Y/SUB/99-MVM64V/5

Y-12

OAK RIDGE
Y-12
PLANT

LOCKHEED MARTIN

Y-12 PLANT GROUNDWATER PROTECTION PROGRAM GROUNDWATER AND SURFACE WATER SAMPLING AND ANALYSIS PLAN FOR CALENDAR YEAR 2000

Prepared by

AJA TECHNICAL SERVICES, INC.
Under Subcontract 70Y-MVM64V

September 1999

for the

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

Managed by

LOCKHEED MARTIN ENERGY SYSTEMS, INC.
for the U.S. DEPARTMENT OF ENERGY
under contract No. DE-AC05-84OR21400

MANAGED BY
LOCKHEED MARTIN ENERGY SYSTEMS, INC.
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 (BC sample groups)
Chestnut Ridge Regime	Chestnut Ridge Hydrogeologic Regime (CR sample groups)
CY	Calendar Year
DOE	U.S. Department of Energy
East Fork Regime	Upper East Fork Poplar Creek Hydrogeologic Regime (EF sample groups)
GWPP	Groundwater Protection Program
LMES	Lockheed Martin Energy Systems, Inc.
SWDF	Solid Waste Disposal Facility

1.0 INTRODUCTION

This plan provides a description of the groundwater and surface water quality monitoring activities planned for calendar year (CY) 2000 at the U.S. Department of Energy (DOE) Y-12 Plant that will be managed by the Y-12 Plant Groundwater Protection Program (GWPP). Groundwater and surface water monitoring during CY 2000 will be performed in three hydrogeologic regimes at the Y-12 Plant: 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 the Y-12 Plant (Figure 1).

Groundwater and surface water monitoring performed under the auspices of the Y-12 Plant GWPP during CY 2000 will comply with:

- Tennessee Department of Environment and Conservation regulations governing detection monitoring at nonhazardous Solid Waste Disposal Facilities (SWDF); and

- DOE Order 5400.1 surveillance monitoring and exit pathway/perimeter monitoring.

Some of the data collected for these monitoring drivers also will be used to meet monitoring requirements of the Integrated Water Quality Program, which is managed by Bechtel Jacobs Company LLC. Data from five wells that are monitored for SWDF purposes in the Chestnut Ridge Regime will be used to comply with requirements specified in the Resource Conservation and Recovery Act post closure permit regarding corrective action monitoring.

Modifications to the CY 2000 monitoring program may be necessary during implementation. Changes in regulatory or 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 Plant GWPP manager and documented as addenda to this sampling and analysis plan.

2.0 MONITORING LOCATIONS

The Y-12 Plant GWPP monitoring network for CY 2000 includes 111 monitoring locations. Groundwater samples will be collected from a total of 79 monitoring wells, including 23 wells located in the Bear Creek Regime (Figure 2), 17 wells located in the Chestnut Ridge Regime (Figure 3), and 39 wells (one well has 10 monitoring locations) located in the East Fork Regime (Figure 4). Samples of groundwater discharging from 10 natural springs also will be collected, including four springs (SS-1, SS-4, SS-5, and SS-6) in the Bear Creek Regime (Figure 2) and six springs (SCR2.1SP, SCR2.2SP, SCR3.4SP, SCR4.3SP, SCR5.1SP, and SCR5.4SP) in the Chestnut Ridge Regime (Figure 3). Surface water samples will be collected from 13 sampling locations during CY 2000, including seven locations in the Bear Creek Regime, one location in the East Fork Regime, and five locations north of Pine Ridge. In the Bear Creek Regime, samples will be collected from Bear Creek at six sampling stations located from about 0.6 to 12 kilometers upstream of the confluence of Bear Creek and East Fork Poplar Creek (BCK-00.63 to BCK-11.97), and from one sampling station along a northern tributary (NT-01) to Bear Creek (Figure 2). In the East Fork Regime, samples will be collected from the Lake Reality Emergency Spillway (Figure 4). The locations north of Pine Ridge include samples collected from three tributaries (NPR07.0SW, NPR10.0SW, and NPR12.0SW) along the north slope of Pine Ridge near the Scarboro Community and two tributaries (GHK2.51ESW and GHK2.51WSW) near Country Club Estates (Figure 5).

3.0 SAMPLE COLLECTION AND HANDLING

Monitoring wells, springs, and surface water stations are subdivided into sample groups based on hydrogeologic regimes. These sample groups, located in the Bear Creek (BC), Chestnut Ridge (CR), and East Fork (EF) hydrogeologic regimes, will be sampled in the sequence shown on Table 1. The sampling sequence is generally from least contaminated to most contaminated location within each sampling group. Groundwater samples will be collected using dedicated sampling equipment (Well Wizard ™ bladder pumps) unless a well is equipped with a Westbay™ multiport sampling system or is specified for conventional method sample collection (Table 1).

Personnel from the Y-12 Plant Analytical Chemistry Organization (ACO) will be responsible for collection, transportation, and chain-of-custody control of the groundwater and surface water samples. Sampling will be performed in accordance with the most recent version of Y-12 Plant System Operating Procedures approved by the Y-12 Plant GWPP Manager for obtaining groundwater samples (Lockheed Martin Energy Systems, Inc. [LMES] 1996a, 1996b, 1997), surface water samples (LMES 1999a), and field measurments (LMES 1996c, 1999b, and 1999c).

During CY 2000, most groundwater samples will be obtained using the low-flow minimal drawdown purging and sampling method (low-flow method); however, the conventional sampling method (three well-volume purging) will be used where specified (Table 1), and the sampling method for wells equipped with a Westbay™ multiport sampling system (Westbay method) will be used where applicable. Groundwater samples collected using the low-flow method will be obtained using dedicated bladder pumps (Well Wizard™). In accordance with the procedure for the low-flow method (LMES 1997), groundwater samples will be collected from the well immediately following the stabilization (minimal variation over four consecutive readings) of field measurements (pH, conductivity, temperature, oxidation-reduction potential, and dissolved oxygen) in the groundwater purged from the well at a low flow rate (<300 milliliters per minute) to ensure minimal drawdown of the water level in the well (<0.1 foot per quarter-hour). Using this sampling method, representative groundwater samples are obtained with no influence from the stagnant water in the well casing. This method differs from the conventional sampling method, which involves pumping at least three well volumes at higher purge rates (1 to 2 gallons per minute) before collecting samples from the well.

Groundwater samples from five monitoring wells will be collected using the conventional sampling method during CY 2000 (Table 1). These locations include three wells in the Bear Creek Regime (GW-627, GW-706, and GW-725) and two wells in the East Fork Regime (GW-763 and GW-791). The conventional method samples will be obtained with portable gas-piston pumps (Bennet Pump™) a few days after collecting the low-flow method samples from these wells. The paired results for these locations will be compared to evaluate the differences in groundwater quality data obtained by each sampling method.

Groundwater sampling using a Westbay™ multiport sampling system at well GW-722 will be performed in accordance with the most recent and approved operating procedures (LMES 1996a and 1996b). The groundwater samples from each sampling port will be collected in a 250-milliliter nonvented stainless steel sample collection bottle filled at the designated depth in the well by opening the sampling port valve. Once filled, the bottle is raised to the surface and the sample is transferred to laboratory sample bottles. Normally, a sample collection bottle will be filled about

seven times at each port to obtain enough groundwater to fill all of the laboratory sample bottles. The first sample bottle is used as a "formation rinse" to obtain field measurements and condition the sample bottle for each particular zone.

Because preliminary results have shown that the low-flow sampling method provides less turbid samples than the conventional sampling method, filtered samples will be collected only from specified monitoring locations (Table 1). These locations include all of the sample groups in the Chestnut Ridge Regime, Westbay well GW-722 in the East Fork Regime, and the surface water locations north of Pine Ridge. These samples will be filtered in the field using a 0.45-micron filter. All samples will be collected in appropriate containers, labeled, logged, placed in ice-filled coolers, and transported to the appropriate ACO laboratory in accordance with chain-of-custody control requirements.

Samples will be collected semiannually from all of the monitoring wells, springs, and surface water stations in each regime during CY 2000. As summarized below, the number of samples to be collected during each quarter will range from 48 to 63, for an annual total of 222 samples.

HYDROGEOLOGIC REGIME/AREA	NUMBER OF SAMPLES PER QUARTER OF CY 2000	
	1st and 3rd	2nd and 4th
Bear Creek Regime	37	0
Chestnut Ridge Regime	16	7
East Fork Regime	10	41
North of Pine Ridge	5	0
TOTAL:	**63**	**48**

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 1. Field blank samples will be collected from at least 10% of the sample groups. A field blank will be collected during each quarter of CY 2000: at BC-2 during the first and third quarters and at EF-2 during the second and fourth quarters. Equipment rinsate samples will be collected from well GW-722 (EF-WB) and from the wells scheduled for conventional sampling (Table 1). The rinsate sample will be obtained in the field immediately after field-cleaning the sampling equipment after collecting samples from the last sampling port (GW-722-17) or after the last well sampled with a particular pump.

Trip blank samples, field duplicate samples, and laboratory quality assurance samples will be prepared and analyzed as specified in the ACO Laboratory Quality Assurance Project Plan (Martin Marietta Energy Systems, Inc. 1991) using applicable analytical procedures. The location (building and room number) where the trip blank samples are prepared will be recorded on the field data sheets. 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 28 field duplicate samples will be collected during CY 2000, including six in the Bear Creek Regime, 10 in the Chestnut Ridge Regime, 10 in the East Fork Regime, and two from offsite surface water stations (Table 1).

4.0 FIELD MEASUREMENTS AND ANALYTICAL PARAMETERS

Field personnel will measure the depth to water before purging and sampling groundwater in each monitoring well. Sampling personnel also will record field measurements of pH, temperature, conductivity, dissolved oxygen, and oxidation-reduction potential before collecting samples at each monitoring location (Table 2).

The monitoring drivers for CY 2000 require an extensive list of analytes (Table 2). For this Sampling and Analysis Plan, specific analytes are grouped by analytical method or by type (e.g., metals) and referenced as analytical parameters. 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.

Unfiltered groundwater and surface water samples will be analyzed for all of the standard laboratory analytes; filtered samples will be analyzed only for the trace metals.

The Y-12 Plant National Pollution Elimination System Program requested results for several radionuclides in addition to the analytes included in the Standard Administrative Parameter Group for surface water samples from BCK-11.97 in BC-3 (Table 1). Groundwater samples from six monitoring wells in the East Fork regime also will be analyzed for specified radionuclides.

5.0 REFERENCES

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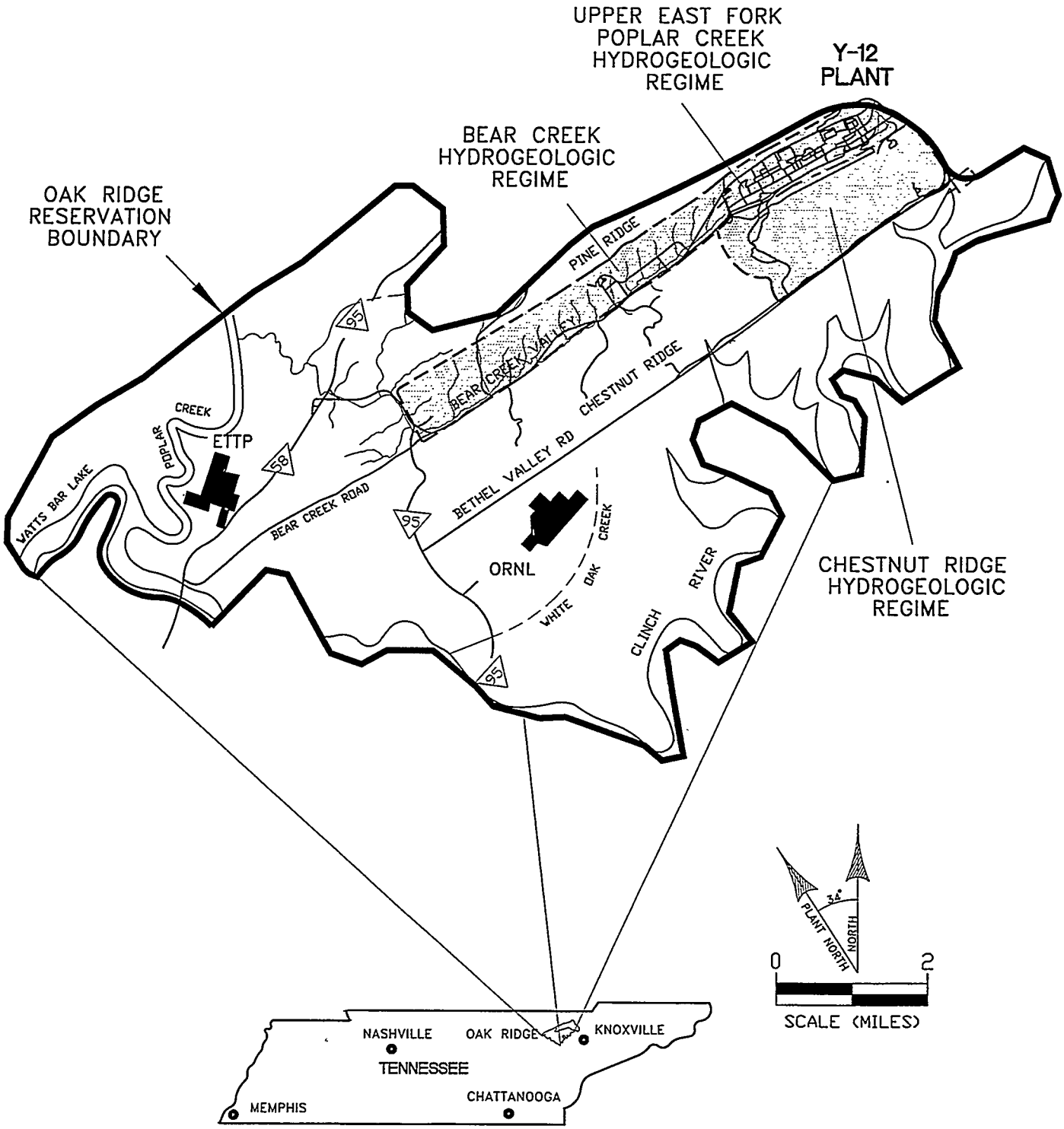
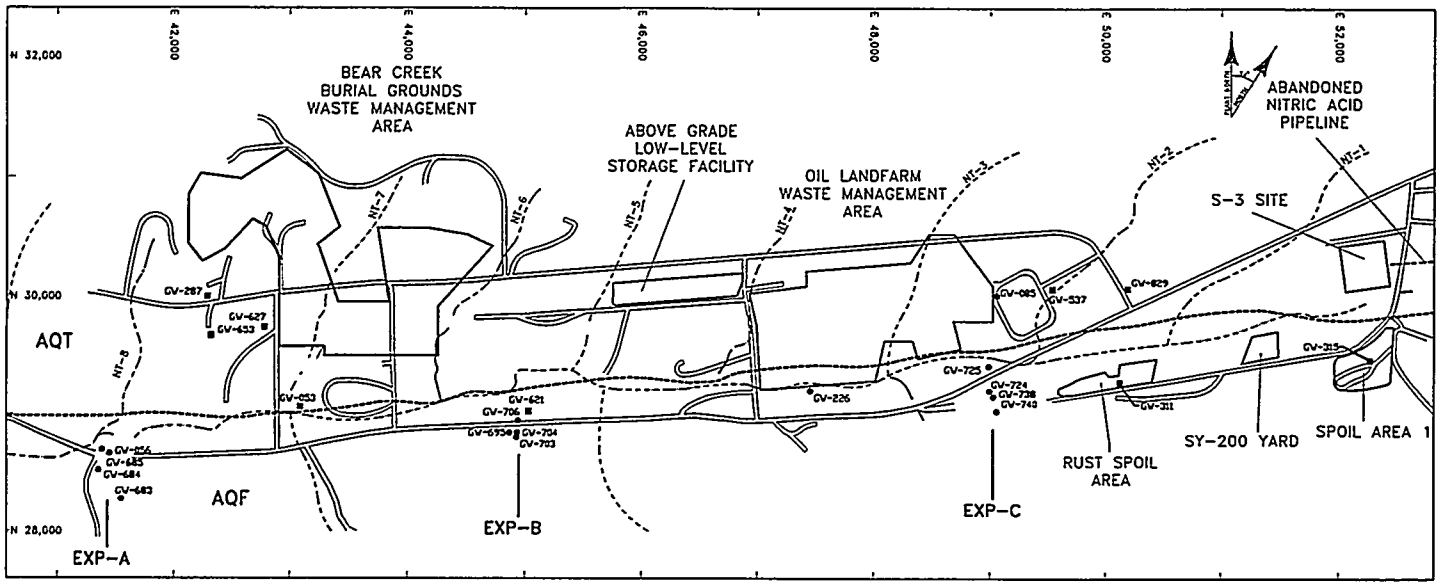
APPENDIX A

FIGURES



97-007

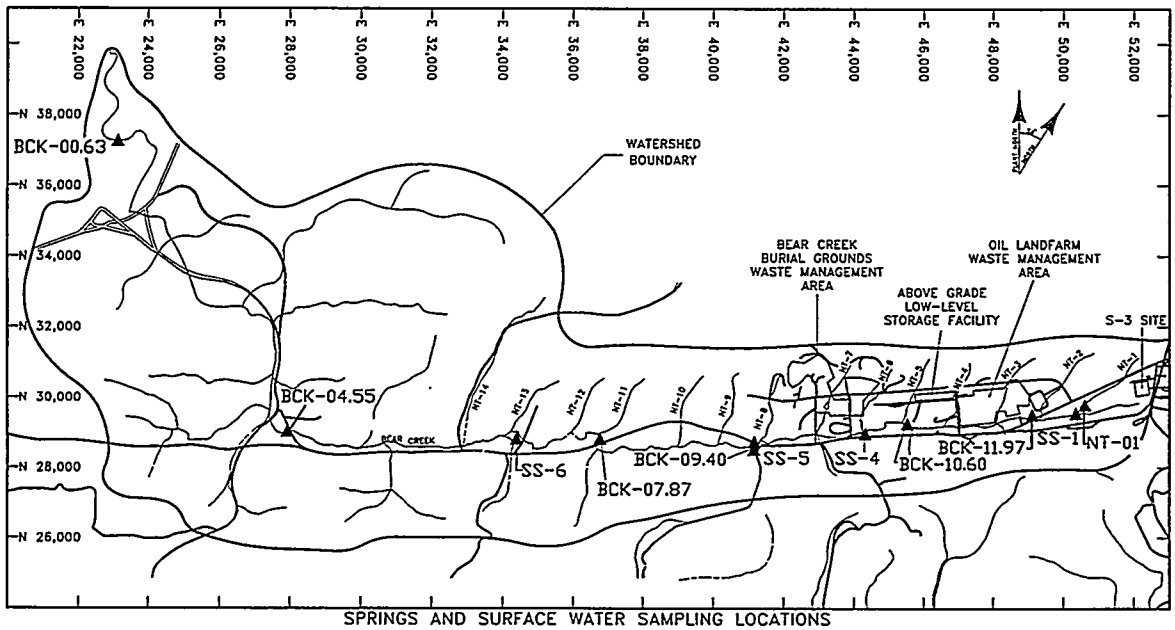
Fig. 1. Hydrogeologic regimes at the Y-12 Plant.



MONITORING WELLS

0 1650

SCALE (ft)



SPRINGS AND SURFACE WATER SAMPLING LOCATIONS

0 4050

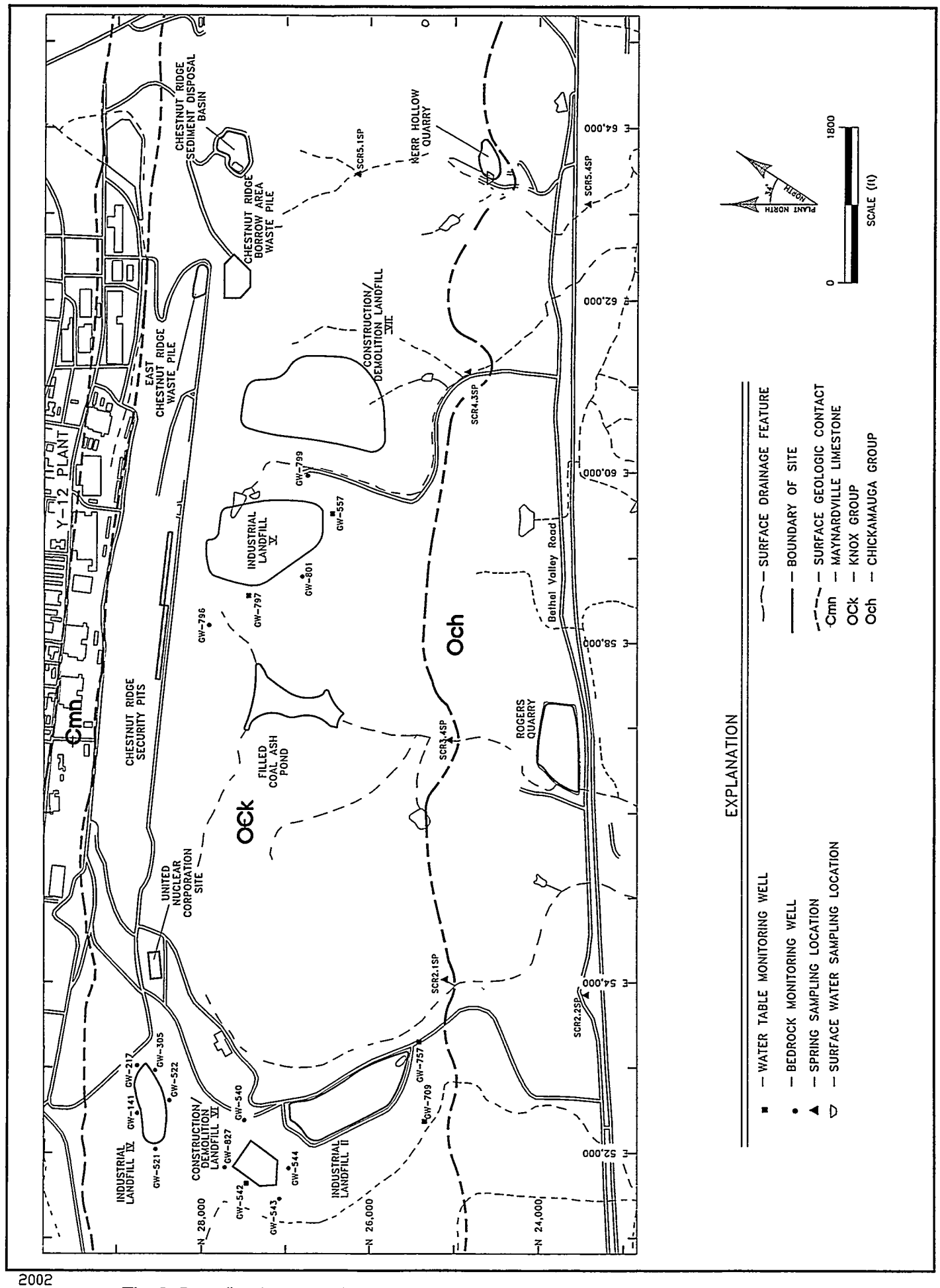
SCALE (ft)

EXPLANATION

- ■ — Water Table Monitoring Well
- ◆ — Bedrock Monitoring Well
- ▲ — Spring or Surface Water 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

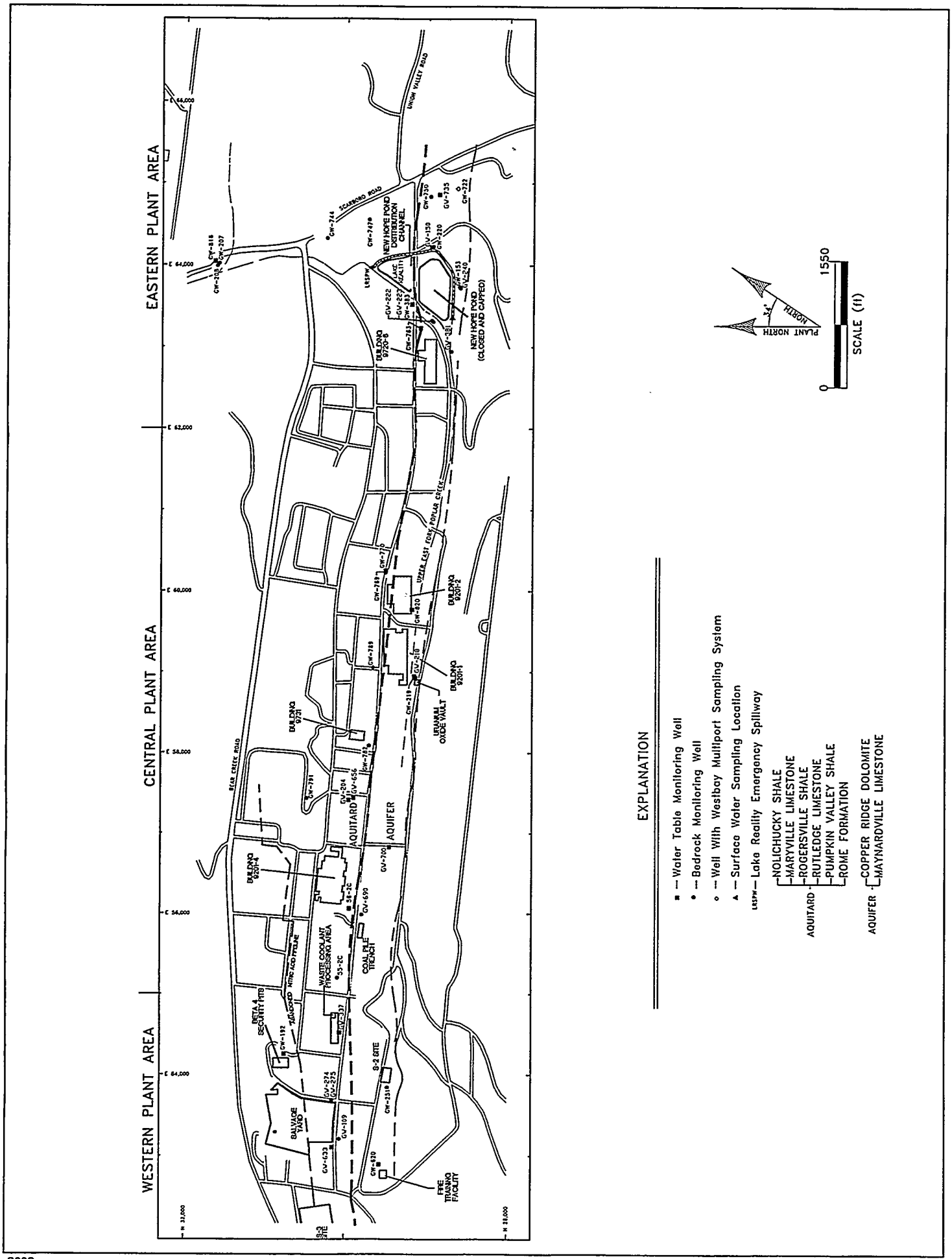
2001.DWG

Fig. 2. Sampling locations in the Bear Creek Hydrogeologic Regime, CY 2000.



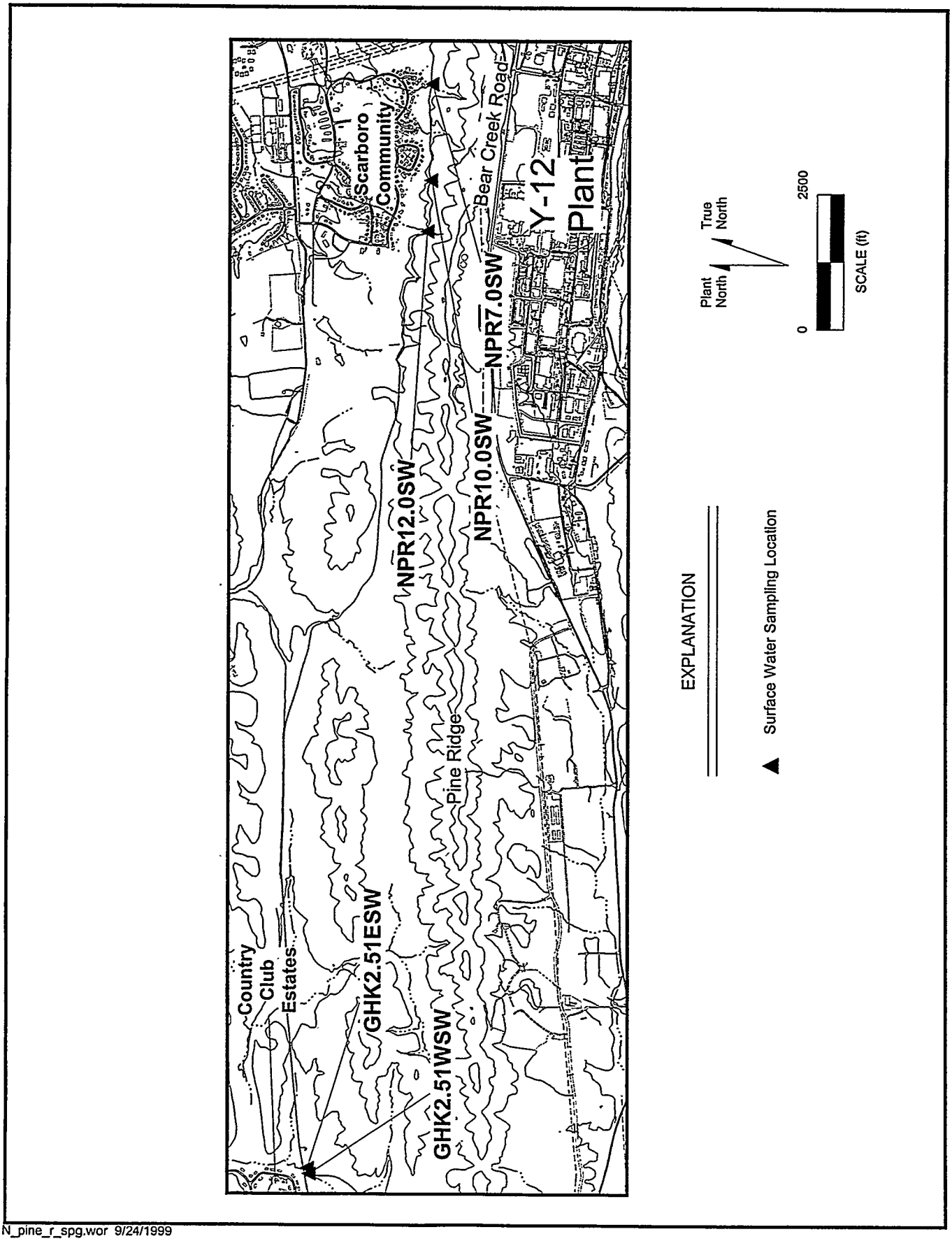
2002

Fig. 3. Sampling locations in the Chestnut Ridge Hydrogeologic Regime, CY 2000.



2003

Fig. 4. Sampling locations in the Upper East Fork Poplar Creek Hydrogeologic Regime, CY 2000.



N_pine_r_spg.wor 9/24/1999

Fig. 5. Surface water sampling locations north of Pine Ridge, CY 2000.

APPENDIX B

TABLES

Table 1. Sampling sequence, frequency, and analytical parameters for groundwater and surface water monitoring during CY 2000

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-A	GW-056	Q1		SMP	STD
	EXP-A	GW-685			SMP	STD
	EXP-A	GW-684		Y	SMP	STD
	EXP-A	GW-683		Y	SMP	STD
	EXP-B	GW-621			SMP	STD
	EXP-B	GW-695		Y	SMP	STD
	EXP-B	GW-703		Y	SMP	STD
	EXP-B	GW-704		Y	SMP	STD
	EXP-B	GW-706	C	Y	SMP	STD
	EXP-C	GW-740		Y	SMP	STD
	EXP-C	GW-738		Y	SMP	STD
	EXP-C	GW-724	Q3	Y	SMP	STD
	EXP-C	GW-725	C	Y	SMP	STD
BC-2 (Q1, Q3)	BG	GW-287	Q1	Y	SMP	STD
	BG	GW-653		Y	SMP	STD
	BG	GW-053		Y	SMP	STD
	BG	GW-627	C	Y	SMP	STD
	SPI	GW-315		Y	SMP	STD
	RS	GW-311	Q3	Y	SMP	STD
	OLF	GW-829		Y	SMP	STD
	OLF	GW-085		Y	SMP	STD
	OLF	GW-537		Y	SMP	STD
	OLF	GW-226		Y	SMP	STD
	FIELD BLANK					VOC(1)

Table 1 (continued)

Sample Group[1]	Location[2]	Sampling Point[3]	Duplicate[4]	Contain[5]	Monitoring Driver[6]	Parameters[7]
BC-3 (Q1, Q3)	EXP-SW	BCK-00.63			EXP	STD
	EXP-SW	BCK-04.55			EXP	STD
	EXP-SW	SS-6	Q1		EXP	STD
	EXP-SW	BCK-07.87			EXP	STD
	EXP-SW	SS-5			EXP	STD
	EXP-SW	BCK-09.40			EXP	STD
	EXP-SW	SS-4			EXP	STD
	EXP-SW	BCK-10.60	Q3		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
Chestnut Ridge Hydrogeologic Regime						
CR-1 (Q1,Q3)	LIV	GW-217			SDM	STD/F
	LIV	GW-141	Q1		SDM	STD/F
	LIV	GW-521			SDM/CMP	STD/F
	LIV	GW-522	Q3		SDM	STD/F
	LIV	GW-305		Y	SDM	STD/F
CR-2 (Q1,Q3)	LV	GW-557			SDM/CMP	STD/F
	LV	GW-799			SDM/CMP	STD/F
	LV	GW-797	Q3		SDM	STD/F
	LV	GW-801			SDM/CMP	STD/F
	LV	GW-796			SDM/CMP	STD/F
	LV	SCR4.3SP	Q1		SDM/EXP	STD/F
CR-3 (Q1,Q3)	EXP-SW	SCR2.1SP			EXP	STD/F
	EXP-SW	SCR2.2SP			EXP	STD/F
	EXP-SW	SCR3.4SP			EXP	STD/F
	EXP-SW	SCR5.1SP	Q1		EXP	STD/F
	EXP-SW	SCR5.4SP	Q3		EXP	STD/F

Table 1 (continued)

Sample Group[1]	Location[2]	Sampling Point[3]	Duplicate[4]	Contain[5]	Monitoring Driver[6]	Parameters[7]
CR-4 (Q2,Q4)	LII	GW-540	Q4		SDM	STD/F
	LII	GW-709			SDM	STD/F
	LII	GW-757	Q2		SDM	STD/F
CR-5 (Q2, Q4)	CDLVI	GW-827			SDM	STD/F
	CDLVI	GW-542			SDM	STD/F
	CDLVI	GW-543	Q2		SDM	STD/F
	CDLVI	GW-544	Q4		SDM	STD/F
Upper East Fork Poplar Creek Hydrogeologic Regime						
EF-1 (Q2,Q4)	GRID F3	GW-789	Q2		SMP	STD
	GRID G3	GW-770	Q4	Y	SMP	STD
	GRID G3	GW-769		Y	SMP	STD
	GRID E3	GW-782		Y	SMP	STD
	GRID D2	GW-791	C	Y	SMP	STD
EF-2 (Q2,Q4)	B4	GW-192	Q2	Y	SMP	STD
	S2	GW-251		Y	SMP	STD
	FTF	GW-620		Y	SMP	STD
	GRID JP	GW-763	C	Y	SMP	STD
	NHP	GW-240		Y	SMP	STD
	NHP	GW-153		Y	SMP	STD
	NHP	GW-150		Y	SMP	STD
	NHP	GW-220	Q4	Y	SMP	STD
	NHP	GW-383		Y	SMP	STD
	NHP	GW-381		Y	SMP	STD
	FIELD BLANK					VOC(1)
EF-3 (Q2,Q4)	EXP-SW	LRSPW	Q2		EXP	STD
	EXP-SR	GW-208			EXP	STD
	EXP-SR	GW-207			EXP	STD
	EXP-SR	GW-816			EXP	STD
	GRID K1	GW-744	Q4		EXP	STD
	GRID K2	GW-747			EXP	STD

Table 1 (continued)

Sample Group[1]	Location[2]	Sampling Point[3]	Duplicate[4]	Contain[5]	Monitoring Driver[6]	Parameters[7]
EF-3 (continued) (Q2,Q4)	EXP-J	GW-750			EXP	STD
	EXP-J	GW-735			EXP	STD
EF-4 (Q2,Q4)	GRID B3	55-2C		Y	SMP	STD
	GRID C3	56-2C		Y	SMP	STD
	SY	GW-274		Y	SMP	STD, RAD(12)
	SY	GW-275		Y	SMP	STD, RAD(12)
	RG	GW-633		Y	SMP	STD, RAD(12)
	S3	GW-109		Y	SMP	STD, RAD(12)
	WCPA	GW-337		Y	SMP	STD
	T0134	GW-204		Y	SMP	STD
	T0134	GW-656		Y	SMP	STD
	UOV	GW-218		Y	SMP	STD, RAD(3)
	UOV	GW-219	Q2	Y	SMP	STD, RAD(3)
	CPT	GW-690		Y	SMP	STD, RAD(12)
	B8110	GW-700		Y	SMP	STD
	B9201-2	GW-820	Q4	Y	SMP	STD
	NHP	GW-222		Y	SMP	STD
	NHP	GW-223		Y	SMP	STD
EF-WB (Q1,Q3)	EXP-J	GW-722-06			EXP	STD/F
	EXP-J	GW-722-30			EXP	STD/F
	EXP-J	GW-722-26	Q1		EXP	STD/F
	EXP-J	GW-722-32			EXP	STD/F
	EXP-J	GW-722-33			EXP	STD/F
	EXP-J	GW-722-10			EXP	STD/F
	EXP-J	GW-722-22	Q3		EXP	STD/F
	EXP-J	GW-722-20			EXP	STD/F
	EXP-J	GW-722-14			EXP	STD/F
	EXP-J	GW-722-17			EXP	STD/F
	RINSATE SAMPLE					STD

Table 1 (continued)

Sample Group[1]	Location[2]	Sampling Point[3]	Duplicate[4]	Contain[5]	Monitoring Driver[6]	Parameters[7]
North of Pine Ridge						
PR-1 (Q2,Q4)	SCA	NPR07.0SW			SMP	STD/F
	SCA	NPR10.0SW			SMP	STD/F
	SCA	NPR12.0SW		Q3	SMP	STD/F
	CCE	GHK2.51ESW			SMP	STD/F
	CCE	GHK2.51WSW		Q1	SMP	STD/F

Notes:

1 Samples will be collected during the calendar year quarter as specified (e.g., Q1). Surface water and spring samples in BC-3 will be collected on or about the same day as groundwater samples will be collected from wells GW-683 and GW-684 in BC-1. Spring samples in CR-3 will be collected about the same time as spring SCR4.3SP in CR-2.

2

Bear Creek Regime

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

Chestnut Ridge Regime

CDLVI - Construction/Demolition Landfill VI
EXP-SW - Exit Pathway Monitoring Location (spring)
LII - Industrial Landfill II
LIV - Industrial Landfill IV
LV - Industrial Landfill V

Table 1 (continued)

Notes: (continued)

2 **East Fork Regime**

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

North of Pine Ridge

SCA	-	Scarboro Community
CCE	-	Country Club Estates

3

BCK	-	Bear Creek Kilometer (Surface Water Sampling Station)
GW	-	Groundwater Monitoring Well
GHK	-	Gum Hollow Kilometer (Surface Water Sampling Station)
LRSPW	-	Lake Reality Spillway (Surface Water Sampling Station)
NPR	-	North Pine Ridge (Surface Water Sampling Station)
NT	-	North Tributary to Bear Creek
SCR	-	South Chestnut Ridge (Spring Sampling Station)
SS	-	Spring Sampling Location: South Side of Bear Creek

4

Q_	-	Field duplicate samples will be collected at these locations during the quarter specified.
C	-	For comparison of sampling method results, additional samples will be collected using the conventional sampling method (three well-volume purging) within a few days after the low-flow sampling event.

5 Y - All purged groundwater will be contained at these locations.

6

CMP	-	RCRA Post-Closure Corrective Action Monitoring
EXP	-	DOE Order 5400.1A Exit Pathway/Perimeter Monitoring
SDM	-	SWDF Detection Monitoring
SMP	-	DOE Order 5400.1A Surveillance Monitoring

Table 1 (continued)

Notes: (continued)

7 Table 2 provides a comprehensive list of analytes and analytical methods grouped by parameter.

/F - Includes filtered sample for dissolved metal concentrations.
STD - Standard administrative parameter group.
See the following list of parameters that apply to CY 2000 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 U-235

Table 2. Field measurements and laboratory analytes for CY 2000 groundwater and surface water samples

FLD - Field Measurements	Analytical Method[1]	Detection Limit[2]	Units[3]
Depth to Water	Y50-71-015	NA	ft
Water Temperature	Y50-71-001	NA	centigrade
pH	Y50-71-001	NA	pH units
Conductivity	Y50-71-001	NA	µmho/cm
Dissolved Oxygen	Y50-71-001	NA	ppm
Oxidation-Reduction Potential	SESD-TP-8201	NA	mV
CHEM - Miscellaneous Laboratory Analytes			
pH	EPA-9040	NA	pH units
Conductivity	EPA-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[4]			
Aluminum	EPA-6010A	0.02	mg/L
Antimony	EPA-200.8	0.005	mg/L
Arsenic	EPA-200.8	0.005	mg/L
Barium	EPA-6010A	0.001	mg/L
Beryllium	EPA-6010A	0.0003	mg/L
Boron	EPA-6010A	0.004	mg/L
Cadmium	EPA-200.8	0.0005	mg/L
Calcium	EPA-6010A	0.008	mg/L
Chromium	EPA-6010A	0.01	mg/L
Cobalt	EPA-6010A	0.005	mg/L
Copper	EPA-6010A	0.004	mg/L
Iron	EPA-6010A	0.005	mg/L
Lead	EPA-200.8	0.0005	mg/L
Lithium	EPA-6010A	0.004	mg/L
Magnesium	EPA-6010A	0.003	mg/L
Manganese	EPA-6010A	0.001	mg/L
Mercury	EPA-7470	0.0002	mg/L
Molybdenum	EPA-6010A	0.01	mg/L

Table 2 (continued)

MET(1) - Metals (cont'd)	Analytical Method[1]	Detection Limit[2]	Units[3]
Nickel	EPA-6010A	0.01	mg/L
Potassium	EPA-6010A	0.6	mg/L
Selenium	EPA-200.8	0.01	mg/L
Silver	EPA-6010A	0.006	mg/L
Sodium	EPA-6010A	0.02	mg/L
Strontium	EPA-6010A	0.0004	mg/L
Thallium	EPA-200.8	0.0005	mg/L
Thorium	EPA-6010A	0.2	mg/L
Uranium	EPA-200.8	0.0005	mg/L
Vanadium	EPA-6010A	0.005	mg/L
Zinc	EPA-6010A	0.002	mg/L
VOC(1) - Volatile Organic Compounds		**CRQL[5]**	
Acetone	EPA-8260B	10	µg/L
Acrolein	EPA-8260B	10	µg/L
Acrylonitrile	EPA-8260B	10	µg/L
Benzene	EPA-8260B	5	µg/L
Bromochloromethane	EPA-8260B	10	µg/L
Bromodichloromethane	EPA-8260B	5	µg/L
Bromoform	EPA-8260B	5	µg/L
Bromomethane	EPA-8260B	10	µg/L
2-Butanone	EPA-8260B	10	µg/L
Carbon disulfide	EPA-8260B	5	µg/L
Carbon tetrachloride	EPA-8260B	5	µg/L
Chlorobenzene	EPA-8260B	5	µg/L
Chloroethane	EPA-8260B	10	µg/L
2-Chloroethyl vinyl ether	EPA-8260B	10	µg/L
Chloroform	EPA-8260B	5	µg/L
Chloromethane	EPA-8260B	10	µg/L
Dibromochloromethane	EPA-8260B	5	µg/L
1,2-Dibromo-3-chloropropane	EPA-8260B	10	µg/L
1,2-Dibromoethane	EPA-8260B	5	µg/L
Dibromomethane	EPA-8260B	10	µg/L
1,2-Dichlorobenzene	EPA-8260B	5	µg/L
1,4-Dichlorobenzene	EPA-8260B	5	µg/L
1,4-Dichloro-2-butene	EPA-8260B	5	µg/L
trans-1,4-Dichloro-2-butene	EPA-8260B	5	µg/L
Dichlorodifluoromethane	EPA-8260B	5	µg/L
1,1-Dichloroethane	EPA-8260B	5	µg/L
1,2-Dichloroethane	EPA-8260B	5	µg/L
1,1-Dichloroethene	EPA-8260B	5	µg/L
1,2-Dichloroethene	EPA-8260B	5	µg/L

Table 2 (continued)

VOC(1) - Volatile Organic Compounds (cont'd)		Analytical Method[4]	CRQL[5]	Units[3]
	cis-1,2-Dichloroethene	EPA-8260B	5	µg/L
	trans-1,2-Dichloroethene	EPA-8260B	5	µg/L
	1,2-Dichloropropane	EPA-8260B	5	µg/L
	cis-1,3-Dichloropropene	EPA-8260B	5	µg/L
	trans-1,3-Dichloropropene	EPA-8260B	5	µg/L
	Dimethylbenzene	EPA-8260B	5	µg/L
	Ethanol	EPA-8260B	500	µg/L
	Ethylbenzene	EPA-8260B	5	µg/L
	Ethyl methacrylate	EPA-8260B	5	µg/L
	2-Hexanone	EPA-8260B	10	µg/L
	Iodomethane	EPA-8260B	5	µg/L
	4-Methyl-2-pentanone	EPA-8260B	10	µg/L
	Methylene chloride	EPA-8260B	5	µg/L
	Styrene	EPA-8260B	5	µg/L
	1,1,1,2-Tetrachloroethane	EPA-8260B	10	µg/L
	1,1,2,2-Tetrachloroethane	EPA-8260B	5	µg/L
	Tetrachloroethene	EPA-8260B	5	µg/L
	Toluene	EPA-8260B	5	µg/L
	1,1,1-Trichloroethane	EPA-8260B	5	µg/L
	1,1,2-Trichloroethane	EPA-8260B	5	µg/L
	Trichloroethene	EPA-8260B	5	µg/L
	Trichlorofluoromethane	EPA-8260B	5	µg/L
	1,2,3-Trichloropropane	EPA-8260B	5	µg/L
	Vinyl acetate	EPA-8260B	10	µg/L
	Vinyl chloride	EPA-8260B	10	µg/L
Radiological Analytes (pCi/L)			**Target MDA[6]**	
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	EPA-905.0	4.0	pCi/L
RAD(2), RAD(12)	Technetium-99	Y/P65-7154	10	pCi/L
RAD(2)	Tritium	EPA-906.0	300	pCi/L
RAD(3)	Uranium-234, 235, & 238	ACO-TP-7226	0.4	pCi/L
RAD(4)	Americium-241	ACO-TP-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	ACO-TP-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/P65-7206	0.4	pCi/L
RAD(13)	Total Uranium and weight % U-235	Y/P65-8044	NA	mg/L

Table 2 (continued)

Notes:

1 Analytical/field methods/procedures from:

- Y-12 Plant System Operation Procedures (LMES 1996c, 1999b, and 1999c)
- *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)
- Lockheed Martin Energy Systems ACO Control Procedures, radiochemistry (ACO-TP-7226 and Y/P65-7206)

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 Filtered samples for dissolved metals analyses will be collected only at specified locations (see Table 1).

5 CRQL - contract-required quantitation limit

6 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.

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