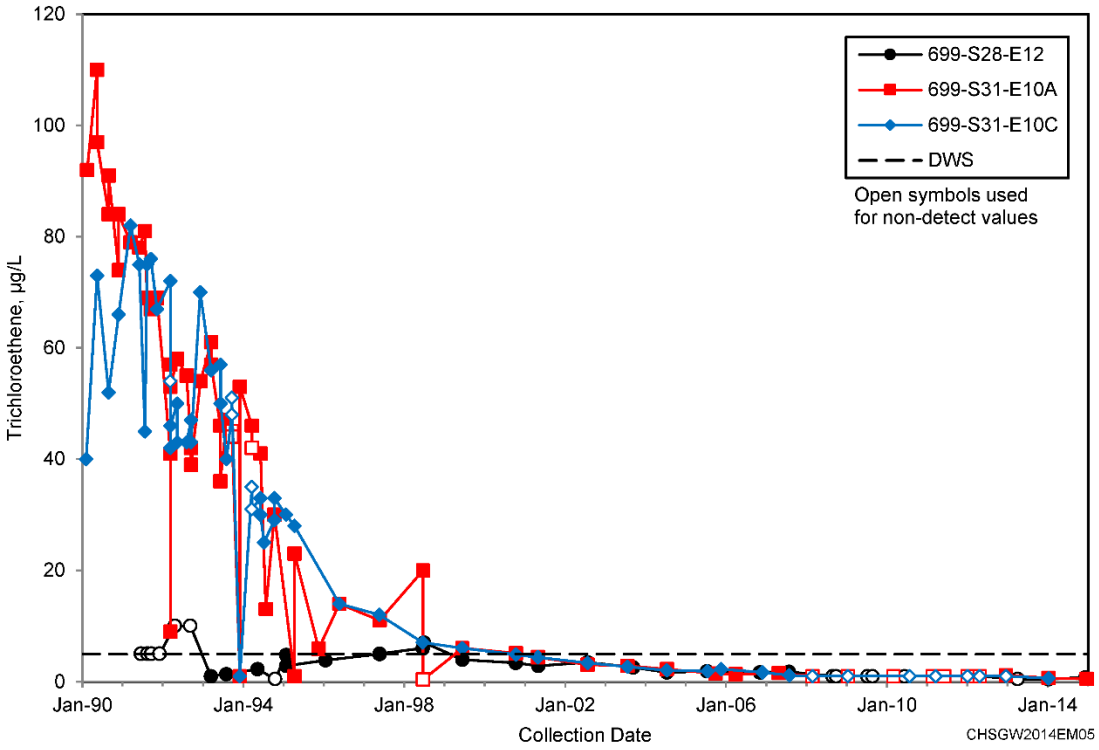

Figure 8-4. TCE Data in 1100-EM-1 Compliance Wells

The City of Richland monitors groundwater quarterly for chemical constituents in the upper portion of the unconfined aquifer at the Horn Rapids Sanitary Landfill (formerly the Richland Landfill), approximately 1 km (0.62 mi) south of the Hanford Site boundary. Maximum concentrations of the following chlorinated hydrocarbons exceeded the DWS in some of the city's monitoring wells in 2013, according to the most recent annual report (City of Richland, 2014, *Horn Rapids Landfill Environmental Monitoring Report Calendar Year 2013*).

- PCE: maximum 46 µg/L
- TCE: maximum 23 µg/L
- Vinyl chloride: maximum 8.3 µg/L

8.4 Tritium

The Hanford Site tritium plume that originated in the 200 Areas extends southeast through the 600 Area and into the 300 Area at levels below the 20,000 pCi/L DWS. The leading edge of the sitewide tritium plume, at concentrations far below the DWS, is monitored annually because of its proximity to the City of Richland's North Well Field (Figure 8-5). A representative background level of tritium in Hanford Site groundwater is 142 pCi/L (95th percentile) (DOE/RL-96-61). The maximum tritium concentration in 2014 was 125 pCi/L in Well 699-S41-E12.

Elevated tritium concentrations are found to the north of 1100-EM in the 300-FF groundwater interest area. Because groundwater flow in the 1100-EM and 300-FF groundwater interest areas is generally west to east, the tritium plume found to the north of 300 Area does not migrate southward toward 1100-EM.

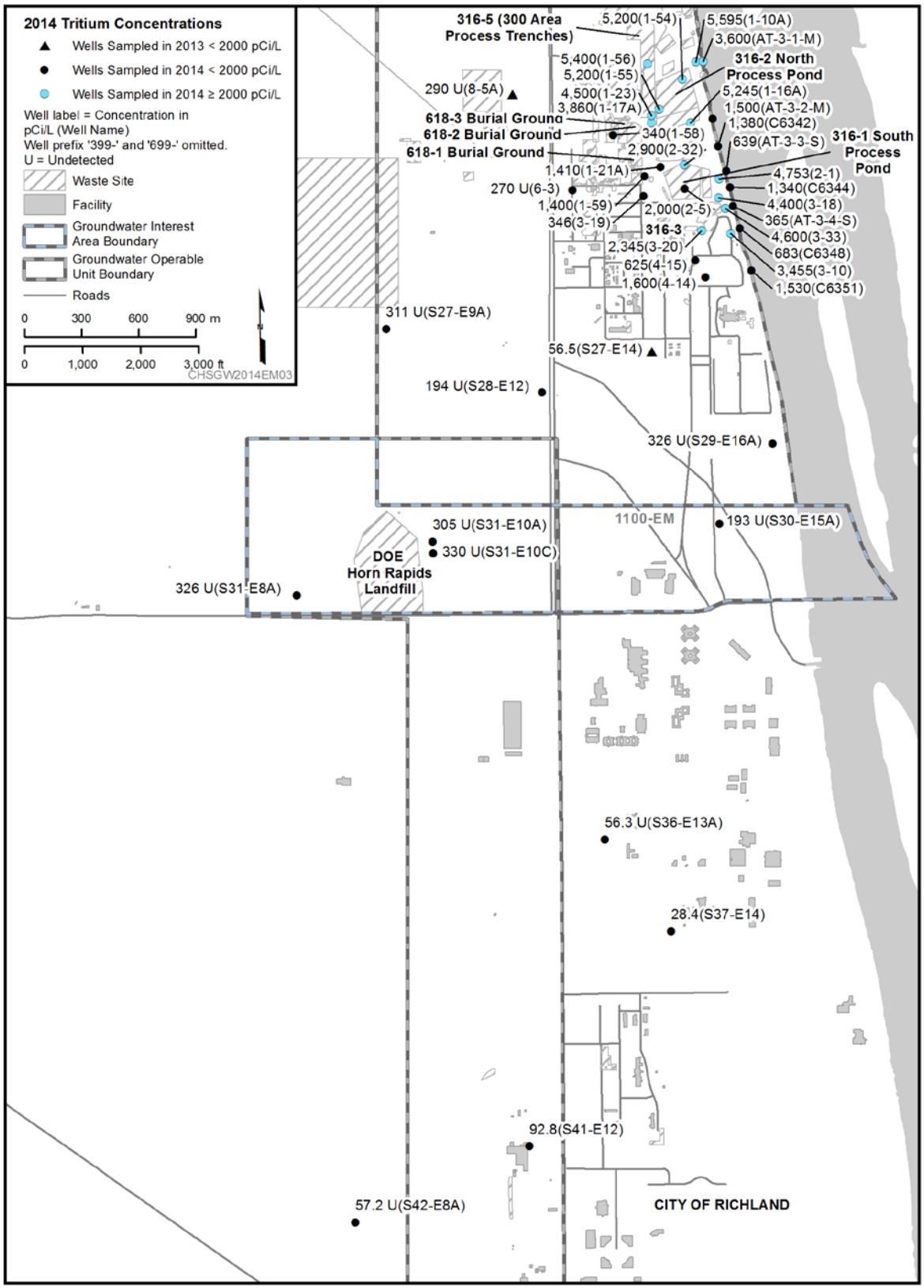

Figure 8-5. Tritium Concentrations in 1100-EM, Richland North, and the 300 Area, 2014

8.5 Nitrate

Nitrate concentrations are above 45 mg/L throughout much of 1100-EM and Richland North (Figure 8-6). Distribution, trends, the direction of groundwater flow, and location of offsite sources indicate that nitrate contamination in this area has likely resulted from industrial and agricultural uses off the Hanford Site. Agricultural uses include fertilizer applications to the irrigated fields west of 1100-EM. The highest concentration in an 1100-EM well on the Hanford Site in 2014 was 205 mg/L in Well 699-S31-E10C. Concentrations have been declining since 2010 (Figure 8-7). The wells are located downgradient of AREVA and the inactive DOE Horn Rapids Landfill.

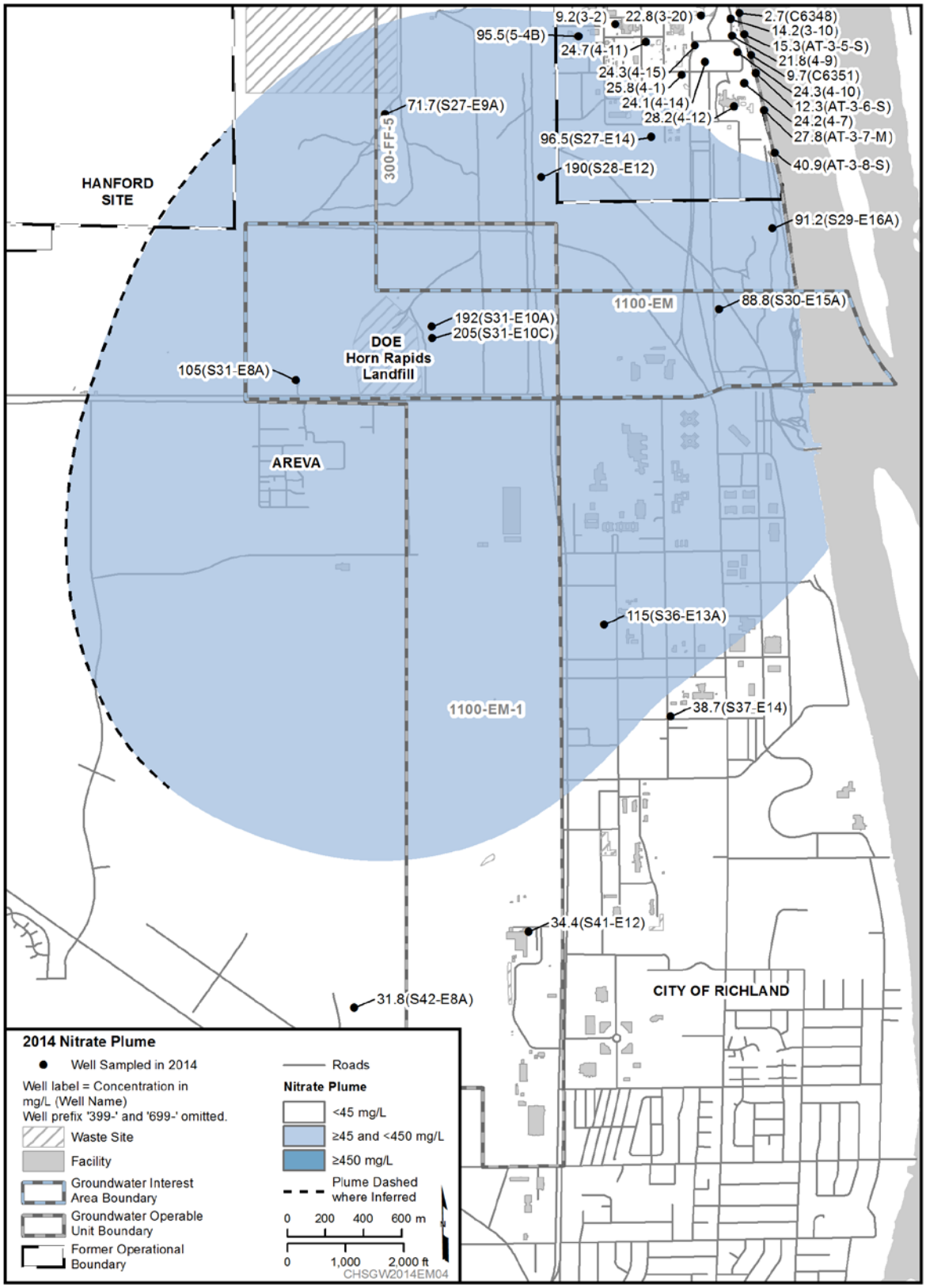

Figure 8-6. Nitrate Plume in 1100-EM, Richland North, and the 300 Area, 2014

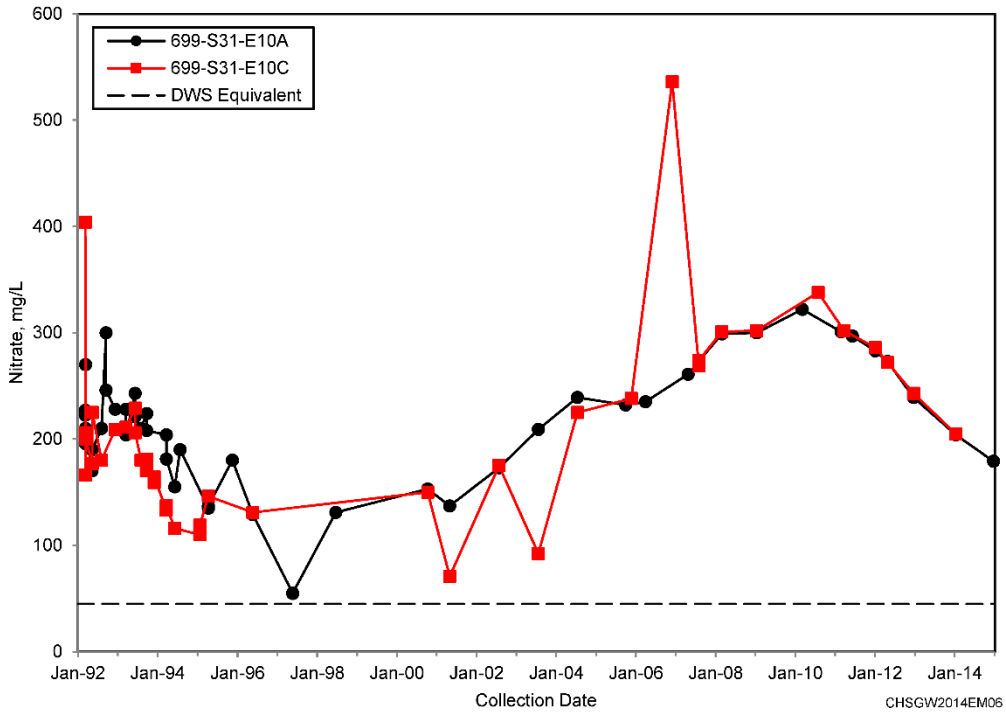

Figure 8-7. 1100-EM Nitrate Data for Wells 699-S31-E10A and 699-S31-E10C

8.6 Uranium

Elevated concentrations of uranium occur downgradient of the AREVA facility. The maximum uranium concentration in an AREVA well in 2013 was 36.5 µg/L (E06-09-006, 2013 *Annual Groundwater Report* AREVA, Richland, Washington).

Uranium concentrations in Hanford Site wells downgradient from AREVA were slightly below the DWS in 2014 (Figure 8-8).

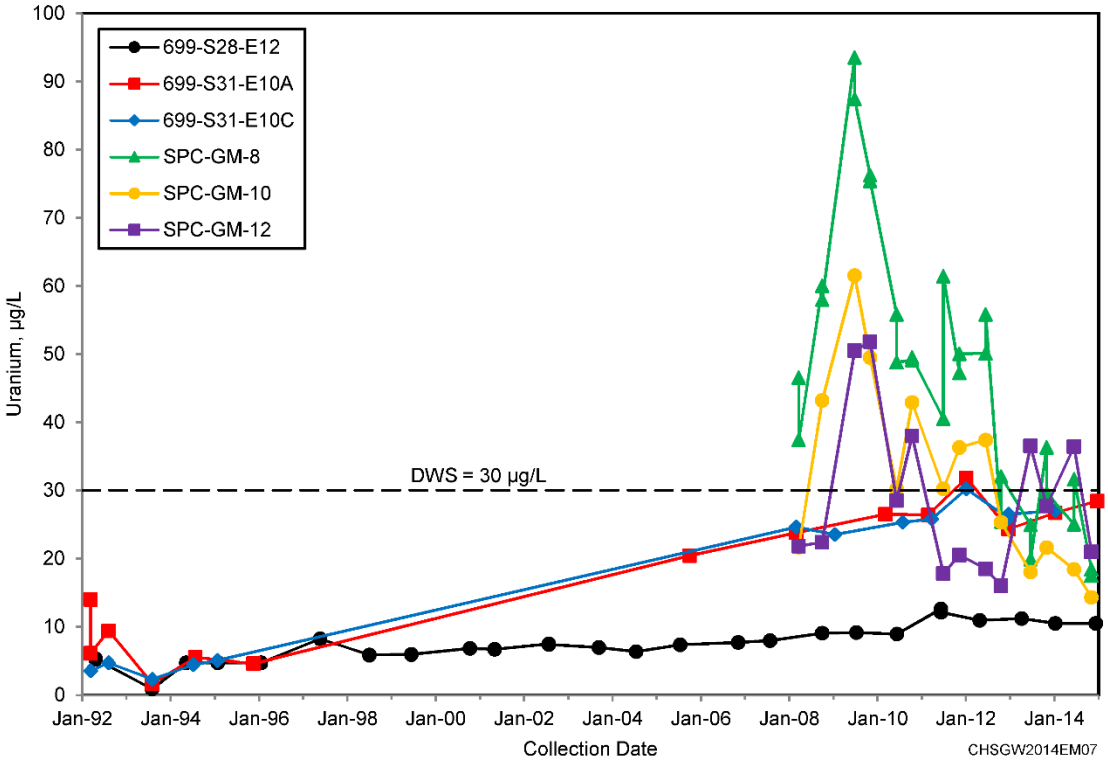

Figure 8-8. 1100-EM Uranium Data for Wells Downgradient of AREVA and Inactive Horn Rapids Landfill