12.0 Introduction to Volume 2 – River Corridor

Volume 2 of the Hanford Site groundwater monitoring report includes information for the portions of the Hanford Site adjacent to the Columbia River. This includes the 100 Areas, where nine nuclear reactors formerly operated, and the 300 Area, which was formerly used for uranium fuel production and research activities. Hanford Site groundwater discharges to the Columbia River, thus it is the primary exposure route for site contaminants to reach human and environmental receptors.

Beginning in the 1990s and continuing today, the U.S. Department of Energy (DOE) has remediated hundreds of waste sites along the River Corridor. This has involved demolishing structures, excavating contaminated soil, and disposing the contaminated material in an engineered landfill in the central portion of the Hanford Site. The former waste sites are being filled in with clean material and the land revegetated. The DOE has identified nearly 1,500 waste sites in the River Corridor. Approximately two-thirds of these waste sites have been remediated to date. Removing the contaminated material eliminates sources of contamination that otherwise could be carried to groundwater by infiltrating precipitation. The DOE has initiated the remedial investigation/feasibility study process to collect additional data needed in order to make final decisions regarding cleanup of waste sites and groundwater along the River Corridor.

Section 12.1 summarizes the organization of this volume. Section 12.2 summarizes monitoring of the Columbia River shoreline. A summary of new documents relating to the River Corridor remedial investigation/feasibility study process is included in Section 12.3.

12.1 Organization of Volume 2

This volume includes information about groundwater OUs near the Columbia River.

Volume 2 includes the following chapters:

- Chapter 13.0, 100-BC-5 Operable Unit (OU)
- Chapter 14.0, 100-KR-4 OU
- Chapter 15.0, 100-NR-2 OU
- Chapter 16.0, 100-HR-3 OU (includes the 100-D and 100-H Areas)
- Chapter 17.0, 100-FR-3 OU
- Chapter 18.0, 300-FF-5 OU
- Chapter 19.0, 1100-EM-1 OU
- Chapter 20.0, Well Installation, Maintenance, and Decommissioning in the River Corridor
- Chapter 21.0, Columbia River
- Chapter 22.0, References for Volume 2
- Appendix A, Supporting Information for CERCLA Groundwater OUs (pertains to both volumes)
- Appendix B, Cost Information for Groundwater Remediation (pertains to both volumes)
- Appendix C, Supporting Information for RCRA Facilities (pertains to both volumes)
- Appendix D, Supporting Information for Aquifer Sampling Tubes

- Appendix E, Quality Assurance/Quality Control (pertains to both volumes).

The portion of the River Corridor between the 100-FR-3 and 300-FF-5 OUs is included with the 200-PO-1 OU and is discussed in Chapter 5.0, Volume 1 (Central Plateau).

12.2 Shoreline Monitoring

Water samples from aquifer tubes and riverbank seeps represent a mixture of river water and groundwater.

The DOE monitors groundwater quality along the Columbia River by collecting samples from aquifer tubes and riverbank seeps (springs). In 2009, DOE studied and collected porewater from within the gravel and sand of the Columbia River bed to define where groundwater is discharging to the river.

Hydrologists estimate that groundwater currently flows from the Hanford Site aquifer to the Columbia River at a rate between 1.1 and 2.5 cubic meters per second (PNNL-13447, *Transient Inverse Calibration of Hanford Site-Wide Groundwater Model to Hanford, Operational Impacts – 1943 to 1996*; PNNL-14753, *Groundwater Data Package for the 2004 Composite Analysis*). This rate is less than 0.074% of the average flow of the Columbia River, ~3,400 cubic meters per second.

The rise and fall of the Columbia River create a zone of interaction that influences contaminant concentrations and groundwater flow patterns. Water samples from aquifer tubes and riverbank seeps nearly always represent a mixture of river water and approaching groundwater. In general, the degree of dilution by river water decreases with depth in the aquifer near the river shoreline. The degree of dilution also varies by location and with seasonal river cycles (PNNL-13674, *Zone of Interaction Between Hanford Site Groundwater and Adjacent Columbia River*).

Data from aquifer tubes and seeps are used for the following purposes:

- In mapping, data indicate minimum concentrations of contaminants in groundwater approaching the Columbia River (because the samples may be mixed with river water, actual concentrations in groundwater may be higher).
- Long-term decreases or increases in contamination in aquifer tubes or seeps may indicate real trends in groundwater. Declines could represent movement of the plume, discharge of the plume to the river, dispersion, or the influence of an upgradient remediation system. Increasing concentrations may indicate plume movement or mobilization of contaminants.
- Data from aquifer tubes have helped determine where additional monitoring and remediation are needed (e.g., aquifer tube data provided the first indication of the southern 100-D Area chromium plume).

Interpreters of these data must keep in mind the following limitations:

- Concentrations in aquifer tubes and seeps may vary seasonally (the same is true for near-river wells).
- Because aquifer tubes have much shorter screens than monitoring wells, the data may not be directly comparable to data from near-river wells.
- Aquifer tube and seep data currently are not used in remedial action decision making (i.e., are not compliance points for pump-and-treat systems).

Aquifer tubes are small-diameter, flexible tubes that have a screen on one end. The tubes are installed in the aquifer along the Columbia River shore by driving a temporary steel casing into the ground, clearing the casing of material, and inserting the screened end of a tube into the casing. The steel casing is then pulled out, leaving

the tube in place. Water is withdrawn from the tube using a small suction pump. Most aquifer tube sites include two or three individual tubes monitoring different depths from ~1 to 8 meters.

In October 2008, the DOE released *Technical Evaluation of the Interaction of Groundwater with the Columbia River at the U.S. Department of Energy Hanford Site, 100-D Area* (SGW-39305). The report provides an expert panel's observations and suggestions to improve the current understanding of groundwater/surface water interactions in the 100 Areas, primarily focusing on the 100-D Area. The recommendations included integrity testing of aquifer tubes. In early 2010, staff evaluated specific conductance data from aquifer tubes collected before and after sampling. The results indicated that pumping the tubes does not cause Columbia River water to migrate down the boring and cause sample dilution. Full results of the evaluation will be presented in an upcoming report.

Representatives from the U.S. Environmental Protection Agency (EPA) and the Washington State Department of Ecology (Ecology) meet annually with DOE and its contractors to plan aquifer tube sampling (DOE/RL-2000-59, *Sampling and Analysis Plan for Aquifer Sampling Tubes*). The individual OU sections of this report summarize aquifer tube results and include location maps. Appendix D provides supporting information for the aquifer tube sampling.

Table 1-3 in Chapter 1 lists the maximum contaminant levels in aquifer tubes sampled during the reporting period. Section 5.2 in Volume 1 (200-PO-1 OU) and multiple sections in Volume 2 (River Corridor) present the results of aquifer tube monitoring.

12.3 Remedial Investigation/Feasibility Study

The Tri-Parties (i.e., DOE, Ecology, and EPA) recently developed a strategy to make final decisions that are necessary to complete cleanup in the River Corridor. Part of the strategy is to split the final cleanup decisions into smaller, more manageable pieces of work.

In January 2010, the DOE released the *Integrated 100 Area Remedial Investigation/Feasibility Study Work Plan* (DOE/RL-2008-46) and a series of addenda addressing specific segments of the River Corridor. Final cleanup decisions for the 100 Areas will be developed for areas associated with the following OUs (Figure 12-1):

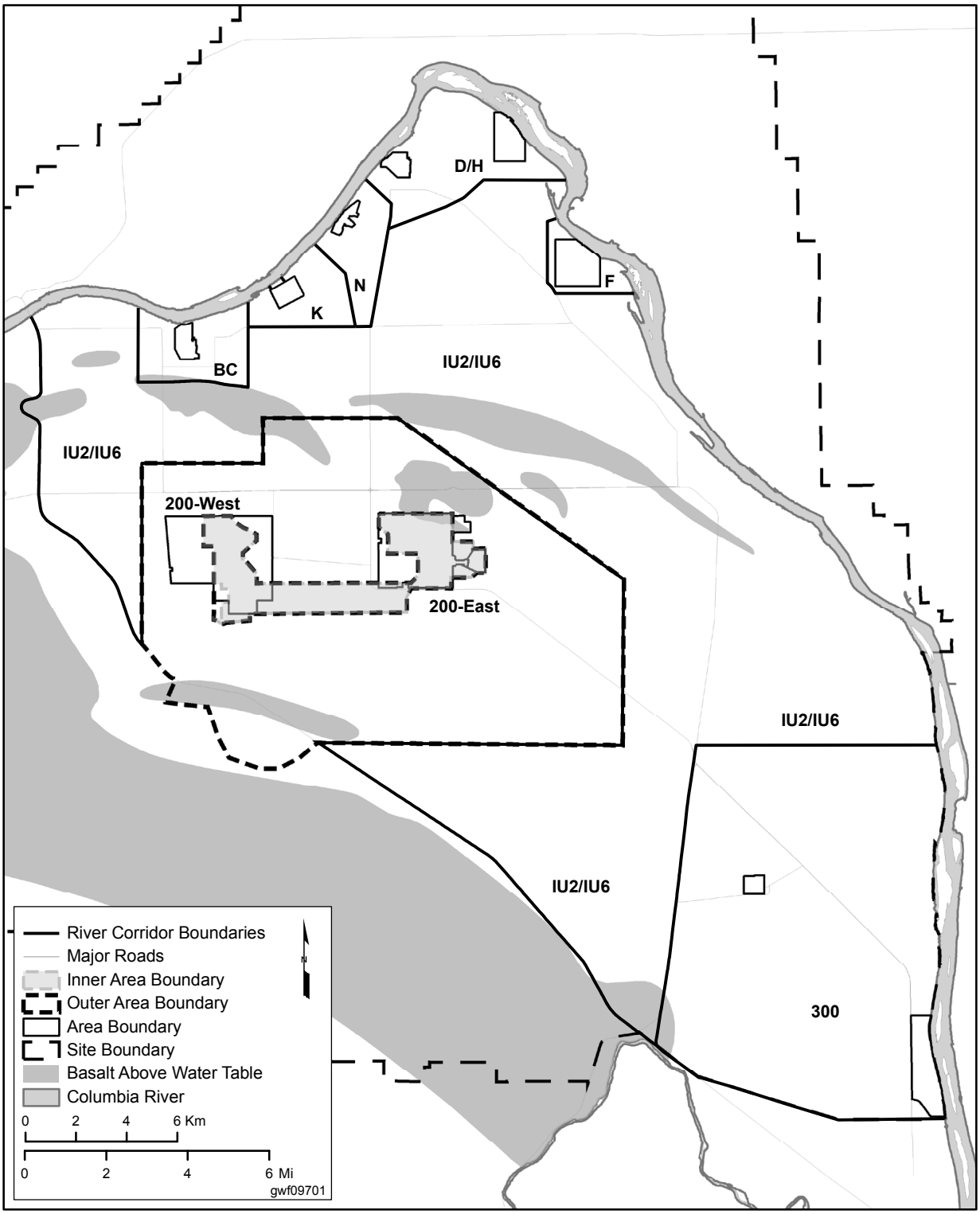
- 100-D and 100-H Areas: DOE/RL-2008-46-ADD1, *Integrated 100 Area Remedial Investigation/Feasibility Study Work Plan, Addendum 1: 100-DR-1, 100-DR-2, 100-HR-1, 100-HR-2, and 100-HR-3 Operable Units*
- 100-K Area: DOE/RL-2008-46-ADD2, *Integrated 100 Area Remedial Investigation/Feasibility Study Work Plan, Addendum 2: 100-KR-1, 100-KR-2, and 100-KR-4 Operable Units*
- 100-B/C Area: DOE/RL-2008-46-ADD3, *Integrated 100 Area Remedial Investigation Study/Work Plan, Addendum 3: 100-BC-1, 100-BC-2, and 100-BC-5 Operable Units*
- 100-F/IU-2/IU-6 Area: DOE/RL-2008-46-ADD-4, *Integrated 100 Area Remedial Investigation/Feasibility Study Work Plan, Addendum 4: 100-FR-1, 100-FR-2, 100-FR-3, 100-IU-2, and 100-IU-6 Operable Units*
- 100-N Area: DOE/RL-2008-46-ADD5, *Integrated 100 Area Remedial Investigation Study/Work Plan, Addendum 5: 100-NR-1 and 100-NR-2 Operable Units*.

The 300 Area OUs (300-FF-1, 300-FF-2, and 300-FF-5) are included in a separate work plan (DOE/RL-2009-30, *300 Area Decision Unit Remedial Investigation/ Feasibility Study Work Plan*). The DOE released the 300 Area work plan in April 2010.

Final decisions for the OUs will address the cleanup of contaminated soil, solid waste burial grounds, groundwater, and releases from reactor buildings. The objective for all of these decisions is to protect human health and the environment.

The work plans, the addenda, and the related sampling and analysis plans identify the data gaps and the data to be collected. The data will then be used to develop a proposed plan for remedial action. The selection of the final action will be documented in a Record of Decision.

Figure 12-1. River Corridor Boundaries for Integrated Remedial Investigation/ Feasibility Study Work Plan (DOE/RL-2008-46).



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