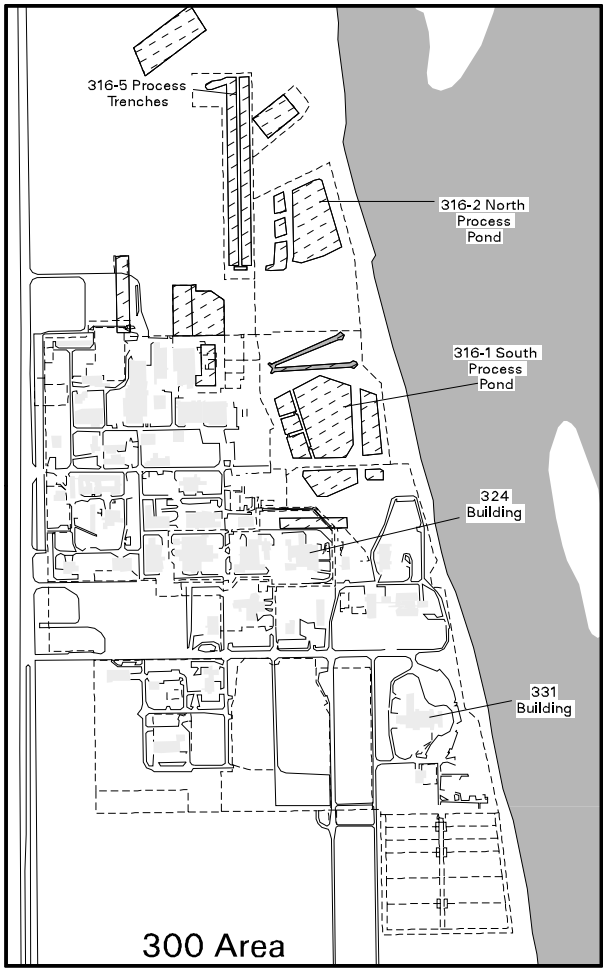
2.12 300 Area

J. W. Lindberg

Uranium is the major contaminant of concern in the 300 Area. Tritium contamination from the 200 East Area impacted the 300 Area at levels less than the interim drinking water standard (see Section 2.13). The 10,000-pCi/L isopleth line trends through the 300 Area and shows little change since fiscal year 1998. Tritium contamination and how it affects the 300 Area is discussed in Sections 2.9.2.2 and 2.13.2. Additional constituents detected during fiscal year 1999 include cis-1,2-dichloroethylene, nitrate, strontium-90, tetrachloroethylene, and trichloroethylene.

2.12.1 Groundwater Flow

The primary influence on changes in groundwater elevation in the 300 Area is the fluctuation in Columbia River stage. Changes in river-stage elevation can be correlated to changes in water-level elevations at wells as far as ~360 meters from the river (PNL-8580). During fiscal year 1999, river-stage fluctuations were typical for an average year, and the water-table elevations and corresponding configuration of the water-table map for March 1999 (see Plate 2) were similar to March water-table maps of previous years. This configuration indicates a slight increase in river stage over average. As an example, the March 1999 water-table map appears very similar to the March 31, 1992, water-table map (see Figure G-6 in DOE/RL-93-21, Rev. 0).



can_hart_99032 January 28, 2000 2:39 PM

Monitoring Objectives in 300 Area

Groundwater monitoring is conducted in the 300 Area:

- annually to describe the nature and extent of contamination
- annually to monitor attenuation of contaminants in the groundwater operable unit
- semiannually to monitor attenuation of contaminants at one RCRA site.

Water-table contours in the vicinity of the 300 Area are somewhat concentric indicating that the 300 Area is a low point, or "sink," in the local unconfined aquifer. Groundwater enters the 300 Area from the northwest, west, and southwest, flows through the 300 Area, and then into the Columbia River. In the immediate vicinity of the 316-5 process trenches, the flow direction was southward during March 1999 based on the water-table contours. Flow rate there was 0.35

to 105 meters per day (see Table A.2) based on the March 1999 gradient. The southward flow direction is a response to the slight increase in river stage. Average river stage would produce a more southeastward flow direction in the vicinity of the 316-5 process trenches.

2.12.2 Uranium

The uranium distribution in the 300 Area is shown in Figure 2.12-1. The highest uranium concentrations are found in the northern part of the 300 Area, downgradient from the 316-5 process trenches and near the 316-1 process pond. Because the 316-1 process pond is downgradient of the process trenches, it is difficult to determine the relative contribution of each facility to the contamination. However, the maximum uranium concentration (20-µg/L proposed drinking water standard) detected in the 300 Area was 322 µg/L in well 399-2-2 in the August 1999 sample. The line of wells from well 399-1-17A through well 399-1-7 to well 399-2-2 has the highest levels of uranium in the 300 Area (and this alignment is along the average groundwater flow direction from the 316-5 process trenches). This alignment suggests that the major source of the uranium contamination is the 316-5 process trenches.

Groundwater in the 300 Area is contaminated with uranium from the process trenches and ponds. Levels have fluctuated since the 1980s, but have declined overall.

Figure 2.12-2 shows the historical trend for uranium in well 399-1-17A, which is the well closest to the inflow portion of the 316-5 process trenches. Uranium concentrations dropped dramatically in 1991 as a result of the expedited response action, which removed much of the contaminated sediment in the trenches. However, uranium concentrations began to rise sharply again when the process trench discharges ceased in December 1994. In fiscal years 1996 and 1997, the rise continued, though not at the rapid rate it did in fiscal year 1995. The average uranium levels in fiscal year 1998 were lower than fiscal year 1997, and the levels in fiscal year 1999 were about the same or slightly less that fiscal year 1998.

Presumably, the amount of uranium found in the unconfined aquifer at the process trenches was diluted by the large quantities of process wastewater prior to January 1995. Because wastewater is no longer discharged to the trenches, the increase in uranium reported in groundwater samples indicates that uranium continues to contribute to groundwater contamination by the soil column at the 316-5 process trenches. The lack of dilution by large quantities of process wastewater caused the uranium in the groundwater to continue to rise during fiscal years 1996 and 1997 and remain elevated during fiscal years 1998 and 1999. The total uranium contribution by the soil column at the trenches during fiscal year 1999 may actually be the same, or even lower, than it was prior to January 1995.

Figure 2.12-2 also shows a yearly cycle for uranium concentration. The peak each year is in the spring with the lowest concentration each year in the fall or early winter. This yearly cycle or yearly fluctuation is caused by high Columbia River stages, which mobilize more uranium in spring and less during low flow stages in fall or early winter.

In previous years, another zone of elevated uranium in 300 Area groundwater was found near the 324 Building, immediately west of well 399-3-11. However, in recent years, the elevated zone of uranium has moved downgradient (southeast) (see Figure 2.12-1). In fiscal year 1996 the reported concentration of uranium in well 399-3-11 was 130 µg/L (Figure 2.12-3). In fiscal years 1996 and 1997, the reported uranium concentrations in well 399-3-11, decreased from 130 to 32 µg/L. At the same time, well 399-4-9, downgradient from well 399-3-11, showed a corresponding increase in uranium concentration over the same years (74 to 130 µg/L) (see Figure 2.12-3). In fiscal year 1999, the reported concentration of uranium at well 399-3-11 was 44.4 µg/L, while the reported concentration at the downgradient well 399-4-9 continued to rise to 163 µg/L. Apparently,

the uranium high near the 324 Building has moved with the groundwater flow to a downgradient position along the Columbia River near well 399-4-9. However, there still appears to be a limited source of uranium near the 324 Building. It is also possible that the uranium near the 324 Building is actually not from the 324 Building but may be a pulse of uranium from farther north (e.g., from the 316-5 process trenches) moving downgradient.

2.12.3 Strontium-90

Strontium-90 (8-pCi/L interim drinking water standard) continues to be detected at well 399-3-11 near the 324 Building. However, the more recently measured concentrations are not as high as those recorded in December 1995 sampling (8.7 pCi/L). Since December 1995, strontium concentration has varied between 3 and 8 pCi/L. During fiscal year 1999, the recorded value was 4.0 pCi/L. Groundwater samples from well 399-3-11 are collected with a bailer and are not filtered. Thus it is possible that much of the strontium-90 is sorbed to sediment in the sample. Although there may have been a release of strontium-90 in the vicinity of the 324 Building, the reported concentration of 8.7 pCi/L in December 1995 was the only result greater than the interim drinking water standard since 1986.

2.12.4 Chlorinated Hydrocarbons

Trichloroethylene was detected at 24 wells in the 300 Area in fiscal year 1999. However, only two had reported concentrations at or above the drinking water standard of 5.0 μg/L. The two wells are 399-1-16B and 399-4-1. Well 399-1-16B is downgradient of the 316-5 process trenches and monitors the lower portion of the unconfined aquifer. The plume downgradient of the 316-5 process trenches is decreasing in concentration as shown in Figure 2.12-4. In fiscal year 1998, the high concentration at well 399-1-16B was 8.0 μg/L. During fiscal year 1999, the concentration of trichloroethylene at well 399-1-16B decreased from 6.0 μg/L in January and February to 4.0 μg/L later in July through September.

Well 399-4-1 is in the southern part of the 300 Area. The source of the trichloroethylene at well 399-4-1 may be the extreme distal portion of the plume from off the Hanford Site to the southwest (Figure 2.12-5 and Section 2.13.4), or more likely, it may be a part of the plume from the 316-5 process trenches. Well 399-4-1 is downgradient of the process trenches because of the south and southwestern component to the groundwater flow direction when the Columbia River stage is high. The plume from the process trenches is the most likely source because the trend of trichloroethylene in well 399-4-1 has been generally decreasing since 1986, a time before the offsite plume approached the 300 Area (Figure 2.12-6). During fiscal year 1999, the reported values of trichloroethylene in well 399-4-1 were 5.0 μg/L in January 1999 and 2.0 μg/L in August 1999.

Trichloroethylene and other chlorinated hydrocarbons are detected in the 300 Area. Levels are declining by natural processes.

A plume of cis-1,2-dichloroethylene was detected at six 300 Area wells, but the reported concentrations exceeded the 70 μg/L drinking water standard in only one well, 399-1-16B. Like trichloroethylene, the source of cis-1,2-dichloroethylene is the 316-5 process trenches. The concentration was at its maximum during fiscal years 1997 and 1998 and decreased slightly during fiscal year 1999 (Figure 2.12-7). During fiscal year 1999, the concentration at well 399-1-16B ranged from 120 to 180 μg/L with the higher reported values at the beginning of the year.

A plume of tetrachloroethylene was detected in the 300 Area during fiscal year 1998. Its source is in the vicinity of the 316-5 process trenches and extends southeast to the Columbia River. The plume continued during fiscal year 1999 (Figure 2.12-8), but the concentration within the plume decreased dramatically (Figure 2.12-9). The maximum reported value at well 399-1-17A, immediately downgradient of the process trenches, was 38 μg/L in fiscal year 1998. The

maximum value at the same well in fiscal year 1999 was 4.0 µg/L. The plume maximum during fiscal year 1999 was 7.0 µg/L at well 399-1-16A, but the yearly average was only 1.8 µg/L.

2.12.5 Nitrate

Nitrate (above background levels, WHC-EP-0595, Table A-1-2) is detected in all wells sampled in the 300 Area (Figure 2.12-10). However, only two of those wells reported nitrate concentrations greater than the 45 mg/L drinking water standards. The wells that reported concentrations greater than the drinking water standard were 399-5-1 and 699-S27-E14 (in the southwestern and southern portions of the 300 Area). The source of the nitrate is probably offsite industry and agriculture (Section 2.13).

2.12.6 316-5 Process Trenches RCRA Parameters

The 316-5 process trenches have been monitored by a *Resource Conservation and Recovery Act of 1976* (RCRA) final status corrective-action network since December 1996. Corrective action is in conjunction with the *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* (see Section 2.12.7). The purpose of groundwater monitoring is to examine the trend of the constituents of concern to determine if they are decreasing in concentration as expected. Eight wells are monitored for uranium and volatile organics (including as a minimum trichloroethylene and cis-1,2-dichloroethylene). During fiscal year 1999, uranium remained above the interim drinking water standard of 20 µg/L in the three downgradient wells that monitor the upper portion of the unconfined aquifer, near the water table. Those three wells are 399-1-10A, 399-1-16A, and 399-1-17A. Cis-1,2-dichloroethylene and trichloroethylene were both found to be above the drinking water standard in well 399-1-16B. Tetrachloroethylene was above the 5 µg/L drinking water standard at 7 µg/L in well 399-1-16A in December 1998, but dropped in concentration to below the detection level starting in June 1998. Uranium, as well as cis-1,2-dichloroethylene and trichloroethylene, appear to be decreasing slightly in concentration when their trends are compared over several years. For more information about uranium and the volatile organics, see Sections 2.12.2 and 2.12.4.

The 316-5 process trenches are a RCRA site monitored under a corrective-action program. The corrective action is deferred to the CERCLA operable units and involves natural attenuation of the contaminants.

2.12.7 300-FF-1 and 300-FF-5 Operable Units

The interim record of decision for the 300-FF-1 and 300-FF-5 Operable Units was approved in July 1996 (ROD 1996b). The selected remedy for the 300-FF-5 Operable Unit is an interim action that involves emplacing security measures to prevent exposures to residual contamination; imposing restriction on the use of the groundwater until such time as health-based criteria are met for uranium, trichloroethylene, and cis-1,2-dichloroethylene; and allowing contaminants in the groundwater to naturally diminish over time.

In fiscal year 1997, remediation of 300-FF-1 Operable Unit started by digging out the contaminated soil at the 316-5 process trenches. By the end of fiscal year 1999, the contaminated soil from the 316-5 process trenches had been completely removed and replaced with clean soil. Also, by the end of fiscal year 1999, the contaminated soil had been completely removed from the 316-2 north process pond and was partially removed at the 316-1 south process pond.

An operation and maintenance plan for the 300-FF-5 Operable Unit was released in September 1996 (DOE/RL-95-73). Its purpose was to complete the tasks necessary to verify the effectiveness of the selected alternative. The groundwater monitoring network includes the eight wells of the RCRA 316-5 process trenches network plus nine other wells in the

300 Area. The constituents of concern are the same as for the RCRA 316-5 process trenches network. During fiscal year 1999, the 300-FF-5 Operable Unit network, like the 316-5 process trenches network, showed that the constituents of concern are still above drinking water standards near the process trenches, but are decreasing with time. For more information, see Sections 2.12.2 and 2.12.4.

2.12.8 Water Quality at Shoreline Monitoring Locations

A seep in the riverbank at the 300 Area is sampled annually in the fall. The most recently available results are from fall 1998. Specific conductance measured 362 µS/cm. This relatively high value indicates the sample was primarily groundwater, not river water draining back from bank storage. Uranium-234 was detected at 30.9 pCi/L, uranium-235 at 0.57 pCi/L, and uranium-238 at 26.2 pCi/L. Gross alpha and gross beta concentrations were 55.6 and 21 pCi/L, respectively. The sample contained 9,590 pCi/L tritium. These results are consistent with contaminants detected in groundwater in the 300 Area.

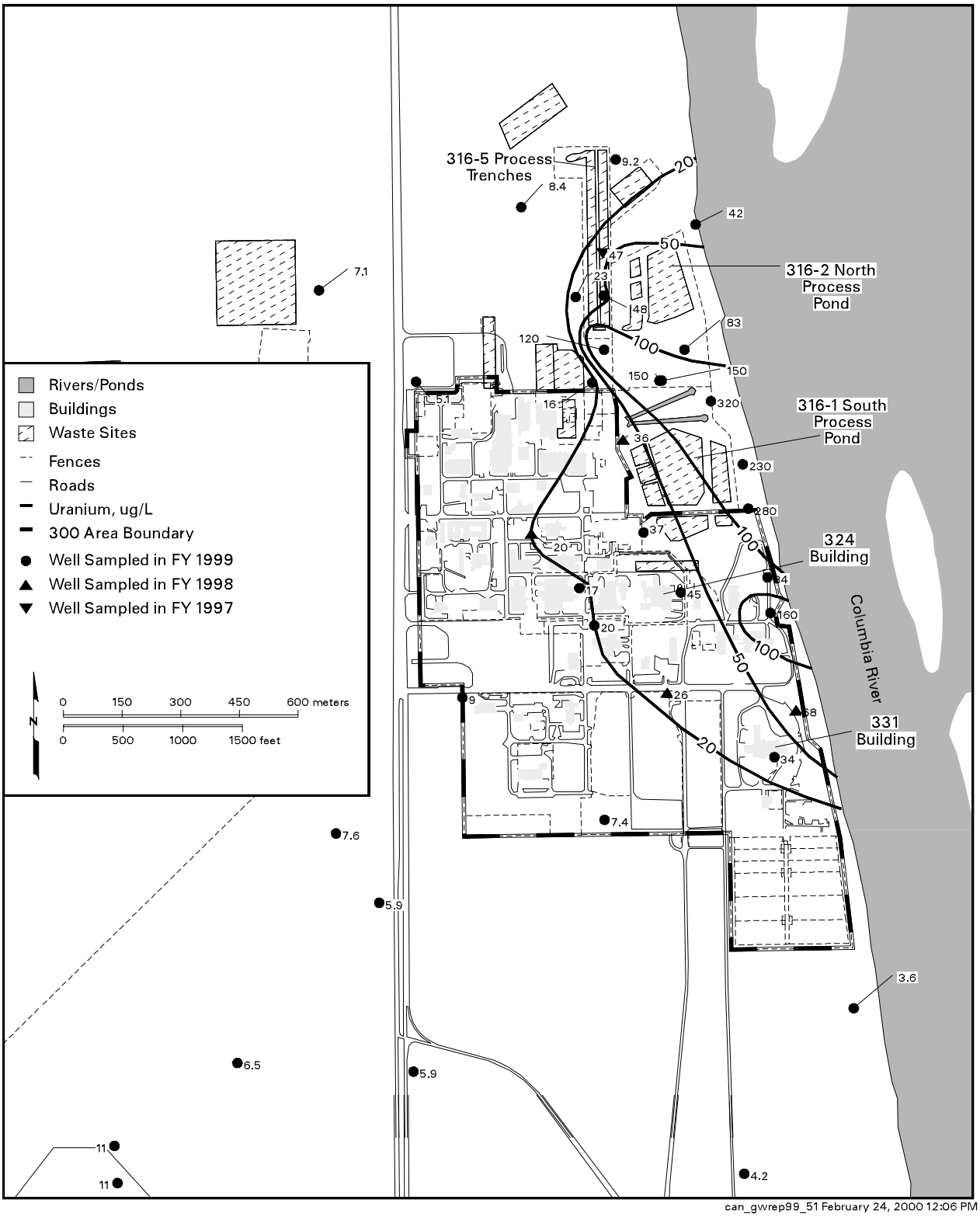


Figure 2.12-1. Average Uranium Concentrations at 300 Area, Top of Unconfined Aquifer

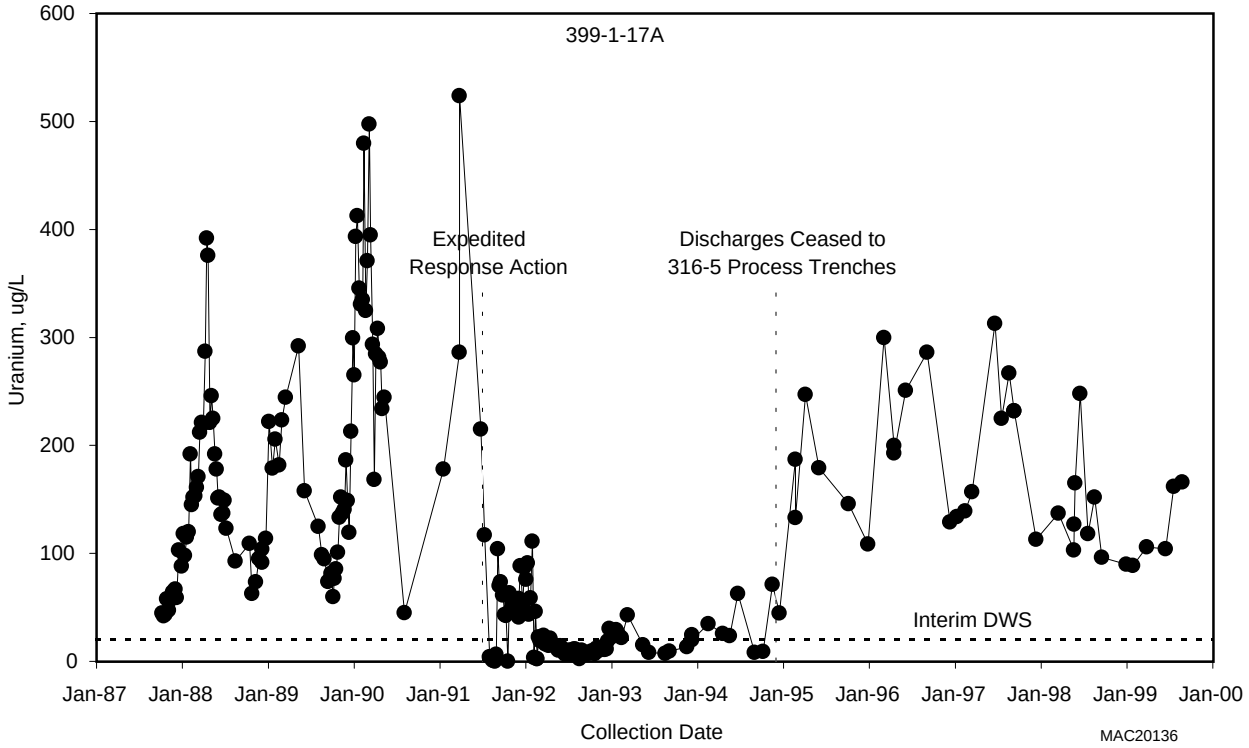


Figure 2.12-2. Uranium in Well 399-1-17A Near 316-5 Process Trenches

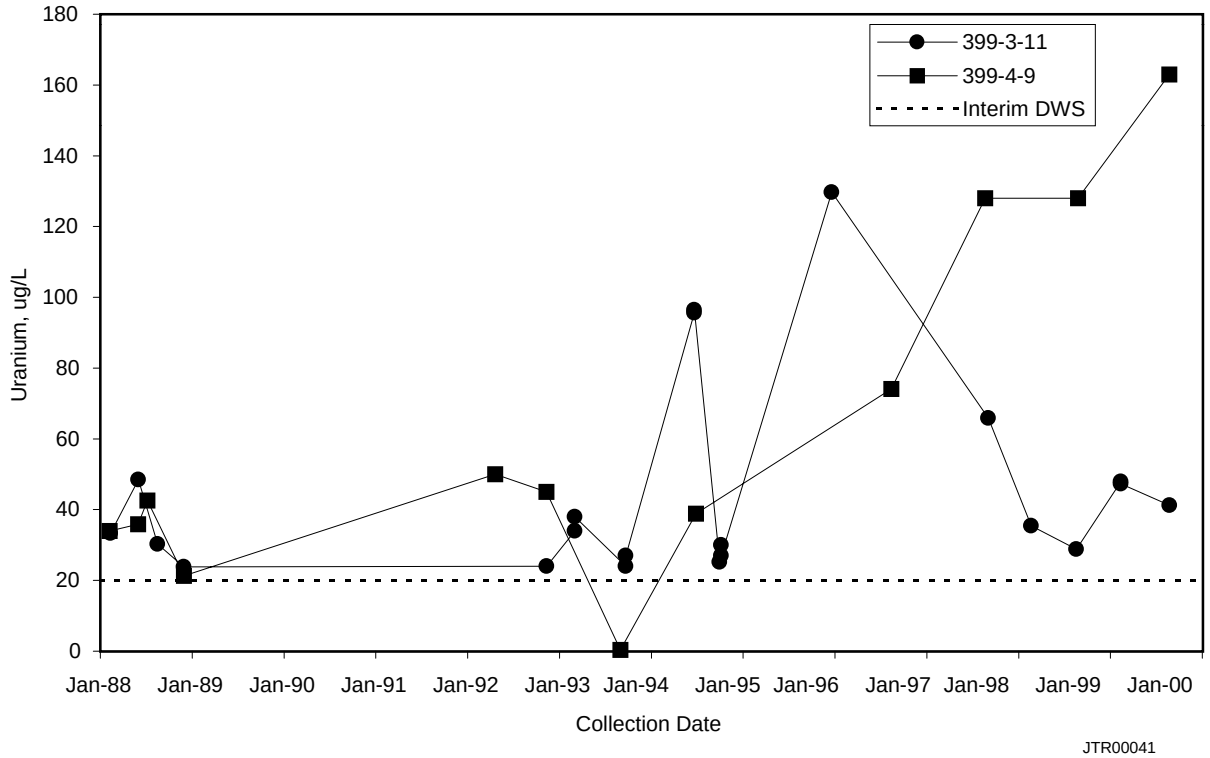


Figure 2.12-3. Uranium in Wells 399-3-11 and 399-4-9 Near 324 Building

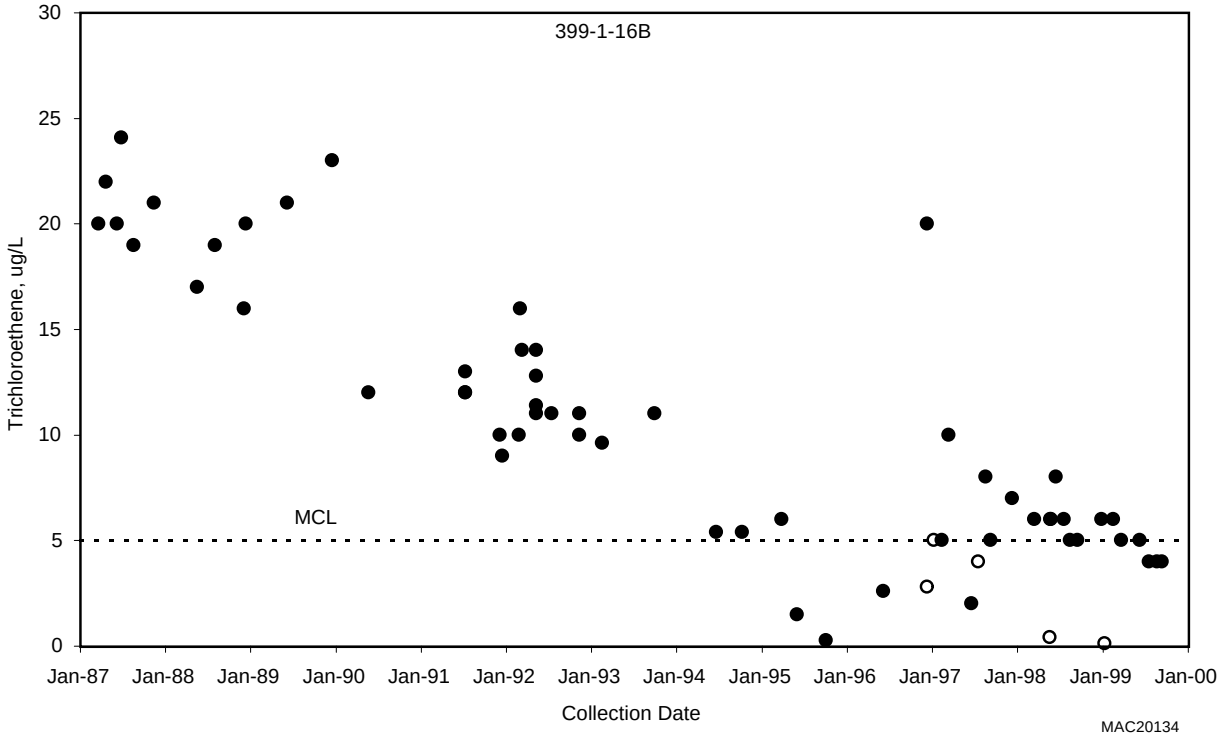


Figure 2.12-4. Trichloroethylene in Well 399-1-16B Near 316-5 Process Trenches

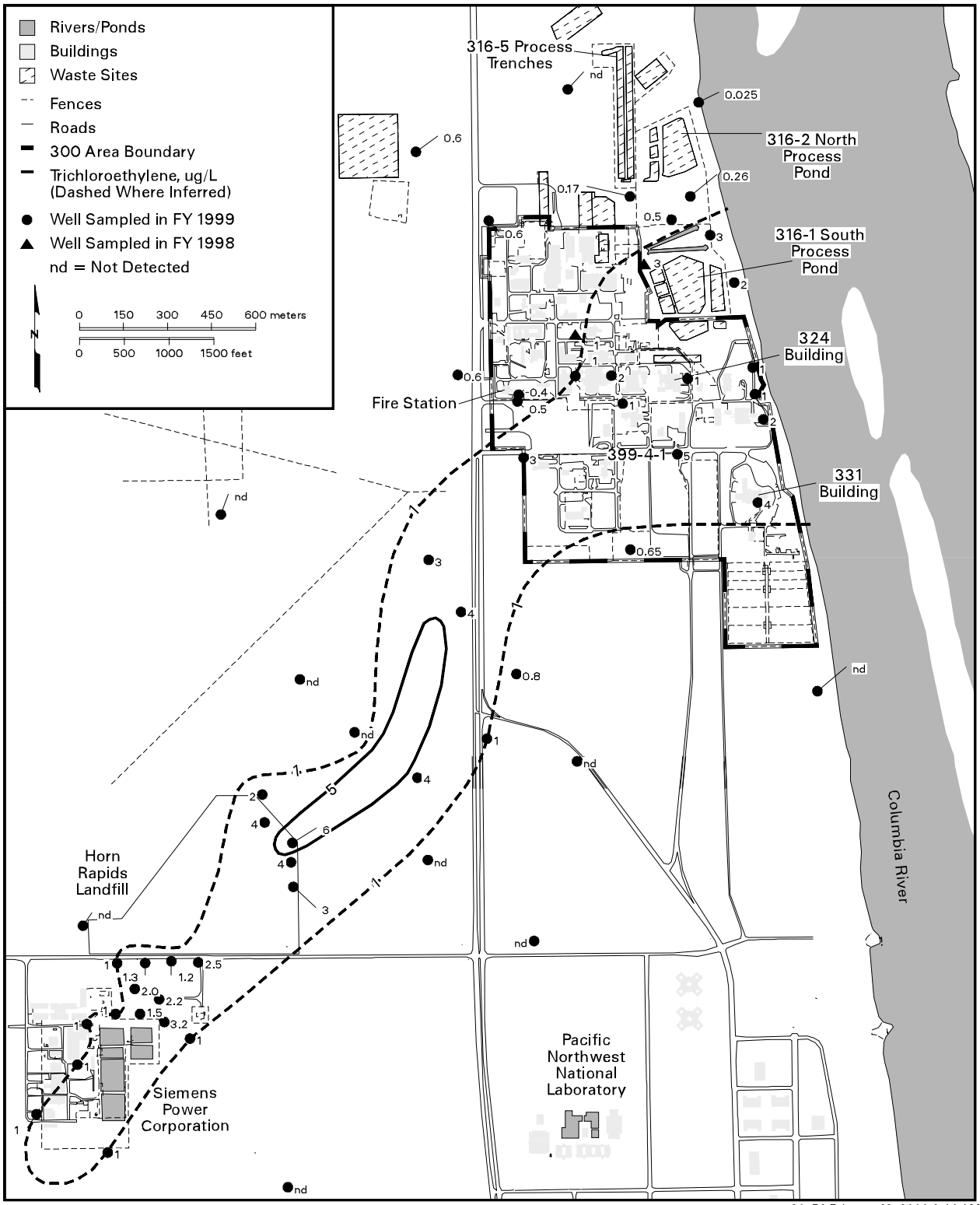


Figure 2.12-5. Average Trichloroethylene Concentrations in the 300 Area and Richland North Area, Top of Unconfined Aquifer

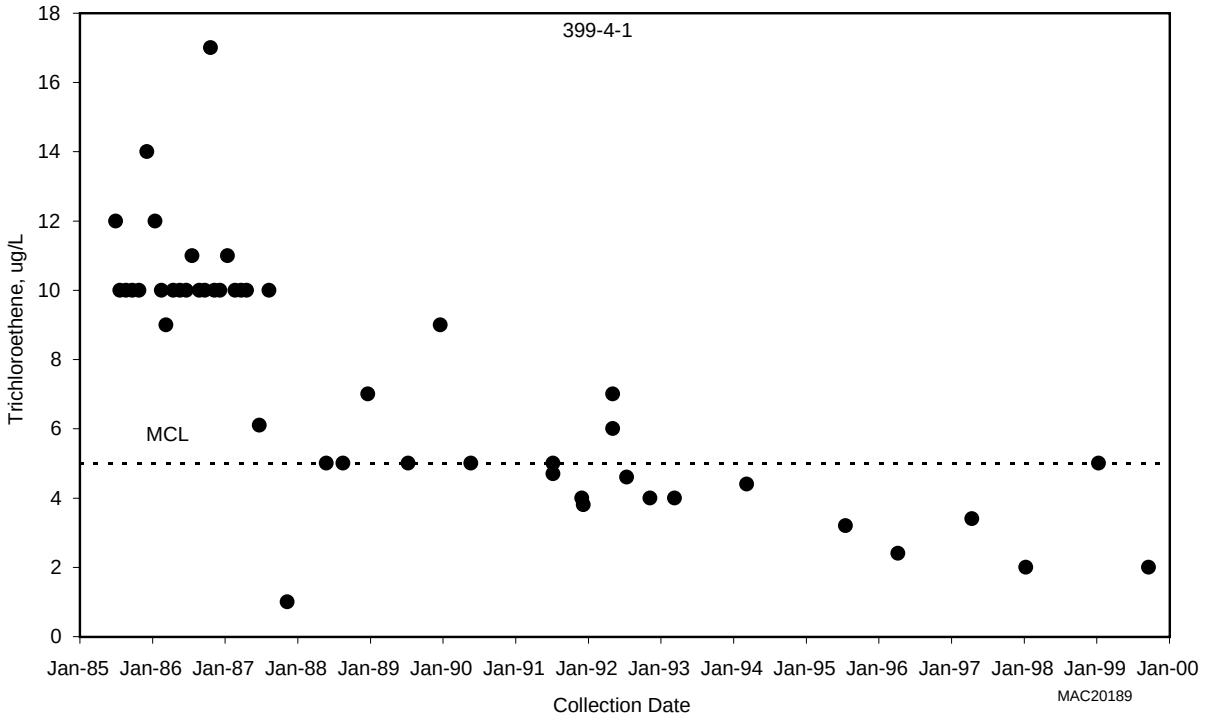


Figure 2.12-6. Trichloroethylene in Well 399-4-1, Southern 300 Area

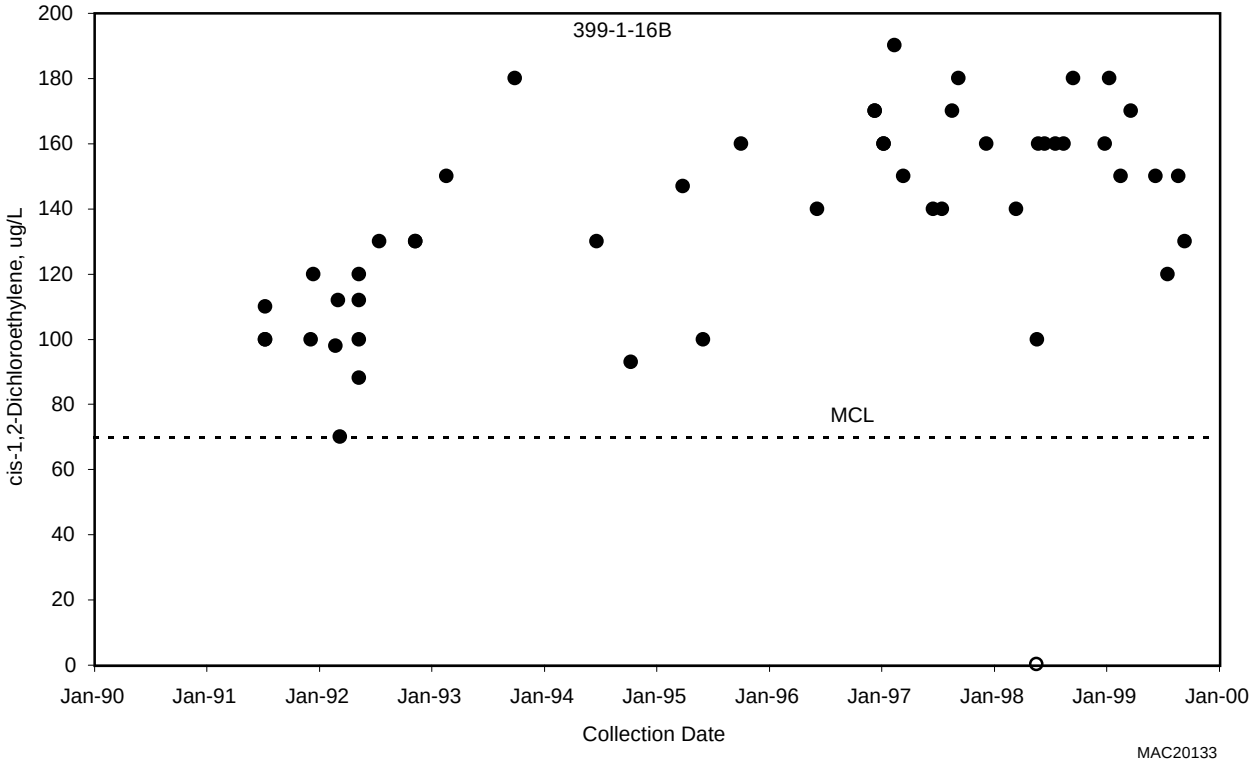
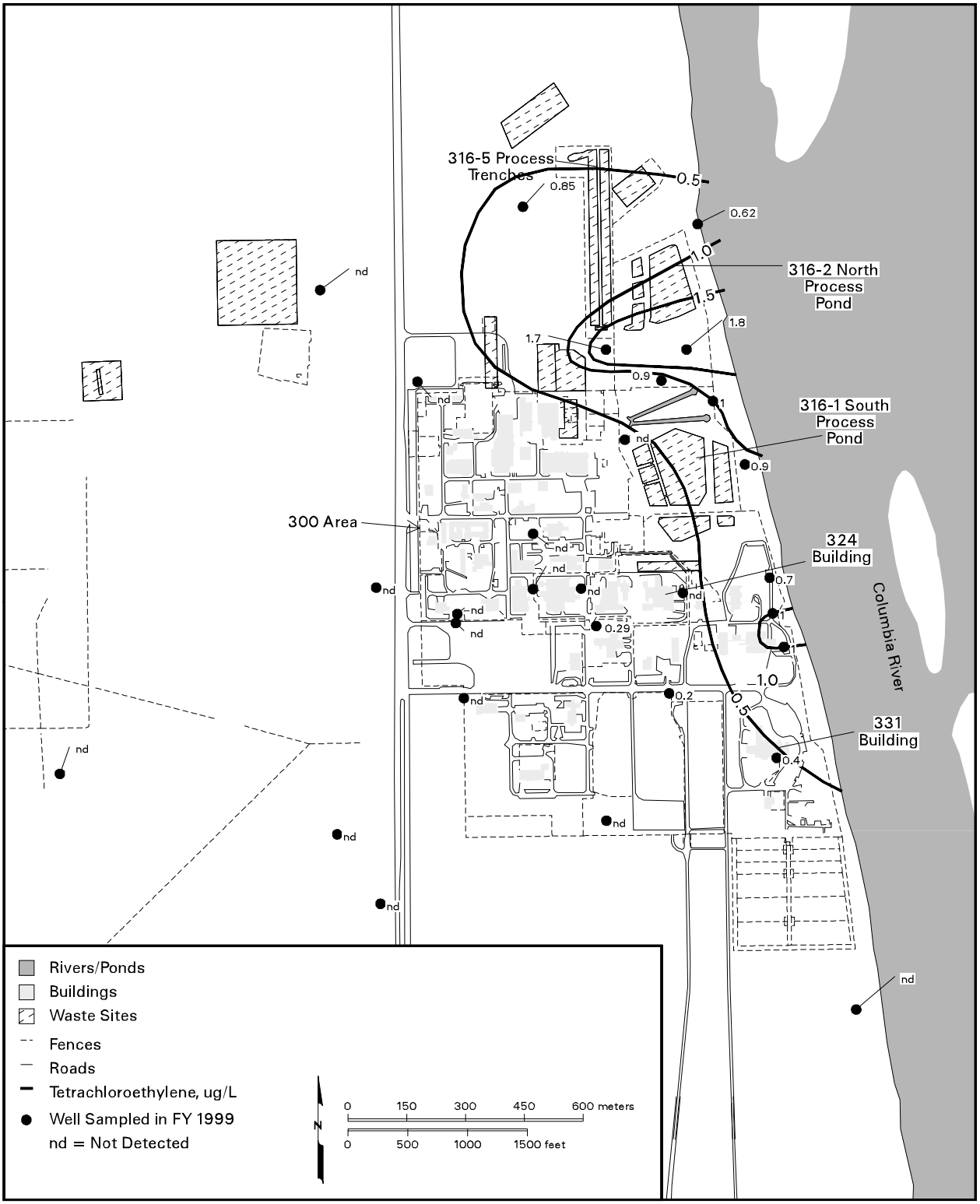


Figure 2.12-7. cis-1,2-Dichloroethylene in Well 399-1-16B Near 316-5 Process Trenches



can_gwrep99_53 February 19, 2000 12:11 PM

Figure 2.12-8. Average Tetrachloroethylene Concentrations in the 300 Area, Top of Unconfined Aquifer

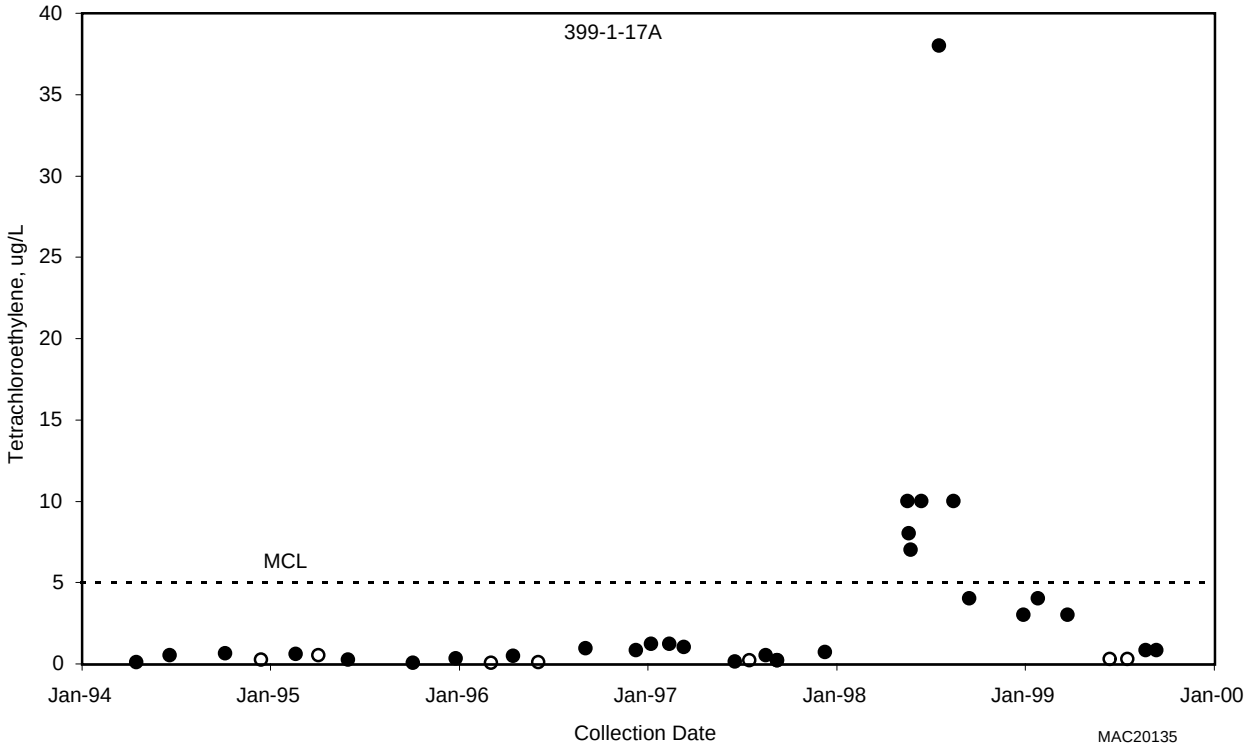


Figure 2.12-9. Tetrachloroethylene in Well 399-1-17A Near 316-5 Process Trenches

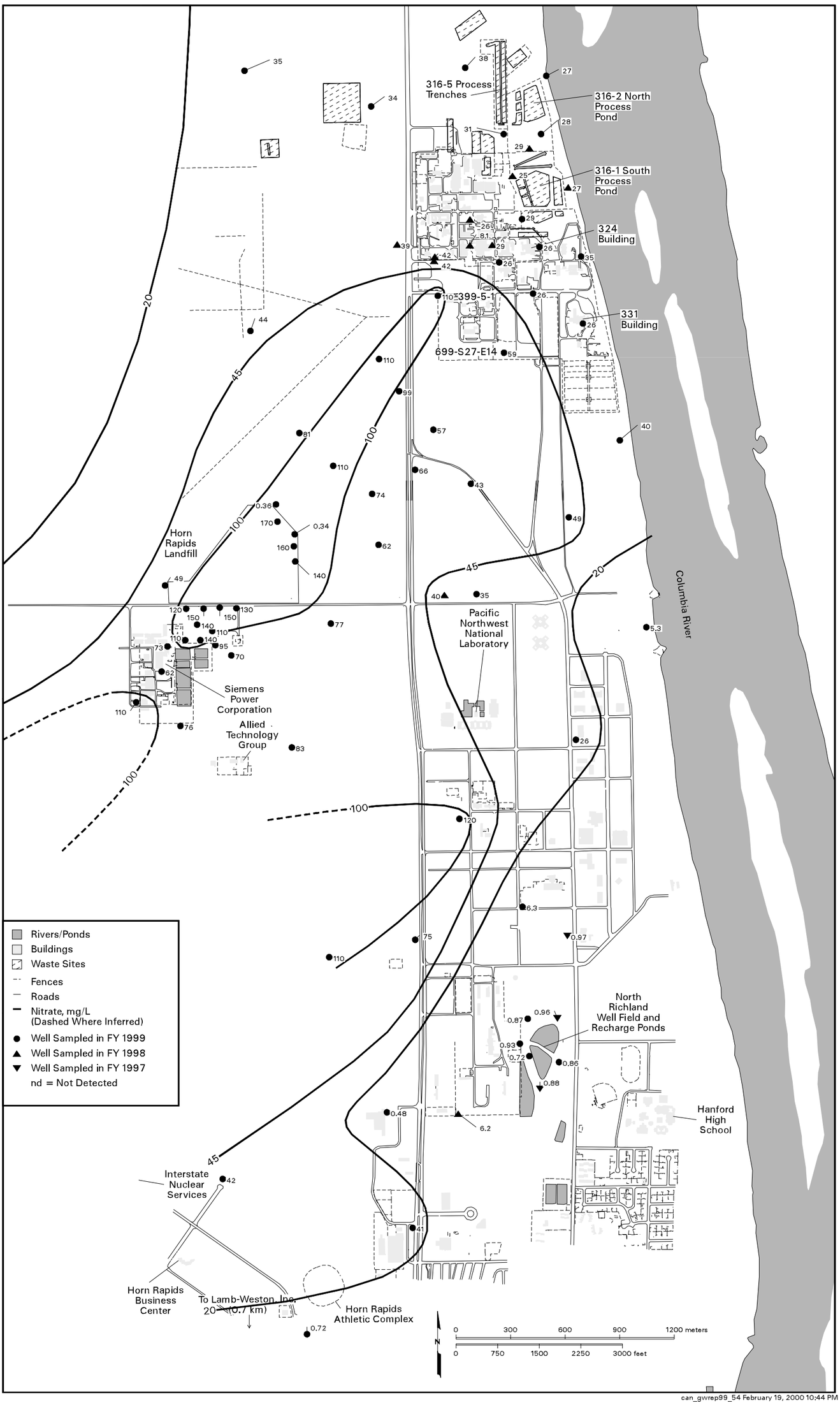


Figure 2.12-10. Nitrate in Wells at the 300 Area and Richland North Area