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Y-12 NATIONAL SECURITY COMPLEX

Y-12 GROUNDWATER PROTECTION PROGRAM GROUNDWATER AND SURFACE WATER SAMPLING AND ANALYSIS PLAN FOR CALENDAR YEAR 2003

September 2002

Prepared by

AJA TECHNICAL SERVICES, INC.
Under Subcontract No. 4300012529

for the

Environmental Compliance Department
Environment, Safety, and Health Organization
Y-12 National Security Complex
Oak Ridge, Tennessee 37831

Managed by

BWXT Y-12, L.L.C.
for the U.S. DEPARTMENT OF ENERGY
under contract No. DE-AC05-00OR22800

MANAGED BY
BWXT Y-12, L.L.C.
FOR THE UNITED STATES
DEPARTMENT OF ENERGY

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List of Acronyms and Abbreviations

ACO	Analytical Chemistry Organization
Bear Creek Regime	Bear Creek Hydrogeologic Regime
BWXT	BWXT Y-12, L.L.C.
Chestnut Ridge Regime	Chestnut Ridge Hydrogeologic Regime
CY	calendar year
DOE	U.S. Department of Energy
East Fork Regime	Upper East Fork Poplar Creek Hydrogeologic Regime
GWPP	Groundwater Protection Program
LMES	Lockheed Martin Energy Systems, Inc.
REDOX	oxidation-reduction potential

1.0 INTRODUCTION

This plan provides a description of the groundwater and surface water quality monitoring activities planned for calendar year (CY) 2003 at the U.S. Department of Energy (DOE) Y-12 National Security Complex that will be managed by the Y-12 Groundwater Protection Program (GWPP). Groundwater and surface water monitoring performed by the GWPP during CY 2003 will be in accordance with the following requirements of DOE Order 5400.1:

- to evaluate and maintain surveillance of existing and potential groundwater contamination sources;
- to provide for the early detection of groundwater contamination and determine the quality of groundwater and surface water where contaminants are most likely to migrate beyond the Oak Ridge Reservation property line;
- to identify and characterize long-term trends in groundwater quality at Y-12; and
- to provide data to support decisions concerning the management and protection of groundwater resources.

Groundwater and surface water monitoring during CY 2003 will be performed primarily in three hydrogeologic regimes at Y-12: the Bear Creek Hydrogeologic Regime (Bear Creek Regime), the Upper East Fork Poplar Creek Hydrogeologic Regime (East Fork Regime), and the Chestnut Ridge Hydrogeologic Regime (Chestnut Ridge Regime). The Bear Creek and East Fork regimes are located in Bear Creek Valley, and the Chestnut Ridge Regime is located south of Y-12 (Figure A.1). Additional surface water monitoring will be performed north of Pine Ridge, along the boundary of the Oak Ridge Reservation (Figure A.1).

Modifications to the CY 2003 monitoring program may be necessary during implementation. Changes in programmatic requirements may alter the analytes specified for selected monitoring wells, or wells could be added or removed from the planned monitoring network. All modifications to the monitoring program will be approved by the Y-12 GWPP manager and documented as addenda to this sampling and analysis plan.

2.0 MONITORING LOCATIONS

The Y-12 GWPP monitoring network for CY 2003 includes 96 monitoring locations: 29 located in the Bear Creek Regime (Figure A.2), seven located in the Chestnut Ridge Regime (Figure A.3), 55 located in the East Fork Regime (Figure A.4), and five located north of Pine Ridge (Figure A.5). Groundwater samples will be collected from a total of 78 monitoring wells, including 21 wells in the Bear Creek Regime (Figure A.2), two wells in the Chestnut Ridge Regime (Figure A.3), and 55 wells (one well has ten discreet sampling points) in the East Fork Regime (Figure A.4). Samples of groundwater discharging from five natural springs will be collected during CY 2003, including three springs (SS-1, SS-4, and SS-5) in the Bear Creek Regime (Figure A.2) and two springs (SCR2.1SP and SCR2.2SP) in the Chestnut Ridge Regime (Figure A.3). Surface water samples will be collected from a total of 13 sampling locations during CY 2003, including five locations in the Bear Creek Regime, three locations in the Chestnut Ridge Regime, and five locations north of Pine Ridge. In the Bear Creek Regime, samples will be collected from Bear Creek at four sampling stations located from about 0.5 to 12 kilometers upstream of the confluence of Bear Creek and East Fork Poplar Creek (BCK-00.63, BCK-04.55, BCK-09.40, and BCK-11.97), and from one sampling station along

a northern tributary (NT-01) to Bear Creek (Figure A.2). The tributaries located in the Chestnut Ridge Regime have been numbered from west to east (SCR1 through SCR5), and surface water samples will be collected from three of the tributaries at stations (SCR1.5SW, SCR3.5SW, and S17 [in SCR5]) located along the north side of Bethel Valley Road (Figure A.3). The surface water sampling locations north of Pine Ridge include three tributaries (NPR07.0SW, NPR12.0SW, and NPR23.0SW) near the Scarboro Community and two locations (GHK2.51ESW and GHK2.51WSW) near Country Club Estates (Figure A.5).

3.0 FIELD MEASUREMENTS AND ANALYTICAL PARAMETERS

Field personnel will measure the static water level in each monitoring well before purging and collecting groundwater samples. Sampling personnel also will record field measurements of pH, temperature, conductivity, dissolved oxygen, and oxidation-reduction potential (REDOX) before collecting samples at each monitoring location (Table B.1). However, REDOX field measurements will not be obtained for sampling ports of monitoring wells equipped with a Westbay™ multiport sampling system.

For this Sampling and Analysis Plan, specific analytes are grouped by analytical method or by type (e.g., trace metals) and referenced as analytical parameters (Table B.1). In addition to field measurements, all groundwater and surface water samples will be analyzed for the following suite of parameters (identified as the Standard Administrative Parameter Group):

- miscellaneous laboratory analytes - pH, conductivity, turbidity, total suspended solids, and total dissolved solids;
- major anions;
- trace metals (includes major cations);
- a comprehensive suite of organic compounds; and
- gross alpha and gross beta activity.

In addition to the analytes included in the Standard Administrative Parameter Group, samples from selected locations will be analyzed for specific radionuclides.

4.0 SAMPLE PLANNING, COLLECTION, AND HANDLING

The monitoring wells, springs, and surface water stations included in the GWPP monitoring network for CY 2003 are assembled into sample groups (e.g., BC-1, CR-1, and EF-1) for sample collection, sample tracking, and data management purposes (Table B.2). Semiannual sample collection for each sample group is specified in Table B.2, and the sampling sequence is generally from least contaminated to most contaminated location within each sampling group. A Groundwater Monitoring Schedule will be prepared for each quarterly sampling event by GWPP personnel based on Table B.2 that includes additional information necessary for field personnel to collect the required samples (e.g., management of purged groundwater).

Personnel from the Y-12 Analytical Chemistry Organization (ACO) will be responsible for collection, transportation, and chain-of-custody control of the groundwater and surface water samples. Based on the analytical parameters for CY 2003 (Table B.1 and Table B.2), ACO personnel will prepare a set of bottle lists that specify the sample container type, size, preservative, and the laboratory test identification needed for each sampling location (see Appendix C). Sample collection will be performed in accordance with the most recent version of administrative procedures for obtaining groundwater samples (Lockheed Martin Energy Systems, Inc. [LMES] 1999a, BWXT Y-12, L.L.C. [BWXT] 2002a , BWXT 2002b) and surface water samples (BWXT 2000a). All field and laboratory activities will be performed in accordance with applicable requirements of the Y-12 Integrated Safety Management System.

Groundwater samples will be collected from monitoring wells using bladder pumps unless a well is equipped with a Westbay™ multiport sampling system (Table B.2). Typically, a bladder pump is permanently installed in each well that is scheduled for sample collection. If well construction prevents permanent installation (e.g., flush-mounted wells), then the pump and tubing will be installed at least 24 hours before sample collection and will be removed when sampling is completed. During CY 2003, the low-flow minimal drawdown purging and sampling method (low-flow method) will be used to collect groundwater samples from all wells that do not have a Westbay multiport sampling system. In accordance with the procedure for the low-flow method (LMES 1999a), groundwater samples will be collected from the well immediately following the stabilization (minimal variation over four consecutive readings) of field measurements (pH, conductivity, temperature, REDOX, and dissolved oxygen) of the groundwater purged from the well at a low flow rate (<300 milliliters per minute) which ensures minimal drawdown of the water level in the well (<0.1 foot per 15 minutes).

Samples from selected monitoring wells also will be collected using the "conventional" sampling method, which was used to collect all groundwater samples through September 1997 (the low-flow method, described above, has been used since October 1997). The conventional sampling method involves removing three well-volumes of groundwater from a well (or purging the well dry) at about 1.5 gallons per minute (much higher than the purge rate for low-flow) before collecting samples. Although the analytical results for the majority of wells did not show a distinct response to the change in method from the conventional to low-flow sampling, the analytical results for some wells did exhibit a clear response (AJA Technical Services, Inc. 2002). To further investigate this phenomenon, samples will be obtained using the conventional method within a few days after collecting samples using the low-flow method. The conventional sampling method will be used to obtain samples from a total of eight monitoring wells during CY 2003 (Table B.2), including four wells (GW-082, GW-225, GW-226, and GW-653) in the Bear Creek Regime (Figure A.2), one well (GW-612) in the Chestnut Ridge Regime (Figure A.3), and three wells (GW-204, GW-633, and GW-782) in the East Fork Regime (Figure A.4).

Groundwater sampling using a Westbay™ multiport sampling system at well GW-722 in the East Fork Regime will be performed in accordance with the most recent and approved operating procedures (BWXT 2002a and 2002b). The groundwater samples from each sampling port will be collected in 250-milliliter nonvented stainless steel Westbay™ sample collection bottles filled at the designated depth in the well. Once filled, the bottles will be raised to the surface and the groundwater will be transferred to laboratory sample containers. The sample collection bottles will be lowered, filled, and retrieved as many times as needed to completely fill the laboratory sample bottles. Groundwater in the first sample collection bottles retrieved from each sampling port will be used as a "formation rinse" to obtain field measurements and to condition the sample collection bottle for each zone.

Unfiltered samples will be collected semiannually from all of the monitoring locations during CY 2003. As summarized below, the number of samples to be collected during each quarter (including conventional method samples) will range from 51 to 62, for an annual total of 226 samples.

HYDROGEOLOGIC REGIME/AREA	NUMBER OF SAMPLES PER QUARTER OF CY 2003	
	1st and 3rd	2nd and 4th
Bear Creek Regime	33	0
Chestnut Ridge Regime	8	0
East Fork Regime	10	57
North of Pine Ridge	0	5
TOTAL:	**51**	**62**

In addition to the groundwater and surface water samples, field blanks and equipment rinsate samples will be collected at the frequencies and analyzed for the parameters specified on Table B.2. Field blank samples will be collected from at least 10% of the sample groups. Therefore, a field blank will be collected during each quarter of CY 2003: in the Bear Creek Regime during the first and third quarters and in the East Fork Regime during the second and fourth quarters. An equipment rinsate sample will be collected from well GW-722, located in the East Fork Regime, immediately after field-cleaning the sampling equipment used to collect samples from the last sampling port (Table B.2).

Trip blank samples, field duplicate samples, and laboratory quality assurance samples will be prepared and analyzed as specified in the *Quality Assurance Plan for the Analytical Chemistry Organization* (BWXT 2002c) using applicable analytical procedures. Trip blank samples will be prepared for each cooler used to transport samples for volatile organic analyses. Duplicate samples will be collected from at least 10% of the sampling locations. A total of 24 field duplicate samples will be collected during CY 2003, including six in the Bear Creek Regime, two in the Chestnut Ridge Regime, 14 in the East Fork Regime, and two from surface water stations located north of Pine Ridge (Table B.2).

All groundwater and surface water samples will be relinquished to the appropriate Y-12 ACO laboratory that will perform the analyses under chain-of-custody control. The Y-12 ACO laboratories will perform each analyses within established holding times and deliver results within established turnaround times (see Appendix C).

5.0 REFERENCES

AJA Technical Services, Inc. 2002. *Calendar Year 2001 Groundwater Monitoring Data Evaluation Report for the U.S. Department of Energy Y-12 National Security Complex, Oak Ridge, Tennessee.* Prepared for BWXT Y-12, L.L.C. (Y/SUB/02-012529/2).

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U.S. Environmental Protection Agency. 1983. *Methods for Chemical Analysis of Water and Wastes*.

U.S. Environmental Protection Agency. 1996. *Test Methods for Evaluating Solid Waste Physical/Chemical Methods.*

APPENDIX A

FIGURES

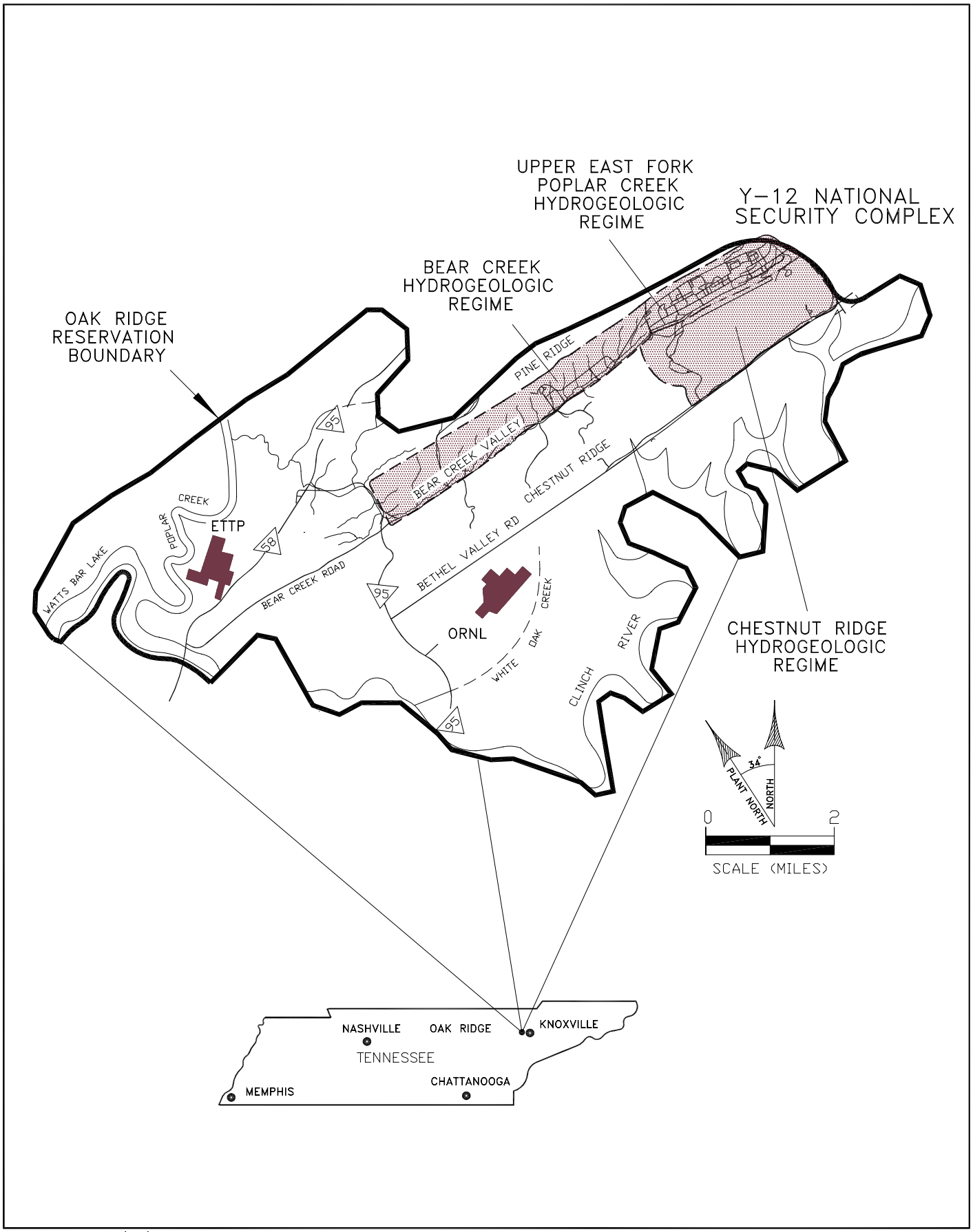

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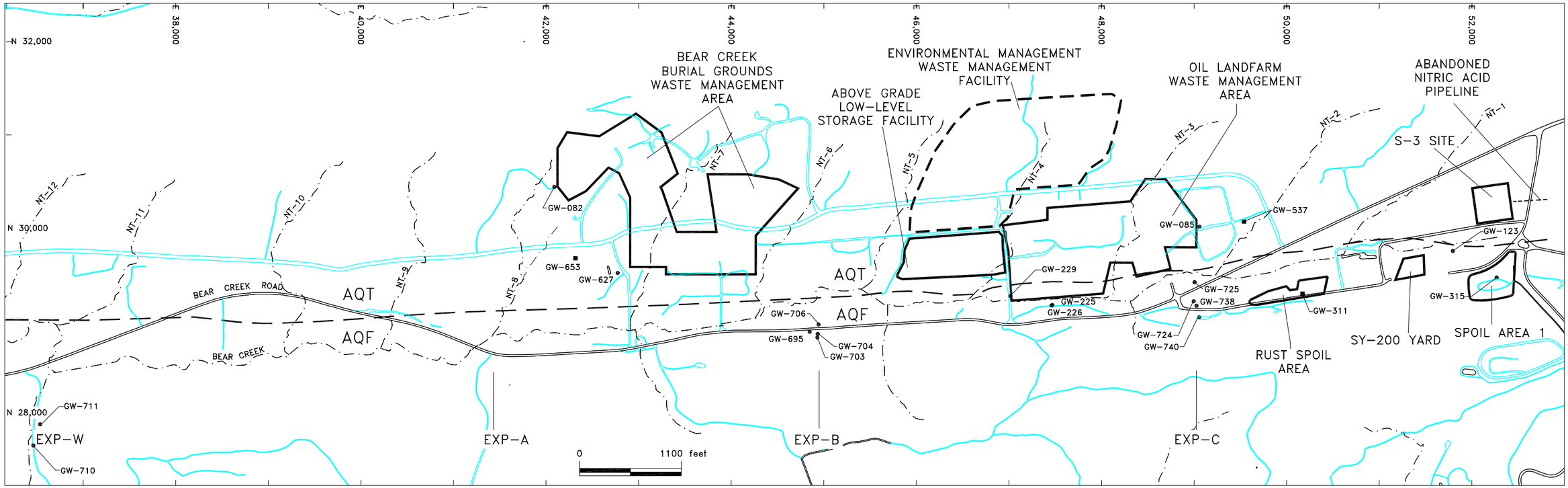
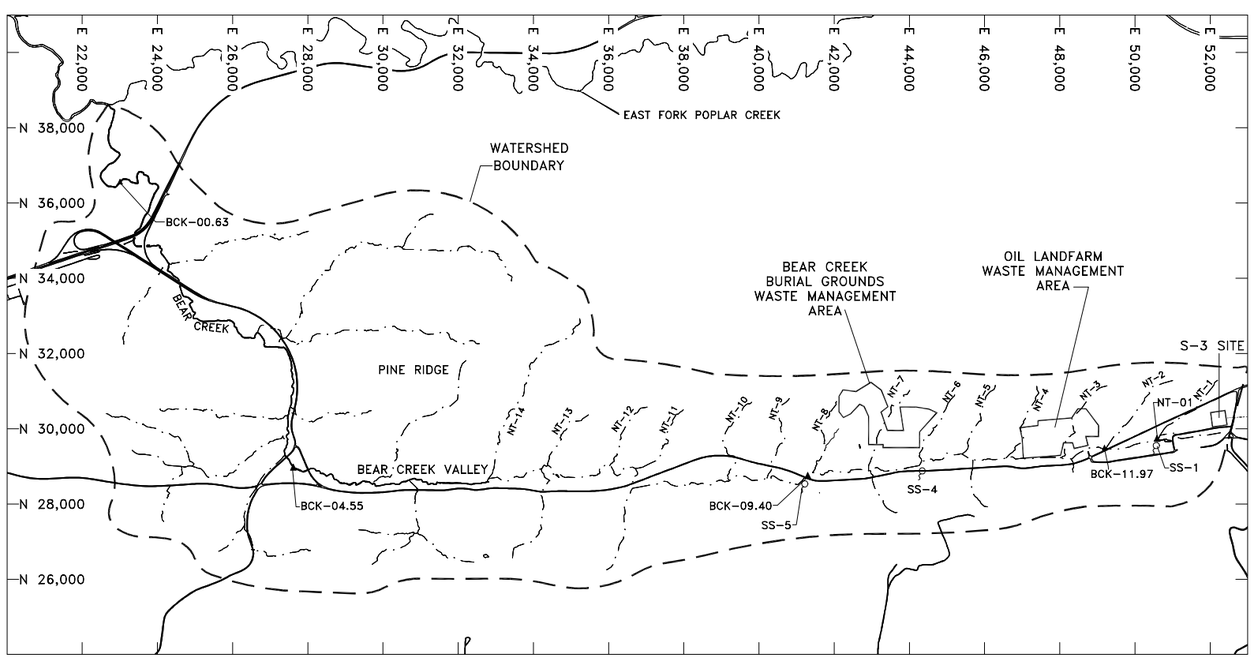
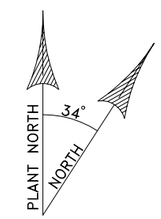
Fig. A.1. Hydrogeologic regimes at the Y-12 National Security Complex.



MONITORING WELL LOCATIONS



SPRING AND SURFACE WATER SAMPLING LOCATIONS



EXPLANATION

- ■ — Water Table Monitoring Well
- • — Bedrock Monitoring Well
- ▲ — Surface Water Sampling Station
- ♀ — Spring Sampling Station
- EXP-C — Exit Pathway, Maynardville Limestone Picket
- —·—·— — Surface Drainage Feature
- NT-5 — North Tributary
- AQT — Aquitard
- — — — Approximate Nolichucky Shale\Maynardville Limestone Contact
- AQF — Aquifer

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Fig. A.2. CY 2003 sampling locations in the Bear Creek Hydrogeologic Regime.

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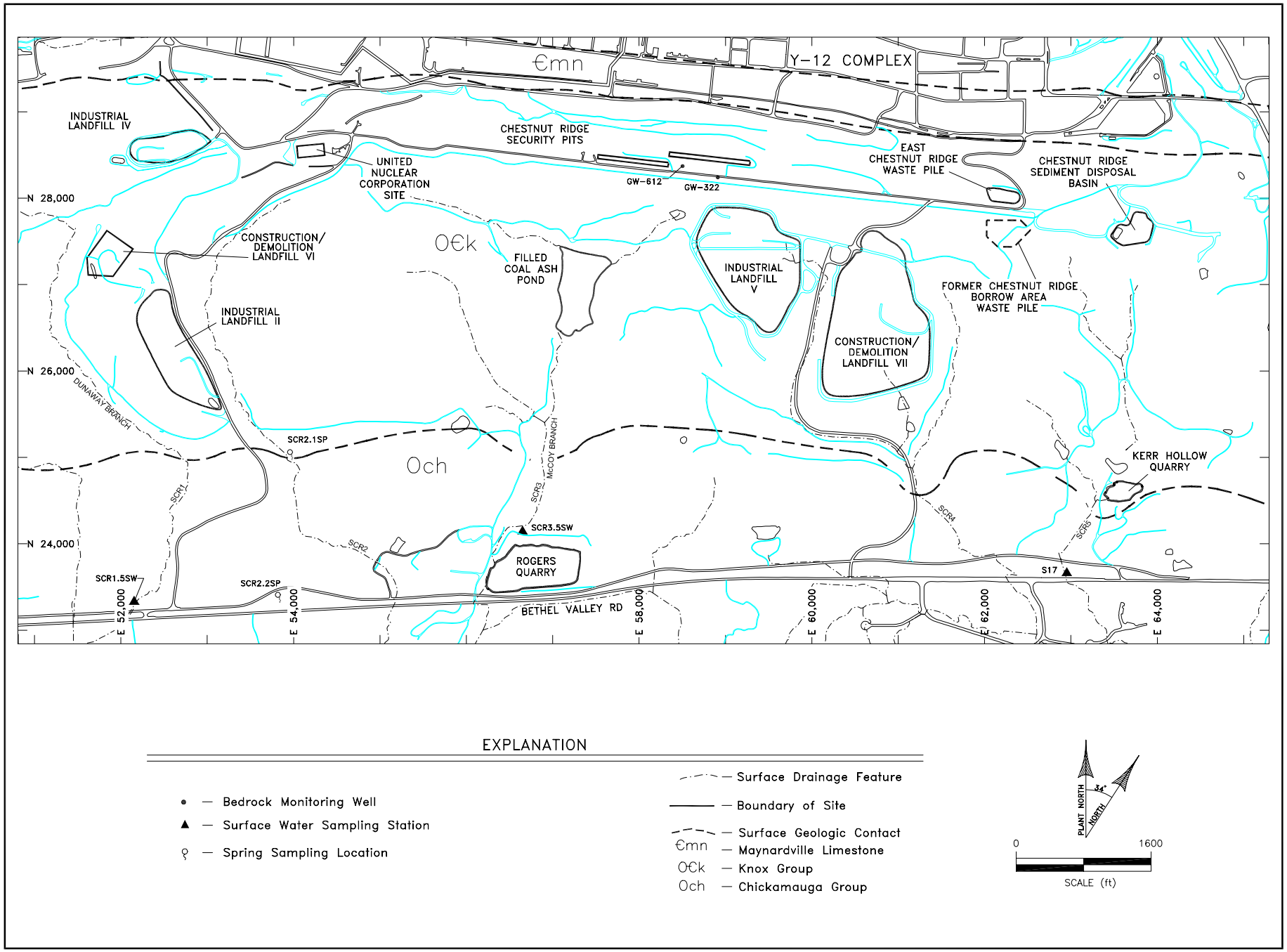
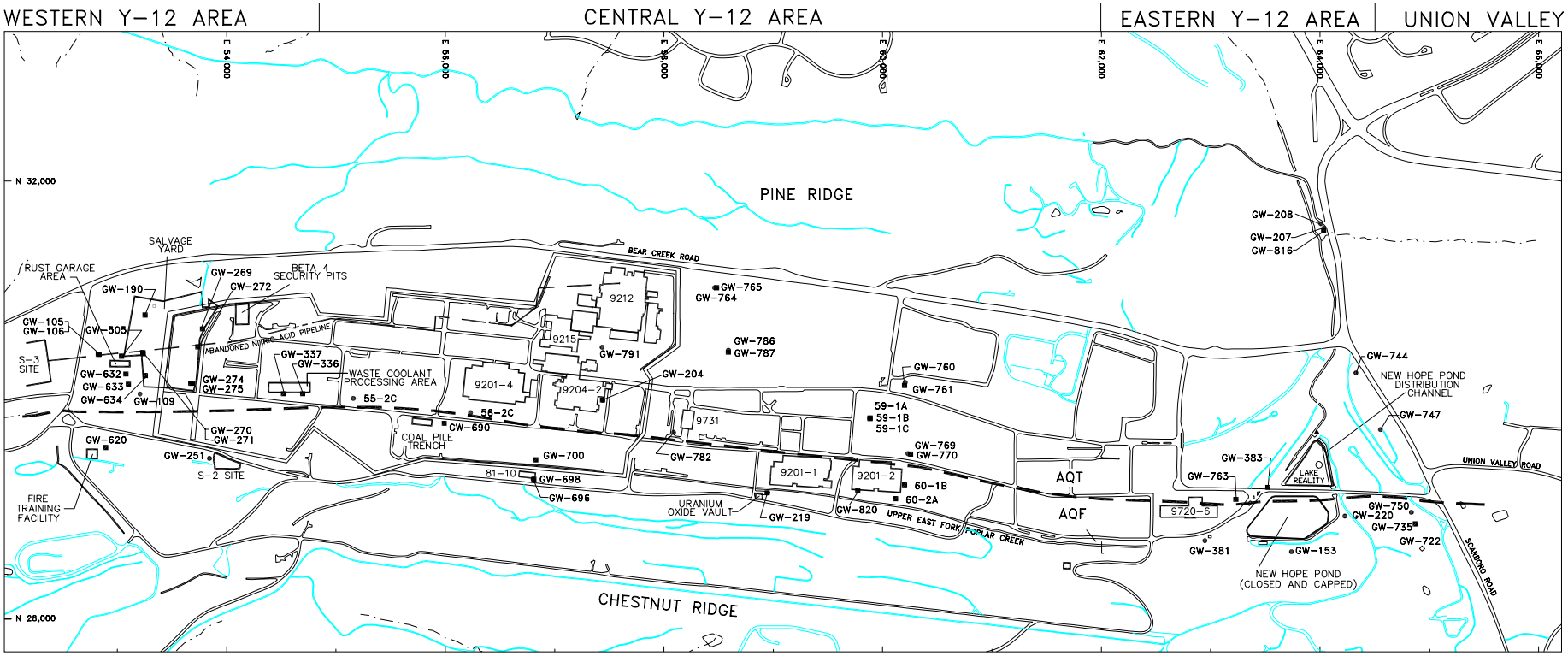


Fig. A.3. CY 2003 sampling locations in the Chestnut Ridge Hydrogeologic Regime.



EXPLANATION

- ■ — Water Table Monitoring Well
- ● — Bedrock Monitoring Well
- ◇ — Well With Westbay Multiport Sampling System
- ▲ — Surface Water Sampling Location
- AQT — Aquitard
- Approximate contact of Nolichucky Shale and Maynardville Limestone
- AQF — Aquifer

SAP03_4.DWG 09/23/02

Fig. A.4. CY 2003 sampling locations in the Upper East Fork Poplar Creek Hydrogeologic Regime.

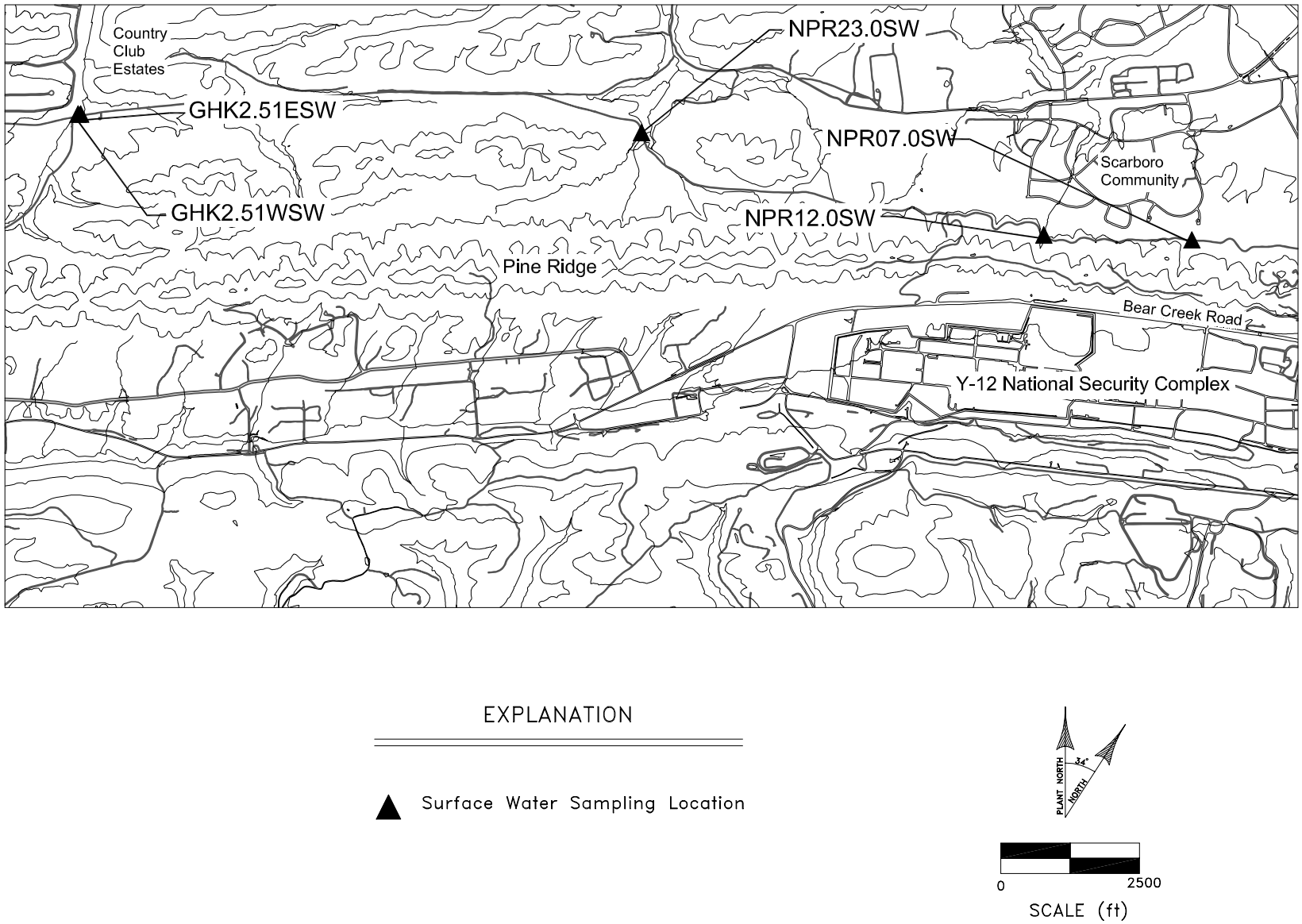


Fig. A.5. CY 2003 surface water sampling locations north of Pine Ridge.

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APPENDIX B

TABLES

Table B.1. Field measurements and analytical parameters for CY 2003 groundwater and surface water samples

FLD-Field Measurements	Analytical Method [1]	Detection Limit [2]	Units [3]
Depth to Water	NA	NA	ft
Water Temperature	NA	NA	centigrade
pH	NA	NA	pH units
Conductivity	NA	NA	µmho/cm
Dissolved Oxygen	NA	NA	ppm
Oxidation-Reduction Potential	NA	NA	mV
CHEM - Miscellaneous Laboratory Analytes			
pH	SW846-9040	NA	pH units
Conductivity	SW846-9050	NA	µmho/cm
Total Dissolved Solids	EPA-160.1	1	mg/L
Total Suspended Solids	EPA-160.2	1	mg/L
Turbidity	EPA-180.1	0.1	NTU
CHEM - Anions			
Alkalinity - HCO3	EPA-310.1	1.0	mg/L
Alkalinity - CO3	EPA-310.1	1.0	mg/L
Chloride	EPA-300.0	0.2	mg/L
Fluoride	EPA-340.2	0.1	mg/L
Nitrate (as Nitrogen)	EPA-300.0	0.028	mg/L
Sulfate	EPA-300.0	0.25	mg/L
MET(1) - Metals/Cations			
Aluminum	SW846-6010B	0.2	mg/L
Antimony	EPA-200.8	0.0025	mg/L
Arsenic	EPA-200.8	0.005	mg/L
Barium	SW846-6010B	0.004	mg/L
Beryllium	SW846-6010B	0.0005	mg/L
Boron	SW846-6010B	0.1	mg/L
Cadmium	EPA-200.8	0.0005	mg/L
Calcium	SW846-6010B	0.2	mg/L
Chromium	SW846-6010B	0.02	mg/L
Chromium	EPA-200.8	0.0025	mg/L
Cobalt	SW846-6010B	0.02	mg/L
Copper	SW846-6010B	0.02	mg/L
Iron	SW846-6010B	0.05	mg/L
Lead	EPA-200.8	0.0005	mg/L
Lithium	SW846-6010B	0.01	mg/L
Magnesium	SW846-6010B	0.2	mg/L
Manganese	SW846-6010B	0.005	mg/L
Mercury	SW846-7470	0.0002	mg/L
Molybdenum	SW846-6010B	0.05	mg/L
Nickel	SW846-6010B	0.05	mg/L
Nickel	EPA-200.8	0.005	mg/L

Table B.1 (continued)

MET(1) - (continued)	Analytical Method [1]	Detection Limit [2]	Units [3]
Potassium	SW846-6010B	2	mg/L
Selenium	EPA-200.8	0.01	mg/L
Silver	SW846-6010B	0.02	mg/L
Sodium	SW846-6010B	0.2	mg/L
Strontium	SW846-6010B	0.005	mg/L
Thallium	EPA-200.8	0.0005	mg/L
Thorium	SW846-6010B	0.2	mg/L
Uranium	EPA-200.8	0.0005	mg/L
Vanadium	SW846-6010B	0.02	mg/L
Zinc	SW846-6010B	0.05	mg/L
VOC(1) - Volatile Organic Compounds		**CRQL [4]**	
Acetone	SW846-8260B-UP	10	µg/L
Acrolein	SW846-8260B-UP	10	µg/L
Acrylonitrile	SW846-8260B-UP	5	µg/L
Benzene	SW846-8260B-UP	5	µg/L
Bromochloromethane	SW846-8260B-UP	5	µg/L
Bromodichloromethane	SW846-8260B-UP	5	µg/L
Bromoform	SW846-8260B-UP	5	µg/L
Bromomethane	SW846-8260B-UP	5	µg/L
2-Butanone	SW846-8260B-UP	5	µg/L
Carbon disulfide	SW846-8260B-UP	5	µg/L
Carbon tetrachloride	SW846-8260B-UP	5	µg/L
Chlorobenzene	SW846-8260B-UP	5	µg/L
Chloroethane	SW846-8260B-UP	5	µg/L
2-Chloroethyl vinyl ether	SW846-8260B-UP	10	µg/L
Chloroform	SW846-8260B-UP	5	µg/L
Chloromethane	SW846-8260B-UP	5	µg/L
Dibromochloromethane	SW846-8260B-UP	5	µg/L
1,2-Dibromo-3-chloropropane	SW846-8260B-UP	10	µg/L
1,2-Dibromoethane	SW846-8260B-UP	5	µg/L
Dibromomethane	SW846-8260B-UP	5	µg/L
1,2-Dichlorobenzene	SW846-8260B-UP	5	µg/L
1,4-Dichlorobenzene	SW846-8260B-UP	5	µg/L
1,4-Dichloro-2-butene	SW846-8260B-UP	5	µg/L
trans-1,4-Dichloro-2-butene	SW846-8260B-UP	5	µg/L
Dichlorodifluoromethane	SW846-8260B-UP	5	µg/L
1,1-Dichloroethane	SW846-8260B-UP	5	µg/L
1,2-Dichloroethane	SW846-8260B-UP	5	µg/L
1,1-Dichloroethene	SW846-8260B-UP	5	µg/L
cis-1,2-Dichloroethene	SW846-8260B-UP	5	µg/L
trans-1,2-Dichloroethene	SW846-8260B-UP	5	µg/L
1,2-Dichloropropane	SW846-8260B-UP	5	µg/L

Table B.1 (continued)

VOC(1) - (continued)	Analytical Method [1]	CRQL [4]	Units [3]
cis-1,3-Dichloropropene	SW846-8260B-UP	5	µg/L
trans-1,3-Dichloropropene	SW846-8260B-UP	5	µg/L
Dimethylbenzene	SW846-8260B-UP	5	µg/L
Ethanol	SW846-8260B-UP	200	µg/L
Ethylbenzene	SW846-8260B-UP	5	µg/L
Ethyl methacrylate	SW846-8260B-UP	5	µg/L
2-Hexanone	SW846-8260B-UP	5	µg/L
Iodomethane	SW846-8260B-UP	5	µg/L
4-Methyl-2-pentanone	SW846-8260B-UP	5	µg/L
Methylene chloride	SW846-8260B-UP	5	µg/L
Styrene	SW846-8260B-UP	5	µg/L
1,1,1,2-Tetrachloroethane	SW846-8260B-UP	5	µg/L
1,1,2,2-Tetrachloroethane	SW846-8260B-UP	5	µg/L
Tetrachloroethene	SW846-8260B-UP	5	µg/L
Toluene	SW846-8260B-UP	5	µg/L
1,1,1-Trichloroethane	SW846-8260B-UP	5	µg/L
1,1,2-Trichloroethane	SW846-8260B-UP	5	µg/L
Trichloroethene	SW846-8260B-UP	5	µg/L
Trichlorofluoromethane	SW846-8260B-UP	5	µg/L
1,2,3-Trichloropropane	SW846-8260B-UP	10	µg/L
Vinyl acetate	SW846-8260B-UP	10	µg/L
Vinyl chloride	SW846-8260B-UP	2	µg/L
Radiological Analytes		**Target MDA [5]**	
RAD(1) Gross Alpha Activity	EPA-900.0	3.5	pCi/L
RAD(1) Gross Beta Activity	EPA-900.0	7.0	pCi/L
RAD(2) Strontium-89/90	Y/P65-7037	4.0	pCi/L
RAD(2), RAD(12) Technetium-99	Y/P65-7060	10	pCi/L
RAD(2) Tritium	EPA-906.0	300	pCi/L
RAD(3) Uranium-234, 235, & 238	Y/P65-7061	0.4	pCi/L
RAD(4) Americium-241	Y/P65-7226	0.4	pCi/L
RAD(4) Iodine-129	EPA-901.1	3.0	pCi/L
RAD(4) Neptunium-237	Y/P65-7206	0.4	pCi/L
RAD(4) Plutonium-238 & 239/240	Y/P65-7226	0.4	pCi/L
RAD(5) Radium-223/224/226	EPA-903.0 - 904.0	0.5	pCi/L
RAD(8) Thorium-228,230,232, & 234	Y/P65-7052	0.4	pCi/L
RAD(13) Total Uranium and weight % Uranium-234, 235, & 238	Y/P65-8044	0.002	mg/L

Table B.1 (continued)

Notes:

1 NA - not applicable

Field measurement procedures:

- LMES 1999a, LMES 1999b, BWXT 2000a, and BWXT 2002a

Analytical methods from:

- *Test Methods for Evaluating Solid Waste Physical/Chemical Methods* (U.S. Environmental Protection Agency 1996)
- *Methods for Chemical Analysis of Water and Wastes* (U.S. Environmental Protection Agency 1983)
- BWXT Analytical Chemistry Organization Controlled Procedures: (Y/P65-7037, Y/P65-7052, Y/P65-7060, Y/P65-7061, Y/P65-7206, Y/P65-7226, and Y/P65-8044)

2 NA - not applicable

3
ft - feet
µg/L - micrograms per liter
µmho/cm - micromhos per centimeter
mg/L - milligrams per liter
mV - millivolts
NTU - nephelometric turbidity units
ppm - parts per million
pCi/L - picoCuries per liter

4 CRQL - contract-required quantitation limit

5 MDA - minimum detectable activity. The target MDA may be obtained under optimal analytical conditions; actual MDAs are sample-specific and may vary significantly from the target value.

Table B.2. Sampling sequence, frequency, and analytical parameters for groundwater and surface water monitoring during CY 2003

Sample Group[1]	Location[2]	Sampling Point[3]	Duplicate[4]	Contain[5]	Monitoring Driver[6]	Parameters[7]
Bear Creek Hydrogeologic Regime						
BC-1 (Q1, Q3)	EXP-W	GW-710		Y	SMP	STD
	EXP-W	GW-711		Y	SMP	STD
	EXP-B	GW-695	Q3	Y	SMP	STD
	EXP-B	GW-703		Y	SMP	STD
	EXP-B	GW-704		Y	SMP	STD
	EXP-B	GW-706		Y	SMP	STD
	EXP-C	GW-740	Q1	Y	SMP	STD
	EXP-C	GW-738		Y	SMP	STD
	EXP-C	GW-724		Y	SMP	STD
	EXP-C	GW-725		Y	SMP	STD
BC-2 (Q1, Q3)	S3	GW-123			SMP	STD
	BG	GW-653(C)		Y	SMP	STD
	BG	GW-627	Q1	Y	SMP	STD
	BG	GW-082(C)		Y	SMP	STD
	SPI	GW-315		Y	SMP	STD
	RS	GW-311		Y	SMP	STD
	OLF	GW-085	Q3	Y	SMP	STD
	OLF	GW-537		Y	SMP	STD
	OLF	GW-229		Y	SMP	STD
	OLF	GW-226(C)		Y	SMP	STD
	OLF	GW-225(C)		Y	SMP	STD
	FIELD BLANK					VOC(1)
BC-3 (Q1, Q3)	EXP-SW	BCK-00.63	Q3		EXP	STD
	EXP-SW	BCK-04.55			EXP	STD
	EXP-SW	SS-5			EXP	STD
	EXP-SW	SS-4	Q1		EXP	STD
	EXP-SW	BCK-09.40			EXP	STD
	EXP-SW	BCK-11.97			EXP	STD, RAD(2,3,4,5,8,13)
	EXP-SW	SS-1			EXP	STD
	EXP-SW	NT-01			EXP	STD

Table B.2 (continued)

Sample Group[1]	Location[2]	Sampling Point[3]	Duplicate[4]	Contain[5]	Monitoring Driver[6]	Parameters[7]
Chestnut Ridge Hydrogeologic Regime						
CR-1 (Q1,Q3)	EXP-SW	SCR1.5SW			EXP	STD
	EXP-SW	SCR2.1SP	Q1		EXP	STD
	EXP-SW	SCR2.2SP			EXP	STD
	EXP-SW	SCR3.5SW			EXP	STD
	EXP-SW	S17			EXP	STD
	CRSP	GW-612(C)		Y	SMP	STD
	CRSP	GW-322	Q3	Y	SMP	STD
Upper East Fork Poplar Creek Hydrogeologic Regime						
EF-1 (Q2,Q4)	FTF	GW-620		Y	SMP	STD
	S2	GW-251		Y	SMP	STD
	S3	GW-105	Q2	Y	SMP	STD, RAD(3,12)
	S3	GW-106		Y	SMP	STD, RAD(3,12)
	RG	GW-505		Y	SMP	STD, RAD(3,12)
	RG	GW-632		Y	SMP	STD, RAD(3,12)
	RG	GW-633(C)		Y	SMP	STD
	S3	GW-109	Q4	Y	SMP	STD
	FIELD BLANK					VOC(1)
EF-2 (Q2, Q4)	B4	GW-190	Q4	Y	SMP	STD
	SY	GW-270		Y	SMP	STD
	SY	GW-271		Y	SMP	STD
	RG	GW-634		Y	SMP	STD
	SY	GW-272		Y	SMP	STD
	SY	GW-269	Q2	Y	SMP	STD
	SY	GW-274		Y	SMP	STD
	SY	GW-275		Y	SMP	STD
EF-3 (Q2, Q4)	B8110	GW-696		Y	SMP	STD
	B8110	GW-698		Y	SMP	STD
	B8110	GW-700	Q4	Y	SMP	STD
	GRID D2	GW-791		Y	SMP	STD
	T0134	GW-204(C)		Y	SMP	STD
	GRID E3	GW-782(C)		Y	SMP	STD

Table B.2 (continued)

Sample Group[1]	Location[2]	Sampling Point[3]	Duplicate[4]	Contain[5]	Monitoring Driver[6]	Parameters[7]
EF-3 (continued) (Q2, Q4)	CPT	GW-690		Y	SMP	STD
	GRID B3	55-2C		Y	SMP	STD, RAD(12)
	GRID C3	56-2C	Q2	Y	SMP	STD
	WC	GW-336		Y	SMP	STD
	WC	GW-337		Y	SMP	STD
EF-4 (Q2,Q4)	GRID E1	GW-765			SMP	STD
	GRID E1	GW-764			SMP	STD
	GRID E2	GW-787			SMP	STD
	GRID E2	GW-786	Q4		SMP	STD
	GRID G2	GW-761			SMP	STD
	GRID G2	GW-760			SMP	STD
	B9202	59-1A			SMP	STD
	B9202	59-1B			SMP	STD
	B9202	59-1C	Q2	Y	SMP	STD
EF-5 (Q2,Q4)	GRID G3	GW-770		Y	SMP	STD
	GRID G3	GW-769	Q2	Y	SMP	STD
	B9201-2	60-1B		Y	SMP	STD
	B9201-2	60-2A	Q4	Y	SMP	STD
	B9201-2	GW-820		Y	SMP	STD
	UOV	GW-219		Y	SMP	STD
	GRID JP	GW-763		Y	SMP	STD
	NHP	GW-381		Y	SMP	STD
	NHP	GW-153		Y	SMP	STD
	NHP	GW-383		Y	SMP	STD
EF-6 (Q2,Q4)	EXP-SR	GW-208			EXP	STD
	EXP-SR	GW-207			EXP	STD
	EXP-SR	GW-816			EXP	STD
	GRID K1	GW-744	Q2		EXP	STD
	GRID K2	GW-747			EXP	STD
	EXP-J	GW-750			EXP	STD
	EXP-J	GW-735			EXP	STD
	NHP	GW-220	Q4	Y	EXP	STD

Table B.2 (continued)

Sample Group[1]	Location[2]	Sampling Point[3]	Duplicate[4]	Contain[5]	Monitoring Driver[6]	Parameters[7]
EF-WB (Q1,Q3)	EXP-J	GW-722-06			EXP	STD
	EXP-J	GW-722-30			EXP	STD
	EXP-J	GW-722-26			EXP	STD
	EXP-J	GW-722-32			EXP	STD
	EXP-J	GW-722-33	Q1		EXP	STD
	EXP-J	GW-722-10			EXP	STD
	EXP-J	GW-722-22		Y	EXP	STD
	EXP-J	GW-722-20		Y	EXP	STD
	EXP-J	GW-722-14		Y	EXP	STD
	EXP-J	GW-722-17	Q3	Y	EXP	STD
	RINSATE SAMPLE					STD
North of Pine Ridge						
PR-1 (Q2,Q4)	EXP-NPR	NPR07.0SW	Q2		EXP	STD
	EXP-NPR	NPR12.0SW			EXP	STD
	EXP-NPR	NPR23.0SW			EXP	STD
	EXP-NPR	GHK2.51ESW	Q4		EXP	STD
	EXP-NPR	GHK2.51WSW			EXP	STD

Notes:

1 Samples will be collected during the calendar year quarter as specified (e.g., Q1).

2 **Bear Creek Regime**

BG - Bear Creek Burial Grounds Waste Management Area
EXP - Exit Pathway Monitoring Location:
Maynardville Limestone Picket (-B, -C, -W)
Spring or Surface Water Location (-SW)
OLF - Oil Landfarm Waste Management Area
RS - Rust Spoil Area
SPI - Spoil Area I

Chestnut Ridge Regime

EXP-SW - Spring or surface water sampling location
CRSP - Chestnut Ridge Security Pits

Table B.2 (continued)

Notes: (continued)

2 (continued)

East Fork Regime

B4	-	Beta-4 Security Pits
B8110	-	Building 81-10
B9201-2	-	Building 9201-2
CPT	-	Coal Pile Trench
EXP-J	-	Maynardville Limestone Exit Pathway Picket J
EXP-SR	-	Exit pathway well in the gap through Pine Ridge along Scarboro Road
FTF	-	Fire Training Facility
GRID	-	Comprehensive Groundwater Monitoring Plan Grid Location
NHP	-	New Hope Pond
RG	-	Rust Garage Area
T0134	-	Underground Storage Tank 0134-U
UOV	-	Uranium Oxide Vault
SY	-	Y-12 Salvage Yard
S2	-	S-2 Site
S3	-	S-3 Site
WC	-	Waste Coolant Processing Area

North of Pine Ridge

EXP-NPR	-	Surface water sampling station located where drainage exits the Oak Ridge Reservation

3	BCK	-	Bear Creek Kilometer (surface water station)
	GW	-	Groundwater monitoring well
	GHK	-	Gum Hollow Kilometer (surface water station)
	NPR	-	North of Pine Ridge (surface water station)
	NT	-	North Tributary to Bear Creek
	S17	-	Surface water station in SCR5
	SCR	-	South Chestnut Ridge (spring or surface water station)
	SS	-	Spring sampling location: South Side of Bear Creek
	(C)	-	A sample will be collected using the conventional sampling method within a few days after collecting the sample using the low-flow sampling method.
4	Q_	-	Field duplicate samples will be collected at these locations during the quarter specified.
5	Y	-	All purged groundwater will be contained at these locations.
6	EXP	-	DOE Order 5400.1 Exit Pathway/Perimeter Monitoring
	SMP	-	DOE Order 5400.1 Surveillance Monitoring

Table B.2 (continued)

Notes: (continued)

7 Table B.1 provides a comprehensive list of analytes and analytical methods grouped by parameter.

STD - Standard administrative parameter group.
The following list of parameters apply to CY 2003 samples:

Standard Administrative Parameter Group:

FLD	-	Field measurements
CHEM	-	Miscellaneous laboratory analytes (e.g., pH) and anions
MET(1)	-	Metals
VOC(1)	-	Volatile organic compounds
RAD(1)	-	Gross alpha and gross beta

Additional Radionuclides:

RAD(2)	-	Strontium-89/90, technetium-99, and tritium
RAD(3)	-	Uranium-234, -235, and -238
RAD(4)	-	Americium-241, iodine-129, neptunium-237, plutonium-238 and -239/240
RAD(5)	-	Radium-223/224/226
RAD(8)	-	Thorium-228, -230, -232, and -234
RAD(12)	-	Technetium-99
RAD(13)	-	Total uranium and weight percent of Uranium-234, -235, and -238

APPENDIX C

LABORATORY REQUIREMENTS
(Bottle List, Holding Times, Turnaround Time)

STD

Parameter	Chemical Preservative [1]	Bottle Types/Size
Turbidity, pH, Conductivity, Anions, and Fluoride	None	1 - 250 mL polyethylene
Total Suspended Solids	None	1 - 250 mL polyethylene
Total Dissolved Solids	None	1 - 250 mL polyethylene
Carbonate, Bicarbonate	None	1 - 250 mL polyethylene
Total Metals (ICP,ICP-MS, and Hg)	HNO_3	1 - 500 mL polyethylene
Radiochemistry (UV / Y-12)	HNO_3	1 – 500 mL polyethylene
VOA	None	2 - 40 mL amber glass with Teflon lined septum lids
Trip Blank (VOA) **(one per cooler)**	None	1 - 40 mL amber glass with Teflon lined septum lid

STD:	**ESLIMS LAB TEST ID**
FLD	GWTRSAMP
CHEM	ALKALINITY-I, ANIONS, FLUORIDE, SOLIDS-TOT-S, SOLIDS-TOT-D, PH9040, TURBIDITY and CONDUCTANCE
MET(1)	ICP6010, ICPMSGW and HG7470
VOC(1)	VOA8260GW
RAD(1)	GROSSAB-ENV

[1] Samples chilled to 4 +/- 2C

STD, RAD (2,3,4,5,8,13)

Parameter	Chemical Preservative [1]	Bottle Types/Size
Turbidity, pH, Conductivity, Anions, and Fluoride	None	1 – 250 mL polyethylene
Total Suspended Solids	None	1 – 250 mL polyethylene
Total Dissolved Solids	None	1 – 250 mL polyethylene
Carbonate, Bicarbonate	None	1 – 250 mL polyethylene
Total Metals (ICP,ICP-MS, and Hg)	HNO_3	1 – 500 mL polyethylene
Total Uranium and $^{234}U\%$, $^{235}U\%$, $^{236}U\%$, $^{238}U\%$	HNO_3	1 – 250 mL polyethylene
Radiochemistry (UV / Y12)	HNO_3	5 – liter polyethylene
Tritium	None	1 – 250 mL glass
VOA	None	2 – 40 mL amber glass with Teflon lined septum lids
Trip Blank (VOA) **(one per cooler)**	None	1 – 40 mL amber glass with Teflon lined septum lid

STD: ESLIMS LAB TEST ID

FLD GWTRSAMP

CHEM ALKALINITY-I, ANIONS, FLUORIDE, SOLIDS-TOT-S, SOLIDS-TOT-D, PH9040, TURBIDITY and CONDUCTANCE

MET(1) ICP6010, ICPMSGW and HG7470

VOC(1) VOA8260GW

RAD (1) = Gross Alpha Beta (GROSSAB-ENV) 500 mL preserved w HNO3

RAD (2) = $^{89/90}$Sr, ^{99}Tc (TOTALSR-ENV, TC99LS-ENV) 1,000 mL preserved w HNO3
^{3}H (TRITIUM-ENV) 250 mL **No HNO3, 4C +/ 2C**

RAD (3) = ^{234}U, ^{235}U, ^{238}U (ASPECU-ENV) 500 mL preserved w HNO3

RAD (4) = ^{241}Am, ^{237}Np, ^{129}I, ^{238}Pu and $^{239/240}$Pu 1,500 mL preserved w HNO3
(ASPECAM-ENV, ASPECNP-ENV, GAMSPEC-ENV, ASPECPU-ENV)

RAD (5) = Radium total (TOTALRA-ENV) 1,000 mL preserved w HNO3

RAD (8) = Thorium ($^{228/230/232}$Th and ^{234}Th) 1,000 mL preserved w HNO3
(ASPECTH-ENV)

RAD (13) = Total U and ^{235}U % , ^{234}U%, ^{236}U%, ^{238}U% 250 mL preserved w HNO3
(TIMS - - - U-ISO-TOTAL)

[1] Samples chilled to 4 +/- 2C

VOC (1)

Parameter	Chemical Preservative [1]	Bottle Types/Size
VOA	None	2 – 40 mL amber glass with Teflon lined septum lid

VOC(1) VOA8260GW

[1] Samples chilled to 4 +/- 2C

STD, RAD 12

Parameter	Chemical Preservative[1]	Bottle Types/Size
Turbidity, pH, Conductivity, Anions, and Fluoride	None	1 – 250 mL polyethylene
Total Suspended Solids	None	1 – 250 mL polyethylene
Total Dissolved Solids	None	1 – 250 mL polyethylene
Carbonate, Bicarbonate	None	1 – 250 mL polyethylene
Total Metals (ICP,ICP-MS, and Hg)	HNO_3	1 – 500 mL polyethylene
Radiochemistry (UV / Y12)	HNO_3	1 – 1L polyethylene
VOA	None	2 – 40 mL amber glass with Teflon lined septum lids
Trip Blank (VOA) **(one per cooler)**	None	1 – 40 mL amber glass with Teflon lined septum lid

STD:	**ESLIMS LAB TEST ID**
FLD	GWSPSAMP
CHEM	ALKALINITY-I, ANIONS, FLUORIDE, SOLIDS-TOT-S, SOLIDS-TOT-D, PH9040, TURBIDITY and CONDUCTANCE
MET(1)	ICP6010, ICPMSGW and HG7470
VOC(1)	VOA8260GW

RAD (1) =	Gross Alpha Beta (GROSSAB-ENV)	500 mL	preserved w HNO3
RAD (12) =	Tc-99 (TC99LS-ENV)	500 mL	preserved w HNO3

[1] Samples chilled to 4 +/- 2C

STD, RAD (3, 12)

Parameter	Chemical Preservative [1]	Bottle Types/Size
Turbidity, pH, Conductivity, Anions, and Fluoride	None	1 – 250 mL polyethylene
Total Suspended Solids	None	1 – 250 mL polyethylene
Total Dissolved Solids	None	1 – 250 mL polyethylene
Carbonate, Bicarbonate	None	1 – 250 mL polyethylene
Total Metals (ICP,ICP-MS, and Hg)	HNO_3	1 – 500 mL polyethylene
Radiochemistry (UV / Y12)	HNO_3	1 – liter polyethylene & 1 – 500 mL polyethylene
VOA	None	2 – 40 mL amber glass with Teflon lined septum lids
Trip Blank (VOA) **(one per cooler)**	None	1 – 40 mL amber glass with Teflon lined septum lid

STD:	**ESLIMS LAB TEST ID**
FLD	GWTRSAMP
CHEM	ALKALINITY-I, ANIONS, FLUORIDE, SOLIDS-TOT-S, SOLIDS-TOT-D, PH9040, TURBIDITY and CONDUCTANCE
MET(1)	ICP6010, ICPMSGW and HG7470
VOC(1)	VOA8260GW

RAD (1) = Gross Alpha Beta (GROSSAB-ENV)	500 mL	preserved w HNO3
RAD (3) = ^{234}U, ^{235}U, ^{238}U (ASPECU-ENV)	500 mL	preserved w HNO3
RAD (12) = Tc-99 (TC99LS-ENV)	500 mL	preserved w HNO3

[1] Samples chilled to 4 +/- 2C

WESTBAY

Parameter	Chemical Preservative [1]	Bottle Types/Size
Turbidity, pH, Conductivity, Anions, and Fluoride	None	1 - 250 mL polyethylene
Total Suspended Solids	None	1 - 250 mL polyethylene
Total Dissolved Solids	None	1 - 250 mL polyethylene
Carbonate, Bicarbonate	None	1 - 250 mL polyethylene
Total Metals (ICP,ICP-MS, and Hg)	HNO_3	1 - 250 mL polyethylene
Radiochemistry (UV / Y-12)	HNO_3	1 – 250 mL polyethylene
VOA	None	2 - 40 mL amber glass with Teflon lined septum lids
Trip Blank (VOA) **(one per cooler)**	None	1 - 40 mL amber glass with Teflon lined septum lid

STD:	**ESLIMS LAB TEST ID**
FLD	GWTRSAMP
CHEM	ALKALINITY-I, ANIONS, FLUORIDE, SOLIDS-TOT-S, SOLIDS-TOT-D, PH9040, TURBIDITY and CONDUCTANCE
MET(1)	ICP6010, ICPMSGW and HG7470
VOC(1)	VOA8260GW
RAD(1)	GROSSAB-ENV

[1] Samples chilled to 4 +/- 2C

ESTABLISHED HOLDING TIMES

Parameter	**Holding Times**
Alkalinity (Carbonate, Bicarbonate)	14 days
Anions (Chloride, Nitrate, Sulfate)	48 hr
Conductance	24 hr
Fluoride	28 days
Mercury	28 days
Metals (ICP, ICPMS)	6 months
pH	analyze immediately
Radiochemistry (except tritium)	6 months
Solids, Total Dissolved	7 days
Solids, Total Suspended	7 days
Tritium	No EPA guidance
Turbidity	48 hours
Uranium by Thermal Ionization Mass Spec	6 months
VOA	7 days

ESTABLISHED TURNAROUND TIMES

The Groundwater Protection Program and the Analytical Chemistry Organization (ACO) laboratory have agreed upon a turnaround time, such that the analytical data generated from all sample locations within a sample group will be transmitted to the Data Manager as a data deliverable. Currently, the turnaround time for all sample groups is 35 days from the receipt of the last sample within a group. Data is transmitted in the form of hard copy of the completed and approved lab reports for each locations, along with an electronic copy in a standardized and compatible format (please see *Y-12 Plant Groundwater Protection Program Data Management Plan, Revision 1*, May 2000, Y/SUB/00-KFX63/C/1)

APPENDIX D

ADDENDA TO THE CY 2003 SAMPLING AND ANALYSIS PLAN
(if issued)

APPENDIX E

CY 2003 GROUNDWATER MONITORING SCHEDULES

DISTRIBUTION

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