2.13 Richland North Area

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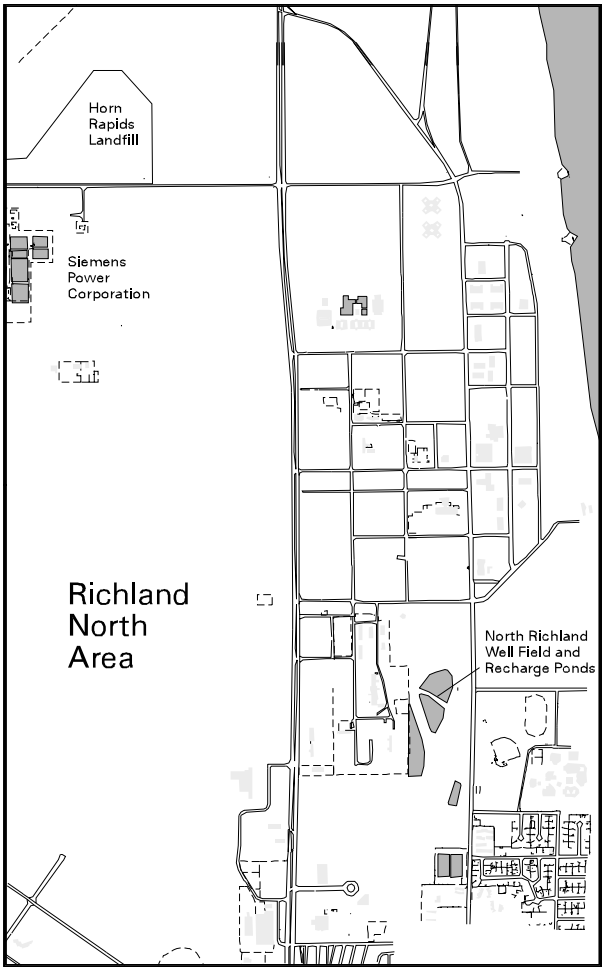
The Richland North Area is located in the southern part of the Hanford Site. The Richland North Area is not formally defined, but includes the former 1100 and 3000 Areas, that part of the 600 Area adjacent to the 300 Area, and parts of nearby Richland between the Yakima and Columbia Rivers. Ownership of the 1100 Area was transferred from the U.S. Department of Energy (DOE) to the Port of Benton in 1998. Ownership of the 3000 Area was transferred from DOE to the Port of Benton in 1996.

2.13.1 Groundwater Flow

Figure 2.13-1 shows the March 1999 water-table elevations (also see Plate 2) and illustrates water-level-elevation trends for selected areas of the Richland North Area. Groundwater in the Richland North Area generally flows eastward from the Yakima River and discharges to the Columbia River. In the northern part of the Richland North Area, groundwater flows northeast and converges with groundwater entering the 300 Area before discharging to the Columbia River.

Recharge from the Yakima River has a regional effect on groundwater flow and is the primary source of groundwater in the Richland North Area. A higher elevation in Yakima River stage than the water table implies that Yakima River water infiltrates and recharges the unconfined aquifer. Leakage from canals and ditches originating from the Yakima River during the summer months is also a source of groundwater recharge.

The city of Richland's North Well Field, in the south-central portion of the Richland North Area, is the primary local influence on changes in groundwater elevation in this area. The groundwater mound in this area continued to be maintained with at least a 2:1 ratio of recharge to discharge at the well field during fiscal year 1999. Groundwater levels in much of



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the area near the well field generally rose between June 1998 and March 1999. The maximum rise was ~0.5 meter and the effect is illustrated in wells immediately west (699-S40-E14) and north (699-S37-E14) of the well field (see Figure 2.13-1). This rise in the water table is the result of variations in net recharge at the well field and recharge pond system during different times of the year. In June, groundwater is withdrawn for supplying the municipal water-supply system, but in March water is not withdrawn for municipal use.

Irrigation of agricultural fields in the area between the Yakima River and the former 1100 Area has

Monitoring Objectives in Richland North Area

Groundwater monitoring is conducted in the Richland North Area:

- triennially to annually to describe the nature and extent of contamination
- annually to detect the impact of contamination from off the Hanford Site
- annually or more frequently to ensure the safety of the city of Richland's North Well Field.

affected seasonal groundwater levels in the Richland North Area. Agricultural irrigation supplied primarily by the Columbia River recharges the unconfined aquifer between the Yakima and Columbia Rivers. This seasonal effect is illustrated from the hydrograph of well 699-S43-E7A (see Figure 2.13-1) and more recently by water-level fluctuations in well SPC-GM-2 near Siemens Power Corporation (Figure 2.13-2). Increasing water levels have been observed to the north of irrigation fields along the southern boundary of the Hanford Site (Figure 2.13-3).

2.13.2 Tritium

The southward migration of the tritium plume and the increasing tritium concentrations in the 300 Area continues to raise concern over the potential impact to the city of Richland's North Well Field recharge ponds (Figure 2.13-4). Figure 2.13-4 shows that tritium concentrations decrease from greater than 10,000 pCi/L to less than 100 pCi/L across the 300 Area. The 2,000-pCi/L contour line changed little since fiscal year 1998. South of the 300 Area, the average detectable tritium concentration ranged between 27 and 516 pCi/L (see Plate 3). Several factors limit significant migration into the Richland North Area:

- Groundwater generally flows from west to east between the Yakima River and the Columbia River.
- Artificial recharge from agricultural irrigation west of the Richland North Area contributes to eastward flow.
- Flow is directed outward from the groundwater mound at the City of Richland's North Well Field recharge ponds.

These factors produce converging flow lines in the 300 Area and discharge to the Columbia River (see Figure 2.13-1 and Plate 2). However, modeling efforts have indicated that groundwater flow would still be predominantly west to east without recharge at the north well field recharge ponds. Thus, there is no indication that the tritium plume is migrating southward and might impact the well field.

In late fiscal year 1999, sampling was conducted in the Richland North Area in response to tritium concentrations in groundwater and plant tissue that were higher than trends projected for the area. Richland North Area wells were sampled, and several drive points were installed along the Columbia River shoreline. The results indicated that the tritium trends had stabilized or decreased from the elevated levels at most of the sample locations. Wells showing elevated trends will continue to be sampled in fiscal year 2000. The highest tritium level detected was 516 pCi/L, which is far below the 20,000 pCi/L drinking water standard, in a well west of the north well field recharge ponds.

The area near Richland's North Well Field is monitored closely to detect the possible impact of the tritium plume from the 200 Areas. In fiscal year 1999, tritium levels increased slightly in some monitoring wells. Although levels are far below the drinking water standard, frequent monitoring will continue.

2.13.3 Nitrate

The nitrate distribution in groundwater was shown in Figure 2.12-10. Nitrate contamination that is found in the Richland North Area is likely a result of industrial and agricultural uses off the Hanford Site. In fiscal year 1999, the nitrate plume continued to expand in size, and concentrations continued to increase in a number of wells. The nitrate plume has generally migrated east toward the Columbia River.

Nitrate contamination migrates to the Richland North Area from industrial and agricultural activities off the Hanford Site. Concentrations increased in fiscal year 1999.

Concentrations above the 45-mg/L maximum contaminant level are found both upgradient and downgradient of Siemens Power Corporation. Nitrate data for Siemens Power Corporation wells are reported in EMF-1865, Addenda 15 and 18. The highest nitrate concentrations in the Richland North Area continued to occur northeast (downgradient) of Siemens Power Corporation. The maximum average concentration was ~170 mg/L immediately downgradient of the Horn Rapids Landfill. In fiscal year 1999, nitrate levels increased in wells upgradient of Siemens Power Corporation and are likely a result of agriculture to the west and southwest.

The largest increases in nitrate levels during fiscal year 1999 occurred in an area northwest of the North Richland well field and recharge ponds. These changes are illustrated by the trend plots in Figure 2.13-5. The most likely source of these increased nitrate levels is agriculture circles to the west. The shape of the plume indicates that the eastward migration of nitrate is being diverted around the groundwater mound that is in the vicinity of the recharge ponds (see Plate 2 of water-table map). Nitrate levels in wells at the well field continued to be lower than ambient groundwater as a result of recharge from infiltration of river water at the recharge ponds.

2.13.4 Trichloroethylene

Trichloroethylene contamination occurs on the Hanford Site beneath the Horn Rapids Landfill and off the site in Siemens Power Corporation wells (see Figure 2.12-6). The distribution of trichloroethylene supports the tritium discussion with respect to northeastward flow around the city of Richland's North Well Field recharge ponds. The plume has an elongated configuration similar to previous years. However, concentrations have decreased in much of the plume area near the Horn Rapids Landfill. In fiscal year 1999, trichloroethylene concentrations ranged from less than detection to 6 μg/L. The highest concentrations were found immediately downgradient of the Horn Rapids Landfill and only two wells (699-S31-E10A and 699-S31-E10C) showed concentrations higher than the 5-μg/L maximum contaminant level. Concentrations were less than this level in the point of compliance wells downgradient of the Horn Rapids Landfill. Trichloroethylene concentrations decreased by more than an order of magnitude in this area since monitoring began in 1990 (Figure 2.13-6). The decreased concentrations in the majority of wells downgradient of the Horn Rapids Landfill suggests that some elements of natural attenuation (e.g., volatilization through passive pumping) may be reducing the plume mass. For a discussion of trichloroethylene in the 300 Area, see Section 2.12.4.

Trichloroethylene concentrations continued to be less than 5 μg/L in all Siemens Power Corporation wells in fiscal year 1999 (EMF-1865, Addenda 15 and 18). The past use of solvent in installing and maintaining process lagoon liners at Siemens Power Corporation is the only potential source of trichloroethylene identified in the Richland North Area (DOE/RL-92-67, Draft B).

Trichloroethylene contamination in the Richland North Area has sources off the Hanford Site. Concentrations are naturally declining.

Vinyl chloride and 1,1-dichloroethylene concentrations, breakdown products of trichloroethylene, continued to be close to or less than their respective minimum detection limits in fiscal year 1999.

2.13.5 Gross Alpha and Uranium

Elevated levels of gross alpha and uranium occur downgradient of Siemens Power Corporation near the Horn Rapids Landfill. Gross alpha levels generally decreased in most of the Siemens Power Corporation wells between fiscal years 1998 and 1999 (EMF-1865, Addenda 15 and 18). Well SPC-GM-8 exhibited the highest gross alpha levels, with an average of 77 pCi/L during fiscal year 1999. Most of the downgradient Siemens Power Corporation wells showed average gross alpha levels that were above the 15-pCi/L maximum contaminant level. Because Siemens Power Corporation manufactures nuclear fuel pellets and assemblies for commercial nuclear power plants, it is probable that the gross alpha levels can be largely attributed to uranium. If gross alpha is attributed to uranium with natural isotopic abundances, then 77 pCi/L gross alpha is equivalent to 111 μg/L uranium, which is above the 20 μg/L proposed maximum contaminant level for uranium. Samples collected from the Siemens Power Corporation wells in fiscal year 1999 were not analyzed for uranium.

Uranium concentrations ranged up to an average of 11.5 μg/L, with the highest concentrations immediately downgradient of the Horn Rapids Landfill in wells 699-S30-E10A, 699-S30-E10B, and 699-S31-E10B. Uranium concentrations have been increasing in wells downgradient of the landfill since approximately 1995. Gross alpha activities, which mimic trends in the uranium concentrations, also increased in these wells since approximately 1995. Gross alpha activities in these wells ranged up to an average of 13.9 pCi/L.

2.13.6 Other Constituents

Ammonia, fluoride, and gross beta are found at low levels in wells near Siemens Power Corporation:

- Ammonia — Concentrations of ammonia in the Siemens Power Corporation wells generally remained steady in fiscal year 1999 (EMF-1865, Addenda 15 and 18). The highest average concentration detected was 12.5 mg/L in well SPC-GM-10. Ammonia is typically absorbed by plants or soil microorganisms or is taken up as an exchangeable ion on soil particles (Hausenbuiller 1972). However, ammonia is usually less stable than nitrate in a biological system like the soil and is rapidly converted to nitrate by nitrification. The fact that ammonia is found in the groundwater suggests that relatively high concentrations reached the soil column.
- Fluoride — Three downgradient Siemens Power Corporation wells (SPC-GM-5, SPC-GM-8, and SPC-GM-10) had fluoride concentrations above the 4-mg/L maximum contaminant level in fiscal year 1999 (EMF-1865, Addenda 15 and 18). The highest average concentration was 5.0 mg/L in well SPC-GM-10. Average fluoride concentrations in onsite wells for this area were all less than 1 mg/L.
- Gross Beta — Gross beta levels exhibited similar trends to the gross alpha levels in most of the Siemens Power Corporation wells (EMF-1865, Addenda 15 and 18). The highest average gross beta measurement in fiscal year 1999 was 50 pCi/L in well SPC-GM-8. The highest average onsite gross beta measurement in this area was 23.8 pCi/L. Low levels of technetium-99, detected near the Horn Rapids Landfill, may be related to the gross beta measurements.

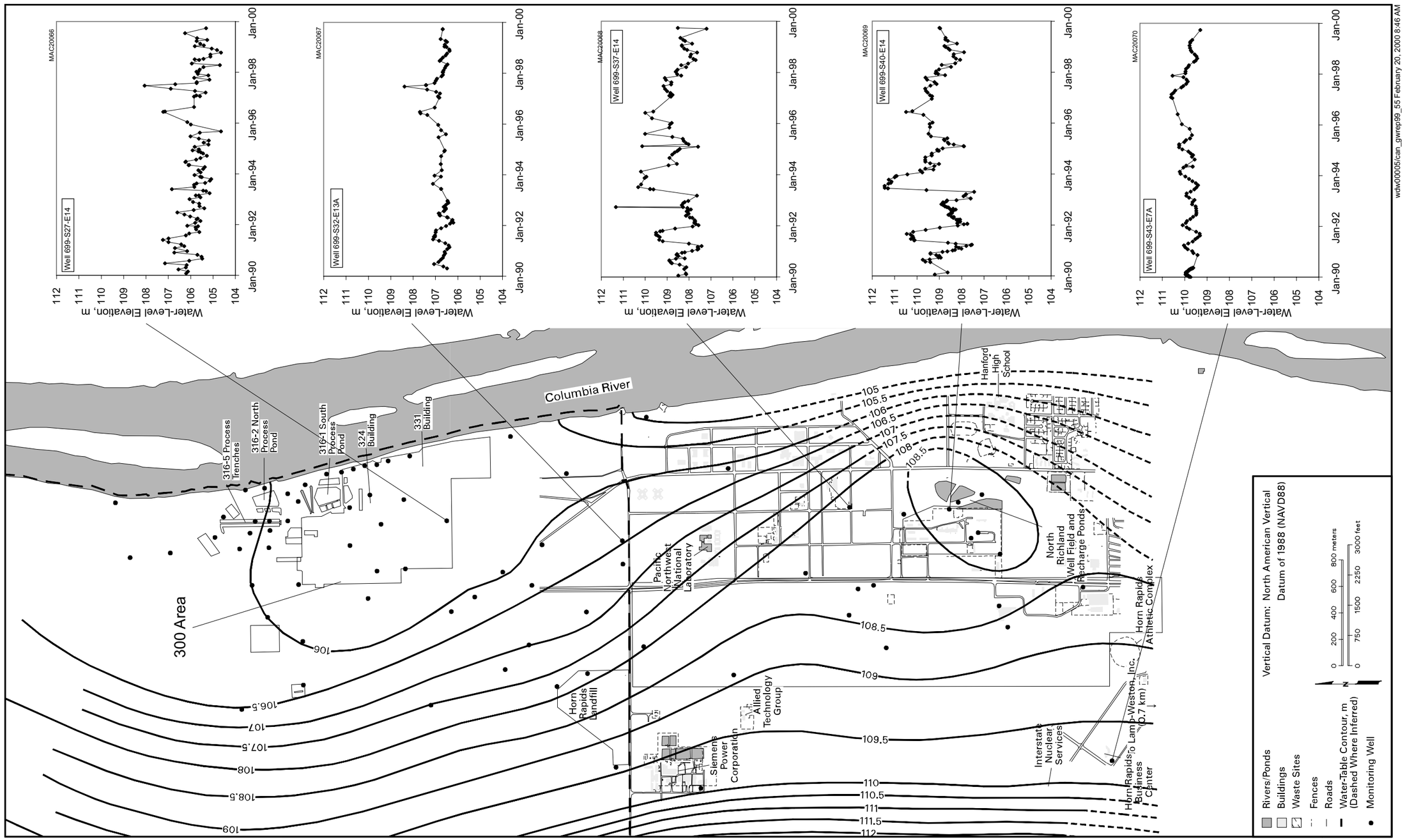

Figure 2.13-1. Water Levels in Wells Monitoring the Richland North Area, March 1999

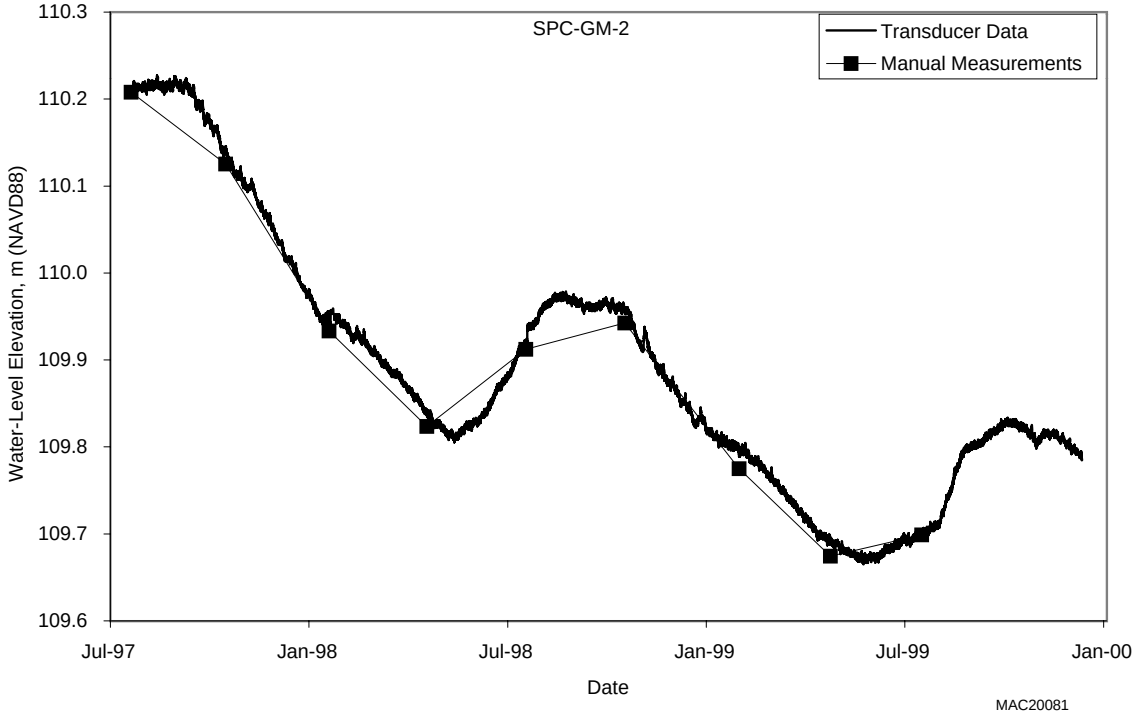

Figure 2.13-2. Water Levels in Well SPC-GM-2 at Siemens Power Corporation

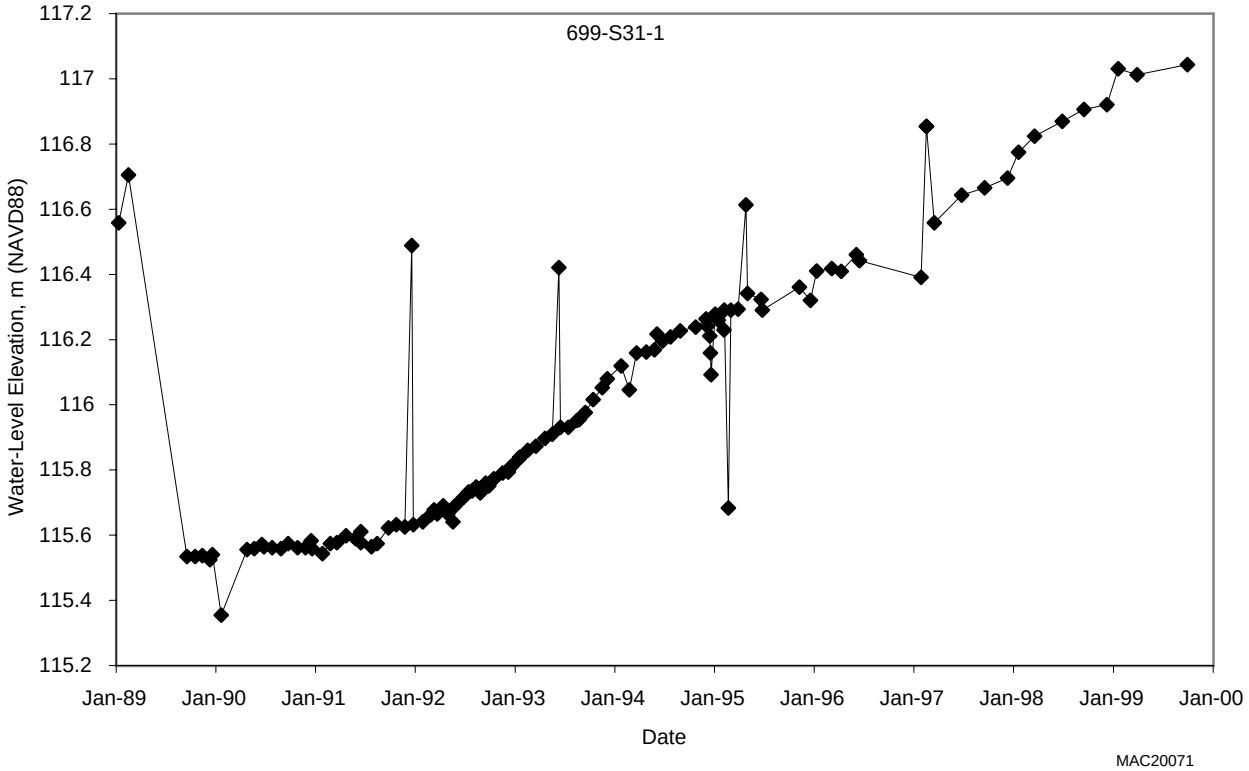

Figure 2.13-3. Water Levels in Well 699-S31-1

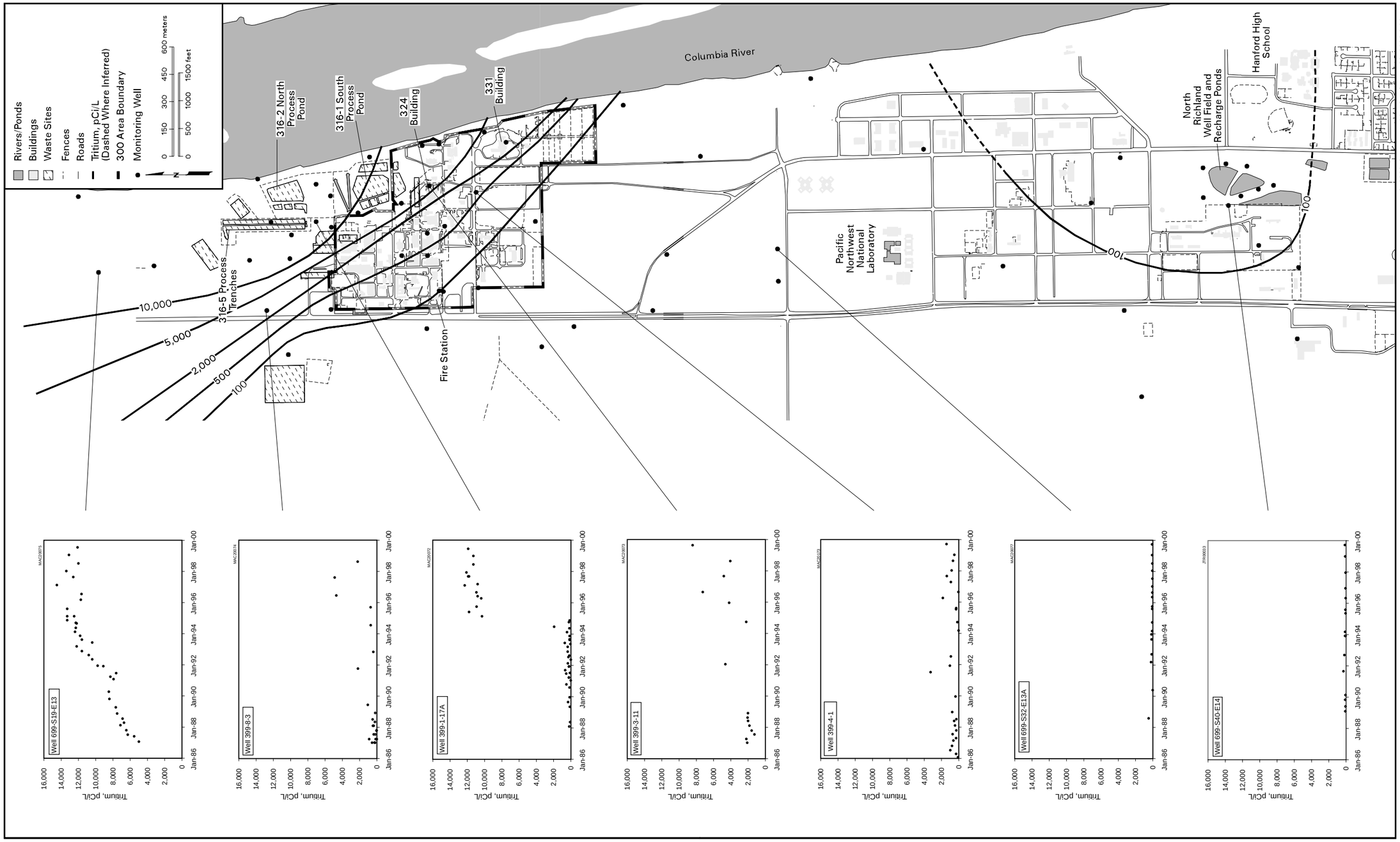

Figure 2.13-4. Tritium Concentrations in Wells at 300 and Richland North Areas, Top of Unconfined Aquifer

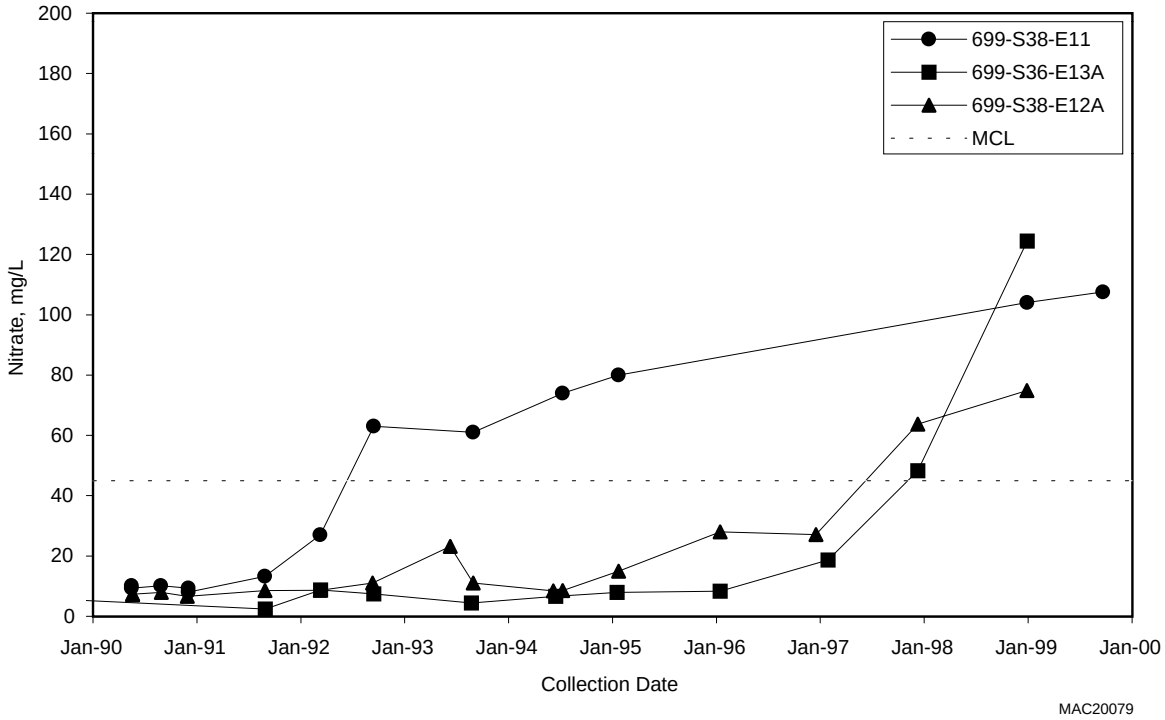

Figure 2.13-5. Nitrate in Wells 699-S38-E11, 699-S36-13A, and 699-S38-E12A

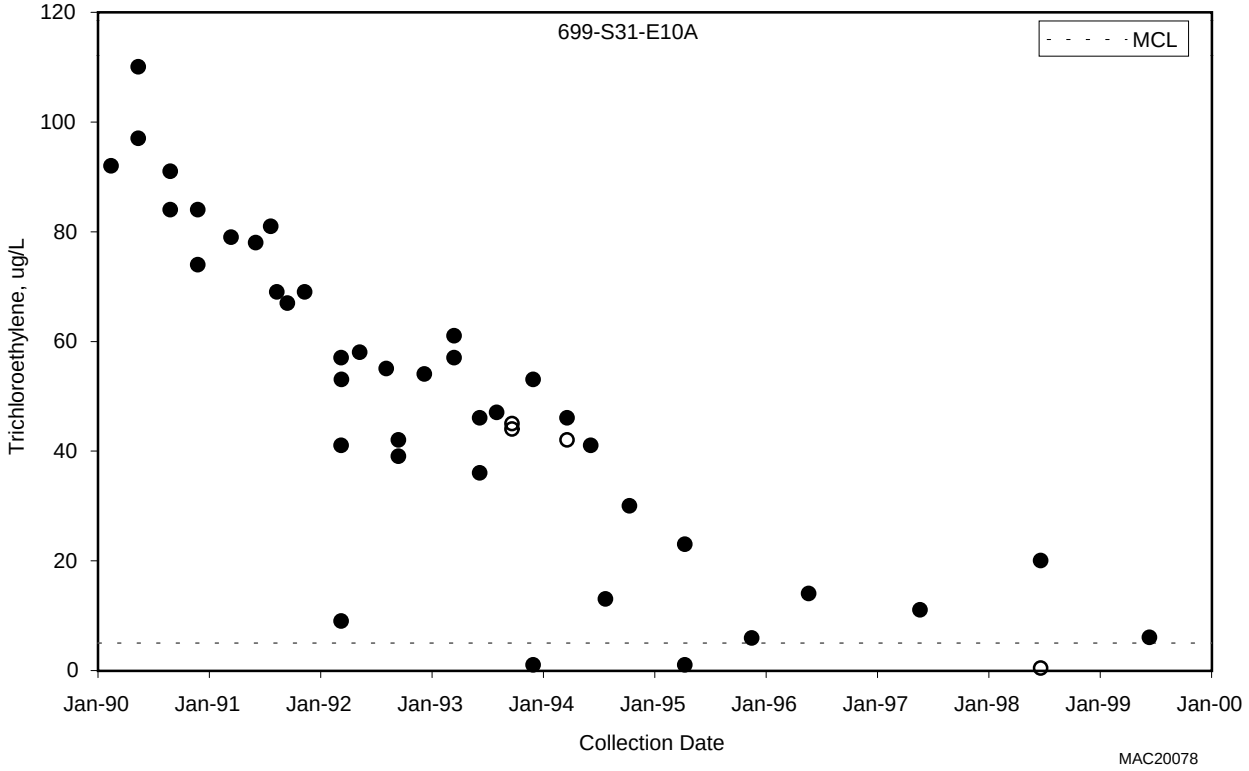

Figure 2.13-6. Trichloroethylene in Well 699-S31-E10A