- Sediment (SD)
  Ecology, Hanford Environmental Information System, Oregon State Department of Energy, Pacific Northwest National Laboratory, Washington Public Power Supply System, U.S. Army Corps of Engineers, Washington State Department of Health

- Seeps (SP)
  Environmental Restoration Contractors, Hanford Environmental Information System, Pacific Northwest National Laboratory, Washington State Department of Health

- Surface Water (SW)
  City of Pasco, City of Richland, Environmental Restoration Contractors, Hanford Environmental Information System, Oregon State Department of Energy, Pacific Northwest National Laboratory, Washington Public Power Supply System, U.S. Geological Survey, Washington State Department of Health, Westinghouse Hanford Company

- External Radiation
  Pacific Northwest National Laboratory, Washington Power Supply System, Washington State Department of Health

The abbreviations given in parentheses following the media names are used throughout this report and in naming data files. These data were processed into concentration input files (media files).

Additional data sets were used for model validation, comparison to other media, and/or special analyses that are limited in scope. The type of additional data and the data source are as follows:

- biota
  Hanford Environmental Information System, Oregon State Department of Energy, Pacific Northwest National Laboratory, Washington Power Supply System, Washington State Department of Health

- cobalt-60 particles
  Pacific Northwest National Laboratory

- drive point groundwater and pore water (chromium data)
  Environmental Restoration Contractors

- N Springs punch point water
  Westinghouse Hanford Company

3.3.4.1 Data Quality

For most of the data used in the screening assessment, the analytical procedures used for the environmental sampling data are known. The following sections summarize the laboratory analytical

protocols under which the samples were analyzed. The analytical procedures used for the samples are given in the raw data files in Appendix A of Volume II, *Data for the Screening Assessment* (Miley et al. 1997).

Groundwater. The groundwater data are available only from Hanford Site programs. These data fall into three major categories by program: Site-wide monitoring by PNNL, CERCLA, and RCRA. These programs all use standard laboratory methods for sample analysis. Two percent of the data were marked with an analysis protocol of "none."

Sediment. Fifty-five percent of the sediment analyses were for PNNL's SESP program. These samples were analyzed through contracts administered by PNNL using standard laboratory procedures. Thirty-two percent of the sediment data were analyzed under CERCLA procedures, and the remainder from various sources were analyzed using standard laboratory procedures.

Seeps. All of the seep data were analyzed using standard laboratory procedures. Forty-three percent of the seep data were for PNNL's SESP program, 27 percent were for CERCLA, 18 percent were other Hanford programs, and 12 percent were from miscellaneous sources.

Surface Water. Sixty-four percent of the surface water samples were analyzed for PNNL's SESP program using standard laboratory procedures. Eighteen percent of the data were analyzed by the Supply System using analytical techniques and laboratory quality assurance procedures documented in their annual environmental monitoring reports. The remainder of the data were analyzed under various agencies and programs using standard laboratory procedures.

3.3.4.2 Raw Data Files

Once the data were gathered, we stored them in a database. This database contains the raw data, the name we use to indicate data not yet prepared for use in the screening assessment.

The raw data from all sources were combined into a single Microsoft Access database for each medium. Access is a Windows™-based database management system that stores and retrieves data, presents information, and automates repetitive tasks. The raw data are provided in Appendix A of Volume II (Miley et al. 1997) and are as received. Therefore, not all fields are available for all analyses. Some fields, such as sampling location, had to be estimated for the data evaluation. These estimated fields were not loaded into the raw data files.

3.3.4.3 Data Sampling Locations

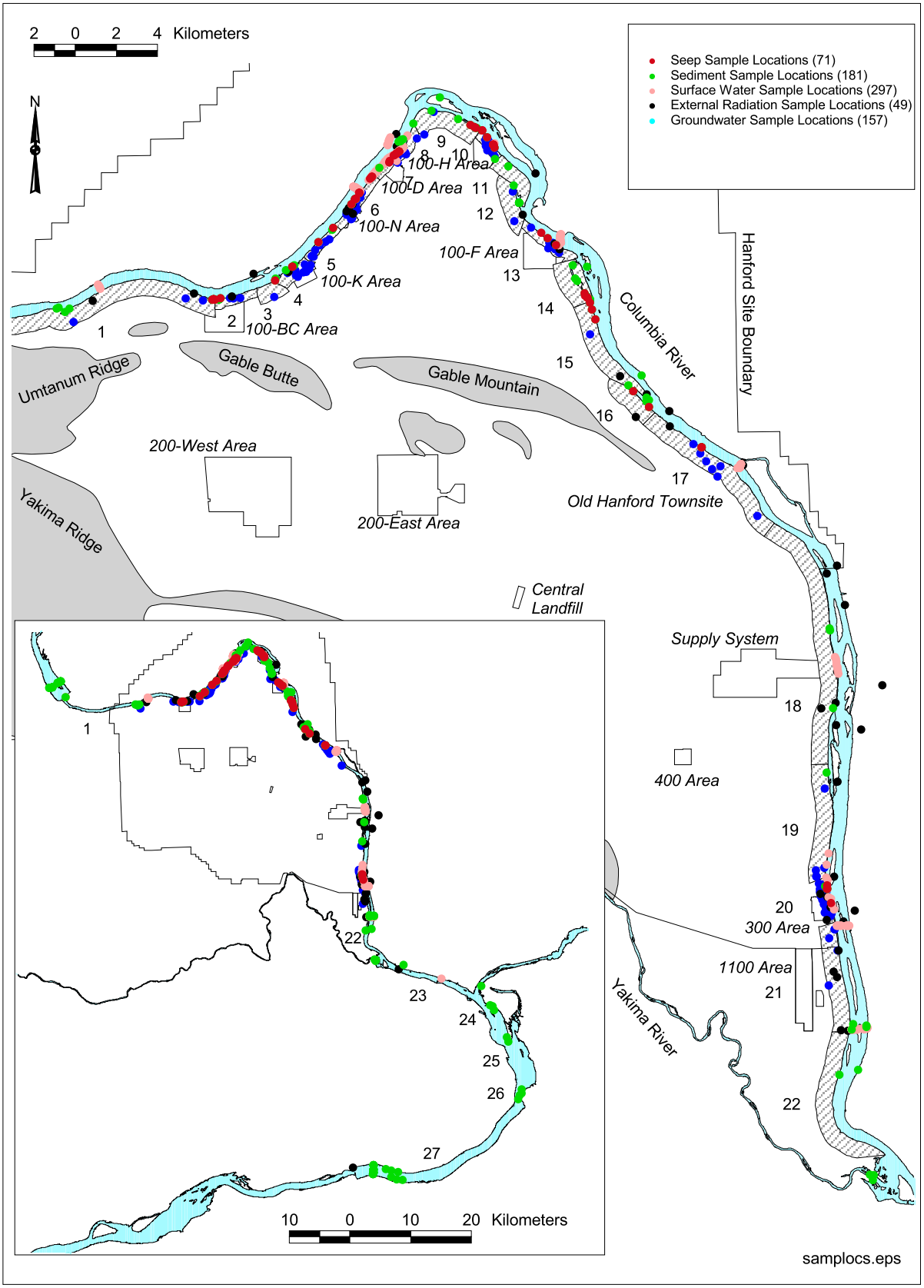
Each media database was queried to identify the set of unique sample locations for the data used for that medium. Some additional work was required to estimate coordinates for sampling locations whose coordinates were not given in the raw data. The coordinates for these samples locations were fed into the Geographic Information System for plotting on a map. Figure 3.9 shows all of the sampling locations used

in the screening assessment for all of the media. Because of concurrent sampling (for example, for seeps and sediment) in some of the locations, not all locations are visible on the map.

The media are listed in the legend in the order of plotting. The number of locations on the map is given in the legend for each medium. A map for each of the media sampling locations is also provided: Figure 3.10 for groundwater, Figure 3.11 for sediment, Figure 3.12 for seeps, Figure 3.13 for surface water, and Figure 3.14 for external radiation. For more detailed information on sample locations, see Appendix B of Volume II (Miley et al. 1997). Each map shows a single segment and the sample locations for all media in that segment. The coordinate grid is provided so that samples may be tracked from the coordinates provided in the raw data.

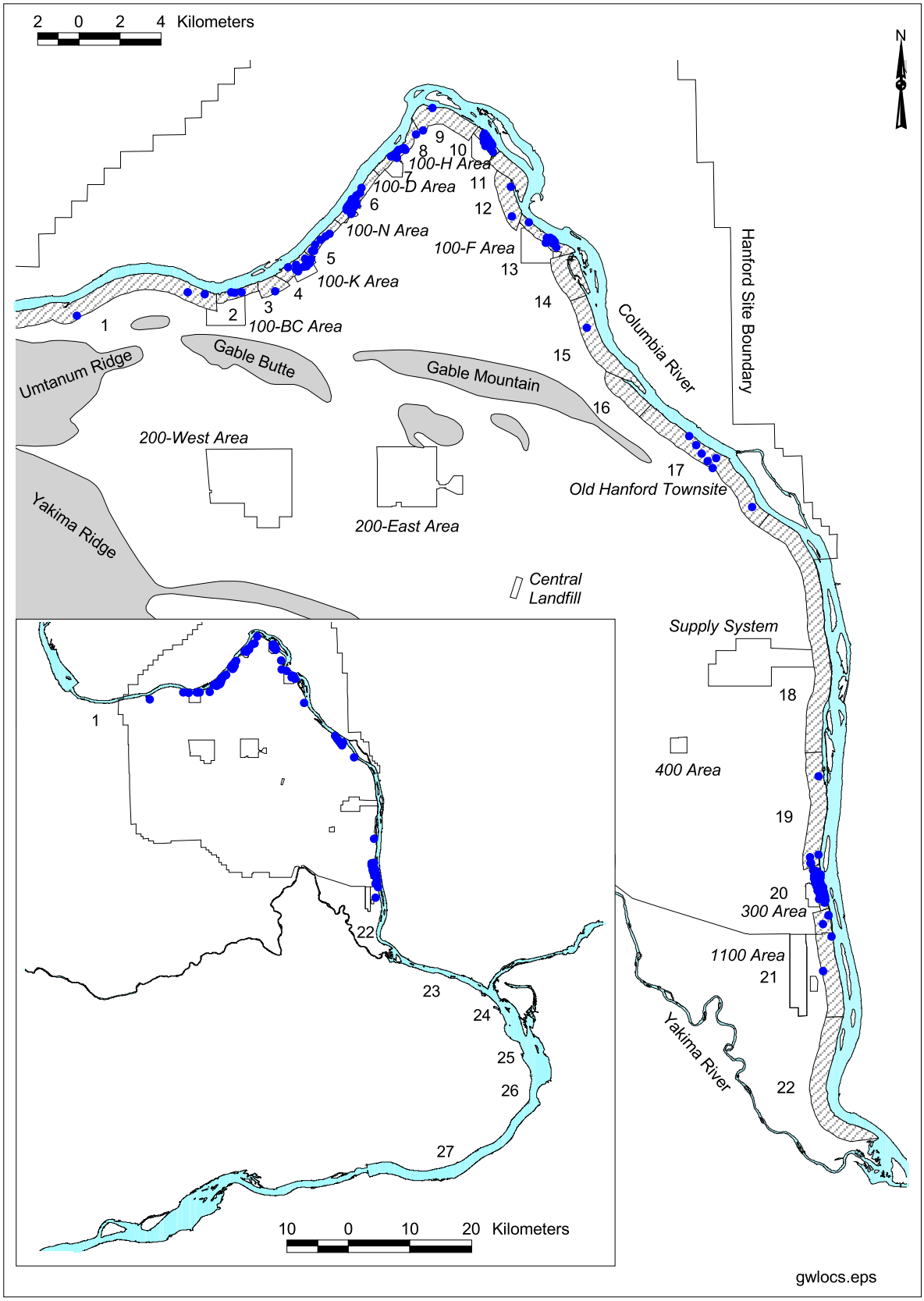
File Contains Data for PostScript Printers Only

Figure 3.9. Sampling Locations for All Data Used in the Screening Assessment


2 0 2 4 Kilometers
N
Seep Sample Locations (71)
Sediment Sample Locations (181)
Surface Water Sample Locations (297)
External Radiation Sample Locations (49)
Groundwater Sample Locations (157)
100-H Area
100-D Area
100-N Area
100-F Area
100-K Area
100-BC Area
Hanford Site Boundary
Columbia River
Umtanum Ridge
Gable Butte
Gable Mountain
200-West Area
200-East Area
Yakima Ridge
Old Hanford Townsite
Central Landfill
Supply System
400 Area
300 Area
1100 Area
Yakima River
10 0 10 20 Kilometers
samplocs.eps

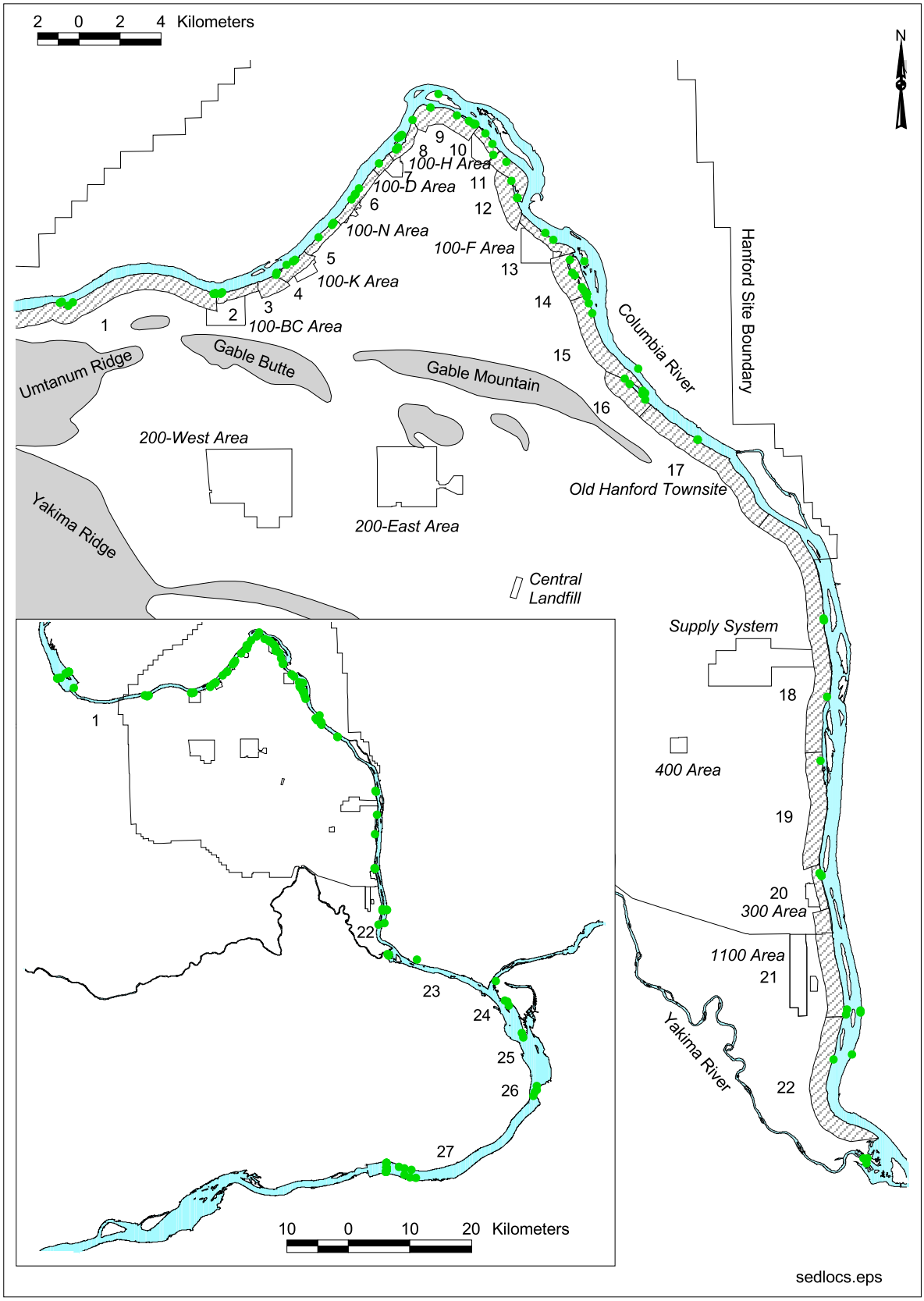
File Contains Data for PostScript Printers Only

Figure 3.10. Sampling Locations for Groundwater Data Used in the Screening Assessment


2 0 2 4 Kilometers
N
100-H Area
100-D Area
100-N Area
100-F Area
100-K Area
100-BC Area
Hanford Site Boundary
Columbia River
Umtanum Ridge
Gable Butte
Gable Mountain
200-West Area
200-East Area
Old Hanford Townsite
Yakima Ridge
Central Landfill
Supply System
400 Area
300 Area
1100 Area
Yakima River
10 0 10 20 Kilometers
gwlocs.eps

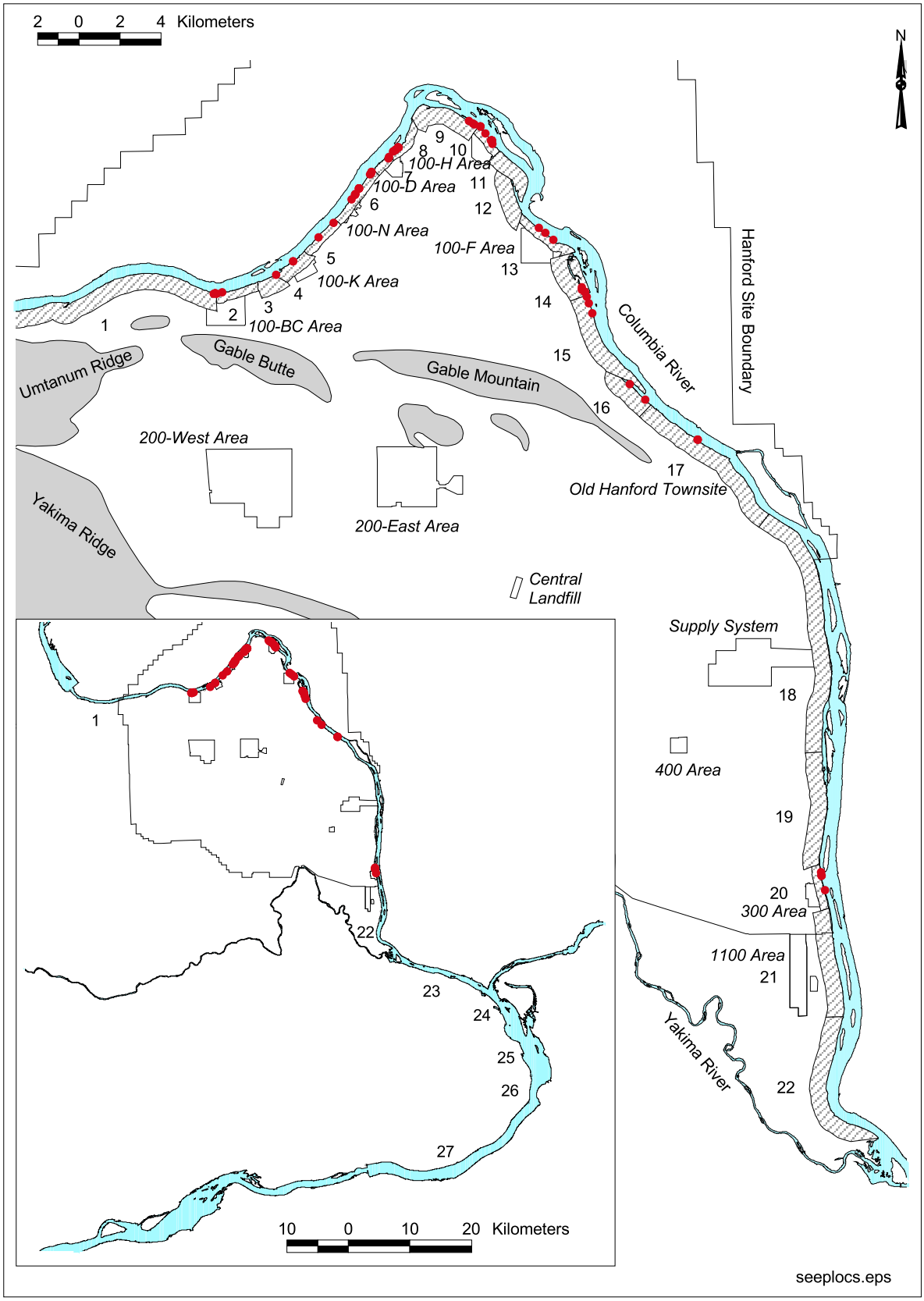
File Contains Data for PostScript Printers Only

Figure 3.11. Sampling Locations for Sediment Data Used in the Screening Assessment


2 0 2 4 Kilometers
N
100-H Area
100-D Area
100-N Area
100-F Area
100-K Area
100-BC Area
Umtanum Ridge
Gable Butte
Gable Mountain
Columbia River
Hanford Site Boundary
200-West Area
200-East Area
Old Hanford Townsite
Yakima Ridge
Central Landfill
Supply System
400 Area
300 Area
1100 Area
Yakima River
10 0 10 20 Kilometers
sedlocs.eps

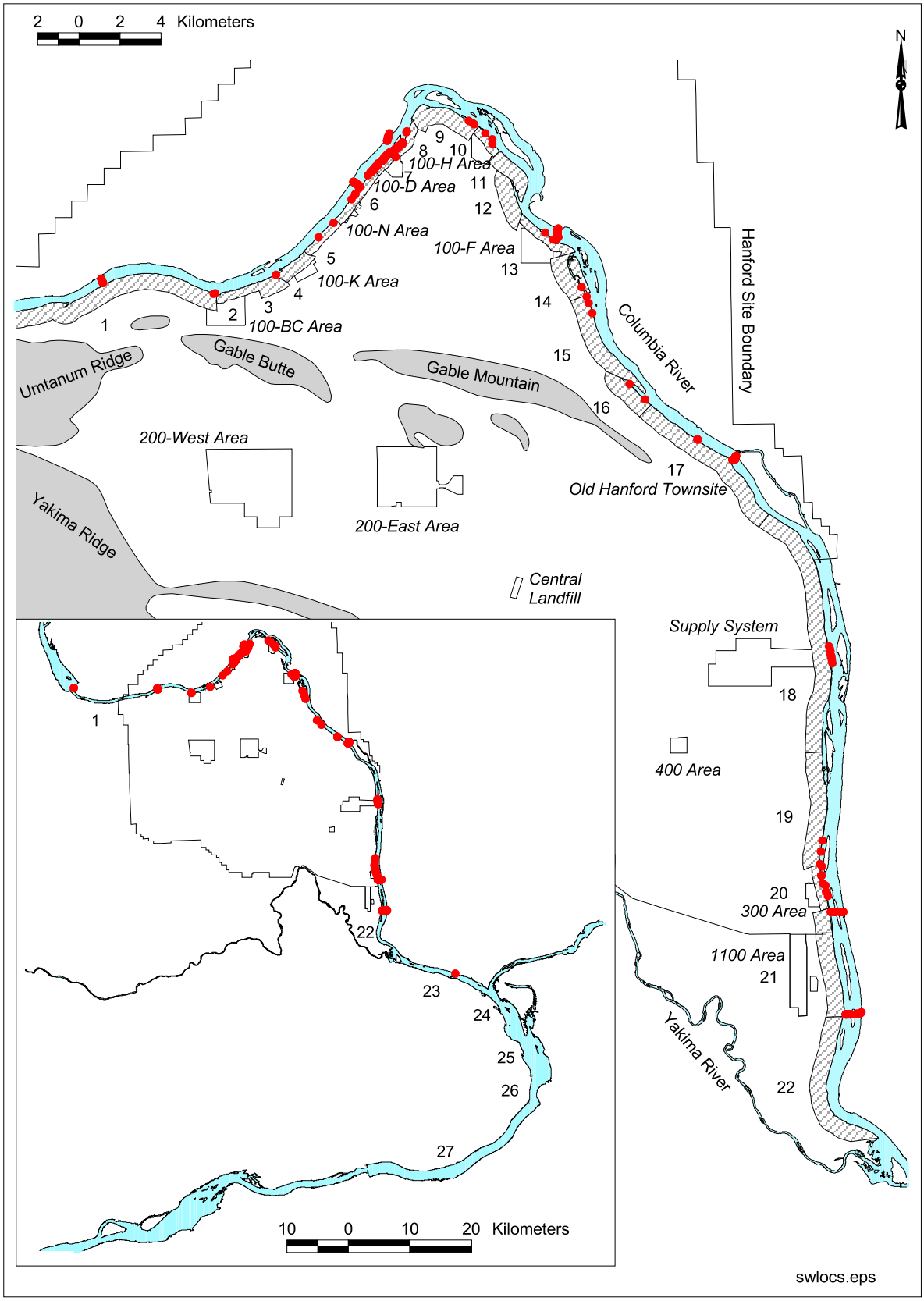
File Contains Data for PostScript Printers Only

Figure 3.12. Sampling Locations for Seep Data Used in the Screening Assessment


2 0 2 4 Kilometers
N
100-H Area
100-D Area
100-N Area
100-F Area
100-K Area
100-BC Area
Umtanum Ridge
Gable Butte
Gable Mountain
Columbia River
Hanford Site Boundary
200-West Area
200-East Area
Old Hanford Townsite
Yakima Ridge
Central Landfill
Supply System
400 Area
300 Area
1100 Area
Yakima River
10 0 10 20 Kilometers
seeplocs.eps

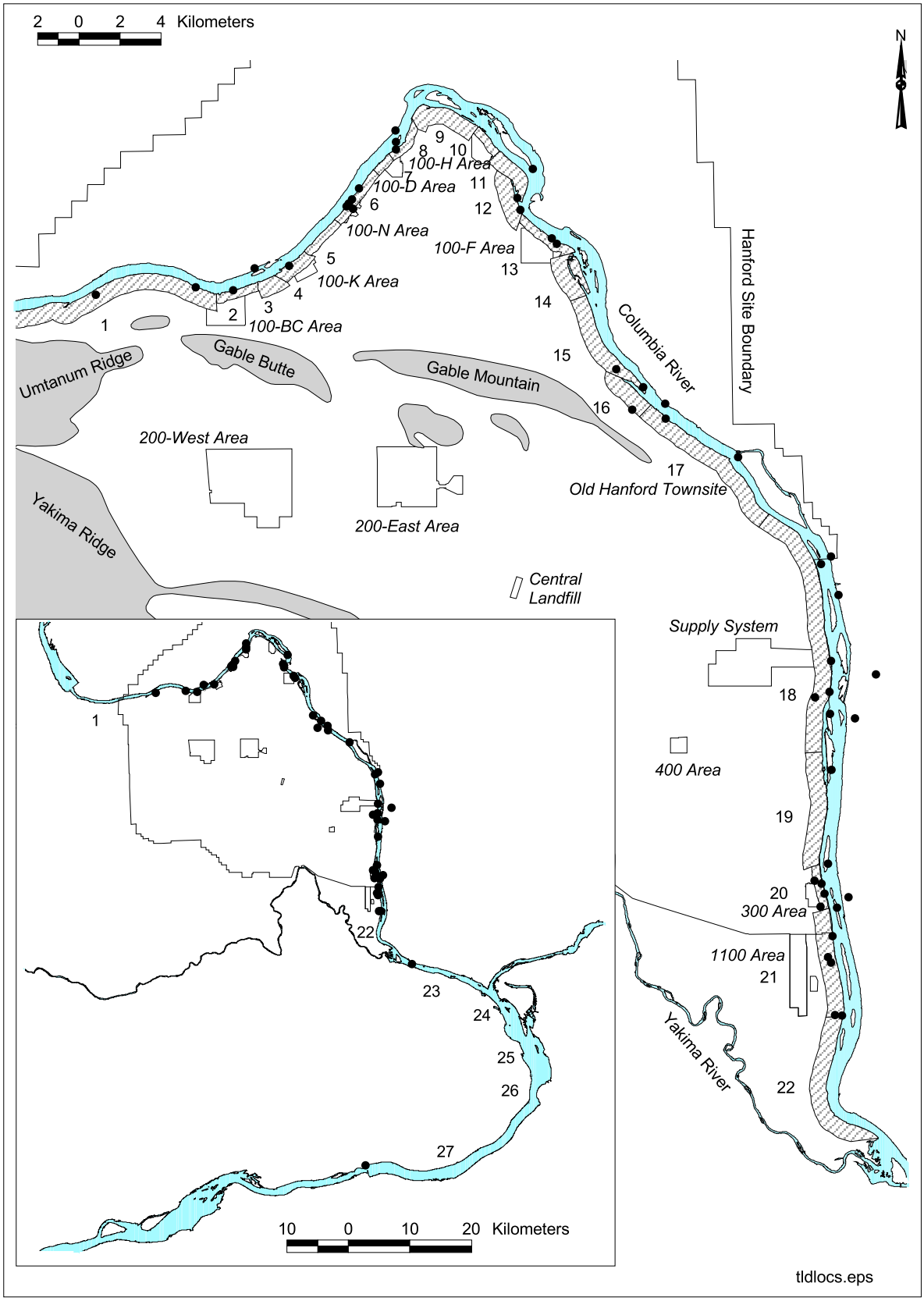
File Contains Data for PostScript Printers Only

Figure 3.13. Sampling Locations for Surface Water Data Used in the Screening Assessment


2 0 2 4 Kilometers
N
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
100-BC Area
100-K Area
100-N Area
100-D Area
100-H Area
100-F Area
Umtanum Ridge
Gable Butte
Gable Mountain
Columbia River
Hanford Site Boundary
200-West Area
200-East Area
Old Hanford Townsite
Yakima Ridge
Central Landfill
Supply System
400 Area
300 Area
1100 Area
Yakima River
10 0 10 20 Kilometers
swlocs.eps

File Contains Data for PostScript Printers Only

Figure 3.14. Sampling Locations for External Radiation Data Used in the Screening Assessment


2 0 2 4 Kilometers
N
100-H Area
100-D Area
100-N Area
100-F Area
100-K Area
100-BC Area
Umtanum Ridge
Gable Butte
Gable Mountain
Columbia River
Hanford Site Boundary
200-West Area
200-East Area
Old Hanford Townsite
Yakima Ridge
Central Landfill
Supply System
400 Area
300 Area
1100 Area
Yakima River
10 0 10 20 Kilometers
tldlocs.eps

3.4 Data Selection Process

This section describes the analysis process used to select concentration input for the screening assessment models from the raw concentration data. This process was repeated for each segment and for each contaminant being evaluated. The process involved choosing a maximum representative value for the concentration of each contaminant for a deterministic run and calculating the parameters that define the concentration probability density function needed for a stochastic run. The term "maximum representative value" is used to mean the highest concentration value that is considered representative of the sampling location. This maximum value was determined after an outlier test was applied to identify at most one outlier.

The data selection process had to be automated because of the volume of data, the desire to reduce subjectivity, and the need for repeatability of the processing. The computational techniques described in this section were applied to all concentration data to select the parameters needed for the assessment. Graphical displays (data plots) of the raw data were used to track the results of the computational techniques and identify needed modifications to final data files. These data plots are published in Appendix C of Volume II (Miley et al. 1997).

3.4.1 Deterministic and Stochastic Analyses

The CRCIA Team decided we should do both deterministic and stochastic analyses.

- **A deterministic analysis means a single (conservatively high) data value is used to represent the existing condition.**
- **A stochastic analysis means the entire range of data values is used.**

To meet the needs of the screening assessment, data were prepared to support two types of analyses:

- a deterministic analysis, where a single calculation is performed with a single value selected for each parameter, such as a concentration value of a contaminant entering the river
- a stochastic analysis, where a set of calculations is performed over the range of some of the input parameters

For the deterministic analysis, the maximum representative concentrations for each contaminant in each medium were used to represent the segment. For the stochastic analysis, a probability density function of the concentration parameter was assumed to be a lognormal distribution truncated at the 99th percentile. The probability density function expresses the state of knowledge about alternative values for the parameter. The particular lognormal distribution assumed is determined by specifying the geometric mean and geometric standard deviation that represent concentration data for each river segment for which risk is computed.