**Y-12
NATIONAL
SECURITY
COMPLEX**

**CALENDAR YEAR 2011
GROUNDWATER MONITORING REPORT,
U.S. DEPARTMENT OF ENERGY
Y-12 NATIONAL SECURITY COMPLEX,
OAK RIDGE, TENNESSEE**

December 2012

Prepared by

**Elvado Environmental LLC
Under Subcontract No. 4300073231**

for the

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

Managed by

**Babcock & Wilcox Technical Services Y-12, LLC
for the U.S. Department of Energy
Under Contract No. DE-AC05-00OR22800**

**MANAGED BY
B&W Y-12, LLC
FOR THE UNITED STATES
DEPARTMENT OF ENERGY**

UCN-13672 (1-08)

DISCLAIMER

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

CALENDAR YEAR 2011
GROUNDWATER MONITORING REPORT,
U.S. DEPARTMENT OF ENERGY
Y-12 NATIONAL SECURITY COMPLEX,
OAK RIDGE, TENNESSEE

December 2012

Prepared by

Elvado Environmental LLC
Under Subcontract No. 4300073231

for the

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

Managed by

Babcock & Wilcox Technical Services Y-12, LLC
for the U.S. Department of Energy
Under Contract No. DE-AC05-00OR22800

CONTENTS

<u>Section</u>	<u>Page</u>
List of In-Text Tables	v
List of Figures	vii
List of Tables	ix
List of Acronyms and Abbreviations	xi
1.0 INTRODUCTION	1-1
2.0 BACKGROUND INFORMATION	2-1
2.1 TOPOGRAPHY AND BEDROCK GEOLOGY	2-1
2.2 SURFACE WATER DRAINAGE.....	2-2
2.2.1 Bear Creek	2-2
2.2.2 Upper East Fork Poplar Creek	2-3
2.2.3 Chestnut Ridge.....	2-3
2.3 GROUNDWATER SYSTEM.....	2-4
2.3.1 Aquifer	2-4
2.3.1.1 Maynardville Limestone	2-4
2.3.1.2 Knox Group	2-6
2.3.2 Aquitard	2-7
2.4 GROUNDWATER CONTAMINATION	2-8
2.4.1 Bear Creek Regime	2-8
2.4.1.1 S-3 Site	2-9
2.4.1.2 Oil Landfarm WMA	2-9
2.4.1.3 Bear Creek Burial Grounds WMA	2-10
2.4.1.4 Maynardville Limestone Exit Pathway.....	2-11
2.4.2 East Fork Regime.....	2-13
2.4.3 Chestnut Ridge Regime	2-14
3.0 CY 2011 MONITORING PROGRAMS	3-1
3.1 SAMPLING LOCATIONS AND FREQUENCY	3-1
3.1.1 Bear Creek Regime.....	3-2
3.1.2 East Fork Regime	3-3
3.1.3 Chestnut Ridge Regime	3-4
3.2 QUALITY ASSURANCE/QUALITY CONTROL SAMPLING	3-5
3.3 SAMPLE COLLECTION AND HANDLING	3-6
3.4 FIELD MEASUREMENTS AND LABORATORY ANALYTES.....	3-7
3.5 DATA MANAGEMENT AND DQO EVALUATION	3-8
3.6 GROUNDWATER ELEVATION MONITORING	3-9

CONTENTS (continued)

<u>Section</u>	<u>Page</u>
4.0 CY 2011 MONITORING DATA	4-1
4.1 SURVEILLANCE MONITORING	4-1
4.1.1 Bear Creek Regime	4-1
4.1.1.1 Aquitard Wells	4-2
4.1.1.2 Aquifer Wells	4-6
4.1.2 East Fork Regime	4-11
4.1.2.1 Aquitard Wells	4-11
4.1.2.2 Aquifer Wells	4-16
4.1.3 Chestnut Ridge Regime	4-20
4.2 EXIT PATHWAY/PERIMETER MONITORING	4-22
4.2.1 Bear Creek Regime	4-22
4.2.1.1 Upper Bear Creek	4-23
4.2.1.2 Middle Bear Creek	4-24
4.2.1.3 Lower Bear Creek	4-25
4.2.2 East Fork Regime	4-26
4.2.2.1 Groundwater	4-26
4.2.2.2 Surface Water	4-27
4.2.3 Chestnut Ridge Regime	4-28
4.2.3.1 Groundwater	4-29
4.2.3.2 Surface Water	4-29
4.2.3.3 Kerr Hollow Branch Nitrate Survey	4-30
5.0 CONCLUSIONS AND RECOMMENDATIONS	5-1
6.0 REFERENCES	6-1

APPENDICES:

A	FIGURES
B	TABLES
C	MONITORING WELL CONSTRUCTION DETAILS
D	CY 2011 MONITORING DATA FOR THE BEAR CREEK HYDROGEOLOGIC REGIME
D.1	Field Measurements, Miscellaneous Analytes, Major Ions, and Trace Metals
D.2	Volatile Organic Compounds
D.3	Radiological Analytes
D.4	Monitoring Data for the EMWMF
E	CY 2011 MONITORING DATA FOR THE UPPER EAST FORK POPLAR CREEK HYDROGEOLOGIC REGIME
E.1	Field Measurements, Miscellaneous Analytes, Major Ions, and Trace Metals
E.2	Volatile Organic Compounds
E.3	Radiological Analytes
F	CY 2011 MONITORING DATA FOR THE CHESTNUT RIDGE HYDROGEOLOGIC REGIME
F.1	Field Measurements, Miscellaneous Analytes, Major Ions, Trace Metals, and Volatile Organic Compounds
F.2	Radiological Analytes
G	CY 2011 QUALITY ASSURANCE/QUALITY CONTROL DATA

List of In-Text Tables

<u>Table</u>	<u>Page</u>
1. CY 2011 sampling locations in the Bear Creek Regime.....	3-2
2. CY 2011 sampling locations in the East Fork Regime, north of Pine Ridge, and in Union Valley	3-3
3. CY 2011 sampling locations in the Chestnut Ridge Regime.....	3-4
4. QA/QC samples analyzed in CY 2011 for the Y-12 GWPP.....	3-5
5. Summary of CY 2011 groundwater elevation monitoring in the Bear Creek, East Fork, and Chestnut Ridge regimes	3-9
6. Bear Creek Regime CY 2011: elevated nitrate and uranium concentrations in surveillance monitoring aquitard wells	4-2
7. Bear Creek Regime CY 2011: maximum VOC concentrations in surveillance monitoring aquitard wells	4-4
8. Bear Creek Regime CY 2011: elevated gross alpha activity and gross beta activity in surveillance monitoring aquitard wells	4-5
9. Bear Creek Regime CY 2011: elevated nitrate and uranium concentrations in surveillance monitoring aquifer wells	4-7
10. Bear Creek Regime CY 2011: maximum VOC concentrations in surveillance monitoring aquifer wells	4-8
11. Bear Creek Regime CY 2011: elevated gross alpha activity and gross beta activity in surveillance monitoring aquifer wells	4-10
12. East Fork Regime CY 2011: elevated nitrate and uranium concentrations in surveillance monitoring aquitard wells	4-12
13. East Fork Regime CY 2011: maximum VOC concentrations in surveillance monitoring aquitard wells	4-13
14. East Fork Regime CY 2011: elevated gross alpha activity and gross beta activity in surveillance monitoring aquitard wells	4-15
15. East Fork Regime CY 2011: elevated nitrate and uranium concentrations in surveillance monitoring aquifer wells	4-16
16. East Fork Regime CY 2011: maximum VOC concentrations in surveillance monitoring aquifer wells	4-18

List of In-Text Tables (continued)

<u>Table</u>	<u>Page</u>
17. East Fork Regime CY 2011: elevated gross alpha activity and gross beta activity in surveillance monitoring aquifer wells	4-19
18. Chestnut Ridge Regime CY 2011: maximum VOC concentrations in surveillance monitoring wells.....	4-21
19. Bear Creek Regime CY 2011: sampling locations used for exit pathway/perimeter monitoring	4-23
20. Upper Bear Creek CY 2011: maximum contaminant concentrations.....	4-23
21. Middle Bear Creek CY 2011: maximum contaminant concentrations	4-24
22. Lower Bear Creek CY 2011: maximum contaminant concentrations	4-25
23. East Fork Regime CY 2011: sampling locations for exit pathway/perimeter monitoring.....	4-26
24. East Fork Regime CY 2011: maximum VOC concentrations in exit pathway/perimeter monitoring wells.....	4-27
25. East Fork Regime CY 2011: maximum contaminant concentrations in exit pathway/perimeter surface water sampling locations.....	4-28
26. Chestnut Ridge Regime CY 2011: sampling locations used for exit pathway/perimeter monitoring	4-28

List of Figures

<u>Figure</u>	<u>Page</u>
A.1 Hydrogeologic regimes at the Y-12 National Security Complex	A-1
A.2 Topography and bedrock geology at the Y-12 National Security Complex	A-2
A.3 Fill areas and pre-construction drainage features in the Upper East Fork Poplar Creek Hydrogeologic Regime	A-3
A.4 Groundwater elevations in the Bear Creek Hydrogeologic Regime, April 2011	A-4
A.5 Groundwater elevations in the Upper East Fork Poplar Creek Hydrogeologic Regime, April 2011	A-5
A.6 Groundwater elevations in the Chestnut Ridge Hydrogeologic Regime, April 2011	A-6
A.7 Generalized extent of nitrate in groundwater at the Y-12 National Security Complex	A-7
A.8 Generalized extent of volatile organic compounds in groundwater at the Y-12 National Security Complex	A-8
A.9 Generalized extent of gross alpha activity in groundwater at the Y-12 National Security Complex	A-9
A.10 Generalized extent of gross beta activity in groundwater at the Y-12 National Security Complex	A-10
A.11 CY 2011 sampling locations in the Bear Creek Hydrogeologic Regime	A-11
A.12 Components of Maynardville Limestone exit pathway pickets A, B, C, and W	A-12
A.13 Westbay™ monitoring system sampling port depths in well GW-134	A-13
A.14 Westbay™ monitoring system sampling port depths in well GW-729	A-14
A.15 CY 2011 sampling locations in the Upper East Fork Poplar Creek Hydrogeologic Regime and in Union Valley	A-15
A.16 CY 2011 surface water sampling locations north of Pine Ridge	A-16
A.17 Westbay™ monitoring system sampling port depths in well GW-722	A-17
A.18 CY 2011 sampling locations in the Chestnut Ridge Hydrogeologic Regime	A-18
A.19 Bear Creek Regime: nitrate and/or uranium concentration trends in surveillance monitoring aquitard wells GW-085, GW-246, GW-276, GW-526, GW-537, and GW-615	A-19

List of Figures (continued)

<u>Figure</u>	<u>Page</u>
A.20 Bear Creek Regime: PCE concentration trends in surveillance monitoring aquitard wells GW-014, GW-046, GW-068, GW-246, GW-276, GW-289, and GW-627	A-20
A.21 Bear Creek Regime: gross alpha and/or gross beta activity trends in surveillance monitoring aquitard wells GW-246, GW-276, and GW-537	A-21
A.22 Bear Creek Regime: nitrate and/or uranium concentration trends in surveillance monitoring aquifer wells GW-229, GW-703, and GW-706	A-22
A.23 Bear Creek Regime: selected VOC concentration trends in surveillance monitoring aquifer wells GW-229, GW-365, GW-704, GW-706, GW-724, and GW-738	A-23
A.24 Bear Creek Regime: gross alpha and/or gross beta activity trends in surveillance monitoring aquifer wells GW-058, GW-229, GW-703, and GW-706	A-24
A.25 East Fork Regime: nitrate and uranium concentration trends in surveillance monitoring aquitard wells 55-2B, GW-108, GW-204, GW-272, GW-274, GW-275, and GW-633	A-25
A.26 East Fork Regime: summed VOC concentration trends in surveillance monitoring aquitard wells 55-3A, 56-2C, GW-337, GW-383, GW-656, GW-658, and GW-769	A-26
A.27 East Fork Regime: gross alpha and/or gross beta activity trends in surveillance monitoring aquitard wells GW-108, GW-204, and GW-633	A-27
A.28 East Fork Regime: nitrate and/or uranium concentration trends in surveillance monitoring aquifer wells GW-154, GW-223, GW-251, GW-253, and GW-606	A-28
A.29 East Fork Regime: selected VOC concentration trends in surveillance monitoring aquifer wells GW-253, GW-382, GW-605, GW-618, and GW-698	A-29
A.30 East Fork Regime: gross alpha and/or gross beta activity trends in surveillance monitoring aquifer wells GW-154, GW-219, and GW-605	A-30
A.31 Chestnut Ridge Regime: VOC trends in surveillance monitoring wells GW-305, GW-322, and GW-798	A-31
A.32 East Fork Regime: PCE concentration trends in exit pathway monitoring wells GW-151, GW-220, GW-722-14, and GW-832	A-32
A.33 East Fork Regime: CTET concentration trend in exit pathway monitoring well GW-722-17	A-33
A.34 Chestnut Ridge Regime: nitrate concentration trend in exit pathway monitoring surface water station S17	A-34

List of Tables

<u>Table</u>	<u>Page</u>
B.1 Summary of CY 2011 sampling and analysis plan addenda	B-1
B.2 CY 2011 groundwater and surface water sampling dates in the Bear Creek Hydrogeologic Regime	B-3
B.3 CY 2011 groundwater and surface water sampling dates in the Upper East Fork Poplar Creek Hydrogeologic Regime	B-7
B.4 CY 2011 groundwater and surface water sampling dates in the Chestnut Ridge Hydrogeologic Regime.....	B-11
B.5 Field measurements and laboratory analytes for CY 2011 groundwater and surface water samples obtained by the Y-12 GWPP.....	B-15
B.6 Depth-to-water measurements and groundwater elevations for selected wells in the Bear Creek Hydrogeologic Regime, April 2011	B-19
B.7 Depth-to-water measurements and groundwater elevations for selected wells in the Upper East Fork Poplar Creek Hydrogeologic Regime, April 2011	B-23
B.8 Depth-to-water measurements and groundwater elevations for selected wells in the Chestnut Ridge Hydrogeologic Regime, April 2011	B-27
B.9 Concentration trends for the principal contaminants detected at CY 2011 sampling locations in the Bear Creek Hydrogeologic Regime	B-31
B.10 Concentration trends for the principal contaminants detected at CY 2011 sampling locations in the Upper East Fork Poplar Creek Hydrogeologic Regime	B-35
B.11 Concentration trends for contaminants detected at CY 2011 sampling locations in the Chestnut Ridge Hydrogeologic Regime.....	B-39

List of Acronyms and Abbreviations

ACO	Analytical Chemistry Organization
BCK	Bear Creek kilometer
BCBG	Bear Creek Burial Grounds
BCV	Bear Creek Valley
Bear Creek Regime	Bear Creek Hydrogeologic Regime
BG	Burial Ground
bgs	below ground surface
BJC	Bechtel Jacobs Company LLC
B&W Y-12	Babcock & Wilcox Technical Services Y-12, LLC
BWXT	BWXT Y-12, L.L.C.
BYBY	Boneyard/Burnyard
CDL	Construction/Demolition Landfill
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
Chestnut Ridge Regime	Chestnut Ridge Hydrogeologic Regime
CRSDB	Chestnut Ridge Sediment Disposal Basin
CRSP	Chestnut Ridge Security Pits
CTET	carbon tetrachloride
CY	calendar year
DNAPL	dense nonaqueous phase liquids
DOE	U.S. Department of Energy
DQO	data quality objective
East Fork Regime	Upper East Fork Poplar Creek Hydrogeologic Regime
ECRWP	East Chestnut Ridge Waste Pile
EM	Environmental Management
EMWMF	Environmental Management Waste Management Facility
FCAP	Filled Coal Ash Pond
ft	feet
ft/d	feet per day
GIMS	Groundwater Information Management System
gpm	gallons per minute
GWPP	Groundwater Protection Program
GWQAP	Groundwater Quality Assessment Plan
HCDA	Hazardous Chemical Disposal Area
ILF	Industrial Landfill
KHB	Kerr Hollow Branch
KHQ	Kerr Hollow Quarry
MC	methylene chloride
MCL	maximum contaminant level
MDA	minimum detectable activity
mg/d	million gallons per day
µg/L	micrograms per liter
mg/L	milligrams per liter
MMES	Martin Marietta Energy Systems, Inc.
mrem/yr	millirem per year
msl	mean sea level
NHP	New Hope Pond

List of Acronyms and Abbreviations (continued)

NOV	Notice of Violation
NPDES	National Pollution Discharge Elimination System
NT	north tributary (of Bear Creek)
OF	outfall
OLF	Oil Landfarm
ORNL	Oak Ridge National Laboratory
ORR	Oak Ridge Reservation
OSY	Old Salvage Yard
PCE	tetrachloroethene
pCi/L	picoCuries per liter
PDB	passive diffusion bag
POC	point-of-compliance
QA/QC	quality assurance/quality control
RCRA	Resource Conservation and Recovery Act
REDOX	oxidation-reduction potential
ROD	record of decision (CERCLA)
SAP	sampling and analysis plan
SCR	south Chestnut Ridge
SDWA	Safe Drinking Water Act
SS	south side (of Bear Creek)
SWDF	Solid Waste Disposal Facility
Tc-99	technetium-99
TCE	trichloroethene
TDEC	Tennessee Department of Environment and Conservation
TDS	total dissolved solids
TPU	total propagated uncertainty
U-234	uranium-234
U-238	uranium-238
UCOR	URS CH2M Oak Ridge LLC
UEFPC	Upper East Fork Poplar Creek
UST	underground storage tank
VC	vinyl chloride
VOC	volatile organic compound
WCPA	Waste Coolant Processing Area
WMA	waste management area
WRRP	Water Resources Restoration Program
Y-12	Y-12 National Security Complex
yd ³	cubic yards
111TCA	1,1,1-trichloroethane
11DCA	1,1-dichloroethane
11DCE	1,1-dichloroethene
12DCA	1,2-dichloroethane
12DCE	1,2-dichloroethene
c12DCE	cis-1,2-dichloroethene
t12DCE	trans-1,2-dichloroethene

1.0 INTRODUCTION

This report contains the groundwater and surface water monitoring data that were obtained during calendar year (CY) 2011 at the U.S. Department of Energy (DOE) Y-12 National Security Complex (Y-12) on the DOE Oak Ridge Reservation (ORR) in Oak Ridge, Tennessee. The CY 2011 monitoring data were obtained from wells, springs, and surface water sampling locations in three hydrogeologic regimes at Y-12 (Figure A.1). The Bear Creek Hydrogeologic Regime (Bear Creek Regime) encompasses a section of Bear Creek Valley (BCV) between the west end of Y-12 and the west end of the Bear Creek Watershed (directions are in reference to the Y-12 grid system). The Upper East Fork Poplar Creek Hydrogeologic Regime (East Fork Regime) encompasses the Y-12 industrial facilities and support structures in BCV. The Chestnut Ridge Hydrogeologic Regime (Chestnut Ridge Regime) encompasses a section of Chestnut Ridge directly south of Y-12. Section 2 of this report provides background information pertinent to groundwater and surface water quality monitoring in each hydrogeologic regime, including the topography and bedrock geology, surface water drainage, groundwater system, and known extent of groundwater contamination.

The CY 2011 groundwater and surface water monitoring data in this report were obtained from sampling and analysis activities implemented under the Y-12 Groundwater Protection Program (GWPP) managed by Babcock & Wilcox Technical Services Y-12, LLC (B&W Y-12) and from sampling and analysis activities implemented under several monitoring programs managed by the DOE Environmental Management (EM) contractor responsible for environmental cleanup on the ORR. In August 2011, URS | CH2M Oak Ridge LLC (UCOR) replaced Bechtel Jacobs Company LLC (BJC) as the DOE EM contractor. For this report, BJC/UCOR will be referenced as the managing contractor for CY 2011. Cooperative implementation of the monitoring programs directed by the Y-12 GWPP and BJC/UCOR (i.e., coordinating sample collection and sharing data) ensures that the CY 2011 monitoring results fulfill requirements of all the applicable monitoring drivers with no duplication of sampling and analysis efforts. Section 3 of this report contains a summary of information regarding the groundwater and surface water sampling and analysis activities implemented under the Y-12 GWPP including sampling locations and frequency; quality assurance (QA)/quality control (QC) sampling; sample collection and handling; field measurements and laboratory analytes; data management and data quality objective (DQO) evaluation; and groundwater elevation monitoring. However, this report does not include equivalent QA/QC or DQO evaluation information regarding the groundwater and surface water sampling and analysis activities associated with the monitoring programs implemented by BJC/UCOR. Such details are deferred to the respective programmatic plans and reports issued by BJC (see Section 3.0).

Collectively, the groundwater and surface water monitoring data obtained during CY 2011 by the Y-12 GWPP and BJC/UCOR address DOE Order 436.1 and DOE Order 458.1 requirements for monitoring groundwater and surface water quality in areas (1) which are, or could be, affected by operations at Y-12 (surveillance monitoring) and (2) where contaminants from Y-12 are most likely to migrate beyond the boundaries of the ORR (exit pathway/perimeter monitoring). Section 4 of this report presents a summary evaluation of the monitoring data with regard to the respective objectives of surveillance monitoring and exit pathway/perimeter monitoring, based on the analytical results for the principal groundwater contaminants at Y-12: nitrate, uranium, volatile organic compounds (VOCs), gross alpha activity, and gross beta activity. Section 5 of this report summarizes the most pertinent findings regarding the principal contaminants, along with recommendations proposed for ongoing groundwater and surface water quality monitoring performed under the Y-12 GWPP.

Narrative sections of this report reference several appendices. Figures (maps and diagrams) and tables (excluding data summary tables presented in the narrative sections) are in Appendix A and Appendix B, respectively. Appendix C contains construction details for the wells in each regime that were sampled during CY 2011 by either the Y-12 GWPP or BJC/UCOR. Field measurements recorded during collection of the groundwater and surface water samples and results of laboratory analyses of the samples are in Appendix D (Bear Creek Regime), Appendix E (East Fork Regime and surrounding areas), and Appendix F (Chestnut Ridge Regime). Appendix G contains data for the QA/QC samples associated with monitoring performed in each regime by the Y-12 GWPP.

2.0 BACKGROUND INFORMATION

The following sections provide information relevant to groundwater and surface water quality monitoring in three hydrogeologic regimes at Y-12 (Figure A.1). These sections include a short description of the topography and geology in each regime; an overview of the hydrogeologic system in each regime; and a discussion of the extent of groundwater contamination in each regime.

2.1 TOPOGRAPHY AND BEDROCK GEOLOGY

The hydrogeologic regimes at Y-12 are located in the Valley and Ridge Physiographic Province, which is characterized by long parallel valleys and ridges formed from folding and thrust faulting that occurred during Paleozoic orogenic events. The geologic strike of the formations generally parallels the axes of the valleys and ridges.

The Bear Creek Regime and the East Fork Regime are each in BCV, which is bound to the north by Pine Ridge and to the south by Chestnut Ridge (Figure A.2). The Bear Creek Regime encompasses several miles of BCV between the western end of the Bear Creek watershed and a low topographic and hydrologic divide near the west end of Y-12. The East Fork Regime encompasses about three miles of BCV east of this topographic/hydrologic divide and west of the ORR property boundary along Scarboro Road. Ground surface elevations along the axis of BCV in each regime range from about 1,000 feet (ft) above mean sea level (msl) near the topographic/hydrologic divide to about 800 ft above msl where Bear Creek cuts through Pine Ridge and about 900 ft above msl where Upper East Fork Poplar Creek (UEFPC) cuts through Pine Ridge.

The Chestnut Ridge Regime is directly south of Y-12 and encompasses a portion of the ridge bordered by BCV to the north, Scarboro Road to the east, Bethel Valley Road to the south, and Dunaway Branch to the west (Figure A.2). The northern flank of the ridge forms a steep slope rising more than 200 ft above the floor of BCV. The crest of the ridge slopes toward the east from an elevation of about 1,200 ft above msl southwest of Y-12 to about 1,060 ft above msl where Scarboro Road crosses the ridge. A series of prominent hills dominate the central part of the broad southern flank of Chestnut Ridge, which gently slopes toward Bethel Valley.

Bedrock geology in the vicinity of Y-12 is characterized by thrust-faulted sequences of southeast-dipping, clastic (primarily shale and siltstone) and carbonate (limestone and dolostone) strata of Lower Cambrian to Upper Ordovician age (Figure A.2). Geologic units in the Bear Creek Regime and the East Fork Regime are the shales and siltstones of the Rome Formation underlying Pine Ridge and the interbedded limestone and shale formations of the Conasauga Group that underlie the southern flank of Pine Ridge and BCV. Carbonates (primarily dolostone) of the Knox Group and the overlying argillaceous limestones and interbedded shales of the Chickamauga Group are the geologic units in the Chestnut Ridge Regime. Strike and dip of bedding in each hydrogeologic regime is generally N55° E and 45° SE, respectively (as referenced to true north).

In BCV, unweathered bedrock is overlain by up to 40 ft of several unconsolidated materials, including alluvium, colluvium, fine-grained residuum, and saprolite (weathered bedrock). Where undisturbed, the saprolite often retains primary textural features of the unweathered bedrock, including fractures (Solomon *et al.* 1992). However, extensive areas of cut-and-fill within Y-12 have substantially altered the shallow subsurface in BCV throughout much of the East Fork Regime. Most of the fill, which contains many voids and generally consists of 5 to 25 ft of a heterogeneous mixture of building debris and

re-compacted soil/residuum (Sutton and Field 1995), was placed in the tributaries and main channel of UEFPC (Figure A.3).

On Chestnut Ridge, bedrock is overlain by as much as 100 ft of red-brown to yellow-orange residuum. The residuum, which is predominantly composed of clay and hematite, contains semicontinuous relict beds of fractured chert and other lithologic heterogeneities (such as silt bodies) that provide a weakly connected network through which saturated flow can occur (Solomon *et al.* 1992). Also, residuum on Chestnut Ridge is thin or nonexistent near karst features such as dolines (sink holes), swallets (sinking streams), and solution pan features (Ketelle and Huff 1984).

2.2 SURFACE WATER DRAINAGE

The following subsections provide a brief description of surface water drainage systems in the Bear Creek Regime, East Fork Regime, and Chestnut Ridge Regime.

2.2.1 Bear Creek

Surface water in the Bear Creek Regime is drained by Bear Creek and its tributaries (Figure A.2). From its headwaters near the west end of Y-12, Bear Creek flows southwest for approximately 4.5 miles, where it turns northward for approximately 2.5 miles to flow into East Fork Poplar Creek. Monitoring locations along the main channel of Bear Creek are specified by the Bear Creek kilometer (BCK) value corresponding to the distance upstream from the confluence with East Fork Poplar Creek (e.g., BCK-09.40). Sections of the main channel are referenced as upper Bear Creek (upstream of BCK-11.84), middle Bear Creek (between BCK-11.84 and BCK-09.20), and lower Bear Creek (downstream of BCK-09.20). Tributaries are designated as north tributary (NT) or south tributary along with a value representing the tributary number counted downstream from the headwaters (e.g., NT-1). Major springs along the south side (SS) of Bear Creek are numbered in ascending order downstream from the headwaters (e.g., SS-1).

Approximately half of the annual precipitation in BCV exits via surface water flow in Bear Creek, and possibly higher proportions during winter and early spring, with the remainder of the annual precipitation lost to evapotranspiration and recharge to the groundwater system (DOE 1997a). Flow in the northern tributaries and creek increases rapidly during rainfall and afterward reflects the relative contributions of overland flow, stormflow, and groundwater discharge. Flow in the main channel and tributaries generally returns to pre-precipitation levels within one or two days. Major sections of upper and middle Bear Creek are seasonally dry, but flow is perennial in lower Bear Creek.

The main channel of Bear Creek functions as a major conduit of the shallow karst network within the Maynardville Limestone (DOE 1997a). Discharge from springs located along the Maynardville Limestone/Copper Ridge Dolomite boundary on the north slope of Chestnut Ridge dominates the hydrology of the creek, especially during droughts when springs provide most of the flow in the main channel. Additionally, the main channel contains alternating gaining and losing reaches. Each gaining reach generally correlates with a major groundwater discharge area. Losing reaches in upper and middle Bear Creek, particularly a section of the main channel directly south of Sanitary Landfill I, play an important role in transferring contaminants from Bear Creek into the Maynardville Limestone, which directly underlies the creek throughout much of BCV.

2.2.2 Upper East Fork Poplar Creek

Surface water in the East Fork Regime is drained by UEFPC, which was extensively modified during construction of Y-12 (Figure A.3). The East Fork Regime is divided into the three major areas for the purposes of this report: the western Y-12 area between Old Bear Creek Road and grid coordinate easting 55,000; the central Y-12 area between grid coordinate eastings 55,000 and 62,000; and the eastern Y-12 area between grid coordinate easting 62,000 and Scarboro Road. The headwaters and several thousand ft of the main channel in the upper reach of UEFPC, including all its northern tributaries in the western and central Y-12 areas, were filled and replaced with an extensive network of underground storm drains. For reference purposes, each buried tributary of UEFPC is designated with a value (e.g., BT-1) representing the tributary number counted downstream (west to east) from the headwaters. The storm drains direct surface runoff into the exposed portion of the UEFPC channel at several locations. Outfall (OF) 200 is at the beginning of the exposed portion of the UEFPC channel about 6,000 ft upstream of New Hope Pond (NHP)/Lake Reality (Figure A.3). Closed and capped in 1988, NHP was an unlined surface impoundment constructed in 1963 to regulate the quantity and quality of surface water exiting Y-12. Lake Reality is a lined surface impoundment that was built in 1988 to replace NHP.

During normal operations, flow in UEFPC is directed through a concrete-lined distribution channel located around the south and east side of NHP/Lake Reality (Figure A.3). Also, a gravel and perforated pipe underdrain beneath portions of the distribution channel captures shallow groundwater. Until December 1996 when flow was rerouted to bypass Lake Reality, surface flow in the UEFPC distribution channel discharged into Lake Reality (and exited through a weir in the western berm). Beginning in July 1998, flow in the UEFPC distribution channel was diverted through the Lake Reality spillway, which discharges into the mainstream of UEFPC directly north (downstream) of Lake Reality. Bypassing Lake Reality reduces mercury contributions to dry-weather flow in UEFPC.

About 70% of dry-weather flow in UEFPC is attributable to once-through non-contact cooling water, condensate, and cooling tower blowdown, and the remaining 30% is from groundwater discharge (Shevenell 1994). Beginning in July 1996 a flow management program was implemented whereby water from the Clinch River is discharged near OF 200 to augment flow in UEFPC, which decreased from as much as 15 million gallons per day (mg/d) to about 2.5 mg/d because of reduced and/or improved operations at Y-12 in recent years. Flow management is needed to achieve the National Pollution Discharge Elimination System (NPDES) minimum daily flow requirement of 5 mg/d at Station 17, which is where UEFPC exits the ORR downstream from Lake Reality (Figure A.3). Flow management also allows compliance with NPDES toxicity requirements and helps lower the elevated water temperature in UEFPC.

2.2.3 Chestnut Ridge

The Chestnut Ridge Regime encompasses five primary tributary drainage basins on south Chestnut Ridge (SCR), informally numbered from west to east (SCR1 through SCR5): Dunaway Branch (SCR1) and SCR2 in the western part of the regime, McCoy Branch (SCR3) in the central part of the regime; and SCR4 and SCR5 in the eastern part of the regime (Figure A.2). These tributaries are mainly intermittent at elevations higher than 900 ft above msl. Each receives flow via surface runoff, stormflow discharge, and groundwater baseflow, which increases with distance downstream and includes substantial contributions from springs. All of the tributaries convey surface flow south toward Bethel Valley and discharge into Melton Hill Lake (Clinch River) south of the Chestnut Ridge Regime.

2.3 GROUNDWATER SYSTEM

The following overview of the groundwater system near Y-12 is based on the conceptual hydrogeologic models described in *Report on the Remedial Investigation of Bear Creek Valley at the Oak Ridge Y-12 Plant, Oak Ridge, Tennessee* (DOE 1997a) and *Report on the Remedial Investigation of the Upper East Fork Poplar Creek Characterization Area at the Oak Ridge Y-12 Plant, Oak Ridge, Tennessee* (DOE 1998), both of which incorporate the hydrogeologic framework and associated nomenclature described in *Status Report — A Hydrologic Framework for the Oak Ridge Reservation* (Solomon *et al.* 1992).

There are two basic hydrogeologic units in the vicinity of Y-12 that are defined for use in this report: the aquifer and the aquitard (Figure A.2). This nomenclature is intended only to differentiate the more permeable carbonate formations that comprise the aquifer from the less permeable formations that comprise the aquitard; no inference to the conventional connotation of each term is implied or intended. The aquifer includes the uppermost carbonate formation of the Conasauga Group (Maynardville Limestone) and the overlying formations of the Knox Group. The aquitard, which is not a true aquitard but transmits groundwater less effectively than the aquifer, consists of the remaining interbedded carbonate and siliciclastic formations of the Conasauga Group (Nolichucky Shale, Maryville Limestone, Rogersville Shale, Rutledge Limestone, and Pumpkin Valley Shale) and the underlying Rome Formation. The following discussion provides a short description of each hydrogeologic unit.

2.3.1 Aquifer

Components of the aquifer underlie the axis of BCV (Maynardville Limestone) and form Chestnut Ridge (Knox Group). Separate overviews of the hydrologic characteristics of the Maynardville Limestone and the Knox Group are provided below.

2.3.1.1 Maynardville Limestone

Most groundwater flow in the Maynardville Limestone occurs at depths less than 100 ft below ground surface (bgs) in an extensively interconnected network of solution conduits and cavities (karst network). Flow in the shallow karst network is relatively rapid and occurs as “quickflow” discharge to nearby surface drainage features (e.g., Bear Creek). Below the shallow karst network, fractures provide the primary flowpaths. Also, there are seven distinct stratigraphic zones (numbered from bottom to top) in the Maynardville Limestone near Y-12 (Shevenell 1995). Because of vuggy porosity related to dissolution of gypsum nodules, the uppermost stratigraphic zone (Zone 6) is the most permeable and probably transmits the bulk of the groundwater in the Maynardville Limestone (Goldstrand 1995).

Available data indicated fairly homogeneous groundwater geochemistry in the Maynardville Limestone; almost every monitoring well in this formation, regardless of depth, yields calcium-magnesium-bicarbonate groundwater. Some shallow wells monitor sulfate-enriched groundwater, which probably reflects dissolution of locally disseminated secondary minerals, including gypsum, anhydrite, and pyrite. Also, several deep wells monitor calcium-magnesium-sulfate groundwater with very high total dissolved solids (TDS).

Isopleths of groundwater elevations in the Maynardville Limestone show a low hydrologic divide in BCV near the west end of Y-12, with flow along geologic strike to the west-southwest in the Bear Creek Regime (Figure A.4) and along geologic strike to the east-southeast in the East Fork Regime (Figure A.5). In the

Bear Creek Regime, groundwater from the deeper flow system in the Maynardville Limestone discharges along major gaining (influent) reaches of Bear Creek. These discharge areas are possibly related to large-scale structural (e.g., cross-strike faults) or stratigraphic discontinuities in the Maynardville Limestone. Also, in the East Fork Regime, shallow flow in the Maynardville Limestone in the eastern Y-12 area is primarily to the east (along geologic strike) toward Union Valley east of the ORR boundary, but the UEFPC distribution channel underdrain apparently functions as a highly permeable groundwater flow path and a constant head (recharge) boundary that strongly influence local flow directions (BJC 1998).

Results of a long-term pumping test and concurrent dye-trace test performed in July 1998 provide the most recent data regarding the hydrologic characteristics of the intermediate and deep groundwater flowpaths in the Maynardville Limestone in the East Fork Regime, and the degree of hydraulic connection between the shallow and deep flow systems in the eastern Y-12 area (BJC 1998). A stepped pump test was performed using a well (GW-845) installed in the Maynardville Limestone about 250 ft southeast of NHP. Groundwater was pumped continuously from the well (which has an open-hole interval from 157 to 438 ft bgs) at progressively increased discharge rates: 25 gallons per minute (gpm) for 24 hours, 50 gpm for 24 hours, and 100 gpm for seven days (pumping started on July 9, 1998 and stopped on July 18, 1998). Water level drawdown and recovery data obtained from nearby monitoring wells indicated: (1) rapid, large responses in wells located along strike to the east and across strike to the north of the pumping well, (2) more moderate responses in wells located oblique to strike near the contact with the Nolichucky Shale to the east of the pumping well, (3) responses in upgradient wells in the Maynardville Limestone to the west of the pumping well, and (4) little if any response in wells located adjacent to Lake Reality and the UEFPC distribution channel underdrain to the north and northeast of the pumping well. The maximum observed radius of influence from the pumping well encompassed the entire subcrop of the Maynardville Limestone in the eastern Y-12 area, with particularly strong anisotropies to the east (along strike) and north (up-dip) of the well and low-permeability boundary effects along the contact with the Nolichucky Shale (BJC 1998).

In conjunction with the pumping test, eosine dye was injected in a shallow (60 ft bgs) well (GW-153) located about 450 ft southwest (upgradient) of the pumping well (GW-845). Rapid breakthrough of the dye observed in the pumping well clearly demonstrated the hydraulic connection between the shallow and intermediate/deep groundwater flowpaths along strike in the Maynardville Limestone. Additionally, confirmed detection of the dye in two shallow wells (GW-220 and GW-832) located about 600 ft northeast (across geologic strike) of the injection well (and about 300 ft northwest of the pumping well) suggests that the degree of hydrologic connection with the UEFPC distribution channel underdrain and groundwater movement along dip parallel or conjugate fracture flowpaths in the shallow flow system are strong enough to overcome the hydraulic capture zone created at the 100 gpm pumping rate in the intermediate to deep flow systems (BJC 1998).

Based on the information obtained from the long-term pumping test and associated dye trace, well GW-845 was designated as the groundwater extraction point for the contaminant plume capture system required under an interim action Record of Decision (ROD) for Union Valley (DOE 1997b). Full operation of the system began in October 2000 and has involved pumping well GW-845 at a rate of 25 gpm and treating the groundwater to remove particulates, iron, manganese, and VOCs. Monthly water level measurements in selected observation wells show that continuous operation of the system has generally maintained 15 to 17 ft of drawdown in the immediate vicinity of well GW-845 (Figure A.5) and has established an elongated zone of influence that extends parallel with geologic strike for at least 900 ft to the east (downgradient) and 600 ft to the west (upgradient) of the pumping well (DOE 2012).

2.3.1.2 Knox Group

The Knox Group formations underlying Chestnut Ridge comprise three vertically gradational hydrogeologic subsystems: (1) the stormflow zone, (2) the vadose zone, and (3) the groundwater zone. The subsystems are distinguished by groundwater flux, which decreases with depth (Solomon et al. 1992).

Investigations on Chestnut Ridge in a watershed located approximately 4,000 ft west of the Chestnut Ridge Regime show that groundwater occurs intermittently above the water table in a shallow "stormflow zone" that extends to a depth of about 8 ft bgs (Wilson et al. 1990). Macropores and mesopores provide the primary channels for lateral flow in the stormflow zone, which lasts only a few days (5 - 10) after rainfall. Most groundwater within the stormflow zone is either lost to evapotranspiration or recharge to the water table, and the remaining water discharges at nearby seeps, springs, or streams (Moore 1989).

The vadose zone occurs between the stormflow zone and the water table, which typically occurs near the bedrock/residuum interface. Soil moisture content in the vadose zone is below the saturation limit except in the capillary fringe above the water table and within wetting fronts during periods of vertical percolation from the stormflow zone (Moore 1989). Most recharge through the vadose zone is episodic and occurs along discrete permeable fractures that become saturated, although surrounding micropores remain unsaturated (Solomon et al. 1992). The residuum is hydrologically heterogeneous, with quickflow via dolines to conduits in the subsurface; residuum on Chestnut Ridge near the Oak Ridge National Laboratory (ORNL) has a mean hydraulic conductivity of about 0.006 feet per day (ft/d) (Moore 1988).

Groundwater below the vadose zone occurs within orthogonal sets of permeable, planar fractures that form water-producing zones within an essentially impermeable matrix. Dissolution of bedrock carbonates has enlarged fractures and produced an interconnected conduit-flow system characteristic of karst aquifers. Because the occurrence of solution features and the frequency, aperture, and connectivity of permeable fractures decrease with depth, the bulk hydraulic conductivity of the groundwater zone is vertically gradational. Most groundwater flux occurs within the transitional horizon between residuum and unweathered bedrock (water table interval); lower flux (and longer solute residence times) occurs at successively greater depths in the bedrock (Solomon et al. 1992).

Available data show that hydraulic conductivity in the Knox Group varies over multiple orders of magnitude, which is typical of karst aquifers. Results of straddle packer tests in core holes indicate hydraulic conductivity ranging from 0.0002 to 3.1 ft/d at depths generally less than 600 ft bgs in the lower Knox Group (King and Haase 1988). Hydraulic conductivity values calculated from results of falling-head slug tests performed in monitoring wells completed at shallow depths (60 to 195 ft bgs) in the middle Knox Group range from about 0.003 to 14 ft/d (Jones 1998). Also, results of a preliminary dye-tracer test at the Chestnut Ridge Security Pits (CRSP) indicate flow rates of about 100 to 300 ft/d (Martin Marietta Energy Systems, Inc. [MMES] 1990a). Although not confirmed by a second test using different tracers (MMES 1993), these findings are supported by the range of flow rates (490 to 1,250 ft/d) indicated by results of a dye-tracer test performed on Chestnut Ridge near ORNL (Ketelle and Huff 1984).

Groundwater elevations on Chestnut Ridge generally mirror surface topography (Figure A.6). Along the crest of the ridge, which is a recharge area and a flow divide, groundwater generally flows from west to east (parallel to geologic strike), with radial components of flow north into BCV and south toward tributary headwaters on the southern flank of the ridge (across geologic strike). The central part of the regime is characterized by radial flow directions from local groundwater flow divides along hilltops between tributaries. Groundwater flow directions in the southern part of the regime are generally south toward Melton Hill Lake. The overall directions of groundwater flow throughout the Chestnut Ridge Regime do

not significantly change during seasonal groundwater flow conditions. Horizontal hydraulic gradients throughout the year are highest along the steep northern flank of Chestnut Ridge (i.e., across geologic strike) and in the upper reaches of tributaries on the southern ridge flank, and are nearly flat along the southern boundary of the regime.

Groundwater in the Knox Group has fairly homogeneous geochemistry. Most wells yield calcium-magnesium-bicarbonate groundwater with pH of 7.5 to 8.0; TDS above 150 milligrams per liter (mg/L); equal or nearly equal molar concentrations of calcium and magnesium; low proportions (<5%) of chloride, sodium, sulfate, and potassium; and very low (i.e., <1 mg/L) carbonate alkalinity and nitrate (as N) concentrations (hereafter synonymous with “nitrate” concentrations). Some wells yield groundwater with enriched chloride and sulfate concentrations that probably reflect the geochemical influence of locally disseminated evaporates (e.g., gypsum) or sulfides (e.g., pyrite). Additionally, groundwater within low permeability (matrix) intervals in the upper Knox Group (e.g., Mascot Dolomite), as indicated by data for several wells at Kerr Hollow Quarry (KHQ), often exhibits greater proportions of sulfate and potassium and higher trace metal concentrations (e.g., strontium) than typical of the groundwater from low yield intervals within the lower Knox Group formations (e.g., Copper Ridge Dolomite). These geochemical differences potentially reflect corresponding differences between carbonate mineralogies in the upper and lower sections of the Knox Group or the proximity to and types of disseminated secondary minerals (Lockheed Martin Energy Systems, Inc. 1996).

2.3.2 Aquitard

The geologic formations that comprise the aquitard directly underlie the primary contaminant source areas in the Bear Creek Regime and the East Fork Regime and are hydraulically upgradient of the Maynardville Limestone throughout much of BCV. Fractures provide the primary groundwater flowpaths in the aquitard; flow through the rock matrix is negligible but nevertheless plays an important role in contaminant migration because of matrix diffusion processes. Flow directions are primarily parallel to bedding (along geologic strike and dip), which may or may not coincide with the direction of maximum horizontal hydraulic gradient inferred from groundwater elevation isopleths. Most flow occurs within the shallow bedrock interval less than 100 ft bgs. Flow across bedding occurs primarily along permeable zones formed by cross-cutting fractures or fracture zones (and possibly small faults). Some of these cross-cutting structures may act as barriers to lateral flow, causing groundwater from deeper intervals to upwell and discharge to the shallower flow system. Others may serve as preferential pathways for migration of contaminants from the aquitard into the Maynardville Limestone.

Most groundwater flow in the aquitard occurs within a highly permeable interval near the bedrock/residuum interface. West of Y-12 in the Bear Creek Regime, flow in the aquitard above the water table occurs in response to precipitation when flowpaths in the residual soils become saturated and rapidly transmit water laterally (stormflow) down slope toward springs, seeps, streams and vertically (recharge) to the water table interval. In the East Fork Regime, however, infiltration into the subsurface and recharge to the water table interval is strongly influenced by the many buildings and other impervious surfaces that cover much of the regime as well as the extensive areas of fill and networks of subsurface storm drains, sewers, and process lines.

Recharge to the water table interval in the aquitard promotes strike-parallel groundwater flow toward nearby discharge areas, which include the subsurface drainage network in the East Fork Regime and the northern tributaries of Bear Creek in the Bear Creek Regime. Although the presence of contaminants in groundwater more than 200 ft bgs in the Nolichucky Shale clearly indicates permeable flowpaths at depth,

flow is most active at depths less than 100 ft bgs, and only a small percentage of total flow ultimately recharges the deeper bedrock, where upward hydraulic gradients predominate. In the Bear Creek Regime, about 94% of the available groundwater in the aquitard discharges to Bear Creek tributaries, about 5% flows along cross-cutting fractures into the aquifer, and about 1% flows through strike-parallel pathways in the deeper subsurface (DOE 1997a).

Decreasing groundwater flux with depth in the aquitard in BCV also is reflected by distinct changes in groundwater geochemistry. Most water table interval and shallow (i.e., <100 ft bgs) bedrock wells monitor calcium-magnesium-bicarbonate groundwater. A fairly abrupt change to sodium-bicarbonate groundwater, which is interpreted to be a function of longer groundwater residence time related to reduced fracture aperture or increased fracture spacing (Solomon *et al.* 1992), occurs at a depth of about 100 ft bgs. Further reduced groundwater flux is indicated by the transition from sodium-bicarbonate groundwater to sodium-chloride groundwater that usually occurs at a depth of about 400 ft bgs. The transition to the sodium-chloride groundwater is accompanied by a general increase in TDS.

Isopleths of seasonal groundwater surface elevations in the aquitard (water table interval) in the Bear Creek Regime (Figure A.4) and East Fork Regime (Figure A.5) indicate flow to the west-southwest and east-southeasterly, respectively, toward the Maynardville Limestone. In the East Fork Regime, however, the operation of basement dewatering sumps and the network of subsurface storm drains and utilities throughout much of the western and central Y-12 areas (Figure A.3) strongly influences the movement and discharge of shallow groundwater. For instance, operation of sumps to suppress the local water table below the basement floor of several buildings (9204-4, 9201-5, and 9201-4, and possibly 9204-2) have influenced local groundwater flow and contaminant transport patterns (DOE 1998). The sumps located in Building 9201-5 were shut down in CY 2005, and water consisting of steam condensate, rainwater, and groundwater has accumulated in the basement since that time.

2.4 GROUNDWATER CONTAMINATION

Groundwater quality monitoring data obtained from the extensive network of monitoring wells associated with Y-12 show that the most widespread groundwater contaminants are nitrate, VOCs, uranium isotopes (primarily uranium-234 [U-234] and uranium-238 [U-238]), and technetium-99 (Tc-99). Maps illustrating the generalized extent of nitrate, VOCs, uranium isotopes (as indicated by gross alpha radioactivity), and Tc-99 (as indicated by gross beta radioactivity) are provided on Figures A.7, A.8, A.9, and A.10, respectively. The following sections provide an overview of groundwater contamination in the Bear Creek Regime, East Fork Regime, and Chestnut Ridge Regime.

2.4.1 Bear Creek Regime

The following sections briefly describe the primary sources of groundwater contamination in the Bear Creek Regime (the S-3 Site, the Oil Landfarm [OLF] waste management area [WMA], and the Bear Creek Burial Grounds [BCBG] WMA) and the principal groundwater transport pathway in the regime (the Maynardville Limestone).

2.4.1.1 S-3 Site

Operation of the former S-3 Ponds emplaced a large reservoir of contamination in the aquitard (Nolichucky Shale) consisting of a heterogeneous mix of inorganic, organic, and radioactive constituents. The principal contaminants are nitrate, Tc-99, uranium isotopes, trace metals (e.g., cadmium), and VOCs. Contaminant concentrations in the aquitard nearest the site have probably reached maximum levels, with the center of mass of the plume slowly moving westward. Westward, strike parallel migration of contaminants in the aquitard occurs until encountering a cross-cutting structure that promotes upward discharge into the shallow flow system or cross-strike flow into the Maynardville Limestone (DOE 1997a). Additionally, matrix diffusion and advective transport processes are slowly releasing contaminants (e.g., nitrate) from the deeper reservoir into the more active (shallow) aquitard flow system.

In the aquitard, nitrate from the former S-3 Ponds extends directly south in the water table interval into the upper reach of Bear Creek and along strike in the water table interval and the deeper bedrock for over 3,000 ft to the west. Because it is highly mobile and chemically stable, nitrate delineates the maximum extent of groundwater transport from the S-3 Site and effectively traces the principal migration pathways in the aquitard. Nitrate concentrations within the plume exceed 10,000 mg/L in the deep bedrock directly below the S-3 Site and exceed 1,000 mg/L in the shallow groundwater near the site (Figure A.7).

Gross alpha activity and gross beta activity within the S-3 Site contaminant plume exceed 1,000 picoCuries per liter (pCi/L). Although a diverse population of radioisotopes is present in the groundwater closest to the site, elevated gross alpha and gross beta activity in the groundwater probably delineate migration of uranium isotopes (U-234 and U-238) and Tc-99, respectively, since these were the dominant radiological constituents in wastes placed into the former S-3 Ponds. Also, sludge produced by denitrification of the waste water in each pond was left in place after closure of the site. Sludge within the saturated zone may release Tc-99 and uranium isotopes to the shallow groundwater flow system in the aquitard (DOE 1997a). These contaminants then may be transported southward towards Bear Creek and westward through the water table interval toward discharge points in NT-1 (DOE 1997a).

Other components of the S-3 Site contaminant plume are trace metals and VOCs. The distribution of trace metals is less extensive than that of nitrate and radioactivity, but the most mobile metals within the plume (e.g., barium) have been transported beyond the acidic groundwater (pH <5) nearest the site. Acetone and tetrachloroethene (PCE) are the principal VOCs within the plume. Concentrations of PCE exceed 5,000 micrograms per liter (µg/L) in wells adjacent to the site, potentially indicating the presence of dense nonaqueous phase liquids (DNAPL) in the subsurface, but decrease to less than 50 µg/L about 500 ft downgradient to the west of the site. This reflects the limited extent of PCE migration and suggests substantial natural attenuation in the subsurface.

2.4.1.2 Oil Landfarm WMA

The primary sources of groundwater contaminants in the OLF WMA are the Boneyard/Burnyard (BYBY), the Hazardous Chemical Disposal Area (HCDA), the OLF disposal plots, and Sanitary Landfill I. Each of these sites except the BYBY is a known or suspected source of VOCs in the shallow groundwater; the BYBY is a major source of elemental uranium and alpha radioactivity in the Bear Creek Regime.

The Boneyard was used for the disposal of magnesium chips and construction debris (e.g., concrete) in unlined shallow trenches. Filled trenches were covered with topsoil and seeded with grass. The Burnyard consisted of two unlined trenches, each about 300 ft long by 40 ft wide, in which various types of refuse

(including pesticide containers, metal shavings, solvents, oils, and laboratory chemicals) were burned. Because the BYBY is a primary source of uranium in the groundwater and surface water in BCV (DOE 1997a), this site was prioritized for Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) remedial action, which was performed in three phases. Remedial designs for the site were prepared during Phase I and remedial action field work began with Phase II. Completed in November 2001, Phase II primarily involved construction of an upgradient subsurface drain to hydraulically isolate the buried wastes at the site in order to reduce the flux of contaminants from the site and to dry the site in preparation of the Phase III field work, which began in May 2002. Phase III focused on the excavation, disposal, and consolidation of wastes from the site and the reconstruction of a section of NT-3 that drains the site. Waste removal actions were completed in October 2002 and involved the excavation of about 64,000 cubic yards (yd³) of waste materials with the highest concentrations of uranium that were in contact with groundwater. These wastes were disposed in the Environmental Management Waste Management Facility (EMWMF). About 17,000 yd³ of other waste materials that had lower levels of uranium contamination and were not in contact with groundwater also were excavated, consolidated onsite, and covered with a low-permeability recompacted clay cap. Installation of the cap, including seeding/mulching the topsoil cover, was completed in November 2002. Field work to restore the NT-3 stream channel with natural meanders and gradients in order to reduce erosion of the bank and more efficiently transport water and sediment load through the site was completed in May 2003.

The HCDA was constructed on top of the Burnyard in 1975 and was used as an area for releasing compressed gas from cylinders with leaking or damaged valves and for disposal of reactive or explosive laboratory chemicals. The chemicals were handled to induce the expected reaction or explosion, and remaining liquids were discharged into a small unlined surface impoundment. A low permeability cap was constructed over the HCDA during closure of the OLF. In June 2002, a section of the northwest corner of the cap was excavated and removed during Phase III of the CERCLA remedial action at the BYBY. Excavated wastes were replaced with uncontaminated soil. The filled area was graded to allow for drainage and seeded with grass.

Groundwater contaminants at the OLF are principally VOCs, and a commingled plume containing two distinct suites of VOCs are evident: one to the northeast dominated by 1,1,1-trichloroethane (111TCA), 1,1-dichloroethane (11DCA), and 1,1-dichloroethene (11DCE); and one to the south dominated by PCE, cis-1,2-dichloroethene (c12DCE), trans-1,2-dichloroethene (t12DCE), and trichloroethene (TCE) (MMES 1989). The dissolved VOC plume appears to be restricted to the shallow flow system. Summed VOC concentrations exceed 1,000 µg/L in the northeast part of the plume and 100 µg/L in the southern part of the plume (Figure A.8); maximum concentrations within the plume do not indicate the presence of DNAPL in the subsurface.

Sanitary Landfill I is a probable source of 11DCA, c12DCE, and t12DCE in the shallow groundwater (aquitard and aquifer) downgradient to the south of the site. Maximum VOC concentrations are typically less than 50 µg/L. In the Maynardville Limestone, these constituents have intermingled with the VOC plume (primarily TCE and c12DCE) originating from upgradient sources. Sanitary Landfill I also may be a source of boron in the groundwater at several wells immediately downgradient (west) of the site.

2.4.1.3 Bear Creek Burial Grounds WMA

Groundwater in the aquitard underlying the BCBG WMA is extensively contaminated with VOCs at both shallow (water table) and deep (bedrock) intervals. There are five primary source areas: Burial Ground (BG)-A (North and South), BG-C (East and West), and the Walk-In Pits (Figure A.8). Dissolved VOC

plumes in the shallow groundwater at several of these source areas are probably related to widespread occurrence of DNAPL in the subsurface. Contamination in the deeper groundwater flow system reflects density-driven, downward migration of DNAPL.

The disposal trenches comprising BG-A (North and South) received almost two million gallons of waste oils and coolants, and DNAPL has been encountered at 260 ft and 330 ft bgs in monitoring wells down dip of source trenches in BG-A South. Dissolved VOC plumes in the groundwater underlying both areas are dominated by PCE, TCE, and c12DCE. Other common plume constituents are 111TCA, 11DCA, and 1,2-dichloroethane (12DCA). Summed concentrations of these plume constituents can exceed 100,000 µg/L. Groundwater in the water table interval transports the plume constituents along strike toward discharge areas in NT-6 and NT-7. Strike-parallel migration also occurs below the water table interval, as reflected by westward (strike-parallel) transport of PCE indicated by data obtained from deeper bedrock wells west of BG-A South.

Separate plumes of dissolved VOCs apparently occur in the shallow groundwater at BG-C East and BG-C West, each plume dominated by c12DCE with lesser amounts of vinyl chloride (VC), both of which are degradation products of PCE. The concentrations of VOCs in each plume are generally less than 500 µg/L. Groundwater containing these VOCs discharges to the NT-8 catchment on the northwest side of the BCBG WMA. Data for both source areas do not clearly indicate the presence of DNAPL in the subsurface (DOE 1997a).

Groundwater near the Walk-In Pits contains a distinct plume of dissolved VOCs dominated by PCE. Concentrations exceed 2,000 µg/L, which is about 1% of the maximum PCE solubility and possibly indicates DNAPL in the subsurface. Contaminants in the shallow groundwater flow system near the Walk-In Pits may not discharge extensively to surface water (DOE 1997a).

Although large quantities of uranium wastes were disposed in the BCBG WMA, few monitoring wells in the area yield radioactive groundwater samples. However, data for soil samples and surface water samples collected from NT-6, NT-7, and NT-8 indicate that uranium isotopes from BG-A South and BG-C East are probable sources of elevated alpha and beta radioactivity (DOE 1997a). Maximum gross alpha and gross beta activities in the samples from these tributaries ranged from about 20 pCi/L to more than 100 pCi/L. The disparity with the groundwater sample data may be an artifact of the monitoring well network (few wells are screened within the shallowest water table interval where radioactive contamination likely occurs), but the relatively low levels of radioactivity in the groundwater also suggest that the bulk of the uranium wastes in BG-A South and BG-C East are not within the saturated zone (DOE 1997a).

Boron is the primary trace metal contaminant in the groundwater at the BCBG WMA. Elevated boron concentrations occur primarily in the shallow groundwater near BG-A South and BG-C (East and West) and probably resulted from disposal of borax wastewater from Y-12. Boron is most likely present in the groundwater as borate $[B(OH)_3]$, which is chemically stable and relatively mobile, and is transported toward discharge points in Bear Creek tributaries NT-7 and NT-8.

2.4.1.4 Maynardville Limestone Exit Pathway

Groundwater contaminants in the Maynardville Limestone originate from the S-3 Site (nitrate and Tc-99), the Rust Spoil Area (VOCs) or an unidentified source area in the Bear Creek floodplain adjacent to the Rust Spoil Area, the BYBY (uranium isotopes), Sanitary Landfill I (VOCs), and the BCBG WMA (VOCs and uranium isotopes). These contaminants enter the Maynardville Limestone through direct recharge,

hydrologic communication with surface water in Bear Creek, and inflow of shallow groundwater from the aquitard. Relative contributions from the source areas and the geochemical characteristics of the contaminants have produced two primary plumes of contamination in the groundwater: one containing nitrate and radioactivity and another containing VOCs. Both plumes occur in the shallow karst network and the deeper fracture flowpaths and are commingled downgradient of the BYBY.

The nitrate plume (Figure A.7) in the aquifer essentially delineates the maximum extent of contaminant transport from the former S-3 Ponds and effectively traces the principal migration pathways in the Maynardville Limestone. The plume is continuous in the deeper bedrock from south of the S-3 Site for about 10,000 ft along strike to the west, whereas attenuation from more active recharge and groundwater flux has reduced nitrate levels and produced a more discontinuous nitrate plume in the shallow karst network. Nitrate concentrations within the plume exceed 500 mg/L south of the S-3 Site, but rapidly decrease to less than 50 mg/L south of the OLF WMA, and are typically highest in the fracture-dominated groundwater flow system at depths greater than 100 ft bgs.

The distribution of VOCs (Figure A.8) in the Maynardville Limestone reflects the relative contributions of several source areas and commingling during downgradient transport. Plume constituents in the upper part of BCBV are TCE, c12DCE, and PCE; probable source areas are Spoil Area I, the S-3 Site, and possibly the Fire Training Facility in the East Fork Regime. The major inputs to the plume occur from: (1) the Rust Spoil Area (TCE) or a nearby source in the Bear Creek floodplain, (2) the HCDA (TCE and c12DCE), Sanitary Landfill I (111TCA and 11DCA), (3) discharge from the Bear Creek tributary (NT-7) that traverses BG-A North and A South (c12DCE and 12DCA), and (4) discharge from the Bear Creek tributary (NT-8) on the west side of the BCBG WMA, including VOCs (PCE, TCE, c12DCE, VC) from BG-C East and BG-C West. The highest concentrations within the plume (i.e., >300 µg/L) occur in the deeper groundwater south (down-dip) of the HCDA. These high concentrations coincide with the downward vertical hydraulic gradients in the Maynardville Limestone in this area and the major losing reach of middle Bear Creek south of Sanitary Landfill I.

Radioactivity in the groundwater in the Maynardville Limestone is primarily from uranium isotopes and Tc-99. The extent of these radionuclides is generally delineated by gross alpha activity (Figure A.9) and gross beta activity (Figure A.10), respectively. The distribution of gross beta activity mirrors that of nitrate, indicating both a common source of nitrate and Tc-99 (the S-3 Site) and migration along common flowpaths. Increased gross alpha activity in the groundwater downstream of the NT-3 catchment reflects inputs of uranium isotopes from former sources in the BYBY. Before their excavation and removal in May 2002 (see Secion. 2.4.1.2), waste materials containing high concentrations of uranium were within the saturated zone during seasonally high groundwater levels. Uranium isotopes that were leached from the wastes were transported with the shallow groundwater that discharges into NT-3 and recharges directly into the Maynardville Limestone. Prior to the removal of the wastes, gross alpha and gross beta activity exceeded 1,000 pCi/L in the shallow groundwater along NT-3 from the northwest corner of the site to the confluence of NT-3 and Bear Creek (Figure A.9 and Figure A.10). After waste removal was completed, total uranium concentrations in NT-3 dropped from 2.39 mg/L in May 2002 to 0.0222 mg/L in November 2002. Subsequent monitoring results show a widely fluctuating and generally increasing uranium concentration trend since CY 2004, with most recent results (CY 2010) ranging from 0.0729 mg/L to 0.259 mg/L.

Most trace metal contamination in the Maynardville Limestone occurs in the shallow groundwater near the S-3 Site and the BYBY. Near the S-3 Site, the principal trace metal contaminants are barium, boron, cadmium, copper, lead, mercury, strontium, and uranium. Some of these metals (e.g., cadmium) were entrained in the highly acidic wastes disposed at the site, and others (e.g., barium and strontium) were

dissolved from the underlying bedrock. Trace metal contamination is sporadic in the groundwater at the BYBY and the principal contaminants are beryllium, manganese, mercury, nickel, and uranium. Boron and uranium are the most common trace metal contaminants in the aquifer downgradient of the S-3 Site and the BYBY, which indicates that relatively mobile ionic species of both metals are present in the groundwater.

2.4.2 East Fork Regime

Sources of groundwater contamination in the East Fork Regime include hazardous and nonhazardous waste treatment, storage, or disposal sites; bulk product transfer, storage, and use areas; former petroleum-fuel underground storage tanks (USTs) and associated dispensing facilities; industrial process buildings; waste and product spill areas; and the many process pipelines, effluent drains, and utilities associated with the industrial operations at Y-12. Also, operation of the former S-3 Ponds emplaced a large reservoir of contamination in the western Y-12 area. Intermingling of contaminants from multiple source areas has produced an extensive, essentially continuous groundwater contaminant plume of varying composition that extends from the western Y-12 area through the southern part of the central and eastern Y-12 areas and into Union Valley east of the ORR (Figure A.8).

A plume of nitrate contamination originating from the former S-3 Ponds extends vertically in the aquitard at least 150 ft bgs and laterally at least 5,000 ft into the western Y-12 area (Figure A.7). Nitrate concentrations within the plume exceed 10,000 mg/L. The geometry of the nitrate plume indicates two principal migration pathways: (1) relatively rapid migration along fairly short, shallow pathways (<30 ft bgs) that typically terminate in storm drains or other utilities, building sumps, and the buried tributaries and original mainstream of UEFPC; and (2) substantially slower migration along much longer strike-parallel pathways at greater depths in the bedrock toward basement sumps in Buildings 9204-4, 9201-4, and 9201-5 (DOE 1998). The S-2 Site also is a minor source of nitrate. However, because the S-2 Site directly overlies the Maynardville Limestone, the plume of nitrate contamination extends much farther from this source (>7,000 ft) than from the S-3 Site in the aquitard (Figure A.7).

The low pH groundwater within the contaminant plume originating from the former S-3 Ponds contains a diverse mix of metal ions and/or ion-complexes (beryllium, cadmium, cobalt, manganese, mercury, and nickel) that are usually not mobile (or are more readily attenuated) in less acidic groundwater, as well as metals that are mobile under a wider range of groundwater pH conditions (barium, boron, strontium, and uranium). Some of these metals were entrained in the acidic wastes disposed at the site (e.g., uranium), and others were dissolved from the underlying saprolite and bedrock (e.g., barium and strontium). Concentrations of several trace metals (e.g., barium) within the plume exceed the applicable Safe Drinking Water Act (SDWA) maximum contaminant level (MCL) for drinking water by an order-of-magnitude or more. Similarly elevated concentrations of several other trace metals (including boron, cadmium, cobalt, copper, mercury, and uranium) occur in the groundwater elsewhere in the East Fork Regime, notably the S-2 Site, but available data do not indicate that extensive plumes of metal ions and/or ion-complexes have developed in the groundwater beyond the immediate vicinity of these sites.

Volatile organic compounds are the most pervasive groundwater contaminants in the East Fork Regime (Figure A.8). The principal components of dissolved VOC plumes in the western Y-12 area and the central Y-12 area are PCE, TCE, c12DCE, 11DCE, and VC. Chloroethanes (primarily 111TCA and 11DCA) are also major components of several plumes in the central Y-12 area. In the eastern Y-12 area, dissolved chloromethanes, primarily carbon tetrachloride (CTET), chloroform, and methylene chloride (MC) are primary components of the VOC plume. Additionally, residual plumes of dissolved petroleum

hydrocarbons (benzene, toluene, ethylbenzene, and total xylenes) occur in shallow groundwater near former petroleum fuel USTs. In the aquitard, concentrations of individual plume constituents exceed 1,000 µg/L in the shallow groundwater near the Waste Coolant Processing Area (WCPA), Building 9201-5, and Tank 0134-U and indicate the presence of DNAPL in the subsurface. At shallow depths (<100 ft bgs) in the Maynardville Limestone, a relatively continuous plume of dissolved VOCs begins near the Fire Training Facility in the western Y-12 area, intermingles with VOC plumes from several sources in the central Y-12 area, and extends underneath NHP in the eastern Y-12 area (Figure A.8). The extent of the plume at intermediate (>200 ft bgs) and deep (>400 ft bgs) intervals in the Maynardville Limestone is not well defined in the western and central Y-12 areas because of very limited well coverage. However, data from the network of wells in the eastern Y-12 area show that a plume of dissolved chloromethanes (primarily CTET), which is believed to originate from several sources, including suspected DNAPL in the Maynardville Limestone west of NHP near Building 9720-6, extends vertically more than 400 ft bgs and laterally (parallel with geologic strike) into Union Valley up to 2,000 ft east of the ORR boundary. Operation of the VOC plume capture system since CY 2000 (see Sect. 2.3.1.1) has effectively reduced VOC concentrations in groundwater downgradient of the pumping well (DOE 2012).

Groundwater with radiological contamination occurs primarily in the aquitard east of the former S-3 Ponds, at the Old Salvage Yard (OSY), Buildings 9204-4 and 9201-5, and Tank 0134-U (Figure A.9 and Figure A.10). In the Maynardville Limestone, radiological contamination occurs near the S-2 Site and upgradient of NHP (the Uranium Oxide Vault, wells GW-605 and GW-606, and the former Oil Skimmer Basin). The former S-3 Ponds are the principal source of uranium isotopes (primarily U-234 and U-238) and Tc-99; the migration of Tc-99 generally mirrors that of nitrate from the site. Gross alpha radioactivity levels within the plume exceed the 15 pCi/L MCL and gross beta radioactivity levels within the plume exceed the SDWA screening level (50 pCi/L) for a 4 millirem per year (mrem/yr) dose equivalent (the drinking water MCL for gross beta radioactivity). Relatively limited influx of radiological contamination directly into the aquifer (or extensive dilution) in the East Fork Regime is indicated by the greatly decreased gross alpha, gross beta, and isotopic uranium activity in the groundwater downgradient of known source areas (e.g., S-2 Site and the former Oil Skimmer Basin).

2.4.3 Chestnut Ridge Regime

Groundwater contamination is much less extensive in the Chestnut Ridge Regime and VOCs are the most common groundwater contaminants (Figure A.8). Dissolved VOCs (primarily chloroethanes and chloroethenes) have been detected in the groundwater samples collected from monitoring wells downgradient from the CRSP and Industrial Landfill (ILF) IV. However, a clearly distinct plume of dissolved VOCs is indicated only by the data for wells at the CRSP.

The CRSP are located on the crest of Chestnut Ridge directly south of the central portion of Y-12, and consist of two areas containing a series of east-west oriented trenches that are about 8 to 10 ft wide, 10 to 18 ft deep, and 700 to 800 ft long. Beginning in 1973, the trenches received hazardous wastes until December 1984 and nonhazardous wastes until the site was closed in November 1988. Data obtained from monitoring wells at the site indicate that a narrow, elongated plume of dissolved VOCs extends parallel with geologic strike for at least 700 ft downgradient to the east, and perpendicular to geologic strike for at least 300 ft downgradient to the north and south. The primary components of the plume include 111TCA, 11DCA, and 11DCE near the western trench area, and PCE, TCE, and 1,2-dichloroethene (12DCE) isomers near the eastern trench area. The distribution of the dissolved plume constituents relative to the respective source areas and elongation of the plume along the axis of Chestnut Ridge, despite steeper hydraulic gradients toward the ridge flanks, suggest primarily strike-parallel horizontal transport (west to east) in the

groundwater (and possibly vapor phase transport). The maximum depth of vertical migration of the VOCs has not been conclusively determined, but is at least 150 ft bgs in the western trench area, 250 ft bgs near the middle of the site, and 270 ft bgs downgradient of the eastern trench area.

Data obtained since the early 1990s show that low concentrations (many are estimated values below analytical reporting limits) of one or more VOCs are present in the groundwater at two wells hydraulically downgradient of the waste disposal trenches at the CRSP: well GW-796 ($<1\text{ }\mu\text{g/L}$), which is located at ILF V about 400 ft directly south of the site, and well GW-798, which is located at Construction/Demolition Landfill (CDL) VII about 1,600 ft south-southeast of the site (Figure A.8). Subsequent monitoring results indicate that VOC levels in both wells remain relatively low, with the more recent data showing that PCE concentrations in well GW-798 occasionally exceed the MCL ($5\text{ }\mu\text{g/L}$). The repeated detection of these compounds in the groundwater at both wells probably reflects southward transport from the CRSP because this site is the only known source of VOCs that is hydraulically upgradient of either well.

The ILF IV, which is located on the crest of Chestnut Ridge directly south of the west end of Y-12, has received non-hazardous solid waste since October 1989 and is a suspected source of 111TCA, 11DCA, 11DCE in groundwater downgradient of the site. These VOCs have been repeatedly detected in a well located south of the eastern portion of the site (GW-305). The results potentially indicate groundwater transport along permeable flowpaths from the unlined portion (about 150 ft X 150 ft) at the eastern end of ILF IV. Although the source of these contaminants has not been formally confirmed, no other waste management facility is located upgradient of these wells. In response to sampling results confirming 11DCE concentrations above the MCL, the Tennessee Department of Environment and Conservation (TDEC) issued a Notice of Violation (NOV) in a letter to BJC dated November 2, 2009 (TDEC 2009). The NOV letter requested implementation of Assessment Monitoring Phase 3 at Industrial Landfill IV in accordance with an approved Groundwater Quality Assessment Plan (GWQAP). The TDEC approved the GWQAP (BJC 2009) for Industrial Landfill IV in December 2009 and Assessment Monitoring Phase 3 subsequently began with groundwater sampling of well GW-305 for VOC analysis per the quarterly frequency specified in the plan.

Kerr Hollow Quarry is on the broad southern flank of Chestnut Ridge about 1,000 ft north of Bethel Valley Road and served as a source of stone construction material until it filled with water and was abandoned in the late 1940's. From the early 1950s until November 1988, the quarry was used for the disposal of reactive materials from Y-12 and ORNL. Wastes were removed from the quarry between mid-1990 and late 1993 to obtain certified clean-closure status from the TDEC, but the site was finally closed with some wastes remaining in place. Low levels ($<5\text{ }\mu\text{g/L}$) of several VOCs, primarily CTET, chloroform, and PCE, occur in the groundwater at monitoring wells located to the south (GW-144) and southeast (GW-142) of KHQ. Each of these VOCs may be present at low concentrations in the groundwater downgradient of the site, possibly as a consequence of wastes being disturbed during attempts to obtain clean closure of the site, but none of the compounds have been detected in the Resource Conservation and Recovery Act (RCRA) wells at the site since 1997.

3.0 CY 2011 MONITORING PROGRAMS

The groundwater and surface water monitoring data included in this report were obtained during CY 2011 from implementation of monitoring programs directed by the Y-12 GWPP and BJC/UCOR. As described in Section 1.0, UCOR replaced BJC as the ORR EM contractor in August 2011 and BJC/UCOR will be referenced in this report as the manager for all of CY 2011 as if it was the contractor for the entire year. The Y-12 GWPP implemented surveillance and exit-pathway/perimeter monitoring (hereafter referenced collectively as DOE monitoring) specifically to meet requirements of DOE Orders 436.1 and 458.1. Associated groundwater and surface water sampling and analysis activities were performed in accordance with the Y-12 GWPP sampling and analysis plan (SAP) for CY 2011 (B&W Y-12 2010a), as modified by applicable addenda (Table B.1). The following subsections provide details regarding these sampling and analysis activities, including: the respective network of sampling locations in each hydrogeologic regime; QA/QC sampling; groundwater and surface water sampling methods; field measurements and laboratory analytes; data management protocols and DQO evaluation; and groundwater elevation monitoring.

The following monitoring programs were implemented by BJC/UCOR at Y-12 during CY 2011: (1) RCRA post-closure detection monitoring and RCRA post-closure corrective action monitoring (collectively referenced as RCRA monitoring); (2) CERCLA monitoring in accordance with applicable RODs or related decision documents (hereafter referenced as CERCLA ROD monitoring); (3) CERCLA baseline monitoring to evaluate pre-remediation water quality; (4) CERCLA detection monitoring at the EMWMF, an operating facility located in the Bear Creek Regime for CERCLA remediation wastes generated on the ORR; and (5) detection or assessment monitoring for four nonhazardous solid waste disposal facilities (SWDFs) located in the Chestnut Ridge Regime (referenced as SWDF monitoring). Groundwater and surface water sampling and analysis activities associated with these programs were performed in general accordance with the requirements specified in the ORR Water Resources Restoration Program (WRRP) SAP for fiscal year 2011 (BJC 2010a); the WRRP quality assurance project plan (BJC 2010b); the environmental monitoring plan for the EMWMF (BJC 2010c); and a SWDF monitoring SAP issued by the subcontractor responsible for the operations of the landfills on Chestnut Ridge (EnergySolutions 2007). The following subsections provide general information regarding the monitoring programs implemented by BJC/UCOR (e.g., sampling locations), but specific details, such as QA/QC sampling information, are deferred to the applicable SAPs and related technical reports issued by BJC/UCOR.

Cooperative implementation of the monitoring programs directed by the Y-12 GWPP and BJC/UCOR (i.e., preparing SAPs, coordinating sample collection, and sharing data) ensures that the CY 2011 monitoring results fulfill requirements of all the applicable monitoring drivers (GWPP, RCRA, CERCLA, and SWDF) with no duplication of sampling and analysis efforts.

3.1 SAMPLING LOCATIONS AND FREQUENCY

This report contains groundwater and surface water quality monitoring data obtained during CY 2011 from 235 sampling locations at Y-12, including 192 monitoring wells (complete construction details for each well are provided in Appendix C), 13 springs, and 30 surface water stations. The following subsections provide details regarding the sampling locations in each hydrogeologic regime and the corresponding sampling frequency for each applicable well, spring, and surface water station.

3.1.1 Bear Creek Regime

As shown below in Table 1, a total of 66 monitoring wells, three springs, and 17 surface water stations in the Bear Creek Regime were sampled during CY 2011 for the purposes of DOE Order monitoring, RCRA monitoring, and CERCLA monitoring. Table B.2 identifies the monitoring program applicable to each well, spring, and surface water station; their locations are shown on Figure A.11.

Table 1. CY 2011 sampling locations in the Bear Creek Regime

Monitoring Driver	Monitoring Wells	Springs	Surface Water Stations
DOE Order	36	2	4
RCRA	6	1	0
CERCLA	24	2	14
Totals:	66	3*	17*
Note: * = Separate samples were collected for DOE Order and CERCLA monitoring purposes at springs SS-4 and SS-5, and at surface water station NT-01 (see Table B.2).			

Samples were collected either annually or semiannually from most of the monitoring locations during CY 2011. Of the monitoring wells, 34 were sampled annually and 16 were sampled semiannually (Table B.2). Spring and surface water samples were collected annually (four locations), semiannually (three locations), during three quarters (six locations), or quarterly (seven locations).

Thirty-one of the wells that were sampled specifically for DOE Order monitoring during CY 2011 are located near waste management areas in BCV (Table B.2 and Figure A.11), including the primary sources of groundwater contamination in the regime (S-3 Site, OLF WMA, and BCBG WMA). The remaining five wells are components of two Exit Pathway Pickets in the regime: Picket B (GW-703) is located about 2,000 ft west of the OLF and Picket C (GW-724, GW-725, GW-738, and GW-740) is located about 3,000 ft west of the S-3 Site (Figure A.12). The wells in each Exit Pathway Picket are completed at various depths along strike-normal transects of the Maynardville Limestone (MMES 1990b), which is the primary groundwater contaminant migration pathway in the Bear Creek Regime. Two of the wells are equipped with Westbay™ multi-port sampling equipment (wells GW-134 and GW-729). Groundwater samples were collected from discrete depth intervals at eight sampling ports in well GW-134 (Figure A.13) and at seven sampling ports in well GW-729 (Figure A.14) during June 2011 (Table B.2).

Springs SS-4 and SS-5 were sampled during CY 2011 specifically for DOE Order exit pathway/perimeter monitoring. This spring discharges into Bear Creek (Table B.2 and Figure A.11) and is located southwest (hydraulically downgradient) of the OLF. The surface water stations (BCK-09.40 and BCK.11.97) are located in the main Bear Creek channel (Figure A.11).

Groundwater samples were collected from six monitoring wells and one spring to meet RCRA post-closure corrective action monitoring requirements in the Bear Creek Regime during CY 2011 (Table B.2). These wells include point-of-compliance (POC) wells located downgradient of the S-3 Site (GW-276), the OLF (GW-008), and the BCBG WMA (GW-046); three plume boundary wells (GW-712, GW-713, and GW-714) at Exit Pathway Picket W (Figure A.11 and Figure A.12). Spring SS-6 also serves as a plume boundary monitoring location (Figure A.11).

A total of 38 monitoring locations in the Bear Creek Regime were sampled to meet CERCLA monitoring requirements during CY 2011 (Table B.2 and Figure A.11). Eight wells, two springs, and 10 surface water

stations were sampled to support CERCLA ROD monitoring requirements. Sixteen wells and five surface water stations were sampled for CERCLA detection monitoring purposes at the EMWMF. Two surface water stations located near the BCBG WMA (NT-07 and NT-08) were sampled for CERCLA baseline monitoring purposes (Figure A.11).

3.1.2 East Fork Regime

As shown below in Table 2, a total of 85 monitoring wells, three springs, and five surface water stations in the East Fork Regime (and surrounding areas) were sampled during CY 2011 to meet the requirements of DOE Order monitoring, RCRA monitoring, and CERCLA monitoring. Table B.3 identifies the monitoring program applicable to each well, spring, and surface water station.

Table 2. CY 2011 sampling locations in the East Fork Regime, north of Pine Ridge, and in Union Valley

Monitoring Driver	Monitoring Wells	Springs	Surface Water Stations
DOE Order	63	1	3
RCRA	5	0	0
CERCLA	18	2	2
Totals:	85 *	3	5
Note: * = The total number is less than the sum because separate samples were collected from well GW-722 for DOE Order and CERCLA monitoring purposes (see Table B.3).			

Most of the CY 2011 sampling locations lie within the boundaries of the East Fork Regime. However, five wells and two springs are located in Union Valley east the ORR boundary at Scarboro Road (Figure A.13), and three surface water stations are located in drainage features along the ORR boundary on the north side of Pine Ridge (Figure A.15). Samples were collected from the locations either annually (62 wells, the springs, and three surface water station) or semiannually (23 wells and three surface water stations).

Sixty-three monitoring wells in East Fork Regime, most of which are located within the western and central areas of Y-12 (Figure A.15), were sampled during CY 2011 specifically to meet DOE Order surveillance monitoring requirements (Table B.3). Six monitoring wells, a spring, and three surface water locations were sampled to meet DOE Order exit pathway/perimeter monitoring requirements (Table B.3). Most of the exit pathway wells are located between UEFPC and Scarboro Road at the east end of Y-12 (Figure A.15). One of the wells is equipped with WestbayTM multi-port sampling equipment (well GW-722). Groundwater samples were collected from discrete depth intervals at five sampling ports in well GW-722 (Figure A.16) during March and July 2011 (Table B.3). The surface water stations are located north of Pine Ridge (Figure A.17), and samples were collected in January 2011 (Table B.3).

Groundwater samples were collected from five wells to meet RCRA post-closure corrective action monitoring requirements in the East Fork Regime during CY 2011. These wells include one POC well (GW-108) which is located in the western Y-12 area about 800 ft southeast of the S-3 Site, and four plume delineation wells (GW-193, GW-605, GW-606, and GW-733) which are located several thousand ft east-southeast of the S-3 Site (Figure A.15).

Eighteen monitoring wells, two springs, and two surface water stations were sampled during CY 2011 specifically to meet CERCLA monitoring requirements (Table B.3). Thirteen monitoring wells and two

springs were sampled for CERCLA ROD monitoring purposes. Eight of these monitoring wells (GW-151, GW-154, GW-223, GW-380, GW-382, GW-722 [five discrete sampling depths], GW-762, and GW-832) are located in the eastern Y-12 area. The surface water stations (200A6 and Station 8) are located in the central Y-12 area. The other five monitoring wells and the springs are located in Union Valley east of the ORR boundary along Scarboro Road (Figure A.15).

3.1.3 Chestnut Ridge Regime

As shown below in Table 3, a total of 41 monitoring wells, seven springs, and eight surface water stations in the Chestnut Ridge Regime were sampled during CY 2011 to meet the requirements of DOE Order monitoring, SWDF detection monitoring, RCRA monitoring, and CERCLA monitoring. Table B.4 identifies the monitoring program applicable to each well, spring, and surface water station; their locations are shown on Figure A.18.

Table 3. CY 2011 sampling locations in the Chestnut Ridge Regime

Monitoring Driver	Monitoring Wells	Springs	Surface Water Stations
DOE Order	5	4	4
SWDF	18	1	0
RCRA	15	0	0
CERCLA	4	2	4
Totals:	41*	7	8
Note: * = The total number is less than the sum because separate samples were collected from well GW-205 for SWDF and CERCLA monitoring purposes (see Table B.4).			

Groundwater samples were collected semiannually from most (27) of the monitoring wells, with samples collected annually from 13 wells and quarterly from well GW-305 (Table B.4). Samples from the springs and surface water stations were collected annually (seven locations) and semiannually (eight locations).

Five monitoring wells located near the CRSP (GW-174, GW-175, GW-176, GW-180, and GW-322) were sampled specifically for DOE Order surveillance monitoring purposes during CY 2011 (Figure A.18 and Table B.4). The sampling locations used for DOE Order exit-pathway/perimeter monitoring include four springs (SCR2.1SP, SCR2.2SP, SCR5.1SP, and SCR5.2SP) and surface water stations SCR1.5SW, SCR3.5SW, KHB-09, and S17 located along Bethel Valley Road in main channels of drainage features where surface water exits the Chestnut Ridge Regime (Figure A.18).

Eighteen monitoring wells and one spring were sampled during CY 2011 to meet SWDF monitoring requirements (Table B.4). The monitoring wells are located at four SWDFs: three wells at ILF II; five wells at ILF IV; five wells at ILF V; and four wells at CDL VII (Figure A.17). Additionally, well GW-205 at the United Nuclear Corporation Site serves as the plume delineation well for SWDF assessment monitoring at ILF IV. Spring SCR4.3SP, sampled for SWDF detection monitoring at ILF V, is located about 2,400 ft southeast of the site (Figure A.18).

Groundwater samples were collected from 15 monitoring wells to meet RCRA monitoring requirements during CY 2011 in the Chestnut Ridge Regime: three wells for RCRA post-closure corrective action monitoring and 12 wells for RCRA post-closure detection monitoring (Table B.4). RCRA post-closure corrective action monitoring at the CRSP included one POC well (GW-177) located at the west end of the site and two plume delineation wells: GW-301 at the former Chestnut Ridge Borrow Area Waste Pile about

3,000 ft east of the site and GW-831 at the Filled Coal Ash Pond (FCAP) about 2,000 ft southwest of the site (Figure A.18). Note that the SWDF detection monitoring results for five monitoring wells and one spring also serve the purposes of RCRA post-closure corrective action monitoring at the CRSP. The monitoring wells include one background well (GW-521) and four plume delineation wells (GW-557, GW-562, GW-799, and GW-801) (Table B.4 and Figure A.18). The spring sampling location (SCR4.3SP) is located south of CDL VII (Figure A.18). During CY 2011, RCRA post-closure detection monitoring included four wells at the Chestnut Ridge Sediment Disposal Basin (CRSDB), four wells at the East Chestnut Ridge Waste Pile (ECRWP), and four wells at KHQ (Table B.4). The RCRA monitoring well network at the CRSDB includes one well (GW-159) located hydraulically upgradient (northwest) of the site and three POC wells (GW-156, GW-731, and GW-732) to the east-southeast (hydraulically downgradient) of the site (Figure A.18). One upgradient/background well (GW-231) and three downgradient POC wells (GW-143, GW-144, and GW-145) comprise the RCRA monitoring well network at KHQ (Figure A.18). The RCRA monitoring network for CY 2011 at the ECRWP included the upgradient/background well (GW-294) and three POC wells (GW-161, GW-296, and GW-298) located hydraulically downgradient of the site (Figure A.18).

Samples were collected from four monitoring wells, two springs, and four surface water stations to meet CERCLA monitoring requirements in the Chestnut Ridge Regime during CY 2011 (Table B.4). The wells and one surface water station are located at the United Nuclear Corporation Site (Figure A.17). One spring (SCR1.25SP) is located along Dunaway Branch in the southwestern portion of the regime, and a spring (SCR3.5SP) and three surface water stations (MCK 1.4, MCK 2.0, and MCK 2.05) are located along McCoy Branch (Figure A.17).

3.2 QUALITY ASSURANCE/QUALITY CONTROL SAMPLING

Quality assurance/quality control sampling activities managed by the Y-12 GWPP during CY 2011 were performed to ensure that the highest level of quality in sampling provided representative groundwater results. Comparable QA/QC sampling protocols also were performed under monitoring programs managed by BJC/UCOR (BJC 2010b and EnergySolutions 2007).

As shown in Table 4, the QA/QC samples associated with the groundwater and surface water monitoring performed under the Y-12 GWPP during CY 2011 included 77 trip blanks, 53 method (laboratory) blanks, two field blanks, three equipment rinsate samples, and 14 duplicate groundwater and surface water samples.

Table 4. QA/QC samples analyzed in CY 2011 for the Y-12 GWPP

Sample Type	Total Number of Samples per Quarter of CY 2011				Annual Total
	First	Second	Third	Fourth	
Trip Blank Samples	20	27	21	9	77
Method Blank Samples	14	20	12	7	53
Field Blank Samples	1	0	0	1	2
Equipment Rinsate Samples	0	2	1	0	3
Duplicate Samples	4	4	5	2	15

The blanks and equipment rinsate samples were prepared and analyzed as specified in the *Field Quality Control Samples* operating procedure (B&W Y-12 2009b). Analytical results for the blank samples help assess the environmental conditions in the field and laboratory under which associated groundwater and surface water samples were collected, transported, stored, and analyzed. Trip blanks were samples of analyte-free water prepared in the laboratory and transported to the field and then to the laboratory in

coolers containing groundwater and surface water samples. Field blanks were samples of analyte-free water that were transported to the field in a sealed glass container and transferred to sample bottles at monitoring wells GW-101 (first quarter) and 55-3C (fourth quarter) and then transported to the laboratory in a cooler containing the other samples from the well. Method blanks were samples of analyte-free water that were prepared in the laboratory and analyzed along with one or more associated groundwater or surface water samples. The equipment rinsates are samples of the analyte-free water from the final rinse of the decontaminated portable sampling equipment after sampling was completed at Westbay™ wells GW-134 and GW-729 during the second quarter and Westbay™ GW-722 during the third quarter.

Method blanks, trip blanks, field blanks, and equipment rinsate samples were analyzed for VOCs. Appendix G provides summaries of detected results for the QA/QC blanks and equipment rinsate samples and shows the method blank and trip blank samples associated with each groundwater and surface water sample collected under management of the GWPP during CY 2011.

A total of 15 field duplicate samples were collected during CY 2011 from five wells and one surface water station in the Bear Creek Regime (Table B.2), eight wells in the East Fork Regime (Table B.3), and one well in the Chestnut Ridge Regime (Table B.4). The duplicate samples were analyzed for the same constituents and parameters specified for the sampling location from which they were collected. Analytical results for the duplicates are presented with the regular sample results in Appendices D, E, and F.

3.3 SAMPLE COLLECTION AND HANDLING

The following discussion pertains to the groundwater and surface water sampling activities managed by the Y-12 GWPP during CY 2011. Personnel with the Environmental Sampling Section of the Y-12 Environmental Compliance Department were responsible for collection, transportation, and chain-of-custody control of the groundwater and surface water samples during CY 2011. Sampling throughout the year was performed in accordance with the most recent version of the technical procedures approved by the Y-12 GWPP Manager (BWXT Y-12, L.L.C. [BWXT] 2002, BWXT 2007a, and BWXT 2008). All samples were collected in appropriate containers, preserved as required, labeled, logged, placed in ice-filled coolers, and transported to the designated laboratory in accordance with chain-of-custody control requirements (B&W Y-12 2009b). Similar protocols were followed under the monitoring programs managed by BJC/UCOR during CY 2011 (BJC 2010b).

Unfiltered samples were collected from the monitoring wells, springs, and surface water stations in each hydrogeologic regime during CY 2011. Groundwater samples were collected from most monitoring wells using dedicated bladder pumps (Well Wizard™). Samples were obtained using passive diffusion bag (PDB) samplers from 17 monitoring wells, and from three wells equipped with a dedicated Westbay™ multi-port sampling apparatus (wells GW-131, GW-722, and GW-729).

The low-flow minimal drawdown sampling method (low-flow sampling) was used to obtain groundwater samples from the wells equipped with dedicated bladder pumps. Under this method, a representative sample is obtained without introducing stagnant water from the well casing. To obtain the sample, groundwater is pumped from the well at a flow rate which is low enough (<300 milliliters per minute) to minimize drawdown of the water level in the well (<0.1 ft per quarter-hour). At five-minute intervals after the water-level drawdown has stabilized, field personnel record measurements of the pH, conductivity, water temperature, oxidation-reduction potential (REDOX), and dissolved oxygen. Samples of the groundwater in the well are collected once the field measurements for each parameter show minimal variation over four consecutive readings.

Groundwater samples were collected from Westbay™ wells GW-134, GW-722, and GW-729 in accordance with the most recent and approved version of the operating procedures for the multi-port sampling equipment (BWXT 2007a and BWXT 2007b). Four 250-milliliter non-vented stainless steel sample collection bottles are used to obtain groundwater samples from the sampling ports. The sample collection bottles are lowered to the designated sampling port, the sampling port valve is opened remotely, and the bottles are allowed to fill with groundwater. The filled bottles are retrieved to the surface and the contents are poured into the appropriate laboratory sample bottle(s). The sample collection bottles are lowered, filled, and retrieved as many times as needed to completely fill the laboratory sample bottles. Groundwater in the first sample collection bottle retrieved from each sampling port is used as a “formation rinse” to obtain field measurements and to condition the sample collection bottles.

Passive (no purge) sampling methods were used to evaluate groundwater quality at 23 wells during CY 2011. A PDB sampler was used to evaluate VOC concentrations in groundwater in 17 of these wells, including four wells in the Bear Creek Regime (Appendix D), 10 wells in the East Fork Regime (Appendix E), and three wells in the Chestnut Ridge Regime (Appendix F). The PDB sampling method is suitable only for monitoring for the presence and concentration of selected VOCs in groundwater. This method involves suspending a polyethylene bag (semipermeable membrane) filled with analyte-free water at a selected depth within the monitored interval of the well and leaving the PDB in place for a prescribed period (at least two weeks). The chemical concentration gradient between the uncontaminated analyte-free water in the PDB and the surrounding contaminated groundwater induces VOCs in the groundwater to diffuse through the bag into the analyte-free water until equilibrium conditions are achieved. When retrieved, the water in the PDB is decanted into VOC sample bottles (U.S. Geological Survey 2001).

During the fourth quarter of CY 2011, verification sampling was performed at well GW-383 (Table B.1) to characterize differences between PDB sampling and low-flow sampling results. Samples were collected using a PDB one day and using the low-flow sampling method the next.

A “no-purge method” was used for wells that have demonstrated a very low pumping rate (<50 ml/min) to meet the minimal drawdown requirement during purging and sample collection. During CY 2011, the no-purge method was used to collect groundwater samples from two wells (GW-071 and GW-623) in the Bear Creek Regime and four wells (55-2A, 55-3C, 56-4A, and GW-779) in the East Fork Regime. For this method, field measurements were obtained and groundwater samples were collected after pumping the stagnant water (calculated volume) from the tubing.

3.4 FIELD MEASUREMENTS AND LABORATORY ANALYTES

The following discussion pertains to the field measurements and laboratory analytes associated with the CY 2011 groundwater and surface water sampling activities directed by the Y-12 GWPP. Identical or functionally equivalent field measurements and laboratory analyses were performed under monitoring programs managed by BJC/UCOR during CY 2011 (BJC 2007, BJC 2010a, BJC 2010c, and EnergySolutions 2007).

Field personnel measured the depth to the static water surface before sampling groundwater in each monitoring well except for Westbay™ wells and wells sampled using PDB samplers. The technicians recorded field measurements of pH, temperature, conductivity, dissolved oxygen, and REDOX for each groundwater and surface water sampling location (Table B.5). The depth to the static water level was converted from pressure measurements for each sampling port in Westbay™ wells GW-134, GW-722, and GW-729. Additionally, REDOX and dissolved oxygen were not recorded for the Westbay™ wells

because the measurements are not applicable when a well is equipped with a multiport sampling system. Field measurements were obtained in accordance with the most recent and approved technical procedures referenced in the CY 2011 SAP for the Y-12 GWPP (B&W Y-12 2009a). The field measurements recorded for the sampling locations in each regime are presented in Appendix D (Bear Creek Regime), Appendix E (East Fork Regime), and Appendix F (Chestnut Ridge Regime).

Most of the CY 2011 groundwater samples and surface water samples were analyzed for: (1) TDS and total suspended solids; (2) major ions and trace metals; (3) VOCs; and (4) gross alpha and gross beta activity (Table B.5). The Y-12 GWPP implemented selective parameter monitoring during CY 2011 for selected monitoring wells. To qualify, a well must have analytical data for eight or more groundwater samples obtained since January 1991 (B&W Y-12 2009a) that clearly demonstrate that the selected parameters are the contaminants of concern and provide sufficient data for the other parameters. For example, samples from 17 monitoring wells were analyzed only for VOCs, and historical data for these locations show consistently low results for inorganic and radiochemical analytes. The CY 2011 results provide the data necessary to meet requirements of the Y-12 GWPP monitoring program.

Laboratory analyses of the samples were performed by the Y-12 Analytical Chemistry Organization (ACO) laboratories in accordance with the analytical methods and procedures listed in Table B.5. Analytical results are presented in Appendix D (Bear Creek Regime), Appendix E (East Fork Regime), and Appendix F (Chestnut Ridge Regime).

3.5 DATA MANAGEMENT AND DQO EVALUATION

The following discussion pertains to the data management protocols associated with the CY 2011 groundwater and surface water sampling activities directed by the Y-12 GWPP. Field measurements and results of specified laboratory analyses performed for the samples collected from each well, spring, and surface water station during CY 2011 were provided to the GWPP in electronic files and hardcopy printouts provided by the ACO. Electronic files and hardcopy printouts of 10% of the monitoring data obtained under the Y-12 GWPP were verified in accordance with the *Y-12 Groundwater Protection Program Data Management Plan* (BWXT 2003a). Appropriate ACO staff and personnel in the B&W Y-12 Information Technology Department worked to resolve any incomplete data transfers, irregular parameter names or reporting units, and discrepancies between electronic and hardcopy versions of the data. All data management functions were performed using Microsoft Access to maintain the GWPP Analytical Data Management System, a component of the GWPP Groundwater Information Management System (GIMS).

The BJC/UCOR data management process (BJC 2007) is similar to the process described above for the Y-12 GWPP. Analytical results and field measurements associated with monitoring programs managed by BJC/UCOR were extracted from the Oak Ridge Environmental Information System and uploaded into the GWPP GIMS by personnel in the B&W Y-12 Information Technology Department. Data were then extracted from GIMS and formatted for presentation in this report.

The CY 2011 groundwater and surface water monitoring data presented in this report have been evaluated with respect to the DQO criteria defined in the *Y-12 Groundwater Protection Program Data Management Plan* (BWXT 2003a). Specific DQO criteria apply to analytical results for field measurements, major ions, trace metals, VOCs, radiological analytes (gross alpha, gross beta, and radionuclides), and miscellaneous laboratory analytes (e.g., total suspended solids). Monitoring results that do not meet applicable DQOs are flagged with an “R” (unusable) or “Q” (inconsistent with historical data) qualifier and described in the introductory section of the applicable data appendices (Appendix D, Appendix E, and Appendix F). Functionally equivalent DQO criteria were employed for most of the monitoring programs

managed by BJC/UCOR (BJC 2010a, BJC 2010c, and EnergySolutions 2007). All of the data obtained to meet RCRA and SWDF monitoring requirements have been similarly evaluated; however, portions of the data obtained to meet CERCLA monitoring requirements have not been fully evaluated. Therefore, some results obtained during 2011 from BJC/UCOR that are presented in this report may not meet the GWPP DQOs.

3.6 GROUNDWATER ELEVATION MONITORING

As shown in Table 5, selected monitoring wells in the Bear Creek, East Fork, and Chestnut Ridge hydrogeologic regimes were used to monitor groundwater elevations during seasonally high flow conditions in CY 2011.

Table 5. Summary of CY 2011 groundwater elevation monitoring in the Bear Creek, East Fork, and Chestnut Ridge regimes

REGIME	DEPTH-TO-WATER MEASUREMENTS		GROUNDWATER ELEVATIONS	
	No. of Wells	Dates	Data	Contour Map
Bear Creek	76	April 12-13, 2011	Table B.6	Figure A.4
East Fork	62	April 11-14, 2011	Table B.7	Figure A.5
Chestnut Ridge	77	April 11-14, 2011	Table B.8	Figure A.6

Field personnel measured the depth to the static water surface in each well in accordance with the operating procedure (BWXT 2004).

4.0 CY 2011 MONITORING DATA

The monitoring data obtained in CY 2011 for compliance with the requirements of DOE Orders 436.1 and 458.1 is presented in this section. Separate discussions of the surveillance monitoring and exit pathway/perimeter monitoring data are provided for the Bear Creek, East Fork, and Chestnut Ridge hydrogeologic regimes. Each discussion of data focuses on the analytical results for the principal groundwater contaminants at Y-12, which are nitrate, uranium, VOCs, gross alpha activity, and gross beta activity. Elevated levels of the contaminants are defined as results that exceed the following screening levels: (1) nitrate concentrations above the MCL for drinking water (10 mg/L); (2) total uranium concentrations above the MCL (0.03 mg/L); (3) individual VOC concentrations exceeding applicable MCLs or summed VOC concentrations exceeding 5 µg/L; (4) gross alpha activity above the MCL (15 pCi/L); and (5) gross beta radioactivity above the SDWA screening level of 50 pCi/L for a 4 mrem/yr dose equivalent (the MCL for gross beta activity).

A more detailed analysis and interpretation of the monitoring data for groundwater and surface water sampling locations is contained in the *Y-12 Groundwater Protection Program Groundwater Monitoring Data Compendium* (B&W Y-12 2009d), hereafter referenced as the GWPP Compendium. For each applicable well, spring, and surface water station, the GWPP compendium provides (1) a sampling history, including sampling methods and distinguishing sampling characteristics; (2) an evaluation of hydrologic data (pre-sampling groundwater elevations and available aquifer test data); (3) a discussion of geochemical characteristics of the groundwater or surface water; and (4) a thorough evaluation of the available sampling results for nitrate, uranium, VOCs, gross alpha activity, and gross beta activity, including data summary tables and trend graphs.

In addition to the data evaluation in the GWPP compendium, the following technical reports issued by BJC/UCOR analyze and interpret the CY 2011 monitoring results for the applicable RCRA, CERCLA, and SWDF sampling locations in the Bear Creek Regime, East Fork Regime, and Chestnut Ridge Regime: the *2012 Remediation Effectiveness Report* (DOE 2012), the *Calendar Year 2011 Resource Conservation and Recovery Act Annual Monitoring Report* (UCOR 2012a), the *Annual Report for FY 2011 Detection Monitoring at the Environmental Management Waste Management Facility, Oak Ridge, Tennessee* (DOE 2012) and each semiannual *Groundwater Monitoring Report for the Oak Ridge Reservation Landfills* (BJC 2011d and UCOR 2011).

4.1 SURVEILLANCE MONITORING

Groundwater quality monitoring data collected during CY 2011 were evaluated to determine if any changes have occurred in areas that are, or could be, affected by Y-12 operations. Due to inherent differences in their characteristics, these evaluations were done for each hydrogeologic unit (aquitard and aquifer) within each hydrogeologic regime (Bear Creek, East Fork, and Chestnut Ridge).

4.1.1 Bear Creek Regime

In CY 2011, groundwater samples were collected from 63 surveillance monitoring wells in the Bear Creek Regime (Table B.2). Forty-three of these wells are completed in the geologic formations comprising the aquitard in BCV (Nolichucky Shale, Maryville Limestone, Rogersville Shale, Pumpkin Valley Shale, and Rome Formation). Twenty-two wells are completed in the geologic formations that comprise the aquifer in BCV (Copper Ridge Dolomite and Maynardville Limestone). Groundwater samples were collected from sampling ports in both the aquitard and aquifer in Westbay™ wells GW-134 (Figure A.13) and GW-729 (Figure A.14).

4.1.1.1 Aquitard Wells

Elevated concentrations of one or more of the principal groundwater contaminants at Y-12 were reported for the groundwater samples collected during CY 2011 from 22 aquitard wells in the Bear Creek Regime (Table B.9). The presence of contaminants in the groundwater at these wells is attributable to the transport/migration of the mobile components of groundwater contaminant plumes emplaced during historical operations of the former S-3 Ponds, the OLF WMA, and the BCBG WMA. These sites are closed former hazardous waste disposal units that are presently regulated under a RCRA post-closure permit. Additionally, the types and concentrations of contaminants detected in the groundwater samples collected from these wells during CY 2011 are generally consistent with the overall extent of nitrate (Figure A.7), total uranium, VOCs (Figure A.8), gross alpha activity (Figure A.9), and gross beta activity (Figure A.10) defined by the available data for the existing network of wells completed in the aquitard formations in BCV west of Y-12.

Nitrate and Uranium

As shown in Table 6, elevated concentrations of nitrate (>10 mg/L) and/or total uranium (>0.03 mg/L) were reported for at least one groundwater sample collected during CY 2011 from eight aquitard wells in the Bear Creek Regime, listed below in sequence from closest to farthest from the S-3 Site (from northeast [hydraulically upgradient] to southwest [hydraulically downgradient]), which is the source of the nitrate and uranium in the groundwater from each well.

Table 6. Bear Creek Regime CY 2011: elevated nitrate and uranium concentrations in surveillance monitoring aquitard wells

Well Number	Direction - Distance from S-3 Site (Figure A.7)		Total Depth (ft bgs)	Nitrate (mg/L)		Uranium (mg/L)	
				Jan-June 2011	Jul-Aug 2011	Jan-June 2011	Jul-Aug 2011
GW-615	South	50 ft	245	11,599	NS	1.05	NS
GW-246		50 ft	76	NS	2,799	NS	0.416
GW-276	Southeast	200 ft	18.5	10	11	0.41	0.38
GW-134-21		300 ft	381	474	NS	0.00402	NS
GW-134-18		300 ft	436	1,240	NS	0.00352	NS
GW-134-15		300 ft	496	1,480	NS	0.00293	NS
GW-134-11		300 ft	588	728	NS	0.00232	NS
GW-134-05		300 ft	750	1,420	NS	0.00312	NS
GW-616	Southwest	400 ft	269	248	NS	.	NS
GW-526	West	1,300 ft	114.6	1,240	NS	NA	NS
GW-537		2,500 ft	23.3	NS	302	NS	NA
GW-085		3,000 ft	58.8	19.5	NS	.	NS
MCL				10		0.03	
Note: “. ” = Not detected; NA = Not analyzed; NS = Not sampled; BOLD = Exceeds MCL.							

These sampling results show that the highest nitrate concentrations occur in the groundwater from wells located directly south (geologically down-dip) of the S-3 Site (GW-615 and GW-246). These results, along with nitrate results for the deepest zones of Westbay™ well GW-134 (Figure A.13), reflect the density-driven vertical (dip-parallel) migration of the highly mineralized acidic wastes disposed at the site. The very high nitrate levels in the groundwater samples from well GW-526 confirm the substantial westward transport of nitrate via strike-parallel flowpaths (e.g., bedding plane fractures) at depth (>100 ft bgs) in the Nolichucky Shale. The high nitrate concentration in the shallow groundwater from well GW-537 (Figure A.7) is believed to reflect upwelling of nitrate-contaminated groundwater from

deeper flowpaths toward discharge features along NT-2. The elevated nitrate levels in the groundwater from well GW-085 indicate continued westward transport of nitrate in the shallow flow system west of NT-2, at least 3,000 ft from the S-3 Site.

As with nitrate, the CY 2011 groundwater sampling results show that the highest concentrations of total uranium occur geologically down-dip to the south of the S-3 Site. Elevated uranium concentrations in the Nolichucky Shale occur only in the low-pH groundwater near the S-3 Site.

The CY 2011 sampling results for the wells listed in Table 6 support the long-term concentration trends (Table B.9), with time-series plots of the nitrate and uranium data (excluding analytical results that do not meet applicable DQOs) for these wells generally showing:

- Decreasing trends for nitrate at GW-085, GW-101, GW-134-18, GW-134-21, GW-246, GW-276, and GW-537, and for uranium at well GW-276. These trends are illustrated by the nitrate data for wells GW-246 and GW-276 located near the S-3 Site and wells GW-085 and GW-537 located the farthest from the S-3 Site (Figure A.19). The decreasing trends reflect substantially reduced flux of nitrate and uranium in the groundwater following closure of the S-3 Ponds and installation of a low-permeability cap in 1988. Additionally, the decreasing concentrations may reflect the long-term cumulative effects of various natural attenuation processes. The data for well GW-085 show long-term fluctuations in nitrate concentrations, suggesting temporal pulses in the level of nitrate in the shallow groundwater.
- Indeterminate trends for nitrate at GW-134-05, GW-134-11, GW-134-15, GW-615, and GW-616 and for uranium at well GW-246, as illustrated by the uranium data for well GW-246 and nitrate data for well GW-615 (Figure A.19). The indeterminate trends are probably a function of the extensive mass of nitrate and uranium emplaced in the Nolichucky Shale beneath the site and the relatively low permeability of the hydrostratigraphic zone intercepted by the monitored interval in the wells.
- Increasing trends for nitrate at well GW-526 and for uranium at well GW-615 (Figure A.19). The increasing uranium concentrations indicated by the data for well GW-615 (excluding outliers in August 2000 and September 2010) potentially reflect a long-term increase in the relative vertical flux of uranium down-dip of the site. This increasing uranium at well GW-615 is somewhat conspicuous in light of the indeterminate trend for nitrate, which is far more mobile in groundwater than uranium. These divergent concentration trends at well GW-615 may reflect a stable nitrate plume (following an earlier arrival time) and a slowly expanding uranium plume with breakthrough evident during the gap in sample collection between 1993 and 2000. Recent monitoring results show that uranium levels at well GW-615 have decreased from the maximum concentration reported in May 2007 (1.65 mg/L) through February 2011 (1.06 mg/L).

Volatile Organic Compounds

Groundwater samples collected during CY 2011 from 15 aquitard wells in the Bear Creek Regime contained one or more dissolved VOCs at individual or summed concentrations of 5 µg/L or more (Table B.9). As shown in Table 7, the maximum concentration of eight VOCs reported for groundwater samples collected from 14 of these wells exceed the respective drinking water MCLs. The presence of dissolved VOCs in the groundwater at these wells reflects their transport/migration from the contaminant source areas emplaced during historical operations of the S-3 Ponds (three wells), OLF (three wells), and various waste disposal areas within the BCBG WMA (11 wells).

**Table 7. Bear Creek Regime CY 2011: maximum VOC concentrations
in surveillance monitoring aquitard wells**

Location/ Well Number (Figure A.8)	Maximum Concentration (µg/L)								
	Chloroethenes					Chloroethanes		Chloro- methane	Petroleum
	PCE	TCE	c12DCE	11DCE	VC	111TCA	11DCA	MC	Benzene
S-3 Site									
GW-246	120	2	.	3	.	.	.	.	14
GW-276	6.2	.	.	.	.	.	.	.	.
OLF									
GW-008	47	13	26	7.8	.	.	14	1.3	.
GW-098	.	6	2	.	.	.	.	.	.
BCBG									
GW-014	18	150	820	45	180	.	190	.	.
GW-046	1,000	980	4,300	60	460	28	210	100	.
GW-068	.	87	2,000	250	460	.	970	140	3
GW-071	300	49	23	65	.	190	2,100	830	.
GW-082	.	2	430	6	140	.	120	6	.
GW-242	.	.	42	.	18	.	3	.	.
GW-289	670	22	10	.	.	.	.	.	.
GW-623	690	2,600	190	80	58	.	1,100	2	12
GW-627	780	290	50	46	64	.	120	.	.
GW-653	10	12	75	3	.	.	5	.	.
GW-729-18	.	.	.	.	.	.	.	.	4
GW-729-22	.	.	.	.	.	.	.	.	3
GW-729-34	.	.	.	.	.	.	.	.	22
MCL	5	5	70	7	2	200	NA	5	5
Note: “.” = Not detected; BOLD = Exceeds MCL.									

As shown in the preceding data summary, extremely high concentrations (>1,000 µg/L) of VOCs (PCE, TCE, c12DCE, and 11DCA) were detected in the groundwater samples collected from several wells located at the BCBG. These results primarily reflect migration/transport of dissolved VOCs in the Nolichucky Shale directly south (down-dip) and/or southwest (along strike) of BG-A South (Figure A.8).

The CY 2011 sampling results for the wells listed in Table 7 support long-term summed VOC (e.g., chloroethenes) concentration trends (Table B.9), with time-series plots of the VOC data for each well generally showing:

- Decreasing trends for wells GW-014, GW-071, GW-098, and GW-276, as illustrated by the PCE results for wells GW-014 and GW-276 (Figure A.20). The decreasing concentration trends reflect a combination of several factors, primarily the substantially reduced flux of VOCs following closure of the former S-3 Ponds, OLF WMA, and BCBG WMA, the components of which were closed in 1986-1988 and covered by low-permeability caps in 1989. Along with reduced flux from the respective source areas, the long-term cumulative effects of various natural attenuation processes, including biologically mediated degradation, also explain the decreasing concentrations of VOCs in the groundwater at these wells.

- Indeterminate trends for wells GW-046, GW-082, GW-242, GW-289, GW-623, GW-729-18, GW-729-22, and GW-729-34 located hydraulically downgradient of the BCBG WMA, as illustrated by the PCE results for wells GW-046 and GW-289 (Figure A.20). For example, PCE concentrations at well GW-046 show wide (seasonal, with peak concentrations in July) fluctuations, but similar results were reported for the groundwater samples collected from the well in January 1998 (1000 µg/L), January 2006 (1000 µg/L), and July 2011 (1000 µg/L).
- Increasing trends for well GW-246 at the S-3 Site, well GW-008 at the OLF WMA, and wells GW-068, GW-627, and GW-653 at the BCBG WMA. The increasing trend indicated by the PCE data for well GW-246 (Figure A.20) spans a 14-year gap (January 1990 - March 2004) in the sampling history for the well. Increasing concentrations of VOCs indicated by the sampling results for wells GW-627 (Figure A.20) and GW-653 potentially reflect an increase in the relative flux of VOCs via the strike-parallel flowpaths in the Nolichucky Shale west of BG-A South, following down-dip migration of dissolved VOCs in the groundwater and DNAPL in the nearby subsurface.

Divergent concentration trends for individual chloroethenes in groundwater from well GW-068 at the BCBG WMA indicate biodegradation. The CY 2011 results show that c12DCE, 11DCE, and VC are the chloroethenes with the highest concentrations (Table 7). Historical data for the well show clearly decreasing trends for concentrations of PCE and TCE (parent compounds), with clearly increasing trends for concentrations of c12DCE and VC (degradation products), as shown by a time-series plot of the PCE and 12DCE concentrations (Figure A.20).

Gross Alpha and Gross Beta Activity

Groundwater samples collected during CY 2011 from 12 of the aquitard wells used for surveillance monitoring in the Bear Creek Regime contained gross alpha activity and/or gross beta activity above the associated minimum detectable activity (MDA) and the corresponding total propagated uncertainty (TPU). As shown in Table 8, elevated levels of gross alpha activity (>15 pCi/L) and/or gross beta activity (>50 pCi/L) were reported for five of these wells.

Table 8. Bear Creek Regime CY 2011: elevated gross alpha activity and gross beta activity in surveillance monitoring aquitard wells

Well	Date Sampled	Gross Alpha Activity (pCi/L)				Gross Beta Activity (pCi/L)			
		MDA	Activity±TPU			MDA	Activity ± TPU		
GW-246	08/08/11	29	98	±	80	42	14,000	±	120
GW-276	01/11/11	2.5	131	±	22	5.03	196	±	31.8
GW-276	07/11/11	2.03	125	±	20.7	4.22	209	±	33.7
GW-537	08/24/11	7.4		<MDA		5.9	140	±	7.5
GW-615	02/02/11	310	440	±	250	360	520	±	220
GW-729-30	06/27/11	18		<MDA		31	83	±	42
Screening Level		15				50			

The elevated levels of gross alpha activity and gross beta activity reflect transport/migration of uranium isotopes and Tc-99, respectively, from the groundwater contaminants (acidified wastes) emplaced at the source during historical operation of the former S-3 Ponds. As with total uranium, the relatively limited extent of elevated gross alpha activity indicated by the CY 2011 sampling results reflects the limited mobility of uranium isotopes beyond the acidic groundwater in the Nolichucky Shale within approximately 500 ft of the site.

As shown by the CY 2011 sampling results summarized in Table 8 and shown on Figure A.10, gross beta activity remains extremely high ($>10,000$ pCi/L) in groundwater from the Nolichucky Shale nearest to the S-3 Site (well GW-246), and exceeds 100 pCi/L in the shallow groundwater 2,500 ft west of the site (well GW-537). Historical data show that Tc-99 is the primary beta-emitting radionuclide in the groundwater at each of these wells. Considered a “signature” contaminant from the former S-3 Ponds, Tc-99 is believed to occur as an ion (TcO_4) that, like nitrate, is not readily attenuated in the subsurface and is highly mobile in the groundwater. This largely explains the similar distribution of nitrate and elevated gross beta activity in the aquitard near the site.

The gross alpha and gross beta activity reported for the groundwater samples collected during CY 2011 support the long-term trends indicated by historical data (Table B.9). Time-series plots of the gross alpha and/or gross beta activity reported for each applicable well, excluding results that do not meet applicable DQOs, generally show:

- Decreasing gross alpha and gross beta trends for wells GW-246 and GW-276 (Figure A.21), which are located south and southeast, respectively, of the S-3 Site (Figure A.11). As shown by data for well GW-276, the decreasing trends for gross alpha and gross beta activity mirror the concurrently decreasing trends evident for nitrate and uranium (Figure A.19) and PCE (Figure A.20). As with the other contaminants in the groundwater from this well, the decreasing levels of gross alpha and gross beta activity likewise primarily reflect the substantially reduced flux of uranium isotopes and Tc-99 that occurred after the former S-3 Ponds were closed and capped.
- Indeterminate trends for gross beta activity at wells GW-537, GW-615, and GW-729-30, as shown by the gross beta results for well GW-537 (Figure A.21). As noted previously, the nitrate concentrations at well GW-537 show a generally decreasing trend (Figure A.19), and the gross beta trend also appears to be decreasing in the groundwater samples collected from the well since August 2003 (659 pCi/L). Groundwater is highly mineralized at well GW-615, which interferes with laboratory analyses for gross activity. Therefore, historical data shows inconsistent detections above elevated MDAs (see Table 8).

4.1.1.2 Aquifer Wells

Elevated concentrations of one or more of the principal groundwater contaminants at Y-12 were reported for the groundwater samples collected during CY 2011 from 20 aquifer wells in the Bear Creek Regime (Table B.9). The presence of contaminants in the groundwater from these aquifer wells is attributable to the migration of groundwater contaminant plumes emanating from historical operations of the former S-3 Ponds, Spoil Area I, Rust Spoil Area, the OLF WMA, and the BCBG WMA and intermixing during transport in the Maynardville Limestone. The types and concentrations of contaminants detected in the groundwater samples collected from these wells during CY 2011 are generally consistent with historical data that define the overall extent of nitrate (Figure A.7), total uranium, VOCs (Figure A.8), gross alpha activity (Figure A.9), and gross beta activity (Figure A.10) in the Maynardville Limestone (and lower Knox Group) in BCV west of Y-12.

Nitrate and Uranium

Elevated concentrations of nitrate (>10 mg/L) and/or total uranium (>0.03 mg/L) were reported for 11 of the aquifer wells used for surveillance monitoring in the Bear Creek Regime, listed below in Table 9 in sequence from closest to farthest from the S-3 Site.

Table 9. Bear Creek Regime CY 2011: elevated nitrate and uranium concentrations in surveillance monitoring aquifer wells

Well Location / Number		Distance and Direction from S-3 Site (Figure A.7)	Nitrate (mg/L)		Uranium (mg/L)		
			Jan-June 2011	Aug 2011	Jan-June 2011	Aug 2011	
S-3 Site	GW-134-36	350 ft Southeast	24.4	NS	.	NS	
	GW-134-35		41.2	NS	.	NS	
	GW-134-33		32.6	NS	.	NS	
Exit Pathway Picket C	GW-122	375 ft Southwest	NS	159	NS	0.00241	
	GW-100	1,150 ft Southwest	22.6	NS	0.0015	NS	
	GW-236	1,650 ft Southwest	NS	10.2	NS	0.00565	
	GW-724	3,000 ft West	13.1	NS	NA	NS	
	OLF WMA	GW-601	4,500 ft West	15.6	NS	NA	NS
		GW-225	4,600 ft West	40.5	NS	0.00211	NS
GW-229		5,000 ft West	.	NS	0.12	NS	
Exit Pathway Picket B	GW-703	7,000 ft West	15.8	NS	0.0146	NS	
	GW-706		15	12	0.059	0.057	
BCBG WMA	GW-058	9,000 ft West	9.53	NS	0.0389	NS	
MCL			10		0.03		
Note: “.” = Not detected; NS = Not sampled; NA = Not analyzed; BOLD = Exceeds MCL.							

These sampling results show that elevated nitrate concentrations in the aquifer extend beyond 7,000 ft west of the S-3 Site (e.g., GW-706). Elevated concentrations of total uranium were reported only for groundwater samples from wells GW-229, GW-706 and GW-058, which are located hydraulically downgradient to the west of the BYBY (Figure A.9). Uranium-bearing wastes were buried at depths below the seasonally high water table at the BYBY. Carbonate dissolved from the limestone bedrock combined with uranyl cations leached from the wastes, which greatly increased the otherwise limited mobility of uranium in the neutral pH groundwater typical of the Maynardville Limestone (DOE 1997a). The bulk of these wastes was excavated and removed during CERCLA remedial actions completed in May 2003.

Elevated concentrations of nitrate and/or uranium in the groundwater samples collected during CY 2011 from the aquifer wells in the Bear Creek Regime support the respective long-term concentration trends indicated by historical data (Table B.9). Time-series plots of the nitrate and uranium data generally show:

- Decreasing trends for nitrate at eight wells (GW-100, GW-122, GW-134 (three ports), GW-225, GW-236, GW-601, GW-706, and GW-724) and for uranium at well GW-706, as illustrated by nitrate and uranium data for well GW-706 (Figure A.22). Decreasing nitrate concentrations reflect a combination of substantially reduced flux of nitrate in the Maynardville Limestone after the former S-3 Ponds were closed and capped, and the cumulative effectiveness of various natural attenuation processes, including the outflow of nitrate-contaminated groundwater into Bear Creek. The sharp

decrease in uranium concentrations at well GW-706 between January and July 2003 may be attributable to the CERCLA remedial actions at the BYBY that were completed in May 2003.

- Indeterminate trends for uranium at well GW-058 and nitrate at well GW-703. The monitoring history for well GW-058 spans a 14-yr sampling gap (September 1992 - June 2006) and recent results show widely fluctuating uranium (and nitrate) concentrations. The indeterminate nitrate trend at well GW-703 (Figure A.22) along with consistently low water level recovery during sample collection suggests that the well yields contaminated groundwater from flow/transport pathways that are not well connected to the most permeable karst network in the Maynardville Limestone. The trend suggests minimal overall change in the relative flux of nitrate within the hydrostratigraphic zones intercepted by the monitored interval.
- An increasing uranium trend for well GW-229 (Figure A.22). Sampling results for well GW-229 show that uranium concentrations increased by an order of magnitude between September 1995 (0.014 mg/L) and March 2002 (0.238 mg/L) then generally decreased through February 2011 (0.12 mg/L). The decreasing uranium trend indicated by the more recent data suggest reduced flux of uranium in response to the removal of uranium-bearing wastes during CERCLA remedial actions at the BYBY.

Volatile Organic Compounds

Groundwater samples collected during CY 2011 from 16 aquifer wells contained individual or summed VOC concentrations of 5 µg/L or more (Table B.9). As shown in Table 10, the maximum concentrations of PCE, TCE, c12DCE, 11DCE, VC, and benzene reported for at least one groundwater sample from one or more wells exceed the respective drinking water MCLs.

Table 10. Bear Creek Regime CY 2011: maximum VOC concentrations in surveillance monitoring aquifer wells

Well Number	Maximum Concentration (µg/L)					
	Chloroethenes					Petroleum Benzene
	PCE	TCE	c12DCE	11DCE	VC	
GW-053	.	.	7	.	.	.
GW-134-33	7	3	.	.	.	.
GW-134-35	14	7	4	.	.	.
GW-225	.	290	3	3	.	.
GW-229	.	3	210	27	65	10
GW-307	.	11	3	.	.	.
GW-315	5	2	.	.	.	.
GW-365	.	3	34	11	4	.
GW-601	5	69	.	.	.	.
GW-703	.	11	9	.	.	.
GW-704	.	26	4.6	2.1	.	.
GW-706	0.43	13	29	4.6	.	.
GW-724	3	73	.	.	.	.
GW-725	.	8	.	.	.	.
GW-729-39	.	4	.	.	.	.
GW-729-44	.	13	.	.	.	.
GW-738	.	14	.	.	.	.
GW-740	.	42	.	.	.	.
MCL	5	5	70	7	2	5
Note: “.” = Not detected; BOLD = Exceeds MCL.						

Sampling results for these wells also show that TCE is the primary VOC in the intermingled plume of contaminants in groundwater from the Maynardville Limestone west of Y-12, with input to the plume from multiple confirmed sources, including the Rust Spoil Area and the OLF WMA (Figure A.8). The CY 2011 sampling results show elevated PCE and/or TCE in the groundwater from several of these wells without concurrent detection of degradation products (e.g., c12DCE) suggesting that the geochemical characteristics of the groundwater near these wells are not especially conducive to biologically mediated degradation processes (reductive dechlorination).

These VOC results support the long-term summed VOC (e.g., chloroethenes) concentration trends (Table B.9), with time-series plots of the VOC data for each well generally showing:

- Variable but generally decreasing trends for 11 wells (GW-053, GW-134 [-33 and -35], GW-225, GW-307, GW-315, GW-365, GW-601, GW-703, GW-704, GW-738, and GW-740), as illustrated by TCE data for wells GW-704 and GW-738 (Figure A.23). The decreasing concentration trends reflect the substantially reduced flux of VOCs following closure of principal source areas (e.g., OLF WMA), and the long-term cumulative effects of various natural attenuation processes.
- Indeterminate trends for 11DCA and benzene at well GW-229 and for summed chloroethenes at wells GW-706, GW-724, and GW-725, as illustrated by the TCE data for wells GW-706 and GW-724 (Figure A.23). The relatively unchanged levels of VOCs in the groundwater from these wells suggest there is minimal change in the advective flux of VOCs in the hydrostratigraphic zone monitored by each well.
- A generally increasing trend for summed chloroethenes at well GW-229, as illustrated by the 12DCE and 11DCE results for the well (Figure A.23). The data for this well and well GW-365 are clearly distinguishable from the other wells listed in Table 10 by the dominant concentrations of TCE degradation products (c12DCE, 11DCE, and VC). The increasing concentrations do not reflect any clear response to the CERCLA remedial actions at the BYBY. This suggests that the site is not a significant source of the VOCs in the groundwater from the well. However, Sanitary Landfill I is located upgradient and along geologic strike to the east of well GW-229, and may be the source of VOCs in groundwater at the well.

Divergent concentration trends observed for individual chloroethenes indicate ongoing biodegradation near wells GW-229 and GW-365. For example, the low-flow sampling results from March 2001 to February 2011 reported for well GW-365 show that TCE (parent compound) concentrations decreased from 54 µg/L to 3 µg/L while c12DCE (degradation product) concentrations concurrently increased from 17 µg/L to 34 µg/L (Figure A.23).

Gross Alpha and Gross Beta Activity

Groundwater samples collected during CY 2011 from 17 aquifer surveillance monitoring wells contained gross alpha and/or gross beta activity above the associated MDA and the corresponding TPU. However, as shown in Table 11, only samples from five of these wells had elevated levels of gross alpha activity (>15 pCi/L) and/or gross beta activity (>50 pCi/L).

Table 11. Bear Creek Regime CY 2011: elevated gross alpha activity and gross beta activity in surveillance monitoring aquifer wells

Well	Date Sampled	Gross Alpha Activity (pCi/L)				Gross Beta Activity (pCi/L)			
		MDA	Activity ± TPU			MDA	Activity ± TPU		
GW-058	01/26/11	5.1	20	±	5.5	6.8	32	±	5.6
GW-134-33	05/26/11	5		<MDA	8.4	64	±	7.7	
GW-134-35	06/02/11	5		<MDA	7.1	82	±	7.9	
GW-229	02/08/11	8.5	36	±	8.3	8.4	53	±	7.3
GW-703	02/14/11	3.1	18	±	5.1	7.8	50	±	7
GW-706	02/17/11	2.51	20.6	±	4.46	4.33	35.2	±	6.47
GW-706	08/04/11	3.27		<MDA		4.48		<MDA	
Screening Level		15				50			
Note: BOLD = Exceeds screening level.									

Elevated gross alpha and gross beta activity in the groundwater at these wells reflects the transport/migration of uranium isotopes (and beta-emitting decay products of uranium) and Tc-99, the principal radiological components of the intermingled contaminant plume in the Maynardville Limestone.

The CY 2011 monitoring results show that the highest level of gross alpha activity occurs in the groundwater from aquifer well GW-229, located downgradient (west-southwest) of the former BYBY (Figure A.9). These results are consistent with historical data for the well, which show that uranium isotopes are the principal source of gross alpha activity and that beta-emitting uranium decay products (e.g., thorium-234) are the principal source of gross beta activity. The primary source of uranium isotopes in the groundwater from this well is considered to be the uranium-bearing wastes that were disposed at the BYBY (see Sect. 2.4.1.2). Elevated gross beta activity at well GW-134 reflects Tc-99 from the S-3 Site and the elevated gross beta at GW-703 reflects a combination of the uranium decay products from the BYBY and Tc-99 from the S-3 Site.

The elevated gross alpha and gross beta activity in samples collected from aquifer wells during CY 2011 supports long-term trends indicated by respective historical data (Table B.9). Time-series plots of the gross alpha and/or gross beta activity reported for each applicable well generally show:

- Decreasing trends for gross alpha activity at well GW-706 and for gross beta activity at well GW-134. The decreasing gross alpha trend for well GW-706 (Figure A.24) reflects a similarly decreasing trend for gross beta activity that was below the screening level in CY 2010 and CY 2011. The long-term gross alpha trend for conventional sampling is highly variable and indeterminate. However, the trend for low-flow sampling results show a generally decreasing trend with a drop in alpha activity in July 2003 that is a possible response to the CERCLA actions at the BYBY completed in May 2003. The decreasing gross beta trends at the two zones in Westbay™ well GW-134 indicate reduced flux of Tc-99 that occurred after the former S-3 Ponds were closed and capped.
- Indeterminate gross alpha trends for wells GW-058 and GW-703 (Figure A.24). These widely-fluctuating long-term trends include sporadic results above 15 pCi/L and may reflect analytical variability rather than actual groundwater conditions. For example, historical data for well GW-703 show that gross alpha activity was less than 5 pCi/L in 30 of the 41 samples collected from the well since June 1991. Only three of the detected results exceeded 15 pCi/L, and each of these elevated results are separated by time gaps of eight or more years.

- Increasing trends for gross alpha activity at well GW-229 and gross beta activity at well GW-703, although both trends are indeterminate to decreasing since CY 2003 (Figure A.24). The gross alpha trend for well GW-229 is similar to the long-term trend for total uranium (Figure A.22) and suggests a reduction in the relative flux of uranium isotopes following removal of uranium-bearing wastes from the BYBY during CERCLA remedial actions completed in May 2003. The increasing gross beta trend at well GW-703 is conspicuous when compared to the stable trend in nitrate concentrations (Figure A.22), because both Tc-99 and nitrate are highly mobile components of the contaminant plume originating at the S-3 Site. Recent monitoring data (since CY 2003) suggest that the levels of gross beta activity in groundwater at well GW-703 have generally stabilized (similar to nitrate concentrations). Consistently low water level recovery during sample collection suggests that the well yields contaminated groundwater from flow/transport pathways that are not well connected to the most permeable karst network in the Maynardville Limestone.

4.1.2 East Fork Regime

In CY 2011, groundwater samples were collected from 75 surveillance monitoring wells in the East Fork Regime (Table B.3). Forty-eight of the wells are completed in geologic formations comprising the aquitard (Nolichucky Shale, Maryville Limestone, Rogersville Shale, Pumpkin Valley Shale, and Rome Formation). The remaining 27 wells are completed in geologic formations comprising the aquifer (Copper Ridge Dolomite and Maynardville Limestone).

4.1.2.1 Aquitard Wells

Elevated concentrations of one or more of the principal groundwater contaminants at Y-12 were reported for groundwater samples collected during CY 2011 from 35 aquitard monitoring wells in the East Fork Regime (Table B.10). The presence of principal contaminants in the groundwater at these wells is attributable to the transport/migration of the mobile components of the groundwater contaminant plumes originating from multiple sources, including the S-3 Site, the OSY, Rust Garage, and the WCPA in the western Y-12 area, various sources in the central Y-12 Area, and USTs in the eastern Y-12 area (see Sect. 2.4.2). Additionally, the types and concentrations of detected contaminants are generally consistent with nitrate (Figure A.7), total uranium, VOCs (Figure A.8), gross alpha activity (Figure A.9), and gross beta activity (Figure A.10) results for the existing network of wells completed in the aquitard formations in the western, central, and eastern Y-12 areas.

Nitrate and Uranium

Elevated concentrations of nitrate (>10 mg/L) or uranium (>0.03 mg/L) were detected in groundwater samples collected during CY 2011 from ten aquitard wells in the East Fork Regime. As shown in Table 12, elevated nitrate concentrations were reported for six wells in the western Y-12 area and three wells in the central Y-12 area. The wells listed below are sequenced from closest to farthest from the S-3 Site, the source of nitrate in the aquitard. Elevated levels of nitrate in the groundwater reflect the substantial transport of nitrate (and other similarly mobile contaminants) eastward from the former S-3 Ponds. During operation, the S-3 Ponds created a local mound in the water table that enabled the contaminants to migrate to the east of the hydrologic divide now separating the UEFPC and Bear Creek watersheds. These sampling results show that nitrate concentrations remain highest in the groundwater within approximately 1,500 ft of the S-3 Site (Figure A.7). The results also illustrate the preferred strike- and dip-parallel flow of groundwater in the water table interval (wells 55-2A, 55-2B, GW-274, and GW-633) and the shallow bedrock (<70 ft bgs) interval (wells 55-2C, GW-108, and GW-275) in the Nolichucky Shale east and southeast of the site.

Table 12. East Fork Regime CY 2011: elevated nitrate and uranium concentrations in surveillance monitoring aquitard wells

Well Location/Number/ Approx. Distance (ft) and Direction from S-3 Ponds (Figure A.7)			Nitrate (mg/L)		Uranium (mg/L)	
			Jan-April 2011	July 2011	Jan-April 2011	July 2011
Western Y-12 Area	GW-270	700 E	100	NS	0.00126	NS
	GW-272	1,350 E	778	NS	0.00783	NS
	GW-633	720 SE	725	NS	0.00094	NS
	GW-108	800 SE	7,700	6,600	0.013	0.012
	GW-274	1,300 SE	1,280	NS	0.00863	NS
	GW-275	1,300 SE	8,940	NS	0.00147	NS
Central Y-12 Area	55-2A	3,000 SE	227	NS	0.00362	NS
	55-2B	3,000 SE	299	NS	.	NS
	55-2C	3,000 SE	272	NS	0.000515	NS
	GW-204	5,100 SE	0.318	NS	0.0351	NS
MCL			10		0.03	
Note: “NS” = Not sampled; “.” = Not detected; BOLD = Exceeds MCL.						

Only the uranium results for samples collected from aquitard well GW-204 during CY 2011 exceeded the drinking water MCL. The CY 2011 sampling results are consistent with historical concentration trends (Table B.10), with time-series plots for each well generally showing:

- Decreasing nitrate trends for wells GW-108, GW-270, GW-274, and GW-633, as illustrated by historical data for wells GW-108, GW-274, and GW-633 (Figure A.25). The decreasing concentrations of nitrate in the Nolichucky Shale downgradient of the S-3 Site reflect substantially reduced flux of nitrate (and other mobile contaminants) in groundwater following closure of the site and installation of the low-permeability cap. The cumulative effectiveness of natural attenuation processes also decreases nitrate concentrations over time.
- Indeterminate trends for uranium at well GW-204 and nitrate at well GW-275 (Figure A.25). Well GW-204, located on the east side of Bldg. 9204-2 (Figure A.15), is installed in the pit where an underground storage tank was removed in August 1988. The source of uranium in the groundwater from this well has not been determined. Available data indicate a widely fluctuating, indeterminate long-term uranium concentration trend. The relatively unchanged nitrate level in the groundwater from well GW-275 seems unusual considering that the S-3 Ponds have been closed for more than 20 years. The persistently high level of nitrate probably reflects both the extensive volume (mass) of nitrate emplaced in the Nolichucky Shale beneath the site and the relatively low permeability of the groundwater flow pathways intercepted by the well. Well GW-275 is deeper than paired well GW-274.
- Increasing nitrate trends for wells 55-2A, 55-2B, 55-2C, and GW-272, as illustrated by historical data for wells 55-2B and GW-272 (Figure A.25). The increasing nitrate concentrations at these wells potentially reflect eastward migration of the S-3 Ponds contaminant plume in the Nolichucky Shale east of the site (DOE 1998).

Volatile Organic Compounds

One or more dissolved VOCs were detected at individual or summed concentrations of 5 µg/L or more in at least one groundwater sample collected during CY 2011 from 30 aquitard wells in the East Fork Regime (Table B.10). Summarized below in Table 13, these sampling results show maximum concentrations of

PCE, TCE, c12DCE, 11DCE, VC, CTET, MC, 12DCA, benzene, and toluene exceeding respective drinking water MCLs.

Table 13. East Fork Regime CY 2011: maximum VOC concentrations in surveillance monitoring aquitard wells

Y-12 Area/ Well	Maximum Concentration (µg/L)									
	Chloroethenes					Chloromethanes		Chloro-ethane	Petroleum	
	PCE	TCE	c12DCE	11DCE	VC	CTET	MC	12DCA	Benzene	Toluene
Western										
GW-108	9.1	4.8	.	1.8	.	.	55	.	1.9	.
GW-265	17	3	.	.	.	.	.	.	.	.
GW-268	.	.	7	4	.	.	.	.	.	.
GW-269	20	4	52	140	.	.	.	.	.	.
GW-274	1,100	9	37	.	4	.	21	.	190	.
GW-332	860	180	800	20	11	.	.	.	.	.
GW-337	330	360	1,100	43	12	.	.	.	.	.
GW-508	.	.	.	.	.	.	.	.	460	930
GW-633	180	3	5	.	.	.	10	.	370	.
Central										
55-2A	240	120	300	7	6	.	.	.	.	.
55-2B	390	200	400	11	11	.	.	.	.	.
55-2C	270	170	480	12	9	.	.	.	.	.
55-3A	38,000	3,400	2,600	30	55	.	.	.	.	.
55-3B	130,000	17,000	4,000	380	1,100	.	.	.	.	4
55-3C	11,000	1,600	1,500	34	110	.	.	.	.	.
56-2A	13	5	7	.	.	.	.	.	.	.
56-2B	740	62	78	.	.	.	.	.	.	.
56-2C	290	410	1,400	23	78	.	.	.	.	.
56-3A	33	5	8	.	.	.	.	.	.	.
56-3B	30	2	3	.	.	.	.	.	.	.
56-3C	270	26	47	.	.	.	.	.	.	.
56-4A	5	.	.	.	.	.	.	.	.	.
GW-656	48	1,600	130	110	4	.	.	.	.	.
GW-769	22	5	4	.	.	160	.	.	.	.
GW-770	.	.	.	.	.	46	.	.	.	.
GW-782	24	10	12	6	.	5	.	.	.	.
GW-783	13	7	8	.	.	.	.	.	.	.
GW-791	29	.	.	.	.	.	.	.	.	.
Eastern										
GW-383	360	180	840	5	6	.	.	.	.	.
GW-658	.	.	.	.	.	.	24	430	7,200	2,000
GW-762	2,500	240	71	59	5.7	.	.	.	.	.
MCL	5	5	70	7	2	5	5	5	5	1,000
Note: “.” = Not detected; BOLD = Exceeds MCL.										

The presence of dissolved VOCs reflects transport/migration from the contaminant plumes from several source areas, including the former S-3 Ponds, the OSY, the WCPA, former petroleum fuel dispensing facilities associated with the Rust Garage Area and the East End Fuel Facility, and various sources within the industrial areas of Y-12. Moreover, the extremely high concentrations (>1,000 µg/L) of VOCs in some wells suggest the likely presence of DNAPL in the aquitard underlying several areas within Y-12. For

example, the CY 2011 sampling data for wells 55-3A, 55-3B, and 55-3C (located in the central Y-12 area south of Bldg. 9201-5) show the highest dissolved concentrations of chlorinated hydrocarbons in the East Fork Regime.

The CY 2011 sampling results for these wells support the long-term summed VOC (e.g., chloroethenes) concentration trends (Table B.10), with time-series plots of the VOC data for each well generally showing:

- Decreasing trends for 14 wells, including four wells in the western Y-12 area (GW-265, GW-332, GW-337, and GW-508) and ten wells in the central Y-12 area (55-2A, 55-2B, 55-2C, 55-3C, 56-2A, 56-2C, 56-3A, GW-656, GW-783, and GW-791). These trends are illustrated by the summed chloroethene concentrations detected in the samples from wells GW-337 and GW-656 (Figure A.26). The decreasing concentration trends reflect several factors, such as the cumulative effectiveness of natural attenuation processes, including biologically mediated degradation. Decreasing VOC concentrations in samples from well 55-2B are concurrent with clearly increasing nitrate concentrations (Figure A.25), which suggest separate sources of VOCs and nitrate.
- Indeterminate trends for six wells, including well GW-268 in the western Y-12 area, wells 55-3A, 56-2B, 56-3B, and 56-3C in the central Y-12 area, and well GW-658 in the eastern Y-12 area. These trends are illustrated (Figure A.26) by summed VOCs detected in shallow wells 55-3A (chloroethenes) and GW-658 (petroleum hydrocarbons). Widely variable but essentially unchanged levels of VOCs suggest minimal changes in the advective flux of VOCs in groundwater pathways intercepted by each well.
- Increasing trends for wells GW-769 and GW-770 in the central Y-12 area and well GW-383 in the eastern Y-12 area. These trends are illustrated by the concentrations of chloroethenes in well GW-383 and chloromethanes in well GW-769 (Figure A.26). These wells yield VOC-contaminated groundwater from shallow depths (<60 ft bgs) in the Nolichucky Shale. Monitoring data for well GW-383 obtained since CY 2002 indicate a generally stable trend that has higher concentrations than previous samples. The increasing concentration trend at well GW-769 that began in CY 2000 suggests a corresponding increase in the relative flux of dissolved VOCs through the hydrostratigraphic zone monitored by the well.
- A mixture of summed VOC concentration trends (Table B.10) for seven wells, including wells GW-108, GW-269, GW-274, and GW-633 in the western Y-12 area, wells 55-3B and GW-782 in the central Y-12 area, and well GW-762 in the eastern Y-12 area. Historical data for each of the wells except for wells 55-3B and GW-782 show an increasing trend for summed chloroethenes, with indeterminate or decreasing trends for chloroethanes and/or chloromethanes. Wells GW-633 and GW-274 also show an increasing trend for petroleum hydrocarbons. The long term trends for wells 55-3B and GW-782 show decreasing or indeterminate summed VOC concentration trends.

Divergent concentration trends observed for individual chloroethenes in wells 56-2C and GW-383 are likely attributable to the effects of biotic and/or chemical degradation processes. Historical data for the wells show decreasing and/or indeterminate trends for concentrations of parent compounds (PCE and/or TCE), with increasing trends for concentrations of degradation products (c12DCE, 11DCE, and/or VC). For example, VOC results for well 56-2C show a decrease in summed PCE + TCE concentrations with a concurrent increase in summed c12DCE + 11DCE + VC concentrations (Figure A.26).

Gross Alpha and Gross Beta Activity

Groundwater samples collected during CY 2011 from 21 aquitard wells contained gross alpha activity and/or gross beta activity above the associated MDA and the corresponding TPU (Appendix E.3). However, as shown in Table 14, only six of these wells had elevated gross alpha activity (>15 pCi/L) and/or gross beta activity (>50 pCi/L).

Table 14. East Fork Regime CY 2011: elevated gross alpha activity and gross beta activity in surveillance monitoring aquitard wells

Location and Well	Date Sampled	Gross Alpha (pCi/L)				Gross Beta (pCi/L)			
		MDA	Activity	±	TPU	MDA	Activity	±	TPU
Western Y-12 Area									
GW-108	01/20/11	55.9	96.2	±	40.3	69.5	12,300	±	1970
GW-108	07/19/11	64.6	101	±	46	120	13,100	±	2110
GW-274	04/20/11	17		<MDA		21	2,800	±	57
GW-275	04/21/11	130	210	±	210	270		<MDA	
GW-505	10/18/11	4	28	±	5.4	8.9		<MDA	
GW-633	03/01/11	27		<MDA		28	1,400	±	57
Central Y-12 Area									
GW-204	02/23/11	4	34	±	5.5	8		<	
Screening Level		15				50			

Groundwater transport/migration of alpha- and beta-emitting radionuclides from the contaminant plume emplaced during historical operations of the former S-3 Ponds accounts for the elevated levels of gross alpha and gross beta activity in the groundwater from wells in the western Y-12 area. Uranium isotopes are the primary alpha-emitting radionuclides in the contaminant plume originating from this site and uranium decay products probably account for some of the gross beta activity in the groundwater. However, Tc-99 is the “signature” component of the S-3 Ponds contaminant plume in the East Fork Regime and is the principal beta-emitting radionuclide in the Nolichucky Shale east of the site. The elevated gross alpha activity (as with the elevated uranium concentration) reported for well GW-204 indicates groundwater transport of radiological contaminants (primarily uranium isotopes) from a legacy production-related source within the central Y-12 area (Figure A.9).

The elevated gross alpha and gross beta activity in groundwater samples collected from aquitard wells during CY 2011 support the long-term trends indicated by historical data (Table B.10). Time-series plots of the gross alpha and/or gross beta activity reported for each well show:

- A decreasing gross beta trend for well GW-633 (Figure A.27). As with the decreasing nitrate concentration trend at the well (Figure A.25), the decreasing gross beta activity reflect reduced flux of mobile contaminants in groundwater following closure of the S-3 Site and installation of the low-permeability cap .
- Indeterminate trends at wells GW-108 (gross alpha), GW-204 (gross alpha), GW-274 (gross beta), GW-275 (gross alpha), and GW-505 (gross alpha), as illustrated by the gross alpha data for wells GW-108 and GW-204 (Figure A.27). Widely variable and not clearly increasing or decreasing levels of gross alpha activity in the groundwater from these wells suggest minimal change in the flux of alpha-emitting radionuclides (primarily uranium isotopes) in the groundwater.
- An increasing gross beta trend for well GW-108 (Figure A.27) that reflects an increase in the flux of Tc-99 (and possibly other beta-emitting radionuclides) in the groundwater pathways intercepted by the

well. The increasing gross beta activity trend contrasts with the decreasing nitrate concentration trend for the well. Considering that both contaminants share a common source (the S-3 Site), the increasing levels of gross beta activity suggest that Tc-99 levels remain unaffected by natural attenuation processes that reduce nitrate concentrations. However, the gross beta activity shows a generally decreasing trend since the maximum result in January 2008, suggesting a temporal pulse of Tc-99 activity in groundwater.

4.1.2.2 Aquifer Wells

Elevated concentrations of one or more of the principal groundwater contaminants at Y-12 were reported for groundwater samples collected during CY 2011 from 18 surveillance monitoring aquifer wells in the East Fork Regime (Table B.10), including three wells located in the western Y-12 area; seven wells located in the central Y-12 area; seven wells in the eastern Y-12 area; and one well in Union Valley east of the ORR boundary.

Nitrate and Uranium

As shown in Table 15, elevated concentrations of nitrate (>10 mg/L) or total uranium (>0.03 mg/L) were detected in the groundwater samples collected during CY 2011 from eight aquifer wells in the East Fork Regime. The S-2 Site is the source of elevated nitrate concentrations in the groundwater from wells GW-251, GW-253, GW-606, and GW-698. As in previous years, the CY 2011 sampling results show the highest nitrate concentrations in the aquifer occur in groundwater immediately downgradient to the east of the S-2 Site (GW-253) in the southwestern section of Y-12 (Figure A.7). The data for well GW-606 show that nitrate concentrations above 10 mg/L occur at least 8,000 ft downgradient of the site (Figure A.7). The elevated uranium concentrations in groundwater reflect transport/migration from the uranium oxide vault (GW-219), one or more unspecified sources upgradient of well GW-605, and from the Oil Skimmer Basin (GW-154 and GW-223). As shown below, the highest concentrations of uranium were reported for well GW-154, located near the former Oil Skimmer Basin.

Table 15. East Fork Regime CY 2011: elevated nitrate and uranium concentrations in surveillance monitoring aquifer wells

Well Location/Number		Nitrate (mg/L)		Uranium (mg/L)	
		Jan-Mar 2011	July-Oct 2011	Jan-Mar 2011	July-Oct 2011
Western Y-12 Area	GW-251	36.5	NS	0.00257	NS
	GW-253	540	NS	.	NS
Central Y-12 Area	GW-219	NA	NS	0.617	NS
	GW-698	NS	116	NS	0.00109
Eastern Y-12 Area	GW-154	NA	NA	0.34	0.33
	GW-223	.	.	0.043	0.042
	GW-605	0.12	0.14	0.14	0.16
	GW-606	11	9.2	0.0052	0.0054
MCL		10		0.03	
Note: BOLD = Exceeds MCL; “.” = Not detected; NS = Not sampled; NA = Not analyzed					

The CY 2011 sampling results support the historical long-term concentration trends (Table B.10), with time-series plots of the nitrate and uranium data generally showing:

- A decreasing nitrate trend for well GW-251 with wide seasonal fluctuations evident for semiannual sampling through CY 2006 (Figure A.28). The highest concentrations typically are reported during seasonally high-flow conditions (April and May). The relationship with seasonal flow conditions suggests that the nitrate concentrations are influenced by local inflow of nitrate-contaminated seasonal recharge and that the well intercepts active groundwater pathways. Also, the overall decrease in nitrate levels in the groundwater from this well probably reflects continued reduced flux of nitrate in the Maynardville Limestone west of the S-2 Site (closed in 1951) and the long-term effectiveness of natural attenuation processes.
- Indeterminate concentration trends for nitrate in wells GW-253 and GW-698, and for uranium in wells GW-154, GW-219, and GW-605. These trends are illustrated by the historical data for wells GW-253 and GW-154 (Figure A.28). The relatively unchanged nitrate levels at well GW-253 suggest minimal long-term change in the flux of nitrate east of the S-2 Site in the groundwater pathways monitored by the well. Such minimal changes in the rate of nitrate flux seem unusual considering that the S-2 Site was closed more than 60 years ago and nitrate is highly mobile in groundwater. The uranium data obtained since 1991 for well GW-154 (Figure A.28) is dominated by conspicuous “peak” concentrations evident in January 1991 (0.81 mg/L) and July 2001 (1.37 mg/L). The latter result corresponds with a sharp spike in the groundwater elevation in the well. This relationship suggests wide temporal changes in the advective flux of uranium in the shallow groundwater flow system near this well.
- Increasing concentration trends for uranium in well GW-223 and for nitrate in well GW-606 (Figure A.28). The uranium levels indicated by the most recent sampling results for well GW-223 show concentrations that are an order-of-magnitude higher than the uranium data for samples collected from January 1989 to January 1990. The Oil Skimmer Basin, closed along with NHP in 1988, is the suspected source of the uranium. The long-term increase in uranium concentrations reflects a corresponding increase in the flux of uranium in the groundwater flowpaths intercepted by the well. The increasing trend in nitrate concentrations at well GW-606 generally began with the change from conventional to low-flow sampling (October 1997). Therefore, it is uncertain whether the higher nitrate concentrations reflect a sampling method bias or an increase in the flux of nitrate from the S-2 Site along groundwater flowpaths monitored by the well. Well GW-606 was redeveloped in June 2002, with higher and widely fluctuating nitrate concentrations in samples collected from the well thereafter that show an indeterminate trend.

Volatile Organic Compounds

Groundwater samples collected during CY 2011 from 17 aquifer wells in the East Fork Regime contained one or more dissolved VOCs at individual or summed concentrations of 5 µg/L or more (Table B.10). As shown in Table 16, the maximum concentrations of PCE, TCE, c12DCE, VC, CTET, and chloroform exceed drinking water MCLs. The presence of VOCs reflects transport/migration of the intermingled plume(s) of dissolved VOCs in the Maynardville Limestone (Figure A.8). The groundwater samples with the highest PCE and CTET concentrations at Westbay™ well GW-934 are from the same sampling ports (GW-934-01, GW-934-07, and GW-934-09) that had elevated nitrate concentrations (Table 15). The VOC (and nitrate) results indicate that these ports intercept the most active (permeable) groundwater flowpaths in the Maynardville Limestone.

Table 16. East Fork Regime CY 2011: maximum VOC concentrations in surveillance monitoring aquifer wells

Location and Well	Maximum Concentration (µg/L)					
	Chloroethenes				Chloromethanes	
	PCE	TCE	c12DCE	VC	CTET	Chloroform
Western Y-12 Area						
GW-251	170	89	10	.	.	6
GW-253	540	390	220	99	21	31
GW-618	.	2.9	9.5	.	.	.
Central Y-12 Area						
GW-686	.	.	5	.	.	.
GW-690	24	2	2	.	.	.
GW-691	22	.	.	.	.	.
GW-698	130	430	45	.	.	8
GW-700	48	9	39	.	.	.
GW-820	4,700	1,000	1,000	100	.	.
Eastern Y-12 Area						
GW-153	3	.	.	.	99	4
GW-223	68	22	43	3.4	.	.
GW-381	3	.	3	.	14	2
GW-382	32	7	7.4	.	550	140
GW-605	90	83	130	2	48	13
GW-606	5.3	.	.	.	28	36
Union Valley						
GW-170	2.6	1.5	.	.	1.9	.
GW-230	.	.	7	1.7	.	.
MCL	5	5	70	2	5	80*
Note: “. “ = Not detected; BOLD = Exceeds MCL; * = MCL for total trihalomethanes (byproducts of drinking water disinfection with chlorine).						

The maximum concentrations of summed VOCs (PCE, TCE, c12DCE, VC, CTET, and/or benzene) in the CY 2011 groundwater samples from wells GW-170 (7 µg/L) and GW-230 (9.8 µg/L) indicate that the dissolved VOC plume extends eastward from Y-12 (parallel with geologic strike in the Maynardville Limestone) into Union Valley east of the ORR boundary along Scarboro Road (Figure A.8). None of the CY 2011 sampling results for the wells in Union Valley exceed the applicable drinking water MCLs.

The CY 2011 VOC results for the aquifer wells support the long-term summed VOC (e.g., chloroethenes) concentration trends (Table B.10), and time-series plots of the VOC data generally show:

- Variable but generally decreasing trends for chloroethene and/or chloromethane concentrations for six wells (GW-223, GW-230, GW-382, GW-618, GW-690, and GW-700), as illustrated by the summed concentration of chloromethanes detected in well GW-382 and chloroethenes in well GW-618 (Figure A.29). The decreasing concentration trends reflect reduced flux of VOCs from the applicable source areas and the long-term effects of natural attenuation processes. The decrease in VOC concentrations at well GW-382 between May 1995 and September 1999 may reflect a sampling method bias with higher concentrations in samples obtained with the conventional method.
- Indeterminate concentration trends for chloroethenes and/or chloromethanes (Table B.10) in groundwater from six wells (GW-153, GW-253, GW-686, GW-691, GW-698, and GW-820). These trends are illustrated by the summed chloroethene concentrations detected in the groundwater samples

from wells GW-253 and GW-698 (Figure A.29). The summed VOC concentrations at well GW-253 suggest minimal change in the flux of dissolved chloroethenes in the groundwater downgradient of the S-2 Site. The VOC concentrations reported for well GW-698 since 1993 generally show seasonal fluctuations with higher VOC concentrations evident during seasonally low flow conditions (October/November). This seasonal fluctuation suggests recharge of less contaminated groundwater that dilutes the VOC concentrations during high flow conditions.

- Increasing summed chloroethene and chloromethane concentration trends at well GW-605 that are evident in the low-flow sampling results (Figure A.29). The VOC concentrations show seasonal fluctuations with high concentrations typically evident in samples collected during seasonally low flow conditions (July). This relationship suggests seasonal inflow of uncontaminated recharge via the groundwater flowpaths intercepted by the monitored interval in the well. The increasing VOC concentration trends probably reflect increased flux in the groundwater flowpaths monitored by the well.
- A combination of indeterminate trends for summed chloroethenes and decreasing trends for summed chloromethanes in groundwater from wells GW-251, GW-381 and GW-606 (Table B.10). The divergent trends suggest different source areas and/or flowpaths for the different types of VOCs detected at these wells.

Divergent concentration trends for individual chloroethenes may reflect biologically mediated degradation at wells GW-223 and GW-253. For instance, historical data for well GW-253 (located near the S-2, Figure A.8) between January 1991 and March 2011 show increasing concentrations of c12DCE (85 µg/L to 220 µg/L) and VC (not detected to 99 µg/L), while concentrations of PCE (540 µg/L to 540 µg/L) and TCE (350 µg/L to 390 µg/L) have remained fairly stable (indeterminate trend).

Gross Alpha and Gross Beta

Groundwater samples collected during CY 2011 from 17 aquifer wells in the East Fork Regime contained gross alpha activity and/or gross beta activity above the MDA and corresponding TPU (Appendix E.3). As shown in Table 17, only four of these wells had elevated gross alpha activity (>15 pCi/L) or gross beta activity (>50 pCi/L).

Table 17. East Fork Regime CY 2011: elevated gross alpha activity and gross beta activity in surveillance monitoring aquifer wells

Well	Date Sampled	Gross Alpha (pCi/L)				Gross Beta (pCi/L)			
		MDA	Activity ± TPU			MDA	Activity ± TPU		
Western Y-12 Area GW-253	03/01/11	3.78	15.1	±	3.88	5.35	16.2	±	4.34
Central Y-12 Area GW-219	02/21/11	3	220	±	13	9.6	99	±	10
Eastern Y-12 Area GW-154	02/24/11	1.9	240	±	39.4	5.39	65.8	±	11.4
GW-154	08/04/11	2.92	267	±	43.8	6.36	94.8	±	16
GW-605	01/11/11	2.3	71	±	12.6	4.58	47.1	±	8.38
GW-605	07/06/11	1.76	55.4	±	9.56	3.86	68.4	±	11.4
Screening Level		15				50			
Note: BOLD = Exceeds the screening level									

Elevated gross alpha and gross beta activity at these aquifer wells reflect the transport/migration of radiological contaminants (primarily uranium isotopes) from the S-2 Site (GW-253), the uranium oxide vault (GW-219), one or more sources upgradient of well GW-605, and the Oil Skimmer Basin (GW-154).

The gross alpha and gross beta activity reported for the samples collected during CY 2011 support the long-term trends indicated by historical data (Table B.10). Time-series plots of the gross alpha and/or gross beta activity reported for each applicable well generally show:

- Widely variable, indeterminate long-term trends for gross alpha activity at wells GW-154, GW-219, GW-253, and GW-605 and for gross beta activity at wells GW-154 and GW-219. These trends, illustrated by the data for wells GW-154, GW-219, and GW-605 (Figure A.30), suggest minimal relative change in the flux of uranium isotopes in hydrostratigraphic intervals monitored by the wells. The gross alpha trend at well GW-219 suggests a potentially increasing trend for the biennial samples collected since October 2005. However, the significance of this increase is questionable with the time gaps between samples. The activity trends for wells GW-154, GW-219, and GW-605 are consistent with the indeterminate long-term total uranium concentration trends evident for these wells (Table B.10).

4.1.3 Chestnut Ridge Regime

The CY 2011 groundwater sampling results for 41 wells on Chestnut Ridge meet the requirements of surveillance monitoring in the Chestnut Ridge Regime. Most of these wells continue to yield uncontaminated groundwater. The high pH (>8.5) with unusually high potassium to sodium ratio for wells GW-205 and GW-757 suggest the geochemical influence of cement grout. Elevated chromium and/or nickel concentrations at wells GW-141 and GW-305 are likely artifacts of corrosion of the stainless steel casing and well screen used to construct the wells.

Nitrate is a potential groundwater contaminant in the Chestnut Ridge Regime, based on high concentrations reported in surface water samples (see Section 4.2.3). None of the nitrate concentrations reported for groundwater samples exceed the 10 mg/L drinking water MCL, and the maximum CY 2011 concentration is above 2 mg/L only at well GW-797 (Table B.11). The historical nitrate data for well GW-797 show an increasing trend that peaked in January and July 2008 (3 mg/L) with a generally decreasing trend since then (2.27 to 2.4 mg/L in CY 2011). The source of the low nitrate levels is unconfirmed, but may reflect fertilizer applications near the well.

Excluding potential artifacts and low nitrate concentrations, VOCs are the contaminants most frequently detected in the groundwater samples collected during CY 2011. A very low TCE concentration (2 µg/L) was reported in January at well GW-298 located at the ECRWP, but TCE was not detected in verification sample collected in March 2011 (see Appendix F). This spurious TCE result is excluded from further evaluation. At least one principal compound was detected (>1 µg/L) in samples from eight wells (Table 18).

Table 18. Chestnut Ridge Regime CY 2011: maximum VOC concentrations in surveillance monitoring wells

Well	Maximum Concentration (µg/L)					
	Chloroethenes			Chloroethanes		Freons
	PCE	c12DCE	11DCE	111TCA	11DCA	TCFM
Near CRSP:						
GW-174	.	.	.	.	.	5 J
GW-175	2 J	.	.	.	.	3 J
GW-176	.	.	23	20	43	.
GW-177	.	.	7.2	5.8	31	.
GW-180	13	.	.	.	.	3 J
GW-322	3 J	.	34	11	57	19
GW-798	9.12	9.38	4.44	.	.	11.5
ILF IV:						
GW-305	.	.	8.29	12.5	47.8	NR
MCL	5	70	7	200	NA	NA
Note: TCFM = trichlorofluoromethane; “.” = Not detected; J = Estimated value; NR = Not reported; NA = Not applicable.						

As shown above, the CRSP are the source of the VOCs in the groundwater at seven of these wells. Historical operation of the eastern and western waste disposal trench areas at the CRSP emplaced an elongated plume of dissolved VOCs in the groundwater that currently extends more than 700 ft east-northeast along the ridge crest (parallel with geologic strike) and at least 300 ft to the north and south down the ridge flanks (Figure A.8). The VOCs most frequently detected in samples from CRSP monitoring wells are PCE, 11DCE, 111TCA, 11DCA, and trichlorofluoromethane (Table 18). The maximum concentration of PCE and/or 11DCE reported for wells GW-176, GW-177, GW-180, GW-322, and GW-798 exceed respective drinking water MCLs.

Historical data show that 111TCA, 11DCA, and 11DCE are the primary VOCs near the western disposal trench area and PCE and 12DCE are the principal VOCs near the eastern disposal trench area. Elongation of the VOC plume along the axis of the ridge and the distribution of plume constituents relative to source trenches indicate primarily west-to-east groundwater flow/contaminant transport in strike-parallel flowpaths (e.g., bedding-plane fractures). However, detection of VOCs in groundwater from wells located south and southeast of the site (down-dip and perpendicular to strike) suggests that conduit transport from the site also occurs.

Over time, the concentrations of the primary components of the plume (PCE and 111TCA) have decreased while the concentrations of degradation products (c12DCE, 11DCE, and 11DCA) have increased or remained stable, which suggests active biotic and/or chemical degradation processes. The annual maximum concentration of degradation products is currently higher than the parent compounds at wells GW-176, GW-177, GW-322, and GW-798.

The CY 2011 sampling results for wells near the CRSP generally continue the long-term decreasing or indeterminate concentration trends indicated by historical VOC data (Table B.11), as illustrated by the VOC data for wells GW-322 and GW-798 (Figure A.31). The 111TCA concentrations at well GW-322 show a steadily decreasing trend, with the summed concentration of degradation products (11DCA and 11DCE) increasing from March 1988 through January 1998 then decreasing concurrently with 111TCA

(Figure A.31). The VOC data for well GW-798 shows an overall indeterminate trend characterized by peak concentrations in January 2003, January 2007, and February 2009 (Figure A.31).

The groundwater samples collected from well GW-305 during CY 2011 contained 11DCE, 11DCA, and 111TCA (Table 18). The source of the VOCs in the groundwater from the well is assumed to be ILF IV, although the waste inventory of the site does not include VOCs. Along with the historical data, the CY 2011 monitoring results continue the concentration trends evident after the sequential detection of 111TCA, 11DCA, and 11DCE beginning in January 1992 (Figure A.31). The data show the arrival of the parent compound (111TCA) followed four years later by the related degradation products (11DCA and 11DCE). As shown by results for January 2007 and October 2011, 111TCA concentrations have decreased (19 µg/L–11.4 µg/L), 11DCE concentrations have remained fairly stable (9.3 µg/L–8.29 µg/L), and 11DCA concentrations have increased (31 µg/L–47.8 µg/L). These trends are similar to those observed near the CRSP, which suggests active biotic and/or chemical degradation processes in groundwater near ILF IV.

4.2 EXIT PATHWAY/PERIMETER MONITORING

This section describes results of groundwater and surface water quality monitoring performed during CY 2011 in areas where contaminants associated with Y-12 are most likely to be transported beyond the boundary of the DOE ORR. Separate discussions of the monitoring data obtained from respective networks of exit pathway/perimeter sampling locations in the Bear Creek, East Fork, and Chestnut Ridge hydrogeologic regimes are provided.

4.2.1 Bear Creek Regime

The CY 2011 monitoring results and historical data for the monitoring wells, springs, and surface water sampling locations listed from upstream to downstream in Table 19 meet exit pathway/perimeter monitoring requirements. These locations are (1) three monitoring wells that are located in a perimeter region (Exit Pathway Picket W, Figure A.12), (2) three springs that represent natural groundwater discharge locations, and (3) 17 surface water stations that measure water quality in strategic locations along Bear Creek. For this report, these sampling locations are assigned to three areas: Upper, Middle, and Lower Bear Creek. Upper Bear Creek encompasses the surface water sampling locations upstream (east) of the confluence of NT-2 with Bear Creek (Figure A.11), including two sampling locations in Bear Creek (BCK-11.97 and BCK-12.34) and a sampling location in NT-1 (NT-01). Middle Bear Creek encompasses the surface water sampling stations and springs that are located along Bear Creek between NT-2 and NT-9 (Figure A.11), including two springs (SS-4 and SS-5), three sampling locations in Bear Creek (BCK-09.20, BCK-09.40, and BCK-11.54), and sampling locations in NT-3 (EMWNT-03A and NT-03), NT-4 (NT-04 and EMW-VWUNDER), NT-5 (EMWNT-05 and EMW-VWEIR), NT-7 (NT-07), and NT-8 (NT-08). The lower Bear Creek sampling locations (downstream of NT-9) include the monitoring wells listed in Table 19, spring SS-6, and three surface water stations in Bear Creek (BCK-03.30, BCK-04.55, and BCK-4.60) (Figure A.11).

Table 19. Bear Creek Regime CY 2011: sampling locations used for exit pathway/perimeter monitoring

Bear Creek Area	Monitoring Wells		Springs	Surface Water Stations	
	Well Number	Monitored Interval Depth (ft bgs)		Bear Creek Main Channel	Bear Creek Tributaries
Upper	-		-	BCK-12.34 BCK-11.97	NT-01
Middle	-		SS-4 SS-5	BCK.11.54 BCK-09.40 BCK-09.20	EMWNT-03A NT-03 NT-04 EMW-VWUNDER (NT-4) EMWNT-05 EMW-VWEIR (NT-5) NT-07 NT-08
Lower	GW-712 GW-713 GW-714	441.5 -457.5 305.0 -315.2 115.1 -145.0	SS-6	BCK-04.60 BCK-04.55 BCK-03.30	-

4.2.1.1 Upper Bear Creek

The chemical quality of surface water in Upper Bear Creek is primarily controlled by inflow of groundwater containing the principal components of the contaminant plume emplaced during historical operations of the S-3 Ponds. To the west of this site, contaminated groundwater discharges from the aquitard (Nolichucky Shale) as base flow into NT-1. The confluence of NT-1 and Bear Creek is about 2,500 ft downstream of the S-3 Site. The highly contaminated groundwater in the Nolichucky Shale extends west of NT-1 to where it upwells into the shallow flow system and ultimately discharges into NT-2, which enters Bear Creek about 1,400 ft downstream of its confluence with NT-1 (Figure A.11). In addition to the influx of contaminants from the NT-1 and NT-2 catchments, contaminated groundwater in the Maynardville Limestone discharges into Bear Creek via seeps and springs along the main channel of the creek.

As shown in Table 20 (sampling locations listed from upstream to downstream), monitoring results obtained during CY 2011 show that nitrate, uranium, and PCE concentrations in Upper Bear Creek remain above respective screening levels. The highest levels of nitrate, PCE, and gross beta activity are reported for NT-01 and the highest uranium concentrations are in the main channel of Bear Creek.

Table 20. Upper Bear Creek CY 2011: maximum contaminant concentrations

Sampling Point	Nitrate (mg/L)	Uranium (mg/L)	PCE (µg/L)	Radioactivity (pCi/)	
				Alpha	Beta
NT-01	364	0.0539	48	.	1,000
BCK-12.34	NA	0.18	NA	NA	NA
BCK-11.97	43.3	0.267	.	97	160
Screening Level	10	0.03	5	15	50
Note: "." = Not detected; BOLD = Exceeds screening level; NA = not analyzed.					

These results are generally consistent with historical data and show that contaminants associated with historical operations at Y-12 continue to substantially impact the quality of surface water in Upper Bear Creek.

4.2.1.2 Middle Bear Creek

Surface water quality in Middle Bear Creek is impacted by contaminants from the S-3 Site (nitrate, uranium, and radioactivity), the OLF WMA (uranium and VOCs), and the BCBG WMA (uranium, VOCs, and radioactivity). Also, results of a study by the U.S. Geological Survey show that much of Middle Bear Creek loses flow to the Maynardville Limestone, particularly the section of the channel immediately south of the OLF WMA. This section of the main channel of Bear Creek plays an important role in transferring contaminants from the creek into the groundwater flow system which discharges from springs SS-4 and SS-5 located downgradient of this losing reach of Bear Creek (DOE 1997a).

As shown in Table 21 (sampling locations listed from upstream to downstream), five of the exit pathway sampling locations in Middle Bear Creek had concentrations above screening levels for one or more of the principal groundwater contaminants. The highest nitrate, gross alpha and gross beta levels were reported for spring SS-4. Although not analyzed in samples collected during CY 2011, historical data shows highest levels of nitrate and radioactivity occur in surface water stations located in the main channel of Bear Creek nearest to the S-3 Site (e.g., BCK-11.54). The highest uranium (NT-08) and VOC concentrations (NT-07 and NT-08) were reported for sampling locations in tributaries to Bear Creek at the BCBG WMA (Figure A.11).

Table 21. Middle Bear Creek CY 2011: maximum contaminant concentrations

Sampling Point	Nitrate (mg/L)	Uranium (mg/L)	Chloroethenes (µg/L)					Radioactivity (pCi/L)	
			PCE	TCE	c12DCE	11DCE	VC	U-238/Alpha	Tc-99/Beta
EMWNT-03A	NA	.	.	.	.	.	.	.	5.06
NT-03	NA	NA	.	.	.	.	.	NA	NA
BCK-11.54	NA	NA	NA	NA	NA	NA	NA	NA	NA
EMW-VWUNDER	NA	.	.	.	.	.	.	0.19	.
NT-04	NA	.	.	.	5 J	.	.	1.41	6.62
EMWNT-05	NA	.	.	.	.	.	.	0.58	6.66
EMW-VWWEIR	NA	.	.	.	.	.	.	1.74	8.36
SS-4	15.7	0.0732	.	7	17	3 J	.	42*	55**
NT-07	0.12	0.02	81	72	300	15	32	6.93	NA
NT-08	5.2	0.25	25	25	96	3.7	2.3	NA	NA
BCK-09.40	5.14	0.05	.	.	.	.	.	20*	19**
SS-5	7.6	0.0327	.	.	2.7	.	.	23*	14**
BCK-09.20	3	NA	NA	NA	NA	NA	NA	NA	NA
Screening Level	10	0.03	5	5	70	7	2	- /15*	900/50*
Note: “.” = Not detected; J = Estimated concentration; NA = Not analyzed; BOLD = Exceeds screening level; * = gross alpha activity; ** = gross beta activity.									

These monitoring results are generally consistent with historical data and show that contaminants associated with Y-12 continue to impact the quality of surface water in Middle Bear Creek. Contaminant levels in this section of Bear Creek reflect downstream transport from Upper Bear Creek plus inputs from tributaries (NT-4, NT-7, and NT-8) and springs (SS-4 and SS-5).

4.2.1.3 Lower Bear Creek

The quality of groundwater and surface water in Lower Bear Creek is substantially less impacted by contaminants present in upstream areas of BCV. As shown by the CY 2011 monitoring results summarized in Table 22 (sampling locations listed from upstream to downstream), none of the results exceed screening levels.

Table 22. Lower Bear Creek CY 2011: maximum contaminant concentrations

Sampling Point	Nitrate (mg/L)	Uranium (mg/L)	Summed VOCs (µg/L)	Radioactivity (pCi/L)	
				Alpha	Beta
Monitoring Wells					
GW-712	0.051	.	.	1.94	.
GW-713	.	.	.	.	4.36
GW-714	0.61	.	.	.	.
Springs					
SS-6	1	0.0084	.	4.57	5.91
Surface Water					
BCK-04.60	NA	NA	.	NA	NA
BCK-04.55	0.252	0.0141	NA	4.5	.
BCK-03.30	NA	NA	NA	NA	NA
Screening Level	10	0.03	MCL or >5 µg/L	15	50
Note: "." = Not detected					

The CY 2011 monitoring results are generally consistent with respective historical data and show that contaminants associated with Y-12 decrease with distance downstream.

Based on the monitoring results for CY 2011 (Tables 20, 21, and 22), the principal groundwater contaminants are detected in Upper Bear Creek, Middle Bear Creek, and Lower Bear Creek. The data generally show higher contaminant concentrations in tributaries and springs with a limited extent of elevated concentrations in Bear Creek. Nitrate and VOC concentrations are below screening levels at station BCK-09.40 in Middle Bear Creek, and all contaminant concentrations are below screening levels at station BCK-04.55 in Lower Bear Creek.

4.2.2 East Fork Regime

The CY 2011 monitoring results and respective historical data for the monitoring wells, springs, and surface water sampling locations listed in Table 23 meet the requirements of exit pathway/perimeter monitoring for the East Fork Regime. The monitoring wells are located near the eastern end of Y-12 and are hydraulically downgradient of NHP/Lake Reality. All but three of the wells (GW-151, GW-220, and GW-832) are within 500 ft of the ORR boundary along Scarboro Road (Figure A.15). The surface water stations in the East Fork Regime (200A6 and Station 8) are in the south-central part of Y-12.

Table 23. East Fork Regime CY 2011: sampling locations for exit pathway/perimeter monitoring

Monitoring Wells/ Monitored Interval Depth				Springs	Surface Water Stations	
Well Number	Depth (ft bgs)	Well Number	Depth (ft bgs)		UEFPC	North of Pine Ridge
GW-151	85.0 - 110.0	GW-744	55.0 - 69.5	SP-17	200A6 Station 8	GHK2.51WSW NPR12.0SW NPR23.0SW
GW-220	31.0 - 45.2	GW-747	60.8 - 73.0	<u>Union Valley</u> SCR7.1SP SCR7.8SP		
GW-722	75.0 - 644.3	GW-750	61.2 - 72.2			
GW-733	240.1 - 256.5	GW-816	2.9 - 15.8			
GW-735	67.5 - 79.2	GW-832	4.0 - 11.8			

In addition to the surface water stations within the East Fork Regime, two springs located along South Illinois Avenue east of Y-12 (Figure A.15) and three sampling stations (GHK2.51WSW, NPR12.0SW, and NPR23.0SW) located in drainage features along the ORR boundary north of Pine Ridge (Figure A.16) also serve as exit pathway/perimeter monitoring locations. Sampling results for these locations showed principal contaminant concentrations below screening levels.

4.2.2.1 Groundwater

At least one of the groundwater samples collected during CY 2011 from the five exit pathway wells located in the Maynardville Limestone (GW-151, GW-220, GW-722, GW-733, and GW-832) had summed concentrations of dissolved VOCs of at least 5 µg/L. Each of these wells are located within 1,000 ft of the groundwater extraction well (GW-845) being used to capture the VOC plume in the groundwater extending from the eastern end of Y-12 into Union Valley east of the ORR boundary along Scarboro Road (see Section 2.3.1.1 and Figure A.15). Groundwater samples from Westbay™ Well GW-722 were collected from five discrete depth intervals (Figure A.17), and the deepest sampling ports have the lowest suffix (e.g., GW-722-14 is deepest). As shown in Table 24, the data for these wells show concentrations above the applicable drinking water MCL for CTET (all wells), PCE (three wells), TCE (two wells), and c12DCE (one well).

Table 24. East Fork Regime CY 2011: maximum VOC concentrations in exit pathway/perimeter monitoring wells

Well (Figures A.15 and A.17)	Maximum Concentration (µg/L)					
	Chloroethenes				Chloromethanes	
	PCE	TCE	c12DCE	11DCE	CTET	Chloroform
GW-151	770	140	77	2.3	1.1	1,200
GW-220	450	130	67	.	.	900
GW-722-22	4	1.5	.	.	.	22
GW-722-20	7.7	1.8	.	.	.	37
GW-722-17	4.9	1.3	.	.	.	34
GW-722-14	2.6	1.1	.	.	.	18
GW-733	.	.	.	.	.	6.4
GW-832	9.1	1.7	1.4	.	.	12
MCL	5	5	70	7	5	NA
Note: “.” = Not detected; NA = Not applicable; BOLD = Exceeds MCL.						

These results are consistent with historical data and illustrate the range of VOC concentrations within in the shallow karst network (GW-151, GW-220, and GW-832) and deeper bedrock intervals (GW-722 and GW-733) in the Maynardville Limestone at the eastern end of Y-12. The CY 2011 monitoring results continue the long-term concentration trends indicated by historical VOC data for these wells (Table B.10), as illustrated by the decreasing PCE trends for sampling ports in Westbay™ well GW-722 (e.g., GW-722-14), the indeterminate PCE trend for well GW-832, and the increasing PCE trends for wells GW-151 and GW-220 (Figure A.32). Although chloroethene concentrations are highest and show a generally increasing long-term trend at paired wells GW-151 and GW-220, there is no evidence of eastward migration of the plume beyond these wells (Figure A.8 and Table 24). Also, the PCE concentration trends at wells GW-151 and GW-220 have remained fairly stable since CY 2005 (Figure A.32). The VOC concentration trends evident for some wells, particularly CTET at Westbay™ well GW-722, suggest a direct response to the long-term operation of groundwater extraction well GW-845 (Figure A.33).

Samples collected in January 2011 from spring SP-17 in the Eastern Y-12 area and springs SCR7.1SP and SCR7.8SP in Union Valley were analyzed for VOCs and no compounds were detected.

4.2.2.2 Surface Water

Maximum concentrations reported for CY 2011 samples, summarized in Table 25 (sampling stations are listed from upstream to downstream along UEFPC), show that nitrate, uranium, gross alpha activity, and/or gross beta activity was detected at four of the surface water sampling stations used for exit pathway/perimeter monitoring.

Table 25. East Fork Regime CY 2011: maximum contaminant concentrations in exit pathway/perimeter surface water sampling locations

Sampling Point	Nitrate (mg/L)	Uranium (mg/L)	Summed VOCs (µg/L)	Radioactivity (pCi/L)	
				Alpha	Beta
UEFPC					
200A6	NA	0.11	NA	NA	NA
Station 8	NA	0.026	NA	13.7	10.2
SP-17	8.14	0.00088	.	.	.
North of Pine Ridge					
GHK2.51WSW	0.069	.	.	.	.
NPR12.0SW	.	.	.	.	10
NPR23.0SW	.	.	.	.	.
Screening Level	10	0.03	5	15	50
Note: “.” = not detected (or below MDA); NA = not analyzed; BOLD = Exceeds screening level.					

The CY 2011 uranium concentration for surface water station 200A6 exceeds the drinking water MCL (0.03 mg/L) and continues the indeterminate long-term concentration trend indicated by historical uranium results (Table B.10). Although below the groundwater screening level, the nitrate concentration at spring SP-17 is above background levels and may reflect transport from the S-2 Site or from the former urea stockpile on the northern flank of Chestnut Ridge (Figure A.7). Principal groundwater contaminant concentrations evident at these locations during CY 2011 reflect the continued impact of legacy Y-12 operations on the quality of surface water in UEFPC upstream of the ORR boundary.

Although not a principal groundwater contaminant because of very low solubility, mercury is a primary contaminant of soils and surface water in the East Fork Regime as a legacy of historical operations at Y-12. Mercury is consistently detected at low levels only in groundwater very close to known sources of mercury. Extensive surface water sampling (flow proportionate and grab samples) is performed by other monitoring programs (e.g., NPDES and CERCLA) and the annual monitoring results are briefly addressed here to provide general information regarding mercury concentrations in UEFPC. Station 17 is a NPDES permit monitoring station located in UEFPC on the south side of Bear Creek Road (Figure A.13) downstream (north) of Lake Reality where the creek exits the ORR. The mercury concentration reported for 93 surface water samples collected during CY 2011 from Station 17 (excluding filtered and duplicate samples) ranged from 0.000105 mg/L (February 2011) to 0.0081883 mg/L (March 2011). The mercury concentration in 24 of the samples exceeded the drinking water MCL (0.002 mg/L).

4.2.3 Chestnut Ridge Regime

The CY 2011 monitoring results reported for the springs and surface water sampling stations listed in Table 26 serve as the exit pathway/perimeter monitoring locations in the Chestnut Ridge Regime.

Table 26. Chestnut Ridge Regime CY 2011: sampling locations used for exit pathway/perimeter monitoring

Groundwater		Surface Water	
SCR1.25SP	SCR4.3SP	KHB-09	SCR1.5SW
SCR2.1SP	SCR5.1SP	MCK 1.4	SCR3.5SW
SCR2.2SP	SCR5.2SP	MCK 2.0	S17
SCR3.5SP		MCK 2.05	UNC SW-1

4.2.3.1 Groundwater

The springs used for exit pathway/perimeter monitoring in the Chestnut Ridge Regime are located in the five primary surface drainage features that traverse the southern flank of Chestnut Ridge, exit the ORR, and discharge into the Melton Hill Lake south of Bethel Valley Road (Figure A.18). The CY 2011 monitoring results for these springs are consistent with respective historical data and show that the springs discharge uncontaminated calcium-magnesium-bicarbonate groundwater characterized by: (1) a wide range of calcium:magnesium ratios; (2) variable but generally low molar proportions (<5%) of chloride, potassium, and sodium; (3) elevated sulfate concentrations at spring SCR4.3SP that probably reflect dissolution of locally disseminated sulfides; and (4) low concentrations of several trace metals, notably barium, iron, manganese, and strontium. Results for uranium were within the range of background levels in the Chestnut Ridge Regime, and VOCs were not detected. Very low levels (<5pCi/L) of gross alpha and/or gross beta activity were detected (above the associated MDA) in only one semiannual sample from three of the springs. These results for springs SCR1.25SP (alpha), SCR3.5SP (beta), and SCR4.3SP (alpha and beta) indicate natural background radiation.

The nitrate concentration reported for the sample collected from spring SCR5.2SP (4.28 mg/L) is below the nitrate screening level for groundwater (10 mg/L), but is more than double the levels reported for the other springs. Spring SCR5.2SP is located directly south of the Upper Hayfield 2 Site where sanitary sewer sludge has been applied (Figure A.18). The elevated nitrate concentrations in groundwater discharged from the spring may reflect transport of nitrate from the sludge application area (see Sect. 4.2.3.3).

Monitoring results for CY 2011 suggest that operations at Y-12 have not significantly impacted the quality of groundwater discharged from natural springs located in the surface drainage features that traverse the Chestnut Ridge Regime.

4.2.3.2 Surface Water

The surface water sampling stations used for exit pathway/perimeter monitoring in the Chestnut Ridge Regime during CY 2011 are located in Dunaway Branch (SCR1.5SW) at the western boundary of the regime; near the headwaters of SCR2 (UNC SW-1); in McCoy Branch downstream of the FCAP (MCK 2.05 and MCK 2.0), upstream of Rogers Quarry (SCR3.5SW), and near the confluence with the Clinch River (MCK 1.4); and in tributary SCR5 downstream of KHQ (KHB-09 and S17) near the southeastern boundary of the regime (Figure A.18).

Analytical results for the surface water samples collected from McCoy Branch during CY 2011 indicate contamination immediately downstream of the FCAP at MCK 2.0 and MCK 2.05. These surface water sampling stations are located upstream (MCK 2.05) and downstream (MCK 2.0) of the FCAP Discharge Treatment Wetland, which was constructed as part of the CERCLA remedial action specified in the ROD for the site (DOE 1996). Samples from MCK 2.05 are representative of FCAP "influent" to the wetland and samples from MCK 2.0 are representative of "effluent" from the wetland (DOE 2012). Historical data show that the surface water samples from both locations are distinguished by elevated concentrations of sulfate and arsenic. The sulfate concentrations in the samples collected in March and August 2011 from MCK 2.05 (25 mg/L and 20 mg/L, respectively) and MCK 2.0 (25 mg/L and 19 mg/L, respectively) exceed background levels. The monitoring results obtained during CY 2011 show that the maximum arsenic concentrations at MCK 2.05 (0.023 mg/L) and MCK 2.0 (0.02 mg/L) are above the drinking water MCL (0.01 mg/L). At station MCK 1.4, located about 4,000 ft downstream from MCK 2.0 south of Bethel Valley Road (Figure A.17), arsenic was not detected in either of the samples collected in CY 2011 (March and August). Nevertheless, the elevated arsenic and sulfate levels reported for samples from MCK 2.0 and MCK 2.05 show continued impacts on surface water quality in upper McCoy Branch near the FCAP.

The CY 2011 monitoring results for surface water stations located in the other drainage features in the Chestnut Ridge Regime show background levels of nitrate, except for the nitrate concentration (10.1 mg/L) that exceeded the groundwater screening level for nitrate (10 mg/L) in the July 2011 sample from station S17 (Table B.11). This surface water station is located in tributary SCR5 north of Bethel Valley Road (Figure A.18). This nitrate result, along with historical data for the location, shows an increasing concentration trend since April 2008 (Figure A.34). However, the nitrate concentration in the surface water sample collected in December 2011 from station S17 (1.74 mg/L) was significantly lower than the nitrate level reported for station S17 in July 2011. Additionally, the nitrate concentration (4.28 mg/L) at spring SCR5.2SP (Sect. 4.2.3.1) was higher than was reported for the surface water samples collected in December 2011 (see discussion below in Sect. 4.2.3.3).

Uranium was detected at low levels (<0.002 mg/L) in the surface water samples from stations KHB-09, S17, SCR1.5SW, and SCR3.5SW. None of the surface water samples collected during CY 2011 contained VOCs. Gross alpha activity and gross beta activity was detected at very low levels only at MCK 2.0. The low activity levels are indicative of natural background radiation and/or analytical variability.

Historical and current waste management operations do not appear to have significantly affected surface-water quality in these drainage features. The only potential impact to surface water quality may be from sewer sludge application areas, although this impact is unconfirmed. Increased nitrate concentration may lead to plant growth that can reduce dissolved oxygen in streams (e.g., the dissolved oxygen at S17 during July 2011 was 3.78 parts per million).

4.2.3.3 Kerr Hollow Branch Nitrate Survey

As described above in Sect. 4.2.3.2, the nitrate concentration (10.1 mg/L) in the surface water sample collected at S17 during July 2011 slightly exceeded the screening level (10 mg/L). A detailed survey of tributary was performed during November and December 2011 to identify the possible source of increasing nitrate in the lower reaches of SCR5, referred to in the survey as Kerr Hollow Branch (KHB). The survey included base- and storm-flow field monitoring of 28 stations along the entire tributary from the confluence of KHB with SCR4, located about 750 ft South of Bethel Valley Road, to the headwaters at spring SCR5.1SP (Figure A.18). The parameters measured included nitrate (as nitrogen) using an ion-specific probe.

To assess the quality of the field nitrate measurements, split samples were collected for laboratory analysis on December 13, 2011 from stations S17 and KHB-09 (located about 20 ft upstream from S17) and from springs SCR5.2SP (located about 150 ft upstream of S17) and SCR5.1SP at the tributary headwaters (Figure A.18). The December 2011 laboratory results confirmed the field results obtained using the nitrate-specific probe in the field.

All of the nitrate concentrations recorded during the survey were below the nitrate screening level. Groundwater coming from spring SCR5.2SP appears to be the source of the elevated nitrate concentrations in KHB with a maximum concentration of 5.72 mg/L recorded for a storm-flow sample collected on November 15, 2011. The sewer sludge (biosolids) application area nearest to stations with highest nitrate concentrations (S17, KHB-09, and SCR5.2SP) is the Upper Hayfield 2 Site (Figure A.18). However, biosolids application activities may be questioned as a source of elevated nitrates reported since CY 2009 in KHB because a relatively low volume of biosolids was applied (<20% of the maximum allowable rate) and all application activities ended in CY 2005. Tributary SCR5 (KHB) and the surrounding areas continue to be evaluated for a possible source of nitrate.

5.0 CONCLUSIONS AND RECOMMENDATIONS

The groundwater and surface water quality data obtained during CY 2011 are generally consistent with: (1) the presence of the principal Y-12 groundwater contaminants from known and suspected source areas in the Bear Creek Regime, East Fork Regime, and Chestnut Ridge Regime; (2) the types of contaminants from respective source areas in each regime and the overall pattern and extent of contaminant transport in each regime; and (3) the long-term contaminant concentration trends evident for the respective groundwater and surface water sampling locations in each regime. This report includes monitoring results for 235 sampling locations: 192 monitoring wells, 13 springs, and 30 surface water stations.

The CY 2011 monitoring results reported for 63 wells (41 aquitard wells and 20 aquifer wells, and two Westbay™ wells with aquitard and aquifer sampling ports) meet surveillance monitoring requirements in the Bear Creek Regime. Groundwater samples from 40 of the wells had elevated concentrations of one or more of the principal contaminants at Y-12, with the highest concentrations reported for samples from wells located near the former S-3 Ponds, the former BYBY/HCDA, and the BCBG WMA. Analytical results for most of these wells do not indicate any significant change in the overall extent of groundwater contamination in the Bear Creek Regime or the relative distribution of contaminants from the primary source areas. Chloroethenes (PCE, TCE, 12DCE, 11DCE, and VC) are the most widespread groundwater contaminants, with elevated concentrations of one or more of these VOCs reported for 29 wells.

The CY 2011 exit pathway/perimeter monitoring locations in the Bear Creek Regime include 12 surface water stations along Bear Creek, seven stations in northern tributaries, six springs that discharge into Bear Creek, and three aquifer wells at the westernmost Exit Pathway Picket (Picket W). None of the groundwater samples from the Picket W wells had elevated concentrations of the principal groundwater contaminants at Y-12, but elevated concentrations of one or more of the contaminants were detected in surface water samples from three sampling stations in Bear Creek (BCK-12.34, BCK-11.97, and BCK-09.40), three tributaries (NT-1, NT-7, and NT-8), and spring SS-4. These results are generally consistent with historical data and show that contaminant concentrations in Bear Creek decrease with distance from each of the principal source areas (the S-3 Site, BYBY/HCDA, and BCBG WMA), including inflow of contaminated water from the northern tributaries of the creek that drain these sites. At station BCK-04.55, which is located where Bear Creek turns north at the westernmost extent of the Bear Creek Regime, the CY 2011 concentrations of all principal contaminants were below applicable screening levels.

The CY 2011 monitoring results for applicable surveillance and exit-pathway/perimeter sampling locations in the Bear Creek Regime continue the long-term contaminant concentration trends indicated by historical data for each applicable sampling location. Increasing concentrations are evident for at least one principal contaminant detected in samples from nine monitoring wells (seven aquitard wells and two aquifer wells). These monitoring locations are downgradient from the S-3 Site, the OLF WMA, and the BCBG WMA. Decreasing or indeterminate (not increasing or decreasing) trends are evident for at least one contaminant detected in samples from 35 wells, six surface water stations, and one spring. Monitoring wells with elevated concentrations of more than one principal contaminant that have different trends for each contaminant (e.g., increasing nitrate trend and decreasing or indeterminate VOC trend), reflect different sources and/or transport flowpaths for the different contaminants. Divergent concentration trends for individual chloroethenes at one well (GW-068) at the BCBG WMA and two wells (GW-229 and GW-365) at the OLF WMA are likely attributable to the effects of biotic and/or chemical degradation processes.

The CY 2011 monitoring results reported for 48 aquitard wells and 27 aquifer wells (including five wells located in Union Valley east of the ORR boundary along Scarboro Road) meet the requirements of surveillance monitoring in the East Fork Regime. Groundwater samples from 53 of the wells had elevated concentrations of one or more of the principal contaminants at Y-12. Aquitard wells with the highest inorganic and radiological contaminant concentrations are located in a portion of the western Y-12 area impacted by the contaminant plume emplaced during historical operations of the former S-3 Ponds. Extremely high ($>20,000$ $\mu\text{g/L}$) VOC concentrations were reported for the groundwater near Building 9201-5 and very high ($>1,000$ $\mu\text{g/L}$) VOC concentrations were reported for wells near the Y-12 Salvage Yard, the WCPA, NHP, and former UST locations (Rust Garage and East End Garage). Aquifer wells with the highest contaminant concentrations are located immediately downgradient (east) of the former S-2 Ponds in the western Y-12 area, Building 9201-1 in the central Y-12 area, and in the eastern Y-12 area near NHP/Oil Skimmer Basin. Chloromethanes (CTET and chloroform) are not commonly present in the western and central Y-12 areas, but are the primary VOCs detected in groundwater in the eastern Y-12 area. Analytical results for these wells do not indicate any significant change in the overall extent of groundwater contamination in the East Fork Regime or the relative distribution of contaminants from the primary source areas.

The CY 2011 monitoring results reported for ten monitoring wells, three springs, and five surface water stations meet the requirements of exit-pathway/perimeter monitoring for the East Fork Regime. Elevated concentrations of one or more of the principal groundwater contaminants at Y-12 were reported for samples from five of the wells (VOCs) and one of the surface water sampling stations (uranium). Sampling results for some of the wells exhibit a direct response (i.e., lower VOC concentrations) to the operation of the groundwater extraction well used to help capture the plume and deter continued migration of VOCs into Union Valley. Uranium concentrations reported for the surface water sampling stations suggest the continued impact of legacy Y-12 operations on the quality of surface water in UEFPC upstream of the ORR boundary. Mercury is a primary concern in the surface water of the East Fork Regime and results of sampling performed under other monitoring programs are not directly addressed in this report. Because of low solubility and other geochemical considerations, mercury is consistently detected only in groundwater samples very near source areas, and is not considered to be a principal groundwater contaminant.

The CY 2011 monitoring results for applicable surveillance and exit-pathway/perimeter sampling locations in the East Fork Regime continue the long-term contaminant concentration trends indicated by historical data for each applicable sampling location. Increasing concentrations are evident for at least one of the principal contaminants detected in samples from 18 wells, and decreasing or indeterminate (not increasing or decreasing) concentration trends are evident for at least one contaminant detected in samples from 55 wells and one surface water station. Monitoring wells with elevated concentrations of more than one principal contaminant commonly have different trends for each contaminant (e.g., increasing nitrate trend and decreasing or indeterminate VOC trend), which reflects different sources, transport flowpaths, and/or geochemical attenuation characteristics for the different contaminants. The effects of biotic and/or chemical degradation processes are the likely cause of divergent concentration trends for individual chloroethenes at wells 56-2C, GW-223, GW-253, and GW-383. Historical data for the wells show decreasing and/or indeterminate trends for concentrations of parent compounds (PCE and/or TCE), with increasing trends for concentrations of degradation products (c12DCE, 11DCE, and/or VC).

The CY 2011 sampling results for 41 wells located on Chestnut Ridge meet the requirements of surveillance monitoring in the Chestnut Ridge Regime. One or more VOCs were detected in groundwater samples from well GW-305 at Industrial Landfill IV and seven wells near the CRSP. Concentrations above applicable drinking water MCLs were reported for PCE (GW-180 and GW-798) and 11DCE

(GW-176, GW-177, GW-305 and GW-322). Analytical results for these wells do not indicate any significant change in the overall extent of VOC-contaminated groundwater in the regime or the relative distribution of contaminants. Additionally, the CY 2011 sampling results continue the VOC concentration trends indicated by historical data for the wells at the CRSP and are consistent with the recent trends evident since the initial detection of VOCs in well GW-305.

The CY 2011 monitoring results reported for seven natural springs and eight surface water sampling stations located in major drainage features that traverse the southern flank of Chestnut Ridge meet the requirements of exit-pathway/perimeter monitoring in the Chestnut Ridge Regime. The principal groundwater contaminants at Y-12 were either not detected or were detected at concentrations within the range of background levels in the samples from most spring and surface water stations in the regime. Nitrate concentration above the groundwater screening level (10 mg/L) was reported for one of the samples from station S17 (10.1 mg/L in July 2011) in the southeastern portion of the regime. This result continued an increasing nitrate concentration trend since April 2008 in the lower portion of SCR5. Further evaluation of nitrate in springs and surface water along SCR5 during November and December 2011 showed lower nitrate levels at station S17 with input of nitrate-bearing groundwater from spring SCR5.2SP. Although the source of nitrate is unconfirmed, SCR5 is adjacent to sewer sludge (biosolids) application areas. The CY 2011 sampling results for sampling stations in McCoy Branch show elevated concentrations of arsenic (>0.01 mg/L) and sulfate (>20 mg/L) immediately downstream of the FCAP, but not farther downstream where this drainage feature exits the ORR.

Based on groundwater and surface water monitoring data obtained during CY 2011, the following observations were noted and/or actions are recommended:

- It is recommended to perform a quantitative-based assessment of the relative stability of the groundwater contaminant plume(s) at Y-12. This assessment could include two tasks: (1) update plume maps to show the current extent of selected contaminants (e.g., specific VOCs and nitrate) and (2) use the Mann-Kendall test to determine the relative stability of each solute plume based on concentration trends at individual wells.
- Some VOC results obtained using PDB samplers were lower than results obtained using the low-flow method. For example, PCE results were much lower than expected at three wells (GW-014, GW-289 and GW-315) in the Bear Creek Regime and six wells (56-2C, GW-220, GW-337, GW-383, GW-700, and GW-820) in the East Fork Regime. Studies have indicated that the PDB sampling method is appropriate for analysis for PCE concentrations. However, these results indicate that low-flow sampling may be the more conservative method for VOC analyses at these wells. It is suggested to limit the use of PDB samplers when PCE is a known contaminant.
- A significant decrease or increase in contaminant concentrations and/or geochemical parameters observed in groundwater samples from a few monitoring wells since implementation of low-flow sampling has been interpreted to reflect a sampling method bias. However, these concentration changes also may reflect bio-fouling of the well screen and/or filter pack. It is recommended to identify wells with potentially decreased performance (permeability of the filter pack and/or well screen) as candidates for rehabilitation (e.g., surging or swabbing) using a workover rig. Subsequent monitoring results could be used to evaluate the effectiveness of rehabilitation methods.

- The most recent monitoring results for well GW-219 in the East Fork Regime suggest that uranium concentrations and gross alpha activity may be increasing in groundwater near the well. The sampling frequency for well GW-219 has been biennial (odd years) since October 2005, and it is recommended to perform additional sampling to assess the possibly increasing trends.

6.0 REFERENCES

- American Public Health Association. 1992. *Standard Methods for Examination of Water and Wastewater*, 18th Edition. (referenced on Table B.5)
- Babcock & Wilcox Technical Services (B&W) Y-12. 2009a. *Field Quality Control Samples*. B&W Y-12 Management Requirement prepared by the Environment, Safety, and Health Organization (Y71-66-EC-003, Rev 09/16/09).
- B&W Y-12. 2009b. *Sample Chain of Custody*. B&W Y-12 Management Requirement prepared by the Environment, Safety, and Health Organization (Y71-66-EC-004, Rev 09/16/09).
- B&W Y-12. 2009c. *Y-12 Groundwater Protection Program Groundwater Monitoring Data Compendium*. Prepared by Elvado Environmental LLC (Y/TS-1983/R3).
- B&W Y-12. 2010. *Y-12 Groundwater Protection Program Groundwater and Surface Water Sampling and Analysis Plan for Calendar Year 2011*. Prepared by Elvado Environmental LLC. (Y/SUB/10-073231/2).
- Bechtel Jacobs Company LLC (BJC). 1998. *East End VOC Plume Pump and Tracer Test Technical Memorandum*. (BJC/OR-103).
- BJC. 2007. *Data Management Implementation Plan for the Water Resources Restoration Program, U.S. Department of Energy, Oak Ridge Reservation, Oak Ridge, Tennessee*. (BJC/OR-754/R2).
- BJC. 2009. *Groundwater Quality Assessment Plan for Assessment Monitoring Phase 3 at Industrial Landfill IV at the Y-2 National Security Complex, Oak Ridge, Tennessee*, BJC/OR-3566, Bechtel Jacobs Company LLC, Oak Ridge, Tennessee.
- BJC. 2010a. *Sampling and Analysis Plan for the Water Resources Restoration Program for Fiscal Year 2011 Oak Ridge Reservation, Oak Ridge, Tennessee*. (WRRP/SAP-2011).
- BJC. 2010b. *Quality Assurance Project Plan for the Water Resources Restoration Program, U.S. Department of Energy, Oak Ridge Reservation, Oak Ridge, Tennessee*. (BJC/OR-235/R3).
- BJC. 2010c. *Environmental Management Waste Management Facility (EMWMF) Environmental Monitoring Plan for Bechtel Jacobs Company LLC, Oak Ridge, Tennessee*. (BJC/OR-2712, Rev.1).
- BJC. 2011. *Groundwater Monitoring Report for the Nonhazardous Solid Waste Landfills at the DOE Y-12 National Security Complex, Oak Ridge Tennessee; First 180-day Reporting Period of Calendar Year 2011*. Prepared by Elvado Environmental LLC (BJC/OR-3542).
- BWXT Y-12, L.L.C. (BWXT). 2002. *Liquid Grab Sampling*. BWXT Y-12, L.L.C. management requirement prepared by the Environment, Safety, and Health Organization (Y50-71-005, currently in revision).

- BWXT. 2003a. *Y-12 Groundwater Protection Program Data Management Plan*. Prepared by Science Applications International Corporation (Y/SUB/03-013288/1).
- BWXT. 2003b. *Updated Subsurface Data Base for Bear Creek Valley, Chestnut Ridge, and Parts of Bethel Valley on the U.S. Department of Energy Oak Ridge Reservation*. (Y/TS-881/R5). (referenced in Appendix C).
- BWXT. 2004. *Measurement of Static Water Level Elevation*. BWXT Y-12, L.L.C. Management Requirement prepared by the Environment, Safety, and Health Organization (Y50-71-015, Rev 1.0).
- BWXT. 2007a. *Groundwater Sampling of Westbay™ Monitoring System Instrumented Wells*. BWXT Y-12, L.L.C. management requirement prepared by the Environment, Safety, and Health Organization (Y50-71-018, Rev. 2.1).
- BWXT. 2007b. *Pressure Profiling of Wells Equipped with Westbay™ Monitoring System Instrumentation*. BWXT Y-12, L.L.C. management requirement prepared by the Environment, Safety, and Health Organization (Y50-71-019, Rev 1.1).
- BWXT. 2008. *Groundwater Sampling*. Oak Ridge Y-12 National Security Complex Procedure prepared by the Environment, Safety, and Health Organization (Y50-71-016, Rev. 2.0).
- EnergySolutions. 2007. *Sampling and Analysis Plan for Environmental Monitoring at the Nonhazardous Solid Waste Landfills on Chestnut Ridge South of the U.S. Department of Energy Y-12 National Security Complex, Oak Ridge, Tennessee*. Prepared by Elvado Environmental LLC. (ORR-LF-SAP, Rev. 1).
- Goldstrand, P.M. 1995. *Stratigraphic Variations and Secondary Porosity Within the Maynardville Limestone in Bear Creek Valley, Y-12 Plant, Oak Ridge, Tennessee*. (Y/TS-1093).
- Hatcher, R.D., Jr., P.J. Lemiszki, R.B. Dreier, R.H. Ketelle, R.R. Lee, D.A. Leitzke, W.M. McMaster, J.L. Foreman, and S.Y. Lee. 1992. *Status Report on the Geology of the Oak Ridge Reservation*. (ORNL/TM-12074) [referenced on Figure A.2].
- Jones, S.B. 1998. *Hydraulic Conductivity Estimates from Landfills in the Chestnut Ridge Hydrogeologic Regime at the Y-12 Plant, 1994-1997*. Letter to AJA Technical Services, Inc. February 12, 1998.
- Ketelle, R.H. and D.D. Huff. 1984. *Site Characterization of the West Chestnut Ridge Site*. Oak Ridge National Laboratory. (ORNL/TM-9229).
- King, H.L. and C.S. Haase. 1987. *Subsurface-Controlled Geological Maps for the Y-12 Plant and Adjacent Areas of Bear Creek Valley*. (ORNL/TM-10112) [referenced on Figure A.2].
- King, H.L. and C.S. Haase. 1988. *Summary of Results and Preliminary Interpretation of Hydrogeologic Packer Testing in Core Holes GW-131 Through GW-135 and CH-157, Oak Ridge Y-12 Plant*. (Y/TS-495).

- Lockheed Martin Energy Systems, Inc. 1996. *Calendar Year 2001 Groundwater Quality Report for the Chestnut Ridge Hydrogeologic Regime, Y-12 Plant, Oak Ridge, Tennessee; Part 2: 1995 Groundwater Quality Data Interpretations and Proposed Program Modifications.* (Y/SUB/96-KDS15V/2).
- Martin Marietta Energy Systems, Inc. (MMES). 1989. *Groundwater Quality Assessment Report for the Oil Landfarm, 1988.* (Y/SUB/89-00206C/3).
- MMES. 1990a. *Study of Ground-Water Flow from Chestnut Ridge Security Pits Using a Fluorescent Dye Tracer.* (Y/SUB/90-00206C/6).
- MMES. 1990b. *Comprehensive Groundwater Monitoring Plan for the Oak Ridge Y-12 Plant.* Prepared by Geraghty and Miller, Inc. (Y/SUB/90-00206CI5).
- MMES. 1993. *Final Report of the Second Dye-Trace Test at the Chestnut Ridge Security Pits, Y-12 Plant, Oak Ridge, Tennessee.* (Y/SUB/93-99928C/Y10/1).
- Moore, G.K. 1988. *Concepts of Groundwater Occurrence and Flow Near Oak Ridge National Laboratory.* Oak Ridge National Laboratory (ORNL/TM-10969).
- Moore, G.K. 1989. *Groundwater Parameters and Flow System Near Oak Ridge National Laboratory.* (ORNL/TM-11368).
- Shevenell, L.A. 1994. *Chemical Characteristics of Water in Karst Formations at the Oak Ridge Y-12 Plant.* (Y/TS/1001).
- Shevenell, L.A. 1995. *Evaluation of Cross Borehole Tests at Selected Wells in the Maynardville Limestone and Copper Ridge Dolomite at the Oak Ridge Y-12 Plant.* (Y/TS-1166).
- Solomon, D.K., G.K. Moore, L.E. Toran, R.B. Dreier, and W.M. McMaster. 1992. *Status Report - A Hydrologic Framework for the Oak Ridge Reservation.* Oak Ridge National Laboratory (ORNL/TM-12053).
- Sutton, G.E., and S.M. Field. 1995. *Distribution of Anthropogenic Fill Material within the Y-12 Plant Area, Oak Ridge, Tennessee.* (Y/TS-1387).
- Tennessee Department of Environment and Conservation (TDEC). 2009. *Notice of Violation Groundwater Protection Standard Industrial Landfill IV (SNL 01-0075).* Letter to Bechtel Jacobs Company LLC, November 2, 2009.
- URS | CH2 Oak Ridge LLC (UCOR). 2011. *Groundwater Monitoring Report for the Nonhazardous Solid Waste Landfills at the DOE Y-12 National Security Complex, Oak Ridge Tennessee; Second 180-day Reporting Period of Calendar Year 2011.* Prepared by Elvado Environmental LLC (UCOR-4005).
- UCOR. 2012a. *CY 2011 Resource Conservation and Recovery Act Annual Monitoring Report for the U.S. Department of Energy Y-12 National Security Complex, Oak Ridge, Tennessee.* Prepared by Elvado Environmental LLC (UCOR-4116).

- UCOR. 2012b. *Annual Report for 2010 - 2011 Detection Monitoring at the Environmental Management Waste Management Facility, Oak Ridge, Tennessee*. Prepared by Elvado Environmental LLC for Professional Project Services, Inc (UCOR-4117).
- U.S. Department of Energy (DOE). 1996. *Record of Decision for Chestnut Ridge Operable Unit 2 (Filled Coal Ash Pond Vicinity) Oak Ridge, Tennessee*. (DOE/OR/02-1410&D3).
- DOE. 1997a. *Report on the Remedial Investigation of Bear Creek Valley at the Oak Ridge Y-12 Plant, Oak Ridge, Tennessee*. Volume 1. (DOE/OR/01-1455/V1&D2).
- DOE. 1997b. *Record of Decision for an Interim Action for Union Valley, East Fork Poplar Creek Characterizations Area, Oak Ridge, Tennessee*. (DOE/OR/02-1545&D2).
- DOE. 1998. *Report on the Remedial Investigation of the Upper East Fork Poplar Creek Characterization Area at the Oak Ridge Y-12 Plant, Oak Ridge, Tennessee*. (DOE/OR/01-164/V3&D1).
- DOE. 2012. *2012 Remediation Effectiveness Report for the U.S. Department of Energy Oak Ridge Reservation, Oak Ridge, Tennessee*. Data and Evaluations (DOE/OR/01-2505&D1).
- U.S. Environmental Protection Agency. 1983. *Methods for Chemical Analysis of Water and Wastes*. (referenced in Table B.5).
- U.S. Environmental Protection Agency. 1996. *Test Methods for Evaluating Solid Waste Physical/Chemical Methods*. (referenced in Table B.5).
- U. S. Geological Survey. 2001. *Users Guide for Polyethylene-Based Passive Diffusion Bag Samplers to Obtain Volatile Organic Compound Concentrations in Wells*, Water Resources Investigations Report 01-4060.
- Wilson, G.V., P.M. Jardine, R.J. Luxmoore, and J.R. Jones. 1990. *Hydrology of a Forested Hillslope During Storm Events*. *Geoderma*, v. 46, p. 119-138.

APPENDIX A

FIGURES

GWPP Fig1 09/23/08

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

SYSTEM		HYDRO UNIT	GROUP	FORMATION	MAP SYMBOL	THICKNESS (FT)
ORDOVICIAN	UPPER	AQUITARD	CHICKA – MAUGA	UNDIFFERENTIATED	Och	1500 TO 2000
	MIDDLE	AQUIFER	KNOX	MISSING SECTION (Subaerial Erosion)		
	LOWER			MASCOT DOLOMITE	Oma	250–400
				KINGSPORT FORMATION	Ok	300–500
				LONGVIEW DOLOMITE	Ol	130–200
				CHEPULTEPEC DOLOMITE	Oc	500–700
UPPER				COPPER RIDGE DOLOMITE	€cr	800–1,100
CAMBRIAN	MIDDLE	AQUITARD	CONASAUGA	MAYNARDVILLE LIMESTONE	€mn	418–450
				NOLICHUCKY SHALE	€n	490–590
				MARYVILLE LIMESTONE	€m	346–445
				ROGERSVILLE SHALE	€rg	90–120
				RUTLEDGE LIMESTONE	€rt	90–120
	PUMPKIN VALLEY SHALE			€pv	260–320	
	LOWER			ROME	€r	NOT DETERMINED

SOURCES: King and Haas 1987
Hatcher et al. 1992

Fig. A.2. Topography and bedrock geology at the Y-12 National Security Complex.

SOURCE: Sutton and Field 1995

EXPLANATION

- - FILL THICKNESS GREATER THAN OR EQUAL TO 5 FT
- - BURIED TRIBUTARY (BT-)
- - SPRING
- 9623 - BUILDING NUMBER

Fig. A-3. Fill areas and pre-construction drainage features in the Upper East Fork Poplar Creek Hydrogeologic Regime.

GROUNDWATER ELEVATIONS APRIL 12-13, 2011

EXPLANATION

■	WATER TABLE INTERVAL MONITORING WELL	—920—	WATER-LEVEL ISOPLETH (ft msl)
●	BEDROCK INTERVAL MONITORING WELL	- - -	SURFACE DRAINAGE FEATURE

GROUNDWATER ELEVATIONS APRIL 11-14, 2011

EXPLANATION

■	WATER TABLE INTERVAL MONITORING WELL	---	SURFACE DRAINAGE FEATURE
●	BEDROCK INTERVAL MONITORING WELL	⊙	BUILDING 9201-2 SUMP
980	APPROXIMATE WATER-LEVEL ISOPLETH (ft msl)	⊗	EXTRACTION WELL AND APPROXIMATE ZONE OF INFLUENCE

Fig. A.5. Groundwater elevations in the Upper East Fork Poplar Creek Hydrogeologic Regime, April 2011.

GROUNDWATER ELEVATIONS APRIL 11-14, 2011

EXPLANATION

- WATER TABLE INTERVAL MONITORING WELL
- BEDROCK INTERVAL MONITORING WELL
- ▲ RCRA BACKGROUND MONITORING WELL
- APPROXIMATE WATER-LEVEL ISOPLETH (ft msl)
- - - SURFACE DRAINAGE FEATURE
- SPRING

Fig. A.6. Groundwater elevations in the Chestnut Ridge Hydrogeologic Regime, April 2011.

SOURCES: U.S. Department of Energy 1997a
U.S. Department of Energy 1998

Fig. A.7. Generalized extent of nitrate in groundwater at the Y-12 National Security Complex.

SOURCES: U.S. Department of Energy 1997a
U.S. Department of Energy 1998

EXPLANATION

Fig. A.8. Generalized extent of volatile organic compounds in groundwater at the Y-12 National Security Complex.

SOURCES: U.S. Department of Energy 1997a
U.S. Department of Energy 1998

EXPLANATION

	— SURFACE DRAINAGE FEATURE		— BUILDINGS
	— BOUNDARY OF SITE		— GROSS ALPHA > 15 pCi/L
	— BOUNDARY OF REGIME		
-
- MAXIMUM CY2011 GROSS ALPHA**
	— 15-150 pCi/L
	— 150-1,500 pCi/L

Fig. A.9. Generalized extent of gross alpha activity in groundwater at the Y-12 National Security Complex.

SOURCES: U.S. Department of Energy 1997a
U.S. Department of Energy 1998

Fig. A.10. Generalized extent of gross beta activity in groundwater at the Y-12 National Security Complex.

MONITORING WELL LOCATIONS

SPRING AND SURFACE WATER SAMPLING LOCATIONS

EXPLANATION

- — Water Table Monitoring Well
- — Bedrock Monitoring Well
- ◆ — Westbay 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

Fig. A.12. Components of Maynardville Limestone exit pathway pickets A, B, C, and W.

GWMR11_13.xls

Fig. A.13. Westbay™ monitoring system sampling port depths in well GW-134 in the Bear Creek Hydrogeologic Regime.

GWMR11_14.xls

Fig. A.14. Westbay™ monitoring system sampling port depths in well GW-729 in the Bear Creek Hydrogeologic Regime.

EXPLANATION

- — Water Table Monitoring Well
- — Bedrock Monitoring Well
- ◆ — Westbay Monitoring Well
- ♀ — Spring Sampling Location
- ⊗ — Plume Capture Well
- ▲ — Surface Water Sampling Location
- AQT — Aquitard
- — Approximate Nolichucky Shale/Maynardville Limestone Contact
- AQF — Aquifer

Elvado: GWMR_15

Fig. A.15. CY 2011 sampling locations in the Upper East Fork Poplar Creek Hydrogeologic Regime and in Union Valley.

EXPLANATION

▲ Surface Water Sampling Location

Fig. A.16. CY 2011 surface water sampling locations north of Pine Ridge.

GWMR11_17.xls

Fig. A.17. Westbay™ monitoring system sampling port depths in well GW-722 in the Upper East Fork Poplar Creek Hydrogeologic Regime.

Fig. A.18. CY 2011 sampling locations in the Chestnut Ridge Hydrogeologic Regime.
A-18

GWMR11 07/16/12

Fig. A.19. Bear Creek Regime: nitrate and/or uranium concentration trends in surveillance monitoring aquitard wells GW-085, GW-246, GW-276, GW-526, GW-537, and GW-615.

Fig. A.20. Bear Creek Regime: PCE concentration trends in surveillance monitoring aquitard wells GW-014, GW-046, GW-068, GW-246, GW-276, GW-289, and GW-627.

Fig. A.21. Bear Creek Regime: gross alpha and/or gross beta activity trends in surveillance monitoring aquitard wells GW-246, GW-276, and GW-537.

Fig. A.22. Bear Creek Regime: nitrate and/or uranium concentration trends in surveillance monitoring aquifer wells GW-229, GW-703, and GW-706.

Fig. A.23. Bear Creek Regime: selected VOC concentration trends in surveillance monitoring aquifer wells GW-229, GW-365, GW-704, GW-706, GW-724, and GW-738.

Fig. A.24. Bear Creek Regime: gross alpha and/or gross beta activity trends in surveillance monitoring aquifer wells GW-058, GW-229, GW-703, and GW-706.

Fig. A.25. East Fork Regime: nitrate and uranium concentration trends in surveillance monitoring aquitard wells 55-2B, GW-108, GW-204, GW-272, GW-274, GW-275, and GW-633.

Fig. A.26. East Fork Regime: summed VOC concentration trends in surveillance monitoring aquitard wells 55-3A, 56-2C, GW-337, GW-383, GW-656, GW-658, and GW-769.

Fig. A.27. East Fork Regime: gross alpha and/or gross beta activity trends in surveillance monitoring aquitard wells GW-108, GW-204, and GW-633.

Fig. A.28. East Fork Regime: nitrate and/or uranium concentration trends in surveillance monitoring aquifer wells GW-154, GW-223, GW-251, GW-253, and GW-606.

Fig. A.29. East Fork Regime: selected VOC concentration trends in surveillance monitoring aquifer wells GW-253, GW-382, GW-605, GW-618, and GW-698.

Fig. A.30. East Fork Regime: gross alpha and/or gross beta activity trends in surveillance monitoring aquifer wells GW-154, GW-219, and GW-605.

Fig. A.31. Chestnut Ridge Regime: VOC trends in surveillance monitoring wells GW-305, GW-322, and GW-798.

Fig. A.32. East Fork Regime: PCE concentration trends in exit pathway monitoring wells GW-151, GW-220, GW-722-14, and GW-832.

Fig. A.33. East Fork Regime: CTET concentration trend in exit pathway monitoring well GW-722-17.

Fig. A.34. Chestnut Ridge Regime: nitrate concentration trend in exit pathway surface water station S17.

APPENDIX B

TABLES

Table B.1. Summary of CY 2011 sampling and analysis plan addenda

Addendum No.	Effective Date	Modification to the CY 2011 Sampling and Analysis Plan ¹
2011-01	08/12/11	Corrects the waste stream identification and the pump intake depth for well GW-322.
2011-02	04/04/11	Adds isotopic analysis for U-234, U-235, and U-238 at well GW-274 and for Tc-99 at well GW-275 in response to results below elevated detection limits for gross alpha activity and gross beta activity, respectively.
2011-03	07/18/11	Changes the parameter group for the rinsate sample collected at GW-722-17 from the standard suite to VOC(1).
2011-04	10/03/11	Changes the sampling method for well GW-508 from a passive diffusion bag sampler to the low-flow minimal drawdown method.
2011-05	04/24/12	Adds confirmatory “paired” sampling of well GW-383 during the fourth quarter event, based on VOC results for the third quarter sample. A sample will be collected using a PDB sampler one day, followed by a sample collected using the low-flow method the next day. Both results will be analyzed only for VOCs.

Note:

- 1 Modification to the *Y-12 Groundwater Protection Program Groundwater and Surface Water Sampling and Analysis Plan for Calendar Year 2011* (B&W Y-12 2010a).

**Table B.2. CY 2011 groundwater and surface water sampling dates
in the Bear Creek Hydrogeologic Regime**

BJC/UCOR ¹		CERCLA ROD (●), Detection (□), and Baseline (○) Monitoring							
		RCRA Post-Closure Corrective Action Monitoring							
GWPP ²		DOE Order Exit Pathway/Perimeter Monitoring							
		DOE Order Surveillance Monitoring							
Sampling Point ³	Functional Area ⁴	CY 2011 Sampling Date ⁵							
		1st Quarter	2nd Quarter	3rd Quarter	4th Quarter				
GW-008	OLF	01/04/11	.	07/07/11	.	x		●	
GW-014	BG	01/25/11	.	.	.	●			
GW-046	BG	01/05/11	.	07/14/11	.	x		●	
GW-053	BG	02/09/11	.	.	.	●			
GW-058	BG	01/26/11	.	.	.	●			
GW-068	BG	02/09/11	.	.	.	●			
GW-071	BG	01/19/11	.	08/22/11	.	●			
GW-077	BG	02/22/11	.	08/03/11	.	x		●	
GW-078	BG	02/22/11	.	08/03/11	.	x		●	
GW-079	BG	02/22/11	.	08/03/11	.	x		●	
GW-080	BG	02/22/11 D	.	08/03/11 D	.	x		●	
GW-082	BG	.	.	08/23/11	.	●			
GW-085	OLF	02/07/11 D	.	.	.	●			
GW-098	OLF	02/07/11	.	.	.	●			
GW-100	S3	02/01/11	.	.	.	●			
GW-101	S3	02/01/11	.	.	.	●			
GW-122	S3	.	.	08/08/11	.	●			
GW-127	S3	.	.	08/08/11	.	●			
GW-134-05	S3	.	06/02/11	.	.	●			
GW-134-11	S3	.	06/07/11	.	.	●			
GW-134-15	S3	.	06/07/11	.	.	●			
GW-134-18	S3	.	06/08/11	.	.	●			
GW-134-21	S3	.	06/02/11	.	.	●			
GW-134-33	S3	.	05/26/11	.	.	●			
GW-134-35	S3	.	06/02/11	.	.	●			
GW-134-36	S3	.	05/25/11 D	.	.	●			
GW-225	OLF	02/10/11	.	.	.	●			
GW-229	OLF	02/08/11 D	.	.	.	●			
GW-236	S3	.	.	08/04/11	.	●			
GW-242	BG	.	.	08/24/11	.	●			
GW-246	S3	.	.	08/08/11 D	.	●			
GW-276	S3	01/11/11	.	07/11/11	.	x		●	
GW-289	BG	.	.	08/23/11	.	●			
GW-307	RS	02/09/11	.	.	.	●			
GW-315	SPI	02/14/11	.	.	.	●			
GW-363*	EMWMF	02/10/11	05/02/11	08/24/11	11/15/11	x		□	
GW-363	EMWMF	.	.	.	11/16/11	x		□	
GW-365	OLF	02/08/11	.	.	.	●			
GW-526	S3	01/27/11	.	.	.	●			
GW-537	OLF	.	.	08/24/11	.	●			

Table B.2 (continued)

BJC/UCOR ¹		CERCLA ROD (●), Detection (□), and Baseline (○) Monitoring							
		RCRA Post-Closure Corrective Action Monitoring							
GWPP ²		DOE Order Exit Pathway/Perimeter Monitoring							
		DOE Order Surveillance Monitoring							
Sampling Point ³	Functional Area ⁴	CY 2011 Sampling Date ⁵							
		1st Quarter	2nd Quarter	3rd Quarter	4th Quarter				
GW-601	OLF	02/09/11	.	.	.	●			
GW-615	S3	02/02/11	.	.	.	●			
GW-616	S3	.	.	08/09/11	.	●			
GW-623	BG	01/24/11	.	.	.	●			
GW-627	BG	01/19/11	.	08/22/11	.	●			
GW-639*	EMWMF	02/09/11	05/02/11	08/24/11	11/15/11	x			□
GW-639	EMWMF	02/11/11	05/03/11	08/25/11	11/16/11	x			□
GW-653	BG	01/18/11	.	.	.	●			
GW-683	EXP-A	02/23/11	.	08/03/11	.	x			●
GW-684	EXP-A	02/23/11	.	08/03/11	.	x			●
GW-703	EXP-B	02/14/11	.	.	.	●			
GW-704	EXP-B	02/23/11	.	08/04/11	.	x			●
GW-706	EXP-B	02/17/11	.	08/04/11	.	x			●
GW-712	EXP-W	01/05/11	.	07/07/11	.		x	●	
GW-713	EXP-W	01/13/11 D	.	07/07/11 D	.		x	●	
GW-714	EXP-W	01/05/11	.	07/06/11	.		x	●	
GW-724	EXP-C	02/16/11	.	.	.	●			
GW-725	EXP-C	02/17/11	.	.	.	●			
GW-729-18	BG	.	06/13/11	.	.	●			
GW-729-22	BG	.	06/23/11	.	.	●			
GW-729-26	BG	.	06/23/11	.	.	●			
GW-729-30	BG	.	06/27/11	.	.	●			
GW-729-34	BG	.	06/28/11	.	.	●			
GW-729-39	BG	.	06/27/11	.	.	●			
GW-729-44	BG	.	06/29/11	.	.	●			
GW-738	EXP-C	02/16/11	.	.	.	●			
GW-740	EXP-C	02/16/11 D	.	.	.	●			
GW-916	EMWMF	02/07/11	05/04/11	08/25/11	11/10/11	x			□
GW-917*	EMWMF	02/07/11	04/26/11	08/23/11 D	11/07/11	x			□
GW-917	EMWMF	.	.	.	11/08/11	x			□
GW-918	EMWMF	02/09/11	05/04/11	08/24/11	11/08/11	x			□
GW-920*	EMWMF	02/07/11	04/26/11	08/22/11	11/07/11	x			□
GW-920	EMWMF	02/08/11	.	.	11/08/11	x			□
GW-921*	EMWMF	02/07/11	05/02/11	08/24/11	11/07/11	x			□
GW-921	EMWMF	02/08/11	05/03/11	.	11/08/11	x			□
GW-922*	EMWMF	02/07/11	04/26/11	08/22/11	11/07/11	x			□
GW-922	EMWMF	2/08/11 D	.	.	11/08/11	x			□
GW-923*	EMWMF	02/07/11	05/02/11	08/22/11	11/07/11	x			□
GW-923	EMWMF	02/08/11	05/03/11	08/23/11	11/08/11	x			□
GW-923	EMWMF	02/09/11	05/04/11	08/24/11	.	x			□
GW-924	EMWMF	02/07/11	05/02/11	08/24/11	11/07/11	x			□
GW-925*	EMWMF	02/08/11	05/03/11	08/25/11	11/14/11	x			□

Table B.2 (continued)

BJC/UCOR ¹		CERCLA ROD (●), Detection (□), and Baseline (○) Monitoring							
		RCRA Post-Closure Corrective Action Monitoring							
GWPP ²		DOE Order Exit Pathway/Perimeter Monitoring							
		DOE Order Surveillance Monitoring							
Sampling Point ³	Functional Area ⁴	CY 2011 Sampling Date ⁵							
		1st Quarter	2nd Quarter	3rd Quarter	4th Quarter				
GW-925	EMWMF	.	.	.	11/15/11	x			□
GW-926	EMWMF	02/10/11	04/28/11	08/23/11	11/09/11 D	x			□
GW-927*	EMWMF	02/07/11	04/26/11	08/22/11	11/08/11	x			□
GW-927	EMWMF	02/08/11	.	08/23/11	.	x			□
GW-961*	EMWMF	02/09/11	05/04/11 D	08/25/11	11/09/11	x			□
GW-961	EMWMF	.	.	.	11/10/11	x			□
GW-964*	EMWMF	.	.	08/24/11	11/14/11	x			□
GW-964	EMWMF	.	.	08/25/11	11/15/11	x			□
GW-965*	EMWMF	.	.	08/25/11	11/14/11	x			□
GW-965	EMWMF	.	.	.	11/15/11	x			□
BCK-03.30	EXP-SW	.	.	.	12/13/11		x		●
BCK-04.55	EXP-SW	.	.	07/26/11 D	.		●		
BCK-04.60	EXP-SW	02/22/11	.	08/02/11	12/13/11		x		●
BCK-09.20	EXP-SW	02/22/11	.	08/02/11	12/13/11		x		●
BCK-09.40	EXP-SW	.	.	07/26/11	.		●		
BCK-11.54	EXP-SW	02/22/11	.	08/02/11	12/13/11		x		●
BCK-11.97	EXP-SW	.	.	07/25/11	.		●		
BCK-12.34	EXP-SW	02/22/11	.	08/02/11	12/13/11		x		●
BCK-12.34	EXP-SW	03/08/11	.	.	.		x		●
EMWNT-03A	EXP-SW	02/07/11	04/11/11	09/08/11	11/21/11		x		□
EMWNT-05	EXP-SW	02/07/11	04/11/11	09/08/11	11/21/11		x		□
EMW-VWEIR	EXP-SW	02/07/11	04/11/11	09/08/11	11/21/11		x		□
EMW-VWUND	EXP-SW	02/09/11	05/04/11	08/29/11	11/09/11		x		□
NT-01	EXP-SW	.	.	07/26/11	.		●		
NT-01	EXP-SW	01/17/11 D	05/10/11 D	07/14/11 D	10/18/11 D		x		●
NT-03	EXP-SW	02/22/11	.	08/02/11	12/13/11		x		●
NT-04	EXP-SW	02/07/11	04/11/11	08/30/11	11/21/11		x		□
NT-07	EXP-SW	02/15/11	.	08/15/11	.		x		○
NT-08	EXP-SW	02/15/11	.	.	12/13/11		x		○
NT-08	EXP-SW	02/22/11	.	.	.		x		●
SS-4	EXP-SW	.	.	07/26/11	.		●		
SS-4	EXP-SW	02/22/11	.	08/02/11	12/13/11		x		●
SS-5	EXP-SW	.	.	07/25/11	.		●		
SS-5	EXP-SW	02/22/11	.	08/02/11	12/13/11		x		●
SS-5	EXP-SW	.	.	.	10/18/11		x		●
SS-6	EXP-SW	01/12/11	.	07/07/11	.		x		●

Table B.2 (continued)

Notes:

- 1 Groundwater and surface water sampling performed for monitoring programs managed by Bechtel Jacobs Company LLC (BJC) or URS | CH2M Oak Ridge LLC (UCOR).
- 2 Groundwater and surface water sampling performed for the Y-12 Groundwater Protection Program (GWPP), managed by Babcock & Wilcox Technical Services Y-12, LLC.
 - x - Denotes the DOE Order monitoring category (surveillance or exit pathway/perimeter) fulfilled by samples collected under programs managed by BJC/UCOR. Although the CY 2011 samples were collected for various monitoring purposes, all of the data meet DOE Order monitoring requirements. Surveillance and exit pathway/perimeter monitoring data evaluations are provided in Section 4.
- 3
 - BCK - Bear Creek Kilometer
 - EMW-VWUND - EMW-VWUNDRDRAIN; outfall for an underdrain installed to lower the water table and relieve hydrostatic pressure beneath the EMWMF liners.
 - GW - Groundwater Monitoring Well
 - NT - Northern Tributary (to Bear Creek)
 - SS - Spring sampling location (south side of Bear Creek)
- 4
 - BG - Bear Creek Burial Grounds Waste Management Area
 - EMWMF - Environmental Management Waste Management Facility
 - EXP-A - Exit Pathway (Maynardville Limestone) Picket A
 - EXP-B - Exit Pathway Picket B
 - EXP-C - Exit Pathway Picket C
 - EXP-SW - Exit Pathway (Bear Creek) Surface Water
 - EXP-W - Exit Pathway Picket W
 - OLF - Oil Landfarm Waste Management Area
 - RS - Rust Spoil Area
 - S3 - S-3 Site
 - SPI - Spoil Area I
- 5
 - . - Not sampled
 - D - Duplicate sample collected on specified date
 - * - Field measurements obtained on the initial date shown, with laboratory samples collected on subsequent days; dependent upon groundwater volume in well after purging.

**Table B.3. CY 2011 groundwater and surface water sampling dates in the
Upper East Fork Poplar Creek Hydrogeologic Regime**

BJC/UCOR ¹		CERCLA ROD Monitoring								
GWPP ²		RCRA Post-Closure Corrective Action Monitoring								
		DOE Order Exit Pathway/Perimeter Monitoring								
		DOE Order Surveillance Monitoring								
Sampling Point ³	Functional Area ⁴	CY 2011 Sampling Date ⁵								
		1st Quarter	2nd Quarter	3rd Quarter	4th Quarter					
55-2A	GRID B3	.	04/27/11	.	.	●				
55-2B	GRID B3	.	04/26/11	.	.	●				
55-2C	GRID B3	.	04/26/11	.	.	●				
55-3A	B9201-5	.	04/27/11	.	10/17/11	●				
55-3B	B9201-5	.	04/28/11	.	10/17/11 D	●				
55-3C	B9201-5	.	04/27/11	.	10/18/11	●				
56-1A	Y12	.	05/02/11	.	.	●				
56-1C	Y12	.	05/02/11	.	.	●				
56-2A	GRID C3	.	05/04/11	.	.	●				
56-2B	GRID C3	.	05/04/11	.	.	●				
56-2C	GRID C3	.	05/05/11	.	.	●				
56-3A	Y12	.	05/04/11	.	.	●				
56-3B	Y12	.	05/05/11 D	.	.	●				
56-3C	Y12	.	05/04/11	.	.	●				
56-4A	Y12	.	04/28/11	.	.	●				
GW-108	S3	01/20/11	.	07/19/11	.	x		●		
GW-151	NHP	02/23/11	.	08/04/11	.		x		●	
GW-153	NHP	.	.	08/25/11	.	●				
GW-154	NHP	02/24/11	.	08/04/11	.	x			●	
GW-169	EXP-UV	03/01/11	.	.	.	x			●	
GW-170	EXP-UV	03/01/11 D	.	08/09/11 D	.	x			●	
GW-171	EXP-UV	02/28/11	.	.	.	x			●	
GW-172	EXP-UV	02/28/11	.	.	.	x			●	
GW-193	T2331	01/26/11	.	07/14/11	.	x		●		
GW-204	T0134	02/23/11	.	.	.	●				
GW-219	UOV	02/21/11	.	.	.	●				
GW-220	NHP	02/15/11 D	.	08/25/11	.		●			
GW-223	NHP	02/24/11	.	08/08/11	.	x			●	
GW-230	EXP-UV	02/28/11	.	.	.	x			●	
GW-240	NHP	.	.	08/25/11	.	●				
GW-251	S2	02/21/11	.	.	.	●				
GW-253	S2	03/01/11	.	.	.	x			●	
GW-265	SY	.	04/25/11	.	.	●				
GW-268	SY	.	04/27/11	.	.	●				
GW-269	SY	.	04/19/11	.	.	●				
GW-270	SY	.	04/25/11	.	.	●				
GW-272	SY	.	04/19/11	.	.	●				

Table B.3 (continued)

BJC/UCOR ¹		CERCLA ROD Monitoring							
		RCRA Post-Closure Corrective Action Monitoring							
GWPP ²		DOE Order Exit Pathway/Perimeter Monitoring							
		DOE Order Surveillance Monitoring							
Sampling Point ³	Functional Area ⁴	CY 2011 Sampling Date ⁵							
		1st Quarter	2nd Quarter	3rd Quarter	4th Quarter				
GW-274	SY	.	04/20/11	.	.	•			
GW-275	SY	.	04/21/11	.	.	•			
GW-281	FF	.	05/25/11	.	.	x			•
GW-332	WCPA	02/24/11	.	.	.	•			
GW-337	WCPA	02/17/11	.	.	.	•			
GW-380	NHP	02/24/11	.	08/04/11	.	x			•
GW-381	NHP	.	.	08/29/11	.	•			
GW-382	NHP	03/03/11	.	08/09/11	.	x			•
GW-383	NHP	.	.	08/30/11	11/01/11	•			
GW-383	NHP	.	.	.	11/02/11	•			
GW-505	RG	.	.	.	10/18/11	•			
GW-508	RG	.	.	.	10/18/11 D	•			
GW-605	EXP-I	01/11/11 D	.	07/06/11 D	.	x		•	
GW-606	EXP-I	01/11/11	.	07/06/11	.	x		•	
GW-618	EXP-E	03/28/11	.	.	.	x			•
GW-633	RG	03/01/11	.	.	.	•			
GW-656	T0134	.	.	08/30/11	.	•			
GW-658	FF	.	05/24/11	.	.	x			•
GW-686	CPT	.	05/09/11	.	.	•			
GW-690	CPT	.	05/09/11	.	.	•			
GW-691	CPT	.	05/11/11	.	10/25/11	•			
GW-692	CPT	.	05/03/11	.	.	•			
GW-698	B8110	.	05/12/11 D	.	10/19/11	•			
GW-700	B8110	.	.	08/29/11 D	.	•			
GW-722-14	EXP-J	03/15/11	.	.	.		x		•
GW-722-14	EXP-J	.	.	07/19/11	.		•		
GW-722-17	EXP-J	03/15/11	.	.	.		x		•
GW-722-17	EXP-J	.	.	07/20/11	.		•		
GW-722-20	EXP-J	03/15/11	.	.	.		x		•
GW-722-20	EXP-J	.	.	07/20/11	.		•		
GW-722-22	EXP-J	03/15/11	.	.	.		x		•
GW-722-22	EXP-J	.	.	07/19/11	.		•		
GW-722-33	EXP-J	03/15/11	.	.	.		x		•
GW-722-33	EXP-J	.	.	07/19/11	.		•		
GW-733	EXP-J	01/11/11	.	07/06/11	.		x	•	
GW-735	EXP-J	.	.	08/01/11 D	.		•		
GW-744	GRID K1	.	.	08/16/11	.		•		
GW-747	GRID K2	.	.	08/15/11	.		•		
GW-750	EXP-J	.	.	08/01/11	.		•		

Table B.3 (continued)

BJC/UCOR ¹		CERCLA ROD Monitoring							
		RCRA Post-Closure Corrective Action Monitoring							
GWPP ²		DOE Order Exit Pathway/Perimeter Monitoring							
		DOE Order Surveillance Monitoring							
Sampling Point ³	Functional Area ⁴	CY 2011 Sampling Date ⁵							
		1st Quarter	2nd Quarter	3rd Quarter	4th Quarter				
GW-762	GRID J3	02/24/11 D	.	08/08/11 D	.	x			•
GW-763	GRID J3	.	.	08/11/11	.	•			
GW-765	GRID E1	.	.	.	10/25/11	•			
GW-769	GRID G3	.	05/16/11	.	10/20/11	•			
GW-770	GRID G3	.	.	.	10/24/11	•			
GW-775	GRID H3	02/10/11	.	.	.	•			
GW-776	GRID H3	02/23/11	.	.	.	•			
GW-779	GRID F2	.	05/17/11	.	.	•			
GW-781	GRID E3	.	.	08/17/11	.	•			
GW-782	GRID E3	.	.	08/17/11	.	•			
GW-783	GRID E3	.	.	08/18/11	.	•			
GW-791	GRID D2	.	.	08/16/11	.	•			
GW-802	FF	.	05/26/11	.	.	x			•
GW-816	EXP-SR	.	.	08/11/11	.		•		
GW-820	B9201-2	.	05/16/11 D	.	.	•			
GW-832	NHP	02/24/11	.	08/04/11	.		x		•
GW-930	GRID D1	02/22/11	.	.	.	•			
GW-959	B9201-2	.	.	.	10/31/11	•			
GW-960	GRID F2	.	05/17/11	.	.	•			
GHK2.51WSW	EXP-SW	01/24/11	.	.	.		•		
NPR12.0SW	EXP-SW	01/24/11	.	.	.		•		
NPR23.0SW	EXP-SW	01/24/11	.	.	.		•		
SCR7.1SP	EXP-SW	01/17/11	.	.	.		x		•
SCR7.8SP	EXP-SW	01/17/11	.	.	.		x		•
SP-17	EXP-SW	01/24/11	.	.	.		•		
200A6*	EXP-SW	02/10/11	.	07/12/11	.		x		•
200A6	EXP-SW	02/24/11	.	08/15/11	.		x		•
STATION 8*	EXP-SW	02/10/11	.	07/12/11	.		x		•
STATION 8	EXP-SW	02/24/11	.	08/15/11	.		x		•

Notes:

- 1 Groundwater and surface water sampling performed for monitoring programs managed by Bechtel Jacobs Company LLC (BJC) or URS | CH2M Oak Ridge LLC (UCOR).

Table B.3 (continued)

Notes: (continued)

- 2 Groundwater and surface water sampling performed for the Y-12 Groundwater Protection Program (GWPP), managed by Babcock & Wilcox Technical Services Y-12, LLC.
 - x** - Denotes the DOE Order monitoring category (surveillance or exit pathway/perimeter) fulfilled by samples collected under programs managed by BJC/UCOR. Although the CY 2011 samples were collected for various monitoring purposes, all of the data meet DOE Order monitoring requirements. Surveillance and exit pathway/perimeter monitoring data evaluations are provided in Section 4.

- 3
 - GHK - Gum Hollow Branch Kilometer (surface water sampling station)
 - GW - Groundwater Monitoring Well (also locations beginning with number 5 or 6)
 - NPR - North of Pine Ridge near the Scarboro Community (surface water sampling station)
 - 200A6 - Storm drain outfall (surface water sampling station)
 - SCR - Spring sampling location in Union Valley (prefix)
 - SP - Spring sampling location (prefix or suffix)
 - STATION 8 - Surface water sampling location in Upper East Fork Poplar Creek, central Y-12
 - STATION 17 - Surface water sampling location in Upper East Fork Poplar Creek, eastern Y-12
 - SW - Surface water sampling location (suffix)

- 4
 - B8110 - Building 81-10
 - B9201-2 - Building 9201-2
 - B9201-5 - Building 9201-5
 - CPT - Coal Pile Trench
 - EXP-E - Exit Pathway Picket E
 - EXP-I - Exit Pathway Picket I
 - EXP-J - Exit Pathway Picket J
 - EXP-SR - Along Scarboro Road in the gap through Pine Ridge
 - EXP-SW - Surface water or spring sampling station
 - EXP-UV - East of the Oak Ridge Reservation boundary in Union Valley
 - FF - Fuel Facility (Building 9754-2)
 - GRID - Comprehensive Groundwater Monitoring Plan Grid Location
 - NHP - New Hope Pond
 - RG - Rust Garage Area
 - S2 - S-2 Site
 - S3 - S-3 Site
 - SY - Y-12 Salvage Yard
 - T0134 - Tank 0134-U
 - T2331 - Tank 2331-U
 - UOV - Uranium Oxide Vault
 - WCPA - Waste Coolant Processing Area
 - Y12 - Y-12 Complex

- 5
 - .
 - D** - Duplicate sample collected on specified date (shown in bold typeface).
 - *
 - Two sets of surface water samples collected; a stormflow sample on the first date shown and a base flow sample collected later during the first and third quarters.

**Table B.4. CY 2011 groundwater and surface water sampling dates
in the Chestnut Ridge Hydrogeologic Regime**

BJC/UCOR ¹		Solid Waste Disposal Facility Detection (●) and Assessment (○) Monitoring										
		RCRA Post-Closure Detection (●) and Corrective Action (○) Monitoring										
		CERCLA ROD (●) and Baseline (○) Monitoring										
GWPP ²		DOE Order Exit Pathway/Perimeter Monitoring										
		DOE Order Surveillance Monitoring										
Sampling Point ³	Functional Area ⁴	CY 2011 Sampling Date ⁵										
		1st Quarter	2nd Quarter	3rd Quarter	4th Quarter							
1090	UNCS	03/03/11	.	08/08/11	.	x		●				
GW-141	LIV	01/27/11	.	07/25/11	.	x					●	
GW-143	KHQ	01/06/11	.	.	.	x			●			
GW-144	KHQ	01/06/11	.	.	.	x			●			
GW-145	KHQ	01/06/11	.	.	.	x			●			
GW-156	CRSDB	01/12/11 D	.	.	.	x			●			
GW-159	CRSDB	01/12/11	.	.	.	x			●			
GW-161	ECRWP	01/12/11	.	07/12/11	.	x			●			
GW-174	CRSP	.	.	08/09/11	.	●						
GW-175	CRSP	.	.	08/10/11 D	.	●						
GW-176	CRSP	.	.	08/09/11	.	●						
GW-177	CRSP	01/13/11	.	07/13/11	.	x			○			
GW-180	CRSP	.	.	08/09/11	.	●						
GW-203	UNCS	03/02/11	.	08/08/11	.	x		●				
GW-205	UNCS	01/19/11	.	07/27/11	.	x					○	
GW-205	UNCS	03/02/11	.	08/08/11	.	x		●				
GW-217	LIV	01/19/11	.	07/19/11	.	x					○	
GW-221	UNCS	03/02/11	.	08/08/11	.	x		●				
GW-231	KHQ	01/06/11 D	.	.	.	x			●			
GW-294	ECRWP	01/13/11 D	.	07/13/11 D	.	x			●			
GW-296	ECRWP	01/13/11	.	07/11/11	.	x			●			
GW-298	ECRWP	01/12/11	.	07/12/11	.	x			●			
GW-298	ECRWP	03/03/11 D	.	.	.	x			●			
GW-301	CRBAWP	01/12/11 D	.	07/12/11 D	.	x			○			
GW-305	LIV	01/18/11	04/18/11	07/14/11	10/27/11	x					○	
GW-322	CRSP	.	.	08/10/11	.	●						
GW-521	LIV	01/18/11	.	07/19/11	.	x					○	
GW-522	LIV	01/19/11 D	.	07/18/11 D	.	x					○	
GW-540	CDLVI	01/20/11	.	07/21/11	.	x					●	
GW-557	LV	01/18/11	.	07/20/11	.	x					●	
GW-560	CDLVII	01/19/11	.	07/21/11	.	x					●	
GW-562	CDLVII	01/19/11	.	07/21/11	.	x					●	
GW-564	CDLVII	01/19/11 D	.	07/20/11 D	.	x					●	
GW-709	LII	01/20/11	.	07/25/11	.	x					●	
GW-731	CRSDB	01/18/11	.	.	.	x			●			
GW-732	CRSDB	01/14/11	.	.	.	x			●			
GW-757	LII	01/20/11	.	07/25/11	.	x					●	

Table B.4 (continued)

BJC/UCOR ¹		Solid Waste Disposal Facility Detection (●) and Assessment (○) Monitoring									
		RCRA Post-Closure Detection (●) and Corrective Action (○) Monitoring									
		CERCLA ROD (●) and Baseline (○) Monitoring									
GWPP ²		DOE Order Exit Pathway/Perimeter Monitoring									
		DOE Order Surveillance Monitoring									
Sampling Point ³	Functional Area ⁴	CY 2011 Sampling Date ⁵									
		1st Quarter	2nd Quarter	3rd Quarter	4th Quarter						
GW-796	LV/CDLVII	01/18/11	.	07/20/11	.	x					●
GW-797	LV	01/20/11	.	07/20/11	.	x					●
GW-798	CDLVII	01/19/11	.	07/20/11	.	x					●
GW-799	LV	01/18/11	.	07/21/11	.	x					●
GW-801	LV	01/18/11	.	07/19/11	.	x					●
GW-831	FCAP	01/13/11	.	07/13/11	.	x			○		
KHB-09	EXP-SW	.	.	.	12/13/11		●				
MCK 1.4	EXP-SW	03/24/11	.	08/23/11	.		x	●			
MCK 2.0	EXP-SW	03/24/11	.	08/23/11	.		x	●			
MCK 2.05	EXP-SW	03/24/11 D	.	08/23/11 D	.		x	●			
S17	EXP-SW	.	.	07/27/11	12/13/11		●				
SCR1.25SP	EXP-SW	03/24/11	.	08/23/11	.		x	○			
SCR1.5SW	EXP-SW	.	.	07/27/11	.		●				
SCR2.1SP	EXP-SW	.	.	07/27/11	.		●				
SCR2.2SP	EXP-SW	.	.	07/27/11	.		●				
SCR3.5SP	EXP-SW	03/24/11	.	08/23/11	.		x	○			
SCR3.5SW	EXP-SW	.	.	07/27/11	.		●				
SCR4.3SP	EXP-SW	01/19/11	.	07/20/11	.		x				●
SCR5.1SP	EXP-SW	.	.	.	12/13/11		●				
SCR5.2SP	EXP-SW	.	.	.	12/13/11		●				
UNC SW-1	EXP-SW	03/07/11	.	09/15/11	.		x				●

Notes:

- 1 Groundwater and surface water sampling performed under monitoring programs managed by Bechtel Jacobs Company LLC (BJC) or URS | CH2M Oak Ridge LLC (UCOR).
- 2 Surface water sampling performed under the Y-12 Groundwater Protection Program (GWPP) managed by Babcock & Wilcox Technical Services Y-12, LLC.
 - x - Denotes the DOE Order monitoring category (site surveillance or exit pathway/perimeter) fulfilled by samples collected under programs managed by BJC/UCOR. Although the CY 2011 samples were collected for various monitoring purposes, all of the data meet DOE Order monitoring requirements. Surveillance and exit pathway/perimeter monitoring data evaluations are provided in Section 4.

Table B.4 (continued)

Notes: (continued)

3	GW	-	Groundwater monitoring well (also 1090)
	KHB	-	Kerr Hollow Branch (SCR5)
	MCK	-	McCoy Branch Kilometer
	SCR	-	South Chestnut Ridge (tributary prefix)
	SP	-	Spring sampling location (suffix)
	SW	-	Surface water sampling location (suffix)
4	CDLVII	-	Construction/Demolition Landfill VII
	CRBAWP	-	Chestnut Ridge Borrow Area Waste Pile (formerly)
	CRSDB	-	Chestnut Ridge Sediment Disposal Basin
	CRSP	-	Chestnut Ridge Security Pits
	ECRWP	-	East Chestnut Ridge Waste Pile
	EXP-SW	-	Exit Pathway (spring or surface water sampling location)
	FCAP	-	Filled Coal Ash Pond
	KHQ	-	Kerr Hollow Quarry
	LII	-	Industrial Landfill II
	LIV	-	Industrial Landfill IV
	LV	-	Industrial Landfill V
	UNCS	-	United Nuclear Corporation Site
5	.	-	Not Sampled.
	D	-	Duplicate sample collected on specified date (shown in bold typeface).

Table B.5. Field measurements and laboratory analytes for CY 2011 groundwater and surface water samples obtained by the Y-12 GWPP

Field Measurements	Analytical Method ¹	Reporting 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
Miscellaneous Laboratory Analytes			
Total Dissolved Solids	SM 2540C 18	1	mg/L
Total Suspended Solids	SM 2540D 18	1	mg/L
Anions			
Carbonate	SM 2320B 18	1	mg/L
Bicarbonate	SM 2320B 18	1	mg/L
Chloride	EPA-300.0	0.2	mg/L
Fluoride	SM 4500F 18	0.1	mg/L
Nitrate (as Nitrogen)	EPA-353.2	0.05	mg/L
Sulfate	SW846-9056	0.25	mg/L
Metals/Cations			
Aluminum	SW846-6010B	0.2	mg/L
Antimony	SW846-6020	0.0025	mg/L
Arsenic	SW846-6020	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	SW846-6020	0.0025	mg/L
Calcium	SW846-6010B	0.2	mg/L
Chromium	SW846-6020	0.01	mg/L
Cobalt	SW846-6010B	0.02	mg/L
Copper	SW846-6010B	0.02	mg/L
Iron	SW846-6010B	0.05	mg/L
Lead	SW846-6020	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/A	0.00005	mg/L
Molybdenum	SW846-6010B	0.05	mg/L
Nickel	SW846-6020	0.005	mg/L
Potassium	SW846-6010B	2	mg/L
Selenium	SW846-6020	0.01	mg/L
Silver	SW846-6010B	0.02	mg/L

Table B.5 (continued)

Metals/Cations (continued)	Analytical Method ¹	Reporting Limit ²	Units ³
Sodium	SW846-6010B	0.2	mg/L
Strontium	SW846-6010B	0.005	mg/L
Thallium	SW846-6020	0.0005	mg/L
Thorium	SW846-6010B	0.2	mg/L
Uranium	SW846-6020	0.0005	mg/L
Vanadium	SW846-6010B	0.02	mg/L
Zinc	SW846-6010B	0.05	mg/L
Volatile Organic Compounds		CRQL ⁴	
Acetone	SW846-8260B UP	10	µg/L
Acetonitrile	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
cis-1,3-Dichloropropene	SW846-8260B UP	5	µg/L
trans-1,3-Dichloropropene	SW846-8260B UP	5	µg/L

Table B.5 (continued)

Volatile Organic Compounds (cont'd)	Analytical Method ¹	CRQL ⁴	Units ³
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
1,1,2-Trichloro-1,2,2-trifluoroethane	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
Total Xylene	SW846-8260B UP	5	µg/L
Radiological Analytes		Target MDA ⁵	
Gross Alpha Activity	EPA-900.0	5	pCi/L
Gross Beta Activity	EPA-900.0	10	pCi/L
Technetium-99	Y50-AC-7060	15	pCi/L
Uranium-234, 235, & 238	Y50-AC-7061	0.4	pCi/L

Notes:

1 NA - not applicable

Analytical methods from:

- EPA: *Methods for Chemical Analysis of Water and Wastes* (U.S. Environmental Protection Agency 1983)
- SM: *Standard Methods for the Evaluation of Water and Wastewater, 18th Edition* (American Public Health Association 1992)
- SW846: *Test Methods for Evaluating Solid Waste Physical/Chemical Methods* (U.S. Environmental Protection Agency 1996)
- B&W Y-12 Analytical Chemistry Organization Control Procedures: (Y50-AC-7060 and Y50-AC-7061)

2 The lowest concentration reported.

NA - not applicable

Table B.5 (continued)

Notes: (continued)

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; estimated values are reported below this level and above the instrument detection limit. Results below the instrument detection limit are reported as not detected at the CRQL.
5	MDA - minimum detectable activity. The target MDA may be obtained under optimal analytical conditions; actual MDAs are sample-specific and, in some cases, may vary significantly from the target value.

**Table B.6. Depth-to-water measurements and groundwater elevations for selected wells
in the Bear Creek Hydrogeologic Regime, April 2011**

Well Number	Location ¹	Hydrogeologic Unit		Measuring Point ²	Date Measured	Depth to Water ³	Groundwater Elevation ⁴
		Aquifer	Aquitard				
GW-001	OLF		●	981.00	04/13/11	14.06	966.94
GW-008	OLF		●	965.39	04/13/11	13.29	952.10
GW-010	OLF		●	952.70	04/13/11	0.51	952.19
GW-012	OLF		●	955.57	04/13/11	5.91	949.66
GW-014	BG		●	934.50	04/12/11	5.63	928.87
GW-016	BG		●	928.81	04/12/11	7.62	921.19
GW-041	BG		●	1008.10	04/12/11	13.00	995.10
GW-046	BG		●	921.17	04/12/11	2.56	918.61
GW-047	BG		●	929.00	04/12/11	6.66	922.34
GW-052	BG	●		905.70	04/12/11	13.71	891.99
GW-053	BG	●		903.42	04/12/11	5.90	897.52
GW-057	EXP-A	●		890.20	04/12/11	4.54	885.66
GW-059	BG	●		912.70	04/12/11	21.37	891.33
GW-065	OLF	●		982.50	04/13/11	24.08	958.42
GW-069	BG		●	927.60	04/12/11	7.60	920.00
GW-078	BG		●	918.10	04/12/11	3.93	914.17
GW-080	BG		●	981.00	04/12/11	18.88	962.12
GW-082	BG		●	964.00	04/12/11	18.78	945.22
GW-084	OLF		●	997.18	04/13/11	11.61	985.57
GW-086	OLF		●	982.80	04/13/11	11.59	971.21
GW-090	BG		●	961.88	04/12/11	3.77	958.11
GW-091	BG		●	952.62	04/12/11	6.84	945.78
GW-097	OLF		●	945.41	04/13/11	8.52	936.89
GW-100	S3	●		987.40	04/12/11	5.07	982.33
GW-101	S3		●	1007.40	04/12/11	8.42	998.98
GW-115	S3		●	1055.01	04/12/11	6.92	1048.09
GW-127	S3		●	1005.90	04/12/11	11.75	994.15
GW-226	OLF	●		943.57	04/13/11	6.76	936.81
GW-227	OLF	●		946.46	04/13/11	7.09	939.37
GW-229	OLF	●		949.00	04/13/11	14.35	934.65
GW-236	S3	●		983.21	04/13/11	9.93	973.28
GW-242	BG		●	978.69	04/12/11	5.32	973.37
GW-245	S3		●	1009.08	04/12/11	11.90	997.18
GW-249	BG		●	991.15	04/12/11	28.35	962.80
GW-257	BG		●	961.68	04/12/11	26.50	935.18
GW-276	S3		●	1001.57	04/12/11	4.55	997.02
GW-287	BG		●	927.04	04/12/11	6.60	920.44
GW-289	BG		●	948.73	04/12/11	10.98	937.75
GW-291	BG		●	948.66	04/12/11	7.44	941.22

Table B.6 (continued)

Well Number	Location ¹	Hydrogeologic Unit		Measuring Point ²	Date Measured	Depth to Water ³	Groundwater Elevation ⁴
		Aquifer	Aquitard				
GW-307	RS	●		993.14	04/14/11	26.20	966.94
GW-309	RS	●		988.17	04/14/11	18.80	969.37
GW-310	RS	●		995.52	04/14/11	19.66	975.86
GW-316	SPI	●		1047.17	04/12/11	51.53	995.64
GW-323	SPI	●		1130.11	04/14/11	85.93	1044.18
GW-325	S3		●	1003.00	04/13/11	7.88	995.12
GW-345	S3		●	999.63	04/13/11	16.68	982.95
GW-347	S3	●		1001.05	04/14/11	14.44	986.61
GW-364	OLF	●		936.16	04/13/11	8.72	927.44
GW-370	BG		●	960.81	04/12/11	14.51	946.30
GW-372	BG		●	983.16	04/12/11	26.38	956.78
GW-531	LD		●	1004.61	04/13/11	10.76	993.85
GW-537	OLF		●	976.65	04/13/11	5.35	971.30
GW-613	S3		●	1013.58	04/13/11	9.18	1004.40
GW-621	EXP-B	●		925.45	04/12/11	8.21	917.24
GW-622	BG		●	924.16	04/12/11	8.40	915.76
GW-624	BG		●	922.15	04/12/11	5.32	916.83
GW-626	BG		●	942.87	04/12/11	23.48	919.39
GW-630	LD		●	986.65	04/13/11	9.01	977.64
GW-638	OLF		●	941.77	04/13/11	5.80	935.97
GW-641	BG		●	946.66	04/13/11	16.27	930.39
GW-642	BG		●	1014.95	04/12/11	17.11	997.84
GW-645	OLF	●		1006.40	04/13/11	70.15	936.25
GW-652	BG	●		900.83	04/12/11	7.73	893.10
GW-653	BG		●	931.84	04/12/11	20.45	911.39
GW-654	BG		●	940.79	04/12/11	6.37	934.42
GW-683	EXP-A	●		972.23	04/12/11	88.39	883.84
GW-695	EXP-B	●		939.54	04/12/11	24.73	914.81
GW-795	AGLLSF		●	926.18	04/13/11	3.25	922.93
GW-800	OLF	●		964.36	04/13/11	17.88	946.48
GW-829	OLF		●	985.95	04/13/11	12.64	973.31
GW-835	S3	●		1000.91	04/12/11	14.25	986.66
GW-916	EMWMF		●	1002.85	04/13/11	4.54	998.31
GW-917	EMWMF		●	997.10	04/13/11	18.49	978.61
GW-918	EMWMF		●	1067.96	04/13/11	5.18	1062.78
GW-921	EMWMF		●	971.29	04/13/11	5.79	965.50
GW-922	EMWMF		●	956.91	04/13/11	4.90	952.01
GW-923	EMWMF		●	1016.73	04/13/11	22.52	994.21
GW-924	EMWMF		●	968.90	04/13/11	8.40	960.50

Table B.6 (continued)

Notes:

- 1
 - AGLLSF - Above Grade Low-Level Storage Facility
 - BG - Bear Creek Burial Grounds Waste Management Area
 - EMWMF - Environmental Management Waste Management Facility
 - EXP-A - Exit Pathway (Maynardville Limestone) Picket A
 - EXP-B - Exit Pathway (Maynardville Limestone) Picket B
 - LD - Lysimeter Demonstration Site
 - OLF - Oil Landfarm Waste Management Area
 - RS - Rust Spoil Area
 - S3 - S-3 Site
 - SPI - Spoil Area I
- 2 The measuring point is the surveyed elevation of a mark on either the top of the innermost well casing or the top of dedicated sampling equipment, in feet above mean sea level.
- 3 The depth to water is in feet below the measuring point.
- 4 The groundwater elevation (measuring point depth to water) is in feet above mean sea level.

Table B.7. Depth-to-water measurements and groundwater elevations for selected wells in the Upper East Fork Poplar Creek Hydrogeologic Regime, April 2011

Well Number	Location ¹	Hydrogeologic Unit		Measuring Point ²	Date Measured	Depth to Water ³	Groundwater Elevation ⁴
		Aquifer	Aquitard				
55-1A	GRIDB2		●	986.91	04/13/11	10.48	976.43
55-3A	B9201-5		●	972.46	04/13/11	11.31	961.15
55-6A	B9103		●	989.29	04/13/11	8.70	980.59
56-1A	Y12		●	969.25	04/13/11	8.43	960.82
56-2A	GRIDC3		●	963.53	04/13/11	8.25	955.28
56-8A	Y12	●		962.46	04/13/11	20.00	942.46
60-1A	Y12	●		929.66	04/12/11	10.73	918.93
GW-105	S3		●	1018.20	04/14/11	8.55	1009.65
GW-108	S3		●	999.00	04/12/11	6.61	992.39
GW-115	S3		●	1055.01	04/12/11	6.92	1048.09
GW-148	NHP	●		907.76	04/11/11	7.94	899.82
GW-151	NHP	●		916.17	04/11/11	14.73	901.44
GW-152	NHP	●		921.18	04/11/11	19.45	901.73
GW-154	NHP	●		911.70	04/11/11	8.43	903.27
GW-167	EXP	●		931.95	04/11/11	27.97	903.98
GW-169	EXP-UV	●		932.12	04/11/11	27.29	904.83
GW-192	B4		●	1008.83	04/13/11	5.11	1003.72
GW-193	T2331	●		934.17	04/13/11	8.52	925.65
GW-195	B4		●	1002.90	04/13/11	5.45	997.45
GW-199	GRIDH1		●	961.08	04/12/11	16.24	944.84
GW-200	RDS		●	969.09	04/12/11	15.49	953.60
GW-202	RDS		●	968.02	04/12/11	9.81	958.21
GW-204	T0134		●	958.74	04/14/11	8.88	949.86
GW-219	UOV	●		935.83	04/12/11	9.26	926.57
GW-251	S2	●		1003.80	04/12/11	11.65	992.15
GW-253	S2	●		1004.24	04/12/11	5.08	999.16
GW-255	S2	●		1027.13	04/12/11	22.05	1005.08
GW-261	SY		●	1049.99	04/12/11	16.85	1033.14
GW-263	SY		●	1057.73	04/12/11	23.95	1033.78
GW-334	WC		●	983.73	04/13/11	10.90	972.83
GW-335	WC		●	981.88	04/13/11	9.41	972.47
GW-349	S2	●		993.50	04/13/11	3.18	990.32
GW-380	NHP	●		913.55	04/12/11	9.44	904.11
GW-383	NHP		●	908.77	04/11/11	8.68	900.09
GW-603	EXP-J		●	961.32	04/11/11	57.59	903.73
GW-605	EXP-I	●		919.06	04/12/11	10.96	908.10
GW-606	EXP-I	●		919.59	04/12/11	12.60	906.99
GW-617	EXP-E	●		985.28	04/13/11	12.02	973.26

Table B.7 (continued)

Well Number	Location ¹	Hydrogeologic Unit		Measuring Point ²	Date Measured	Depth to Water ³	Groundwater Elevation ⁴
		Aquifer	Aquitard				
GW-619	FTF	•		1015.42	04/12/11	16.18	999.24
GW-686	CPT	•		963.76	04/14/11	11.97	951.79
GW-691	CPT	•		968.59	04/13/11	11.44	957.15
GW-696	B8110	•		969.78	04/14/11	20.03	949.75
GW-733	EXP-J	•		959.84	04/11/11	56.54	903.30
GW-734	EXP-J	•		939.93	04/11/11	37.62	902.31
GW-735	EXP-J		•	924.46	04/11/11	22.14	902.32
GW-746	GRIDK1		•	906.88	04/11/11	6.99	899.89
GW-748	GRIDK2		•	911.19	04/11/11	6.40	904.79
GW-752	GRIDJ3		•	912.78	04/11/11	3.74	909.04
GW-754	GRIDJ2		•	928.78	04/11/11	8.62	920.16
GW-756	GRIDJ1		•	928.11	04/11/11	5.49	922.62
GW-759	GRIDG1		•	994.01	04/11/11	17.35	976.66
GW-761	GRIDG2		•	968.23	04/11/11	8.81	959.42
GW-763	GRIDJ3		•	915.03	04/12/11	8.35	906.68
GW-765	GRIDE1		•	1008.54	04/12/11	18.73	989.81
GW-767	GRIDI2		•	948.54	04/12/11	10.54	938.00
GW-770	GRIDG3		•	944.72	04/12/11	10.53	934.19
GW-774	GRIDH2		•	963.16	04/12/11	12.80	950.36
GW-776	GRIDH3		•	931.25	04/12/11	10.15	921.10
GW-778	GRIDB2		•	1001.84	04/12/11	6.44	995.40
GW-783	GRIDE3		•	948.49	04/12/11	10.06	938.43
GW-792	GRIDD2		•	992.74	04/14/11	24.15	968.59
GW-816	EXP-SR		•	898.42	04/11/11	11.88	886.54
GW-960	GRIDF2		•	963.26	04/12/11	12.63	950.63

Table B.7 (continued)

Notes:

- 1
 - B4 = Beta-4 Security Pits
 - B8110 = Building 81-10
 - B9103 = Building 9103
 - B9201-2 = Building 9201-2
 - CPT = Coal Pile Trench
 - EXP = Exit Pathway (Maynardville Limestone) monitoring well
 - E, -I, or -J: Maynardville Limestone Picket
 - SR: Along Scarboro Road in the gap through Pine Ridge
 - UV: Offsite in Union Valley
 - FTF = Fire Training Facility
 - GRID = Comprehensive Groundwater Monitoring Plan Grid Location
 - NHP = New Hope Pond
 - RDS = Ravine Disposal Site
 - S2 = S-2 Site
 - S3 = S-3 Site
 - SY = Y-12 Plant Salvage Yard
 - T0134 = Tank 0134-U
 - T2331 = Tank 2331-U
 - UOV = Uranium Oxide Vault
 - WC = Waste Coolant Processing Area
 - Y12 = Y-12 Complex
- 2 The measuring point is the surveyed elevation of a mark on either the top of the innermost well casing or the top of dedicated sampling equipment, in feet above mean sea level.
- 3 The depth to water is in feet below the measuring point.
- 4 The groundwater elevation (measuring point depth to water) is in feet above mean sea level.

Table B.8. Depth-to-water measurements and groundwater elevations for selected wells in the Chestnut Ridge Hydrogeologic Regime, April 2011

Well Number	Location ¹	Measuring Point ²	Date Measured	Depth to Water ³	Groundwater Elevation ⁴
1082	ORSF	837.28	04/14/11	23.83	813.45
1084	ORSF	965.40	04/14/11	62.71	902.69
1090	UNCS	1104.48	04/12/11	40.80	1063.68
GW-141	LIV	1186.23	04/12/11	92.38	1093.85
GW-142	KHQ	971.15	04/14/11	134.04	837.11
GW-144	KHQ	913.54	04/14/11	78.85	834.69
GW-145	KHQ	840.24	04/14/11	3.79	836.45
GW-156	CRSDB	1049.28	04/11/11	142.32	906.96
GW-159	CRSDB	1051.38	04/11/11	116.98	934.40
GW-160	CRBAWP	1093.09	04/11/11	124.90	968.19
GW-173	CRSP	1115.00	04/12/11	125.40	989.60
GW-174	CRSP	1116.66	04/12/11	103.05	1013.61
GW-175	CRSP	1084.19	04/14/11	110.55	973.64
GW-176	CRSP	1125.30	04/12/11	115.75	1009.55
GW-177	CRSP	1158.20	04/12/11	117.32	1040.88
GW-178	CRSP	1143.49	04/12/11	88.76	1054.73
GW-179	CRSP	1128.00	04/12/11	114.37	1013.63
GW-180	CRSP	1104.14	04/12/11	95.61	1008.53
GW-184	RQ	927.63	04/14/11	110.06	817.57
GW-186	RQ	831.32	04/14/11	14.12	817.20
GW-188	RQ	837.09	04/14/11	20.07	817.02
GW-203	UNCS	1105.45	04/12/11	71.82	1033.63
GW-205	UNCS	1104.14	04/12/11	68.85	1035.29
GW-217	LIV	1177.03	04/13/11	104.53	1072.50
GW-221	UNCS	1106.16	04/12/11	74.12	1032.04
GW-231	KHQ	849.67	04/14/11	12.65	837.02
GW-241	CRSDB	982.84	04/12/11	35.20	947.64
GW-292	ECRWP	1073.00	04/12/11	109.25	963.75
GW-298	CRBAWP	1049.01	04/11/11	104.51	944.50
GW-299	CRBAWP	1053.86	04/11/11	92.28	961.58
GW-300	CRBAWP	1073.12	04/11/11	105.69	967.43
GW-301	CRBAWP	1086.55	04/11/11	125.17	961.38
GW-302	UNCS	1141.84	04/12/11	93.12	1048.72
GW-303	CRSDB	1007.16	04/11/11	82.57	924.59
GW-304	CRSDB	1045.49	04/11/11	116.06	929.43
GW-305	LIV	1183.72	04/12/11	115.67	1068.05
GW-322	CRSP	1134.98	04/12/11	138.81	996.17
GW-339	UNCS	1124.83	04/12/11	62.63	1062.20

Table B.8 (continued)

Well Number	Location ¹	Measuring Point ²	Date Measured	Depth to Water ³	Groundwater Elevation ⁴
GW-511	CRSP	1093.21	04/12/11	89.21	1004.00
GW-512	FCAP	1001.54	04/12/11	15.65	985.89
GW-521	LIV	1182.88	04/14/11	80.74	1102.14
GW-522	LIV	1175.48	04/14/11	91.88	1083.60
GW-539	LII	1093.20	04/14/11	100.52	992.68
GW-541	CDLVI	1058.40	04/14/11	61.20	997.20
GW-542	CDLVI	1051.81	04/14/11	69.88	981.93
GW-543	CDLVI	1024.01	04/14/11	63.81	960.20
GW-544	CDLVI	1045.19	04/14/11	50.05	995.14
GW-546	CDLVI	1072.21	04/14/11	76.96	995.25
GW-557	LV	1081.36	04/12/11	122.60	958.76
GW-558	SSCR	981.42	04/12/11	43.44	937.98
GW-559	SSCR	1102.79	04/12/11	132.68	970.11
GW-560	CDLVII	949.05	04/12/11	44.92	904.13
GW-562	CDLVII	934.69	04/12/11	6.75	927.94
GW-564	CDLVII	938.07	04/12/11	10.12	927.95
GW-608	CRSP	1075.38	04/12/11	117.99	957.39
GW-609	CRSP	1112.31	04/12/11	158.42	953.89
GW-610	CRSP	1059.44	04/14/11	80.02	979.42
GW-611	CRSP	1048.38	04/14/11	98.43	949.95
GW-612	CRSP	1131.03	04/12/11	117.22	1013.81
GW-674	FCAP	883.79	04/14/11	5.99	877.80
GW-676	FCAP	846.50	04/14/11	3.02	843.48
GW-677	FCAP	1030.40	04/12/11	21.21	1009.19
GW-678	FCAP	1000.70	04/12/11	7.66	993.04
GW-679	FCAP	1026.90	04/12/11	42.00	984.90
GW-680	FCAP	1001.50	04/12/11	22.71	978.79
GW-709	LII	906.81	04/12/11	25.25	881.56
GW-731	CRSDB	1049.38	04/11/11	123.78	925.60
GW-732	CRSDB	1064.29	04/11/11	157.05	907.24
GW-743	CRSP	1100.36	04/12/11	108.12	992.24
GW-757	LII	961.64	04/14/11	82.85	878.79
GW-796	LV	1052.62	04/12/11	59.70	992.92
GW-797	LV	1060.00	04/12/11	70.25	989.75
GW-798	CDLVII	1006.00	04/12/11	74.70	931.30
GW-799	LV	981.29	04/12/11	21.20	960.09
GW-801	LV	1097.16	04/12/11	102.10	995.06
GW-827	CDLVI	1051.60	04/14/11	38.32	1013.28
GW-831	FCAP	1091.29	04/12/11	124.20	967.09

Table B.8 (continued)

Notes:

- 1 CDLVI = Construction/Demolition Landfill VI
 CDLVII = Construction/Demolition Landfill VII
 CRBAWP = Chestnut Ridge Borrow Area Waste Pile
 CRSDB = Chestnut Ridge Sediment Disposal Basin
 CRSP = Chestnut Ridge Security Pits
 ECRWP = East Chestnut Ridge Waste Pile
 FCAP = Filled Coal Ash Pond
 KHQ = Kerr Hollow Quarry
 LII = Industrial Landfill II
 LIV = Industrial Landfill IV
 LV = Industrial Landfill V
 ORSF = Oak Ridge Sludge Farm
 RQ = Rogers Quarry
 SSCR = South Side Chestnut Ridge
 UNCS = United Nuclear Corporation Site
- 2 The measuring point is the surveyed elevation of a mark on either the top of the innermost well casing or the top of dedicated sampling equipment, in feet above mean sea level.
- 3 The depth to water is in feet below the measuring point.
- 4 The groundwater elevation (measuring point - depth to water) is in feet above mean sea level.

**Table B.9 Concentration trends for the principal contaminants detected at
CY 2011 sampling locations in the Bear Creek Hydrogeologic Regime**

Sampling Location ¹	Hydro. Unit ²		Contaminant Type and Long-Term Trend ³ (○ = indeterminate, + = increasing, ▼ = decreasing)							
	A Q T	A Q F	Inorganics ⁴		VOCs ⁵				Radioactivity ⁶	
			NO ³	U	Ethenes	Ethanes	Methanes	Petrol.	Alpha	Beta
GW-008	●		NA	.	+	+	.	.	.	.
GW-014	●		.	.	▼	▼	.	.	.	.
GW-046	●		NA	.	○	○	.	○	.	.
GW-053		●	.	.	▼	.	.	.	NA	NA
GW-058		●	.	○	.	.	.	.	○	.
GW-068	●		.	.	+	+	.	+	NA	NA
GW-071	●		NA	.	▼	▼	.	▼	NA	NA
GW-077	●		NA	.	.	.	.	.	NA	NA
GW-078	●		NA	.	.	.	.	.	NA	NA
GW-079	●		NA	.	.	.	.	.	NA	NA
GW-080	●		NA	.	.	.	.	.	NA	NA
GW-082	●		NA	NA	○	○	.	○	NA	NA
GW-085	●		▼	NA	.	.	.	.	.	.
GW-098	●		.	.	▼	.	.	.	.	.
GW-100		●	▼	.	.	.	.	.	.	.
GW-101	●		▼	.	.	.	.	.	.	.
GW-122		●	▼	.	.	.	.	.	.	.
GW-127	●		.	.	.	.	.	.	.	.
GW-134-05	●		○	.	.	.	.	.	.	.
GW-134-11	●		○	.	.	.	.	.	.	.
GW-134-15	●		○	.	.	.	.	.	.	.
GW-134-18	●		▼	.	.	.	.	.	.	.
GW-134-21	●		▼	.	.	.	.	.	.	.
GW-134-33		●	▼	.	▼	.	.	.	.	▼
GW-134-35		●	▼	.	▼	.	.	.	.	▼
GW-134-36		●	▼	.	.	.	.	.	.	.
GW-225		●	▼	.	▼	.	.	.	.	.
GW-229		●	.	+	+	○	.	○	+	+
GW-236		●	▼	.	.	.	.	.	.	.
GW-242	●		.	.	○	.	.	.	NA	NA
GW-246	●		▼	○	+	.	+	.	▼	▼
GW-276	●		▼	▼	▼	.	.	.	▼	▼
GW-289	●		.	.	○	.	.	.	.	.
GW-307		●	.	.	▼	.	.	.	NA	NA
GW-315		●	.	.	▼	.	.	.	.	.
GW-363	●		NA	.	.	.	.	.	NA	NA
GW-365		●	.	.	▼	▼	.	.	.	.
GW-526	●		+	NA	.	.	.	.	.	.
GW-537	●		▼	NA	.	.	.	.	.	○
GW-601		●	▼	NA	▼	.	.	.	NA	NA
GW-615	●		○	+	.	.	.	.	○	○
GW-616	●		○	.	.	.	.	.	.	.

Table B.9 (continued)

Sampling Location ¹	Hydro. Unit ²		Contaminant Type and Long-Term Trend ³ (○ = indeterminate, + = increasing, ▼ = decreasing)							
	A Q T	A Q F	Inorganics ⁴		VOCs ⁵				Radioactivity ⁶	
			NO ³	U	Ethenes	Ethanes	Methanes	Petrol.	Alpha	Beta
GW-623	●		NA	NA	○	○	○	.	NA	NA
GW-627	●		NA	NA	+	+	.	.	NA	NA
GW-639	●		NA	.	.	.	.	.	NA	NA
GW-653	●		.	.	+	+	.	.	.	.
GW-683		●	.	.	.	.	.	.	.	.
GW-684		●	.	.	.	.	.	.	.	.
GW-703		●	○	.	▼	.	.	.	○	+
GW-704		●	.	.	▼	.	.	.	.	.
GW-706		●	▼	▼	○	.	.	.	▼	.
GW-712		●	.	.	.	.	.	.	.	.
GW-713		●	.	.	.	.	.	.	.	.
GW-714		●	.	.	.	.	.	.	.	.
GW-724		●	▼	NA	○	.	.	.	NA	NA
GW-725		●	.	.	○	.	.	.	.	.
GW-729-18	●		.	.	.	.	.	.	.	.
GW-729-22	●		.	.	.	.	.	.	.	.
GW-729-26	●		.	.	.	.	.	○	.	.
GW-729-30	●		.	.	.	.	.	.	.	○
GW-729-34	●		.	.	.	.	.	○	.	.
GW-729-39		●	.	.	.	.	.	.	.	.
GW-729-44		●	.	.	○	.	.	.	.	.
GW-738		●	.	.	▼	.	.	.	.	.
GW-740		●	NA	NA	▼	.	.	.	NA	NA
GW-916	●		NA	.	.	.	.	.	NA	NA
GW-917	●		NA	.	.	.	.	.	NA	NA
GW-918	●		NA	.	.	.	.	.	NA	NA
GW-920	●		NA	.	.	.	.	.	NA	NA
GW-921	●		NA	.	.	.	.	.	NA	NA
GW-922	●		NA	.	.	.	.	.	NA	NA
GW-923	●		NA	.	.	.	.	.	NA	NA
GW-924	●		NA	.	.	.	.	.	NA	NA
GW-925	●		NA	.	.	.	.	.	NA	NA
GW-926	●		NA	.	.	.	.	.	NA	NA
GW-927	●		NA	.	.	.	.	.	NA	NA
GW-961	●		NA	.	.	.	.	.	NA	NA
GW-964	●		NA	.	.	.	.	.	NA	NA
GW-965	●		NA	.	.	.	.	.	NA	NA
BCK-03.30	.	.	NA	NA	NA	NA	NA	NA	NA	NA
BCK-04.55	.	.	.	.	.	.	.	.	.	.
BCK-04.60	.	.	NA	NA	NA	NA	NA	NA	NA	NA
BCK-09.20	.	.	.	NA	NA	NA	NA	NA	NA	NA
BCK-09.40	.	.	.	○	.	.	.	.	○	.
BCK-11.54	.	.	NA	NA	NA	NA	NA	NA	NA	NA
BCK-11.97	.	.	○	○	.	.	.	.	○	○
BCK-12.34	.	.	NA	○	NA	NA	NA	NA	NA	NA
EMWNT-03A	.	.	NA	.	.	.	.	.	.	.

Table B.9 (continued)

Sampling Location ¹	Hydro. Unit ²		Contaminant Type and Long-Term Trend ³ (○ = indeterminate, + = increasing, ▼ = decreasing)							
	AQT	AQF	Inorganics ⁴		VOCs ⁵				Radioactivity ⁶	
			NO ³	U	Ethenes	Ethanes	Methanes	Petrol.	Alpha	Beta
EMWNT-05	.	.	NA	.	.	.	.	.	.	.
EMW-VWEIR	.	.	NA	.	.	.	.	.	NA	NA
EMW-VWUND	.	.	NA	.	.	.	.	.	NA	NA
NT-01	.	.	○	○	○	.	.	.	.	○
NT-03	.	.	NA	NA	.	.	.	.	NA	NA
NT-04	.	.	NA	.	.	.	.	.	NA	NA
NT-07	.	.	.	.	▼	▼	.	.	NA	NA
NT-08	.	.	.	▼	▼	▼	.	.	NA	NA
SS-4	.	.	○	○	○	.	.	.	.	.
SS-5	.	.	.	.	.	.	.	.	.	.
SS-6	.	.	.	.	.	.	.	.	.	.

Notes:

- 1 The exit pathway/perimeter monitoring locations are in bold typeface.
- 2 Hydrostratigraphic Unit
 - AQF - Monitored interval in the formations comprising the aquifer
 - AQT - Monitoring interval in the formations comprising the aquitard
- 3 Trend types were interpreted from data tables or plots of concentration changes over time.
 - .
 - NA - Not analyzed
 - Q - Results inconsistent (higher) with respect to historical data.
 - - Indeterminate trend: insufficient data, fairly stable trend, affected by sampling methods, or highly fluctuating with no clear upward or downward trend.
 - ▼ - Generally decreasing trend
 - +
 - Generally increasing trend.
- 4 CY 2011 nitrate (NO³) concentration greater than or equal to 10 mg/L.
Total uranium (U) concentration greater than or equal to 0.03 mg/L.
- 5 Summed CY 2011 concentration of a VOC group (see below) greater than or equal to 5µg/L.
 - Ethenes = Summed chloroethenes (PCE, TCE, 12DCE, 11DCE, vinyl chloride)
 - Ethanes = Summed chloroethanes (111TCA, 11DCA, chloroethane)
 - Methanes = Summed chloromethanes (carbon tetrachloride, chloroform, methylene chloride)
 - Petrol = Summed petroleum hydrocarbons (benzene, toluene, ethylbenzene, xylene)
- 6 Maximum CY 2011 gross alpha activity greater than or equal to 15 pCi/L
Maximum CY 2011 gross beta activity greater than or equal to 50 pCi/L

**Table B.10 Concentration trends for the principal contaminants detected at CY 2011
sampling locations in the Upper East Fork Poplar Creek Hydrogeologic Regime**

Sampling Location ¹	Hydro. Unit ²		Contaminant Type and Long-Term Trend ³ (○ = indeterminate, + = increasing, ▼ = decreasing)							
	A Q T	A Q F	Inorganics ⁴		VOCs ⁵				Radioactivity ⁶	
			NO ³	U	Ethenes	Ethanes	Methanes	Petrol.	Alpha	Beta
55-2A	●		+	.	▼	▼	.	.	.	.
55-2B	●		+	.	▼	▼	.	.	.	.
55-2C	●		+	.	▼	▼	.	.	.	.
55-3A	●		.	.	○	○	.	.	.	.
55-3B	●		.	.	○	▼	.	▼	.	.
55-3C	●		.	.	▼	▼	.	.	.	.
56-1A	●		.	.	.	.	.	.	.	.
56-1C	●		.	.	.	.	.	.	.	.
56-2A	●		.	.	▼	.	.	.	NA	NA
56-2B	●		NA	NA	○	.	.	.	NA	NA
56-2C	●		.	.	▼	.	.	.	.	.
56-3A	●		.	.	▼	.	.	.	NA	NA
56-3B	●		.	.	○	.	.	.	.	.
56-3C	●		NA	NA	○	.	.	.	NA	NA
56-4A	●		.	.	.	.	.	.	.	.
GW-108	●		▼	.	+	.	○	.	○	+
GW-151		●	.	.	+	.	+	.	.	.
GW-153		●	.	.	.	.	○	.	.	.
GW-154		●	NA	○	.	.	.	.	○	○
GW-169		●	.	NA	.	.	.	.	.	.
GW-170		●	.	NA	.	.	.	.	.	.
GW-171		●	NA	NA	.	.	.	.	NA	NA
GW-172		●	NA	NA	.	.	.	.	NA	NA
GW-193		●	NA	NA	NA	NA	NA	NA	NA	NA
GW-204	●		NA	○	NA	NA	NA	NA	○	.
GW-219		●	NA	○	NA	NA	NA	NA	○	○
GW-220		●	NA	NA	+	.	+	.	NA	NA
GW-223		●	.	+	▼	.	.	.	.	.
GW-230		●	NA	NA	▼	.	.	.	NA	NA
GW-240		●	.	.	.	.	.	.	.	.
GW-251		●	▼	.	○	.	▼	.	.	.
GW-253		●	○	.	○	.	○	.	○	.
GW-265	●		.	.	▼	.	.	.	.	.
GW-268	●		.	.	○	.	.	.	.	.
GW-269	●		NA	NA	+	▼	.	.	.	.
GW-270	●		▼	.	.	.	.	.	.	.
GW-272	●		+	.	.	.	.	.	.	.
GW-274	●		▼	.	+	.	○	+	.	○
GW-275	●		○	.	.	.	.	.	○	.
GW-281	●		NA	NA	.	.	.	.	NA	NA
GW-332	●		.	.	▼	▼	.	.	.	.
GW-337	●		NA	NA	▼	▼	.	.	NA	NA

Table B.10 (continued)

Sampling Location ¹	Hydro. Unit ²		Contaminant Type and Long-Term Trend ³ (○ = indeterminate, + = increasing, ▼ = decreasing)							
	A Q T	A Q F	Inorganics ⁴		VOCs ⁵				Radioactivity ⁶	
			NO ³	U	Ethenes	Ethanes	Methanes	Petrol.	Alpha	Beta
GW-380		●	.	.	.	.	.	.	.	.
GW-381		●	NA	NA	○	.	▼	.	NA	NA
GW-382		●	.	.	▼	.	▼	.	.	.
GW-383	●		NA	NA	+	.	.	.	NA	NA
GW-505	●		NA	.	NA	NA	NA	NA	○	.
GW-508	●		NA	NA	.	.	.	▼	NA	NA
GW-605		●	.	○	+	.	+	.	○	.
GW-606		●	+	.	○	.	▼	.	.	.
GW-618		●	.	.	▼	.	.	.	.	.
GW-633	●		▼	.	+	.	▼	+	.	▼
GW-656	●		NA	NA	▼	▼	.	.	NA	NA
GW-658	●		NA	NA	.	○	○	○	NA	NA
GW-686		●	.	.	○	.	.	.	.	.
GW-690		●	.	.	▼	.	.	.	.	.
GW-691		●	.	.	○	.	.	.	.	.
GW-692		●	.	.	.	.	.	.	.	.
GW-698		●	○	.	○	.	○	.	.	.
GW-700		●	.	.	▼	.	.	.	.	.
GW-722-14		●	.	.	.	.	▼	.	.	.
GW-722-17		●	.	.	▼	.	▼	.	.	.
GW-722-20		●	.	.	▼	.	▼	.	.	.
GW-722-22		●	.	.	.	.	▼	.	.	.
GW-722-33		●	.	.	.	.	.	.	.	.
GW-733		●	NA	NA	.	.	▼	.	.	.
GW-735		●	.	.	.	.	.	.	.	.
GW-744	●		.	.	.	.	.	.	.	.
GW-747	●		.	.	.	.	.	.	.	.
GW-750	●		.	.	.	.	.	.	.	.
GW-762	●		.	.	+	○	.	.	.	.
GW-763	●		NA	NA	.	.	.	.	NA	NA
GW-765	●		.	.	.	.	.	.	.	.
GW-769	●		.	.	+	.	+	.	.	.
GW-770	●		.	.	.	.	+	.	.	.
GW-775	●		NA	NA	.	.	.	.	NA	NA
GW-776	●		.	.	.	.	.	.	.	.
GW-779	●		.	.	.	.	.	.	.	.
GW-781	●		.	.	.	.	.	.	.	.
GW-782	●		.	.	▼	▼	○	.	.	.
GW-783	●		.	.	▼	.	.	.	.	.
GW-791	●		.	.	▼	.	.	.	.	.
GW-802	●		NA	NA	.	.	.	.	NA	NA
GW-816	●		.	.	.	.	.	.	.	.
GW-820		●	.	.	○	.	.	.	.	.
GW-832		●	.	.	+	.	▼	.	.	.
GW-930	●		NA	NA	.	.	.	.	NA	NA

Table B.10 (continued)

Sampling Location ¹	Hydro. Unit ²		Contaminant Type and Long-Term Trend ³ (○ = indeterminate, + = increasing, ▼ = decreasing)							
	AQT	AQF	Inorganics ⁴		VOCs ⁵				Radioactivity ⁶	
			NO ³	U	Ethenes	Ethanes	Methanes	Petrol.	Alpha	Beta
GW-959		●	.	.	.	.	.	.	.	.
GW-960	●		.	.	.	.	.	.	.	.
200A6	.	.	NA	○	NA	NA	NA	NA	NA	NA
GHK2.51WSW	.	.	.	.	.	.	.	.	.	.
NPR12.0SW	.	.	.	.	.	.	.	.	.	.
NPR23.0SW	.	.	.	.	.	.	.	.	.	.
SCR7.1SP	.	.	NA	NA	.	.	.	.	NA	NA
SCR7.8SP	.	.	NA	NA	.	.	.	.	NA	NA
SP-17	.	.	.	.	.	.	.	.	.	.
STATION 8	.	.	NA	.	NA	NA	NA	NA	.	.

Notes:

- 1 The exit pathway/perimeter monitoring locations are in bold typeface.
- 2 Hydrostratigraphic Unit
 - AQF - Monitored interval in the formations comprising the aquifer
 - AQT - Monitored interval in the formations comprising the aquitard
- 3 Trend types were interpreted from data tables or plots of concentration changes over time.
 - .
 - NA - Not analyzed
 - Q - Elevated concentration, unsupported by other samples from the location (suspect data)
 - - Indeterminate trend: insufficient data, fairly stable trend, affected by sampling methods, or highly fluctuating with no clear upward or downward trend.
 - ▼ - Generally decreasing trend
 - +
 - Generally increasing trend.
- 4 CY 2011 nitrate (NO³) concentration greater than or equal to 10 mg/L.
Total uranium (U) concentration greater than or equal to 0.03 mg/L.
- 5 Summed CY 2011 concentration of a solvent group (see below) greater than or equal to 5µg/L.
 - Ethenes = Summed chloroethenes (PCE, TCE, 12DCE, 11DCE, vinyl chloride)
 - Ethanes = Summed chloroethanes (111TCA, 11DCA, chloroethane)
 - Methanes = Summed chloromethanes (carbon tetrachloride, chloroform, methylene chloride)
 - Petrol = Summed petroleum hydrocarbons (benzene, ethylbenzene, toluene, and total xylene)
- 6 Maximum CY 2011 gross alpha activity greater than or equal to 15 pCi/L
Maximum CY 2011 gross beta activity greater than or equal to 50 pCi/L

**Table B.11 Concentration trends for contaminants detected at CY 2011
sampling locations in the Chestnut Ridge Hydrogeologic Regime**

Sampling Location ¹	Contaminant Type and Long-Term Trend ² (○ = indeterminate, + = increasing, ▼ = decreasing)						
	VOCs ³				Nitrate ⁴	Radioactivity ⁵	
	Ethenes	Ethanes	Methanes	Freons		Alpha	Beta
1090	NA	NA	NA	NA	.	.	.
GW-141	.	.	.	.	.	.	.
GW-143	.	.	.	NA	NA	.	.
GW-144	.	.	.	NA	NA	.	.
GW-145	.	.	.	NA	NA	.	.
GW-156	NA	NA	NA	NA	NA	NA	NA
GW-159	NA	NA	NA	NA	NA	NA	NA
GW-161	.	.	.	NA	.	.	.
GW-174	.	.	.	▼	NA	NA	NA
GW-175	.	.	.	▼	NA	NA	NA
GW-176	○	▼	.	.	NA	NA	NA
GW-177	○	▼	.	NA	NA	.	.
GW-180	▼	.	.	○	NA	NA	NA
GW-203	NA	NA	NA	NA	.	.	.
GW-205	NA	NA	NA	NA	.	.	.
GW-217	.	.	.	.	.	.	.
GW-221	NA	NA	NA	NA	.	.	.
GW-231	.	.	.	NA	NA	.	.
GW-294	.	.	.	NA	.	.	.
GW-296	.	.	.	NA	.	.	.
GW-298	Q	.	.	NA	.	.	.
GW-301	.	.	.	NA	NA	NA	NA
GW-305	+	+	.	.	.	.	.
GW-322	▼	▼	.	▼	NA	NA	NA
GW-521	.	.	.	.	.	.	.
GW-522	.	.	.	.	.	.	.
GW-540	.	.	.	.	.	.	.
GW-557	.	.	.	.	.	.	.
GW-560	.	.	.	.	.	.	.
GW-562	.	.	.	.	.	.	.
GW-564	.	.	.	.	.	.	.
GW-709	.	.	.	.	.	.	.
GW-731	NA	NA	NA	NA	NA	NA	NA
GW-732	NA	NA	NA	NA	NA	NA	NA
GW-757	.	.	.	.	.	.	.
GW-796	.	.	.	.	.	.	.
GW-797	.	.	.	.	+	.	.
GW-798	+	.	.	○	.	.	.
GW-799	.	.	.	.	.	.	.
GW-801	.	.	.	.	.	.	.
GW-831	.	.	.	NA	NA	NA	NA

Table B.11 (continued)

Sampling Location ¹	Contaminant Type and Long-Term Trend ² (○ = indeterminate, + = increasing, ▼ = decreasing)						
	VOCs ³				Nitrate ⁴	Radioactivity ⁵	
	Ethenes	Ethanes	Methanes	Freons		Alpha	Beta
KHB-09	NA	NA	NA	NA	.	NA	NA
MCK 1.4	NA	NA	NA	NA	NA	NA	NA
MCK 2.0	NA	NA	NA	NA	NA	.	.
MCK 2.05	NA	NA	NA	NA	NA	.	.
S17	.	.	.	.	+	.	.
SCR1.25SP	.	.	.	NA	.	.	.
SCR1.5SW	.	.	.	.	.	.	.
SCR2.1SP	.	.	.	.	.	.	.
SCR2.2SP	.	.	.	.	.	.	.
SCR3.5SP	.	.	.	NA	.	.	.
SCR3.5SW	.	.	.	.	.	.	.
SCR4.3SP	.	.	.	.	.	.	.
SCR5.1SP	NA	NA	NA	NA	.	NA	NA
SCR5.2SP	NA	NA	NA	NA	○	NA	NA
UNC SW-1	NA	NA	NA	NA	.	.	.

Notes:

- 1 The exit pathway/perimeter monitoring locations are in bold typeface.
- 2 Trend types were interpreted from data tables or plots of concentration changes over time.
 - .
 - NA
 - Q
 -
 - ▼
 - +
 - Not a contaminant (criteria defined below, in notes 3 and 4)
 - Not analyzed
 - Inconsistent with other measurements for the location (suspected outlier)
 - Indeterminate trend: fairly stable trend, insufficient data
 - Generally decreasing trend
 - Generally increasing trend
- 3 Summed CY 2011 concentration of a VOC group (see below) greater than or equal to 1µg/L. (excluding trace levels of common laboratory reagents or suspected artifacts).
 - Ethenes = Summed chloroethenes (PCE, TCE, 12DCE, 11DCE, vinyl chloride)
 - Ethanes = Summed chloroethanes (111TCA, 11DCA, chloroethane)
 - Methanes = Summed chloromethanes (carbon tetrachloride, chloroform, methylene chloride)
 - Freons = Summed chlorofluorocarbons (1,1,2-trifluoroethane and trichlorofluoromethane)

Note that individual compounds have different long-term concentration trends at wells GW-177, GW-178, GW-305 and GW-322.
- 4 Maximum CY 2011 nitrate concentration greater than or equal to 2 mg/L
- 5 Maximum CY 2011 gross alpha activity greater than or equal to 15 pCi/L
Maximum CY 2011 gross beta activity greater than or equal to 50 pCi/L

APPENDIX C

MONITORING WELL CONSTRUCTION DETAILS

EXPLANATION

Hydrogeologic Regime:

- BC - Bear Creek Hydrogeologic Regime
- CR - Chestnut Ridge Hydrogeologic Regime
- EF - Upper East Fork Poplar Creek Hydrogeologic Regime

Location:

- B8110 - Building 81-10
- B9201-2 - Building 9201-2
- B9201-5 - Building 9201-5
- BG - Bear Creek Burial Grounds WMA
- CDLVII - Construction/Demolition Landfill VII
- CPT - Coal Pile Trench
- CRBAWP - Chestnut Ridge Borrow Area Waste Pile (former site)
- CRSDB - Chestnut Ridge Sediment Disposal Basin
- CRSP - Chestnut Ridge Security Pits
- ECRWP - East Chestnut Ridge Waste Pile
- EMWMF - Environmental Management Waste Management Facility
- EXP - Exit Pathway Monitoring Location:
 - Maynardville Limestone Picket (-A, -B, -C, -E, -I, -J, and -W)
 - Along Scarboro Road in the gap through Pine Ridge (-SR)
 - East of Scarboro Road in Union Valley (-UV)
- FCAP - Filled Coal Ash Pond
- FF - Fuel Facility (Building 9754-2)
- GRID - Comprehensive Groundwater Monitoring Plan Grid Location (MMES 1990b)
- KHQ - Kerr Hollow Quarry
- LII - Industrial Landfill II
- LIV - Industrial Landfill IV
- LV - Industrial Landfill V
- NHP - New Hope Pond
- OLF - Oil Landfarm WMA
- RG - Rust Garage Area
- RS - Rust Spoil Area
- S2 - S-2 Site
- S3 - S-3 Site
- SPI - Spoil Area I
- SY - Y-12 Salvage Yard
- T0134 - Tank 0134-U
- T2331 - Tank 2331-U, near Building 9201-1
- UNCS - United Nuclear Corporation Site
- UOV - Uranium Oxide Vault
- WCPA - Waste Coolant Processing Area
- Y12 - Y-12 Complex

EXPLANATION (continued)

General Information:

- Depth - Feet below ground surface (rounded to nearest 0.1 ft)
- Coordinates - Y-12 grid system (rounded to nearest foot)
- Measuring Point - Top of well casing (TOC) or top of Well Wizard[™] (TOWW)
- Elevation - Feet above mean sea level (rounded to nearest 0.01 ft)
- Tag Depth - Depth to the bottom of the well (feet below the measuring point)
- . - Not applicable or not available

Geologic Information (regarding the monitored interval):

Hydrostratigraphic Unit:

- AQF - Aquifer (Maynardville Limestone and Knox Group)
- AQT - Aquitard (other formations of the Conasauga Group)

Geologic Formation:

- OCk - Knox Group, undifferentiated
- Cc - Conasauga Group, undifferentiated
- Cm - Maryville Limestone
- Cn - Nolichucky Shale
- Cmn - Maynardville Limestone
- Cpv - Pumpkin Valley Shale
- Cr - Rome Formation
- Crg - Rogersville Shale
- Crt - Rutledge Formation

Aquifer Zone:

- BDR - Bedrock interval (monitored interval top is in fresh rock)
- WT - Water table interval (monitored interval top is above fresh rock)
- Depth - Feet below ground surface (rounded to nearest 0.1 ft)

Conductor (Surface) Casing and Well Casing:

- Depth - Feet below ground surface (rounded to nearest 0.1 ft)
- Diameter - Outside or inside dimensions, in inches
- PVC40 - Polyvinyl chloride, schedule 40
- SS304 - Stainless steel, type 304
- SS316 - Stainless steel, type 316
- STL - Carbon steel
- S/GALV - Galvanized steel
- SF25/SJ55 - Steel, American Petroleum Institute Grade

EXPLANATION (continued)

Monitored Interval:

- Top - Depth to top of filter pack or open-hole (feet below ground surface)
- Bottom - Depth to bottom of filter pack or open-hole (feet below ground surface)

Screen Material:

- PVC/sl - PVC, slotted
- SS/ppk - Stainless steel prepack screen, spiral wound
- SS/sl - Stainless steel, slotted
- SS/sw - Stainless steel, spiral wound
- Slot Size - size of screen or slot openings, in inches

NOTE:

Data compiled from the *Updated Subsurface Data Base for Bear Creek Valley, Chestnut Ridge, and parts of Bethel Valley on the U.S. Department of Energy Oak Ridge Reservation* (BWXT 2003b) and subsequent updates maintained electronically.

APPENDIX C: MONITORING WELL CONSTRUCTION DETAILS, CY 2011

Well Number Hydrogeologic Regime Functional Area	1090 CR UNCS	55-2A EF GRIDB3	55-2B EF GRIDB3	55-2C EF GRIDB3	55-3A EF B9201-5	55-3B EF B9201-5	55-3C EF B9201-5	56-1A EF Y12	56-1C EF Y12
General Information									
Date Installed	1982	08/08/83	1983	08/22/83	1983	1983	1983	1983	08/25/83
Total Depth Drilled	96.7	14.1	27.6	75.9	14.3	38.1	77.5	19.0	75.3
East Coordinate	53,853	55,195	55,199	55,203	55,695	55,699	55,703	56,079	56,077
North Coordinate	28,718	30,085	30,085	30,085	29,959	29,959	29,959	30,351	30,355
Measuring Point	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW	TOC
Measuring Point Elevation	1,104.48	976.74	977.42	977.02	972.46	973.32	974.34	969.25	969.49
Ground Surface Elevation	1,101.58	976.17	976.17	976.07	971.59	971.57	971.76	968.72	968.89
Tag Depth-(TOC)	98.02	13.98	27.69	76.00	14.25	37.98	77.43	18.95	73.45
Geologic Information									
Hydrostratigraphic Unit	AQF	AQT	AQT	AQT	AQT	AQT	AQT	AQT	AQT
Geologic Formation	OCK	Cn	Cn	Cn	Cn	Cn	Cn	Cn	Cn
Aquifer Zone	WT	WT	WT	BDR	WT	WT	BDR	WT	BDR
Weathered Rock-Depth	.	11.5	10.0	14.5	7.0	5.0	7.0	2.0	6.0
Fresh Rock-Depth	.	.	.	47.2	.	.	.	.	10.0
Conductor Casing									
Casing Depth	.	.	.	15.5	.	.	.	.	7.0
Outside Diameter	.	.	.	4.5	.	.	.	.	4.5
Inside Diameter	.	.	.	.	.	.	.	.	.
Casing Material	.	.	.	STL	.	.	.	.	STL
Well Casing									
Borehole Depth	96.7	14.1	27.6	75.9	14.3	38.1	77.5	19.0	75.3
Borehole Diameter	8	6	6	6	6	6	6	6	6
Casing Depth	.	9.1	22.6	70.9	9.3	33.1	72.5	14.0	70.3
Outside Diameter	6.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Inside Diameter	.	4	4	4	4	4	4	4	4
Casing Material	PVC40	PVC40	PVC40	PVC40	PVC40	PVC40	PVC40	PVC40	PVC40
Monitored Interval									
Top-Depth	.	6.1	19.6	67.9	6.3	30.1	69.5	11.0	67.3
Midpoint-Depth	.	10.1	23.6	71.9	10.3	34.1	73.5	15.0	71.3
Pump Intake-Depth	84.80	11.43	25.00	73.30	12.13	33.75	72.42	15.97	.
Bottom of Screen-Depth	.	14.1	27.6	75.9	14.3	38.1	77.5	19.0	75.3
Bottom-Depth	96.7	14.1	27.6	75.9	14.3	38.1	77.5	19.0	75.3
Top-Elevation	.	970.07	956.57	908.17	965.29	941.47	902.26	957.72	901.59
Midpoint-Elevation	.	966.07	952.57	904.17	961.29	937.47	898.26	953.72	897.59
Pump Intake-Elevation	1016.78	964.74	951.22	902.82	959.46	937.82	899.34	952.75	.
Bottom-Elevation	1,004.88	962.07	948.57	900.17	957.29	933.47	894.26	949.72	893.59
Screen Length	.	5	5	5	5	5	5	5	5
Screen Material	PVC/sl	SS/sw	SS/sw	SS/sw	SS/sw	SS/sw	SS/sw	SS/sw	SS/sw
Slot Size	.	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Open-Hole Length	.	.	.	.	.	.	.	.	.
Open-Hole Diameter	.	.	.	.	.	.	.	.	.

APPENDIX C: MONITORING WELL CONSTRUCTION DETAILS, CY 2011

Well Number Hydrogeologic Regime Functional Area	56-2A EF GRIDC3	56-2B EF GRIDC3	56-2C EF GRIDC3	56-3A EF Y12	56-3B EF Y12	56-3C EF Y12	56-4A EF Y12	GW-008 BC OLF	GW-014 BC BG
General Information									
Date Installed	1983	1983	08/18/83	1983	1983	08/02/83	1983	09/21/83	09/29/83
Total Depth Drilled	15.1	38.8	77.3	17.8	33.4	55.5	12.1	25.5	13.2
East Coordinate	56,229	56,226	56,231	56,453	56,478	56,449	56,802	47,596	44,308
North Coordinate	29,881	29,884	29,885	29,867	29,866	29,859	29,820	29,783	29,848
Measuring Point	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW
Measuring Point Elevation	963.53	962.45	965.11	963.03	964.33	962.86	962.07	965.39	934.50
Ground Surface Elevation	962.52	962.21	962.44	962.35	962.74	962.36	960.10	962.11	931.50
Tag Depth-(TOC)	15.03	38.63	77.03	17.92	30.85	55.35	12.60	26.69	14.50
Geologic Information									
Hydrostratigraphic Unit	AQT	AQT	AQT	AQT	AQT	AQT	AQT	AQT	AQT
Geologic Formation	Cn	Cn	Cn	Cn	Cn	Cn	Cn	Cn	Cn
Aquifer Zone	WT	WT	BDR	WT	WT	BDR	WT	WT	WT
Weathered Rock-Depth	.	.	11.5	3.5	.	8.0	8.5	0.6	4.0
Fresh Rock-Depth	.	.	17.0	.	.	.	.	.	.
Conductor Casing									
Casing Depth	.	.	11.5	.	.	.	.	.	.
Outside Diameter	.	.	4.5	.	.	.	.	.	.
Inside Diameter	.	.	.	.	.	.	.	.	.
Casing Material	.	.	STL	.	.	.	.	.	.
Well Casing									
Borehole Depth	15.1	38.8	77.3	17.8	33.4	55.5	12.1	25.5	13.2
Borehole Diameter	6	6	6	6	6	6	6	4.5	6
Casing Depth	10.1	33.8	72.3	12.8	28.4	50.5	7.1	15.7	10.0
Outside Diameter	4.5	4.5	4.5	4.5	4.5	4.5	4.5	2.37	2.37
Inside Diameter	4	4	4	4	4	4	4	2	2
Casing Material	PVC40	PVC40	PVC40	PVC40	PVC40	PVC40	PVC40	SS304	SS304
Monitored Interval									
Top-Depth	7.1	30.8	69.3	9.8	25.4	47.5	4.1	13.0	5.0
Midpoint-Depth	11.1	34.8	73.3	13.8	29.4	51.5	8.1	19.3	9.1
Pump Intake-Depth	12.00	35.80	72.30	14.82	26.91	52.00	9.53	17.70	9.00
Bottom of Screen-Depth	15.1	38.8	77.3	17.8	33.4	55.5	12.1	20.7	12.0
Bottom-Depth	15.1	38.8	77.3	17.8	33.4	55.5	12.1	25.5	13.2
Top-Elevation	955.42	931.41	893.14	952.55	937.34	914.86	956.00	949.11	926.50
Midpoint-Elevation	951.42	927.41	889.14	948.55	933.34	910.86	952.00	942.86	922.40
Pump Intake-Elevation	950.53	926.45	890.11	947.53	935.83	910.36	950.57	944.39	922.50
Bottom-Elevation	947.42	923.41	885.14	944.55	929.34	906.86	948.00	936.61	918.30
Screen Length	5	5	5	5	5	5	5	5	2
Screen Material	SS/sw	SS/sw	SS/sw	SS/sw	SS/sw	SS/sw	SS/sw	SS/sw	SS/sw
Slot Size	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Open-Hole Length	.	.	.	.	.	.	.	.	.
Open-Hole Diameter	.	.	.	.	.	.	.	.	.

APPENDIX C: MONITORING WELL CONSTRUCTION DETAILS, CY 2011

Well Number	GW-046	GW-053	GW-058	GW-068	GW-071	GW-077	GW-078	GW-079	GW-080
Hydrogeologic Regime	BC	BC	BC	BC	BC	BC	BC	BC	BC
Functional Area	BG	BG	BG	BG	BG	BG	BG	BG	BG
General Information									
Date Installed	10/27/83	11/04/83	03/06/84	03/22/84	03/25/84	03/29/84	03/30/84	03/23/84	03/24/84
Total Depth Drilled	20.5	39.7	45.2	85.0	220.6	100.5	21.1	65.0	30.0
East Coordinate	43,284	43,086	43,211	43,377	44,191	41,234	41,209	41,616	41,621
North Coordinate	29,562	29,066	28,714	29,500	29,495	29,729	29,730	30,630	30,622
Measuring Point	TOWW	TOWW	TOC	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW
Measuring Point Elevation	921.17	903.42	913.30	924.61	928.90	919.30	918.10	981.20	981.00
Ground Surface Elevation	918.13	900.50	910.00	921.20	925.40	914.70	914.50	977.20	977.10
Tag Depth-(TOC)	23.85	35.13	48.90	86.10	218.40	104.10	23.40	64.70	33.00
Geologic Information									
Hydrostratigraphic Unit	AQT	AQF	AQF	AQT	AQT	AQT	AQT	AQT	AQT
Geologic Formation	Cn	Cmn	Cmn	Cn	Cn	Cn	Cn	Crg	Crg
Aquifer Zone	WT	WT	BDR	BDR	BDR	BDR	BDR	BDR	WT
Weathered Rock-Depth	7.7	4.0	.	.	5.5	7.0	6.5	4.0	3.5
Fresh Rock-Depth	.	.	20.8	25.0	16.0	13.0	8.5	26.5	23.5
Conductor Casing									
Casing Depth	.	6.0	.	.	16.0	35.0	.	.	.
Outside Diameter	.	6.5	.	.	10.63	4.5	.	.	.
Inside Diameter	.	.	.	.	10	4	.	.	.
Casing Material	.	STL	.	.	PVC40	STL	.	.	.
Well Casing									
Borehole Depth	20.5	39.7	45.2	85.0	220.6	100.5	21.1	65.0	30.0
Borehole Diameter	6	4	4	8.75	8.75	3.88	6.5	6.5	6.5
Casing Depth	8.1	26.6	42.2	71.9	198.4	90.3	16.1	59.9	24.7
Outside Diameter	2.37	2.37	2.37	2.37	2.37	2.37	2.37	2.37	2.37
Inside Diameter	2	2	2	2	2	2	2	2	2
Casing Material	SS304	SS304	SS304	SS304	SS304	SS304	SS304	SS304	SS304
Monitored Interval									
Top-Depth	5.0	11.4	38.8	70.0	195.1	87.4	11.7	49.9	20.8
Midpoint-Depth	12.7	22.1	41.5	76.8	207.1	93.9	16.4	57.4	25.3
Pump Intake-Depth	12.00	871.42	43.70	77.59	208.50	.	.	61.80	.
Bottom of Screen-Depth	18.1	31.6	44.2	82.1	219.0	100.3	21.1	64.9	29.7
Bottom-Depth	20.3	32.8	44.2	83.6	219.0	100.3	21.1	64.9	29.7
Top-Elevation	913.13	889.10	871.20	851.20	730.30	827.30	902.80	927.30	956.30
Midpoint-Elevation	905.48	878.40	868.50	844.40	718.35	820.85	898.10	919.80	951.85
Pump Intake-Elevation	906.17	29.08	866.30	843.61	716.90	.	.	915.40	.
Bottom-Elevation	897.83	867.70	865.80	837.60	706.40	814.40	893.40	912.30	947.40
Screen Length	10	5	2	10.2	20.6	10	5	5	5
Screen Material	SS/sw	SS/sw	SS/sw	SS/sw	SS/sw	SS/sw	SS/sw	SS/sw	SS/sw
Slot Size	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Open-Hole Length	.	.	.	.	.	.	.	.	.
Open-Hole Diameter	.	.	.	.	.	.	.	.	.

APPENDIX C: MONITORING WELL CONSTRUCTION DETAILS, CY 2011

Well Number Hydrogeologic Regime Functional Area	GW-082 BC BG	GW-085 BC OLF	GW-098 BC OLF	GW-100 BC S3	GW-101 BC S3	GW-108 EF S3	GW-122 BC S3	GW-127 BC S3	GW-134 BC S3
General Information									
Date Installed	03/17/84	03/22/84	09/21/84	09/12/84	09/12/84	09/26/84	07/25/85	1984	32944
Total Depth Drilled	35.0	62.0	104.0	20.7	17.5	58.6	142.0	24.0	842.0
East Coordinate	42,090	49,058	46,959	50,957	51,844	53,207	51,807	51,828	52,533
North Coordinate	30,434	30,003	29,452	29,759	30,241	30,070	29,741	29,850	29,741
Measuring Point	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW	TOC
Measuring Point Elevation	964.00	983.57	945.95	987.40	1,007.40	999.00	1,007.20	1,005.90	1,005.63
Ground Surface Elevation	960.52	979.80	942.40	984.60	1,005.10	995.80	1,004.15	1,003.67	1,002.50
Tag Depth-(TOC)	38.45	62.34	105.65	17.87	19.18	58.30	145.28	26.52	845.13
Geologic Information									
Hydrostratigraphic Unit	AQT	AQT	AQT	AQF	AQT	AQT	AQF	AQT	AQT
Geologic Formation	Cm	Cn	Cn	Cmn	Cn	Cn	Cmn	Cn	Cm
Aquifer Zone	BDR	BDR	BDR	WT	WT	BDR	BDR	WT	BDR
Weathered Rock-Depth	7.0	2.0	1.0	14.0	14.0	4.0	.	.	.
Fresh Rock-Depth	23.0	40.0	7.5	.	17.5	.	37.0	.	.
Conductor Casing									
Casing Depth	25.0	.	20.0	0.3	2.7	20.7	39.0	.	30.0
Outside Diameter	6.5	.	10.63	7	7	10.63	10.75	.	10.75
Inside Diameter	.	.	10	.	.	10	10	.	.
Casing Material	STL	.	PVC40	S/GALV	S/GALV	PVC40	SF25	SS	SF25
Well Casing									
Borehole Depth	35.0	62.0	104.0	20.7	17.5	58.6	92.0	24.0	35.0
Borehole Diameter	4	4	9	6.5	6.5	9	9.79	6.5	9.87
Casing Depth	29.4	53.8	82.4	10.2	12.3	46.7	92.0	18.8	35.0
Outside Diameter	2.37	2.37	4.5	2.37	2.37	4.5	4.5	2.37	4.5
Inside Diameter	2	2	4	2	2	4	4	2	.
Casing Material	SS304	SS304	SS304	PVC	PVC	PVC40	SF25	SS304	SF25
Monitored Interval									
Top-Depth	24.1	48.4	76.6	3.8	10.1	41.0	92.0	14.0	35.0
Midpoint-Depth	29.3	53.6	90.3	12.3	13.8	49.8	117.0	19.0	438.5
Pump Intake-Depth	31.50	51.20	96.40	.	989.40	49.80	131.90	981.40	.
Bottom of Screen-Depth	34.4	58.8	103.4	14.2	16.3	55.7	.	22.8	.
Bottom-Depth	34.4	58.8	104.0	20.7	17.5	58.6	142.0	24.0	842.0
Top-Elevation	936.42	931.40	865.80	980.80	995.00	954.80	912.15	989.67	967.50
Midpoint-Elevation	931.27	926.20	852.10	972.35	991.30	946.00	887.15	984.67	564.00
Pump Intake-Elevation	929.00	928.57	845.95	.	15.70	946.00	872.20	22.27	.
Bottom-Elevation	926.12	921.00	838.40	963.90	987.60	937.20	862.15	979.67	160.50
Screen Length	5	5	21	4	4	9	.	4	.
Screen Material	SS/sw	SS/sw	SS/sw	PVC/sl	PVC/sl	PVC/sl	.	PVC/SL	.
Slot Size	0.01	0.01	0.01	0.01	0.01	0.01	.	0.01	.
Open-Hole Length	.	.	.	.	.	.	50	.	807
Open-Hole Diameter	.	.	.	.	.	.	4	.	3.7

APPENDIX C: MONITORING WELL CONSTRUCTION DETAILS, CY 2011

Well Number Hydrogeologic Regime Functional Area	GW-141 CR LIV	GW-143 CR KHQ	GW-144 CR KHQ	GW-145 CR KHQ	GW-151 EF NHP	GW-153 EF NHP	GW-154 EF NHP	GW-156 CR CRSDB	GW-159 CR CRSDB
General Information									
Date Installed	09/04/87	10/24/85	10/24/85	10/14/85	08/14/85	10/31/85	07/30/85	10/18/85	10/18/85
Total Depth Drilled	156.0	253.0	195.0	110.0	96.5	60.0	11.2	157.6	157.0
East Coordinate	52,463	63,522	63,502	63,266	64,232	63,728	63,346	64,020	63,496
North Coordinate	28,755	24,257	24,255	24,441	28,958	28,613	28,987	27,626	27,764
Measuring Point	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW
Measuring Point Elevation	1,186.23	913.98	913.54	840.24	916.17	921.68	911.70	1,049.28	1,051.38
Ground Surface Elevation	1,183.45	911.04	910.48	837.29	913.06	918.53	908.60	1,046.94	1,048.79
Tag Depth-(TOC)	158.81	252.70	194.34	113.49	99.63	60.84	13.35	157.65	155.87
Geologic Information									
Hydrostratigraphic Unit	AQF	AQF	AQF	AQF	AQF	AQF	AQF	AQF	AQF
Geologic Formation	Ock	Ock	Ock	Ock	Cmn	Cmn	Cmn	Ock	Ock
Aquifer Zone	BDR	BDR	BDR	BDR	BDR	BDR	WT	BDR	BDR
Weathered Rock-Depth	.	.	.	.	.	.	11.2	84.0	.
Fresh Rock-Depth	57.0	18.0	40.0	12.0	12.0	14.0	.	93.0	100.0
Conductor Casing									
Casing Depth	65.0	20.0	40.0	12.0	12.0	29.0	.	94.0	123.0
Outside Diameter	10.75	10.63	12.5	12.5	12.5	10.63	.	10.75	10.75
Inside Diameter	10	9.87	11.75	11.75	11.75	9.88	.	10	10
Casing Material	SF25	PVC40	PVC40	PVC40	PVC40	PVC40	.	SF25	SF25
Well Casing									
Borehole Depth	156.0	205.0	195.0	110.0	96.5	60.0	11.2	157.0	157.0
Borehole Diameter	10	10	11	11	11	11	8	8.5	8.5
Casing Depth	144.5	205.0	150.0	88.5	86.0	49.5	5.7	147.0	147.0
Outside Diameter	4.5	6.62	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Inside Diameter	4	6.12	4	4	4	4	4	4	4
Casing Material	SS304	SF25	PVC40	PVC40	PVC40	PVC40	PVC40	PVC40	PVC40
Monitored Interval									
Top-Depth	141.0	205.0	148.0	86.0	85.0	45.0	4.7	145.0	145.0
Midpoint-Depth	148.5	229.0	171.5	98.0	90.8	52.5	8.0	151.3	151.0
Pump Intake-Depth	147.70	226.10	170.90	100.00	90.80	52.90	8.40	150.70	148.40
Bottom of Screen-Depth	155.2	.	190.0	108.5	96.0	59.5	10.7	157.0	157.0
Bottom-Depth	156.0	253.0	195.0	110.0	96.5	60.0	11.2	157.6	157.0
Top-Elevation	1,042.45	706.04	762.48	751.29	828.06	873.53	903.90	901.94	903.79
Midpoint-Elevation	1,034.95	682.04	738.98	739.29	822.31	866.03	900.65	895.64	897.79
Pump Intake-Elevation	1035.73	684.98	739.54	737.24	822.27	865.68	900.20	896.28	900.38
Bottom-Elevation	1,027.45	658.04	715.48	727.29	816.56	858.53	897.40	889.34	891.79
Screen Length	10.7	.	40	20	10	10	5	10	10
Screen Material	SS/sw	.	PVC/sl	PVC/sl	PVC/sl	PVC/sl	PVC/sl	PVC/sl	PVC/sl
Slot Size	0.01	.	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Open-Hole Length	.	48	.	.	.	.	.	.	.
Open-Hole Diameter	.	6	.	.	.	.	.	.	.

APPENDIX C: MONITORING WELL CONSTRUCTION DETAILS, CY 2011

Well Number Hydrogeologic Regime Functional Area	GW-161 CR ECRWP	GW-169 EF EXP-UV	GW-170 EF EXP-UV	GW-171 EF EXP-UV	GW-172 EF EXP-UV	GW-174 CR CRSP	GW-175 CR CRSP	GW-176 CR CRSP	GW-177 CR CRSP
General Information									
Date Installed	07/07/87	09/16/86	04/01/86	02/26/86	05/05/86	08/15/85	06/22/88	08/27/85	10/24/85
Total Depth Drilled	400.0	34.8	156.9	31.2	133.9	145.0	166.7	145.0	145.0
East Coordinate	62,146	66,854	66,843	69,654	69,579	59,215	58,686	58,450	57,497
North Coordinate	27,805	28,545	28,545	28,403	28,358	28,205	28,677	28,294	28,483
Measuring Point	TOC	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW
Measuring Point Elevation	1,093.54	932.12	932.64	920.72	926.69	1,116.66	1,084.19	1,125.30	1,158.20
Ground Surface Elevation	1,090.91	929.95	930.70	918.55	922.85	1,114.06	1,081.89	1,122.13	1,155.52
Tag Depth-(TOC)	402.88	36.23	156.16	32.64	137.50	151.94	169.49	147.33	150.69
Geologic Information									
Hydrostratigraphic Unit	AQF	AQF	AQF	AQF	AQF	AQF	AQF	AQF	AQF
Geologic Formation	OCk	Cmn	Cmn	Cmn	Cmn	OCk	OCk	OCk	OCk
Aquifer Zone	BDR	WT	BDR	WT	BDR	BDR	BDR	BDR	BDR
Weathered Rock-Depth	65.0	.	.	.	15.0	51.0	46.0	.	62.0
Fresh Rock-Depth	95.5	.	30.0	.	19.0	80.0	98.5	84.0	98.0
Conductor Casing									
Casing Depth	108.0	.	30.0	.	35.0	80.0	61.3	88.0	82.0
Outside Diameter	12.5	.	8.63	.	8.63	10.75	10.75	10.75	10.75
Inside Diameter	.	.	.	.	.	10	10	10	10
Casing Material	SF25	.	PVC40	.	SF25	SF25	.	SF25	SF25
Well Casing									
Borehole Depth	350.0	42.0	104.0	31.2	105.0	145.0	166.7	145.0	145.0
Borehole Diameter	11	8	6.62	8	6.62	10	9.5	10	8
Casing Depth	350.0	29.7	104.0	26.8	105.0	135.0	150.6	135.0	133.0
Outside Diameter	6.62	2.37	4.38	2.37	4.38	4.5	4.5	4.5	4.5
Inside Diameter	.	2	4	2	4	4	4	4	4
Casing Material	SF25	PVC40	STL	PVC40	STL	SS304	SS304	SS304	PVC40
Monitored Interval									
Top-Depth	350.0	28.7	104.0	25.8	105.0	134.0	148.3	134.0	130.0
Midpoint-Depth	375.0	31.8	130.5	28.5	119.4	139.5	157.5	139.5	137.5
Pump Intake-Depth	.	.	124.10	.	123.20	969.66	162.70	983.30	.
Bottom of Screen-Depth	.	34.7	.	31.2	.	145.0	166.4	145.0	143.0
Bottom-Depth	400.0	34.8	156.9	31.2	133.8	145.0	166.7	145.0	145.0
Top-Elevation	740.91	901.25	826.70	892.75	817.85	980.06	933.59	988.13	1,025.52
Midpoint-Elevation	715.91	898.20	800.25	890.05	803.45	974.56	924.39	982.63	1,018.02
Pump Intake-Elevation	.	.	806.64	.	799.69	144.40	919.19	138.83	.
Bottom-Elevation	690.91	895.15	773.80	887.35	789.05	969.06	915.19	977.13	1,010.52
Screen Length	.	5	.	4.4	.	10	15.8	10	10
Screen Material	.	PVC/sl	.	PVC/sl	.	SS/sw	SS/sw	SS/sw	PVC/sl
Slot Size	.	0.01	.	0.01	.	0.01	0.01	0.01	0.01
Open-Hole Length	50	.	52.9	.	28.8	.	.	.	.
Open-Hole Diameter	11	.	3.88	.	3.63	.	.	.	.

APPENDIX C: MONITORING WELL CONSTRUCTION DETAILS, CY 2011

Well Number Hydrogeologic Regime Functional Area	GW-180 CR CRSP	GW-193 EF T2331	GW-203 CR UNCS	GW-204 EF T0134	GW-205 CR UNCS	GW-217 CR LIV	GW-219 EF UOV	GW-220 EF NHP	GW-221 CR UNCS
General Information									
Date Installed	08/11/87	08/04/89	10/24/85	08/30/89	10/25/85	08/13/87	07/30/87	08/22/85	10/24/85
Total Depth Drilled	144.0	18.5	156.0	17.5	164.0	180.0	11.3	45.2	158.0
East Coordinate	59,220	59,536	54,190	57,411	54,008	53,020	58,929	64,225	54,389
North Coordinate	28,494	29,344	28,356	29,956	28,363	28,758	29,163	28,949	28,359
Measuring Point	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW
Measuring Point Elevation	1,104.14	934.17	1,105.45	958.74	1,104.14	1,177.03	935.83	915.64	1,106.16
Ground Surface Elevation	1,101.43	931.11	1,102.34	955.47	1,101.46	1,174.29	931.27	912.74	1,103.36
Tag Depth-(TOC)	146.08	21.17	157.61	20.23	165.13	179.13	15.59	49.00	159.34
Geologic Information									
Hydrostratigraphic Unit	AQF	AQF	AQF	AQT	AQF	AQF	AQF	AQF	AQF
Geologic Formation	OCK	Cmn	OCK	Cc	OCK	OCK	Cmn	Cmn	OCK
Aquifer Zone	BDR	WT	BDR	WT	BDR	BDR	WT	BDR	BDR
Weathered Rock-Depth	58.0	2.5	86.0	10.0	100.0	55.0	.	.	36.0
Fresh Rock-Depth	90.0	.	93.0	.	146.0	75.0	.	11.0	90.0
Conductor Casing									
Casing Depth	90.6	5.0	94.0	.	154.0	81.7	.	13.0	92.0
Outside Diameter	10.75	9.63	10.75	.	10.75	10.75	.	12.5	6.63
Inside Diameter	10	.	10	.	10	10	.	11.75	.
Casing Material	SF25	STL	SF25	.	SF25	SF25	NONE	PVC40	SF25
Well Casing									
Borehole Depth	144.0	18.5	156.0	17.5	164.0	180.0	11.3	45.2	158.0
Borehole Diameter	10	8	8.5	6	10	10	10	11	6
Casing Depth	132.2	8.2	146.0	7.3	154.0	166.8	5.7	34.7	148.0
Outside Diameter	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Inside Diameter	4	4	4	4	4	4	4	4	4
Casing Material	SS304	SS304	PVC40	SS304	PVC40	SS304	SS304	PVC40	PVC40
Monitored Interval									
Top-Depth	126.0	5.5	144.0	6.5	152.0	165.2	4.3	31.0	146.0
Midpoint-Depth	135.0	12.0	150.0	11.9	158.0	172.6	7.8	38.1	152.0
Pump Intake-Depth	963.14	13.90	146.90	11.70	147.30	172.10	922.33	41.10	149.20
Bottom of Screen-Depth	143.0	18.5	156.0	17.3	164.0	177.4	11.3	44.7	158.0
Bottom-Depth	144.0	18.5	156.0	17.3	164.0	180.0	11.3	45.2	158.0
Top-Elevation	975.43	925.61	958.34	948.97	949.46	1,009.09	926.97	881.74	957.36
Midpoint-Elevation	966.43	919.14	952.34	943.57	943.46	1,001.69	923.47	874.64	951.36
Pump Intake-Elevation	138.29	917.17	955.45	943.74	954.14	1002.23	8.94	871.64	954.16
Bottom-Elevation	957.43	912.66	946.34	938.17	937.46	994.29	919.97	867.54	945.36
Screen Length	10.8	10.3	10	10	10	10.6	5.6	10	10
Screen Material	SS/sw	SS/sw	PVC/sl	SS/sw	PVC/sl	SS/sw	SS/sw	PVC/sl	PVC/sl
Slot Size	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Open-Hole Length	.	.	.	.	.	.	.	.	.
Open-Hole Diameter	.	.	.	.	.	.	.	.	.

APPENDIX C: MONITORING WELL CONSTRUCTION DETAILS, CY 2011

Well Number Hydrogeologic Regime Functional Area	GW-223 EF NHP	GW-225 BC OLF	GW-229 BC OLF	GW-230 EF EXP-UV	GW-231 CR KHQ	GW-236 BC S3	GW-240 EF NHP	GW-242 BC BG	GW-246 BC S3
General Information									
Date Installed	08/21/85	10/08/85	10/30/85	05/12/86	10/02/85	10/16/85	10/31/85	11/20/85	03/11/86
Total Depth Drilled	90.5	200.0	55.0	406.4	35.0	18.5	29.5	17.0	76.0
East Coordinate	63,311	47,461	47,017	69,617	63,410	50,453	63,726	43,144	52,098
North Coordinate	28,938	29,155	29,256	28,388	24,725	29,712	28,604	31,004	29,992
Measuring Point	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW
Measuring Point Elevation	911.62	943.11	949.00	923.11	849.67	983.21	922.90	978.69	1,009.19
Ground Surface Elevation	908.97	940.21	945.71	919.57	846.90	980.39	919.50	974.78	1,006.07
Tag Depth-(TOC)	93.57	203.30	51.45	409.48	37.70	21.14	32.55	20.18	76.50
Geologic Information									
Hydrostratigraphic Unit	AQF	AQF	AQF	AQF	AQF	AQF	AQF	AQT	AQT
Geologic Formation	Cmn	Cmn	Cmn	Cmn	OCK	Cmn	Cmn	Cpv	Cn
Aquifer Zone	BDR	BDR	BDR	BDR	BDR	WT	BDR	WT	WT
Weathered Rock-Depth	.	.	.	19.0	.	9.0	.	9.0	26.0
Fresh Rock-Depth	10.0	25.0	30.0	38.0	10.5	18.5	14.0	.	.
Conductor Casing									
Casing Depth	11.0	32.0	37.0	31.0	11.0	.	14.0	.	27.0
Outside Diameter	12.5	10.75	10.75	8.63	10.63	.	12.5	.	12.5
Inside Diameter	11.75	10	10	.	10	.	12	.	12
Casing Material	PVC40	STL	STL	STL	PVC40	NONE	PVC40	.	PVC40
Well Casing									
Borehole Depth	90.5	150.0	40.0	341.0	35.0	18.5	29.5	17.0	76.0
Borehole Diameter	11	10	10	5.5	11	8	11	8	11
Casing Depth	80.0	150.0	40.0	341.0	24.5	13.0	24.0	10.6	46.5
Outside Diameter	4.5	4.5	4.5	4.38	4.5	4.5	4.5	2.37	6.5
Inside Diameter	4	4	4	4	4	.	4	.	6
Casing Material	PVC40	STL	STL	STL	PVC40	PVC40	PVC40	SS304	PVC40
Monitored Interval									
Top-Depth	79.0	150.0	40.0	341.0	22.8	10.0	21.0	9.0	34.2
Midpoint-Depth	84.8	175.0	47.5	373.7	28.9	14.3	25.3	13.0	55.1
Pump Intake-Depth	84.40	190.10	44.70	383.50	28.70	964.71	26.60	13.1	59.40
Bottom of Screen-Depth	90.0	.	.	.	34.5	18.0	29.0	17.0	74.6
Bottom-Depth	90.5	200.0	55.0	406.4	35.0	18.5	29.5	17.0	76.0
Top-Elevation	829.97	790.21	905.71	578.57	824.10	970.39	898.50	965.78	971.87
Midpoint-Elevation	824.22	765.21	898.21	545.87	818.00	966.14	894.25	961.78	950.97
Pump Intake-Elevation	824.62	750.11	901.00	536.11	818.17	15.68	892.90	961.69	946.69
Bottom-Elevation	818.47	740.21	890.71	513.17	811.90	961.89	890.00	957.78	930.07
Screen Length	10	.	.	.	10	5	5	6.4	28.1
Screen Material	PVC/sl	.	.	.	PVC/sl	PVC/sl	PVC/sl	SS/sw	PVC/sl
Slot Size	0.01	.	.	.	0.01	0.01	0.01	0.01	0.03
Open-Hole Length	.	50	15	65.4	.	.	.	.	.
Open-Hole Diameter	.	4	4	3.63	.	.	.	.	.

APPENDIX C: MONITORING WELL CONSTRUCTION DETAILS, CY 2011

Well Number Hydrogeologic Regime Functional Area	GW-251 EF S2	GW-253 EF S2	GW-265 EF SY	GW-268 EF SY	GW-269 EF SY	GW-270 EF SY	GW-272 EF SY	GW-274 EF SY	GW-275 EF SY
General Information									
Date Installed	04/08/86	04/11/86	06/16/86	06/10/86	06/16/86	06/09/86	06/16/86	06/09/86	05/30/86
Total Depth Drilled	51.0	50.0	23.1	35.0	30.0	18.5	16.2	35.0	65.5
East Coordinate	53,843	54,057	53,308	53,608	53,779	53,236	53,737	53,673	53,688
North Coordinate	29,467	29,404	30,763	30,616	30,649	30,424	30,485	30,152	30,151
Measuring Point	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW
Measuring Point Elevation	1,003.80	1,004.24	1,032.68	1,026.47	1,027.81	1,008.96	1,009.16	995.60	995.53
Ground Surface Elevation	1,001.60	1,001.60	1,030.85	1,024.13	1,025.38	1,006.35	1,006.62	992.94	993.08
Tag Depth-(TOC)	50.04	50.51	25.68	36.22	33.50	21.50	19.16	36.12	68.47
Geologic Information									
Hydrostratigraphic Unit	AQF	AQF	AQT	AQT	AQT	AQT	AQT	AQT	AQT
Geologic Formation	Cmn	Cmn	Cm	Cm	Cm	Cn	Cn	Cn	Cn
Aquifer Zone	BDR	WT	WT	WT	WT	BDR	WT	WT	BDR
Weathered Rock-Depth	32.5	.	10.0	2.5	10.0	5.0	5.0	3.0	5.0
Fresh Rock-Depth	.	.	22.0	35.0	.	11.0	15.0	35.0	35.0
Conductor Casing									
Casing Depth	.	.	.	.	.	.	.	.	38.0
Outside Diameter	.	.	.	.	.	.	.	.	10.63
Inside Diameter	.	.	.	.	.	.	.	.	10
Casing Material	.	.	NONE	NONE	.	NONE	NONE	.	PVC40
Well Casing									
Borehole Depth	51.0	50.0	23.1	35.0	30.0	18.5	16.2	35.0	65.5
Borehole Diameter	8.25	8.25	10	10	10	10	10	8	10
Casing Depth	37.5	37.0	17.5	28.1	23.7	13.0	10.9	28.5	54.8
Outside Diameter	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Inside Diameter	4	4	4	4	4	4	4	4	4
Casing Material	PVC40	PVC40	PVC40	PVC40	PVC40	SS304	SS304	SS304	SS304
Monitored Interval									
Top-Depth	35.0	36.2	15.5	26.5	21.9	11.0	8.8	25.8	53.3
Midpoint-Depth	43.0	43.1	19.3	30.8	26.0	14.8	12.5	30.4	59.4
Pump Intake-Depth	42.80	41.60	20.67		28.10	989.96	992.66	30.80	62.60
Bottom of Screen-Depth	47.1	46.7	23.1	33.7	29.4	18.4	16.2	33.9	65.2
Bottom-Depth	51.0	50.0	23.1	35.0	30.0	18.5	16.2	35.0	65.5
Top-Elevation	966.60	965.40	1,015.35	997.63	1,003.48	995.35	997.82	967.14	939.78
Midpoint-Elevation	958.60	958.50	1,011.55	993.38	999.43	991.60	994.12	962.54	933.68
Pump Intake-Elevation	958.80	960.04	1010.18	1024.13	997.31	16.39	13.96	962.10	930.53
Bottom-Elevation	950.60	951.60	1007.75	990.43	995.38	987.85	990.42	957.94	927.58
Screen Length	9.6	9.7	5.6	5.6	5.7	5.4	5.3	5.4	10.4
Screen Material	PVC/sl	PVC/sl	PVC/SL	PVC/SL	PVC/sl	SS/sw	SS/sw	SS/sw	SS/sw
Slot Size	0.01	0.01	0.02	0.02	0.02	0.01	0.01	0.01	0.01
Open-Hole Length	.	.	.	.	.	.	.	.	.
Open-Hole Diameter	.	.	.	.	.	.	.	.	.

APPENDIX C: MONITORING WELL CONSTRUCTION DETAILS, CY 2011

Well Number Hydrogeologic Regime Functional Area	GW-276 BC S3	GW-281 EF FF	GW-289 BC BG	GW-293 CR ECRWP	GW-294 CR ECRWP	GW-296 CR ECRWP	GW-298 CR ECRWP	GW-301 CR CRBAWP	GW-305 CR LIV
General Information									
Date Installed	07/15/86	08/20/86	11/20/86	06/11/87	05/01/87	05/11/87	07/27/87	07/02/87	08/25/87
Total Depth Drilled	18.5	17.5	40.8	214.0	128.0	147.0	190.0	182.0	179.6
East Coordinate	52,557	61,907	42,875	62,321	62,483	62,023	62,445	61,964	52,962
North Coordinate	29,926	29,771	29,982	28,112	27,958	27,994	27,495	27,662	28,548
Measuring Point	TOWW	TOC	TOWW	TOC	TOC	TOC	TOC	TOWW	TOWW
Measuring Point Elevation	1,001.57	946.10	948.73	1,063.90	1,083.60	1,090.99	1,049.01	1,086.55	1,183.72
Ground Surface Elevation	998.70	946.53	946.32	1,061.70	1,083.67	1,088.29	1,046.40	1,083.94	1,181.07
Tag Depth-(TOC)	21.34	14.85	43.14	216.40	130.76	148.16	189.36	165.23	181.06
Geologic Information									
Hydrostratigraphic Unit	AQT	AQT	AQT	AQF	AQF	AQF	AQF	AQF	AQF
Geologic Formation	Cn	Cn	Cm	OCk	OCk	OCk	OCk	OCk	OCk
Aquifer Zone	WT	WT	WT	BDR	BDR	BDR	BDR	BDR	BDR
Weathered Rock-Depth	18.5	17.5	24.0	57.0	62.0	67.0	65.0	94.0	53.0
Fresh Rock-Depth	.	.	38.0	110.0	87.0	81.5	80.0	136.0	84.0
Conductor Casing									
Casing Depth	.	.	.	57.8	74.5	86.5	83.3	105.0	64.0
Outside Diameter	.	.	.	10.75	10.75	10.75	10.75	10.75	10.75
Inside Diameter	.	.	.	10	10	10	10	10	10
Casing Material	.	.	.	SF25	SF25	SF25	SF25	SF25	SF25
Well Casing									
Borehole Depth	18.5	17.5	40.8	197.0	128.0	147.0	190.0	163.5	179.6
Borehole Diameter	8	6	9	10	10	10	10	10	10
Casing Depth	13.0	5.0	30.6	197.0	117.6	136.3	176.0	151.0	168.9
Outside Diameter	4.5	4.5	4.5	6.62	4.5	4.5	4.5	4.5	4.5
Inside Diameter	4	4	4	.	4	4	4	4	4
Casing Material	SS304	SS304	SS304	SF25	SS304	SS304	SS304	SS304	SS304
Monitored Interval									
Top-Depth	11.3	4.0	28.9	197.0	113.0	134.4	171.1	148.5	165.3
Midpoint-Depth	14.9	9.5	34.9	205.5	120.5	140.7	180.6	156.0	172.5
Pump Intake-Depth	14.10	.	35.60	.	.	.	.	157.40	173.40
Bottom of Screen-Depth	18.3	15.0	40.6	.	128.0	146.8	186.0	161.0	179.6
Bottom-Depth	18.5	15.0	40.8	214.0	128.0	147.0	190.0	163.5	179.6
Top-Elevation	987.40	942.53	917.42	864.70	970.67	953.89	875.30	935.44	1,015.77
Midpoint-Elevation	983.80	937.03	911.47	856.20	963.17	947.59	865.85	927.94	1,008.62
Pump Intake-Elevation	984.57	.	910.73	.	.	.	.	926.55	1007.62
Bottom-Elevation	980.20	931.53	905.52	847.70	955.67	941.29	856.40	920.44	1,001.47
Screen Length	5.3	10	10	.	10.4	10.5	10	10	10.7
Screen Material	SS/sw	SS/sl	SS/sw	.	SS/sw	SS/sw	SS/sw	SS/sw	SS/sw
Slot Size	0.01	0.01	0.01	.	0.01	0.01	0.01	0.01	0.01
Open-Hole Length	.	.	.	17	.	.	.	.	.
Open-Hole Diameter	.	.	.	6	.	.	.	.	.

APPENDIX C: MONITORING WELL CONSTRUCTION DETAILS, CY 2011

Well Number Hydrogeologic Regime Functional Area	GW-307 BC RS	GW-315 BC SPI	GW-322 CR CRSP	GW-332 EF WCPA	GW-337 EF WCPA	GW-363 BC EMWMF	GW-365 BC OLF	GW-380 EF NHP	GW-381 EF NHP
General Information									
Date Installed	07/15/87	09/25/87	09/02/87	08/11/87	08/12/87	03/16/88	05/02/88	08/19/88	04/25/88
Total Depth Drilled	41.6	104.0	193.0	24.1	22.1	75.0	150.0	15.5	60.4
East Coordinate	49,655	52,268	58,912	54,882	54,519	46,872	46,490	62,938	62,948
North Coordinate	29,346	29,455	28,241	30,058	30,057	29,961	29,150	28,714	28,715
Measuring Point	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW
Measuring Point Elevation	993.14	1,047.45	1,134.98	981.24	987.48	957.91	935.58	913.55	913.36
Ground Surface Elevation	991.01	1,044.84	1,131.81	979.55	984.12	955.41	933.03	913.66	913.44
Tag Depth-(TOC)	43.60	105.98	191.99	27.07	25.33	77.27	152.49	15.80	61.01
Geologic Information									
Hydrostratigraphic Unit	AQF	AQF	AQF	AQT	AQT	AQT	AQF	AQF	AQF
Geologic Formation	Cmn	Cmn	OCK	Cn	Cn	Cn	Cmn	Cmn	Cmn
Aquifer Zone	WT	BDR	BDR	WT	WT	BDR	BDR	WT	BDR
Weathered Rock-Depth	41.6	54.0	49.0	6.0	.	9.0	11.0	15.5	13.5
Fresh Rock-Depth	.	71.0	120.0	.	.	21.0	15.0	.	26.0
Conductor Casing									
Casing Depth	.	84.4	61.0	.	.	36.0	18.5	.	13.5
Outside Diameter	.	10.75	10.75	.	.	10.75	11.75	.	13
Inside Diameter	.	10	10	.	.	10	11	.	.
Casing Material	NONE	SF25	SF25	.	.	STL	STL	.	STL
Well Casing									
Borehole Depth	41.6	104.0	135.0	24.1	22.1	50.0	126.7	15.5	49.3
Borehole Diameter	10	10	10	10	10	9.5	10.75	10	9.5
Casing Depth	30.9	93.3	128.0	18.7	16.7	48.3	124.2	4.8	47.8
Outside Diameter	4.5	4.5	7	4.5	4.5	6.62	6.62	4.5	6.62
Inside Diameter	4	4	.	4	4	.	.	.	.
Casing Material	SS304	SS304	STL	SS304	SS304	SF25	SF25	SS304	SF25
Monitored Interval									
Top-Depth	28.7	90.0	128.0	16.8	15.0	50.0	126.7	2.8	49.3
Midpoint-Depth	35.2	97.0	160.5	20.5	18.6	62.5	138.4	9.2	54.9
Pump Intake-Depth	954.64	97.40	182.30	21.30	16.60	62.50	787.58	12.60	55.50
Bottom of Screen-Depth	41.6	103.3	.	24.1	22.1	.	.	15.2	.
Bottom-Depth	41.6	104.0	193.0	24.1	22.1	75.0	150.0	15.5	60.4
Top-Elevation	962.31	954.84	1,003.81	962.75	969.12	905.41	806.33	910.86	864.14
Midpoint-Elevation	955.86	947.84	971.31	959.10	965.57	892.91	794.68	904.51	858.59
Pump Intake-Elevation	36.37	947.45	949.48	958.24	967.48	892.91	145.45	901.05	857.96
Bottom-Elevation	949.41	940.84	938.81	955.45	962.02	880.41	783.03	898.16	853.04
Screen Length	10.7	10	.	5.4	5.4	.	.	10.4	.
Screen Material	SS/sw	SS/sw	.	SS/sw	SS/sw	.	.	SS/sw	.
Slot Size	0.01	0.01	.	0.01	0.01	.	.	0.01	.
Open-Hole Length	.	.	65	.	.	25	23.3	.	11.1
Open-Hole Diameter	.	.	6	.	.	6	6	.	6.1

APPENDIX C: MONITORING WELL CONSTRUCTION DETAILS, CY 2011

Well Number Hydrogeologic Regime Functional Area	GW-382 EF NHP	GW-383 EF NHP	GW-505 EF RG	GW-508 EF RG	GW-521 CR LIV	GW-522 CR LIV	GW-526 BC S3	GW-537 BC OLF	GW-540 CR LII
General Information									
Date Installed	04/11/88	04/04/88	04/06/88	04/18/88	09/14/88	09/20/88	06/13/88	09/14/88	06/02/89
Total Depth Drilled	173.0	24.1	13.5	15.0	136.0	195.5	123.0	24.5	171.5
East Coordinate	62,956	63,522	53,037	53,148	52,040	52,612	50,708	49,539	52,371
North Coordinate	28,716	29,201	30,400	30,281	28,541	28,377	30,033	30,057	27,489
Measuring Point	TOC	TOWW	TOWW	TOC	TOWW	TOWW	TOWW	TOWW	TOWW
Measuring Point Elevation	913.17	908.77	1,015.19	1,010.74	1,182.88	1,175.48	998.25	976.65	1,072.31
Ground Surface Elevation	913.16	906.00	1,011.60	1,009.41	1,179.46	1,172.04	995.34	974.49	1,069.38
Tag Depth-(TOC)	173.20	26.54	16.80	15.11	136.70	197.10	123.80	27.35	173.83
Geologic Information									
Hydrostratigraphic Unit	AQF	AQT	AQT	AQT	AQF	AQF	AQT	AQT	AQF
Geologic Formation	Cmn	Cn	Cn	Cn	OCk	OCk	Cn	Cn	OCk
Aquifer Zone	BDR	WT	WT	WT	BDR	BDR	BDR	WT	BDR
Weathered Rock-Depth	12.7	11.5	.	.	.	85.0	3.5	14.9	110.0
Fresh Rock-Depth	17.0	.	.	.	54.0	130.0	23.6	.	150.0
Conductor Casing									
Casing Depth	12.7	5.0	.	.	60.5	90.0	23.6	.	154.0
Outside Diameter	10.75	10.75	.	.	10.75	10.75	10.75	.	10.75
Inside Diameter	10	10	.	.	10	10	10	.	10
Casing Material	STL	STL	NONE	.	STL	STL	STL	.	STL
Well Casing									
Borehole Depth	125.0	24.1	13.5	15.0	136.0	195.5	101.0	24.5	171.5
Borehole Diameter	9.5	8.75	7	7	9.5	9.5	9.5	8.75	9.25
Casing Depth	123.2	18.1	1.9	2.2	124.9	184.6	99.7	8.0	161.2
Outside Diameter	6.62	4.5	2.37	2.37	4.5	4.5	6.62	4.5	4.5
Inside Diameter	.	4	2	2	4	4	.	4	4
Casing Material	SF25	SS304	SS304	SS304	SS304	SS304	SF25	SS304	SS304
Monitored Interval									
Top-Depth	125.0	16.6	1.5	1.3	123.2	183.0	101.0	4.8	158.5
Midpoint-Depth	149.0	20.1	7.5	8.2	129.6	189.2	112.0	14.1	165.0
Pump Intake-Depth	.	20.50	997.69	.	129.00	187.60	112.10	22.80	166.10
Bottom of Screen-Depth	.	23.1	12.3	12.5	135.2	195.0	.	23.0	171.5
Bottom-Depth	173.0	23.6	13.5	15.0	136.0	195.3	123.0	23.3	171.5
Top-Elevation	788.16	889.40	1,010.10	1,008.11	1,056.26	989.04	894.34	969.69	910.88
Midpoint-Elevation	764.16	885.90	1,004.10	1,001.26	1,049.86	982.89	883.34	960.44	904.38
Pump Intake-Elevation	.	885.47	13.91	.	1050.48	984.48	883.25	951.65	903.31
Bottom-Elevation	740.16	882.40	998.10	994.41	1,043.46	976.74	872.34	951.19	897.88
Screen Length	.	5	10.4	10.3	10.3	10.4	.	15	10.3
Screen Material	.	SS/sw	SS/sw	SS/sw	SS/sw	SS/sw	.	SS/sw	SS/sl
Slot Size	.	0.01	0.01	0.01	0.01	0.01	.	0.01	0.01
Open-Hole Length	48	.	.	.	.	.	22	.	.
Open-Hole Diameter	6.13	.	.	.	.	.	6.1	.	.

APPENDIX C: MONITORING WELL CONSTRUCTION DETAILS, CY 2011

Well Number Hydrogeologic Regime Functional Area	GW-557 CR LV	GW-560 CR CDLVII	GW-562 CR CDLVII	GW-564 CR CDLVII	GW-601 BC OLF	GW-605 EF EXP-I	GW-606 EF EXP-I	GW-615 BC S3	GW-616 BC S3
General Information									
Date Installed	12/02/88	12/30/88	01/13/89	01/27/89	08/31/89	03/19/91	03/20/91	02/13/90	03/10/90
Total Depth Drilled	139.0	117.0	133.0	88.0	356.0	40.5	175.0	245.0	269.0
East Coordinate	59,520	60,743	61,640	59,865	47,629	62,002	61,951	52,224	51,907
North Coordinate	26,450	25,692	26,276	25,873	28,903	28,707	28,708	30,009	29,724
Measuring Point	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW
Measuring Point Elevation	1,081.36	949.05	934.69	938.07	1,002.80	919.06	919.59	1,017.55	1,011.81
Ground Surface Elevation	1,078.63	945.76	931.86	935.12	999.09	916.97	916.98	1,014.17	1,009.81
Tag Depth-(TOC)	136.07	82.90	61.24	78.74	358.61	42.00	174.36	246.84	270.59
Geologic Information									
Hydrostratigraphic Unit	AQF	AQF	AQF	AQF	AQF	AQF	AQF	AQT	AQT
Geologic Formation	Ock	Ock	Ock	Ock	Cmn	Cmn	Cmn	Cn	Cn
Aquifer Zone	WT	WT	WT	WT	BDR	BDR	BDR	BDR	BDR
Weathered Rock-Depth	113.8	92.0	.	.	8.0	.	.	15.0	35.0
Fresh Rock-Depth	134.0	.	52.0	72.0	54.0	9.5	10.8	40.0	42.0
Conductor Casing									
Casing Depth	85.0	.	.	.	41.4	9.5	64.7	84.5	45.6
Outside Diameter	10.75	.	.	.	11.75	11.75	7	11.75	11.75
Inside Diameter	10	.	.	.	11	11	6.4	11	11
Casing Material	STL	.	.	.	STL	SJ55	SJ55	SJ55	SJ55
Well Casing									
Borehole Depth	138.0	117.0	60.0	81.0	319.0	40.5	175.0	222.5	219.7
Borehole Diameter	9.5	9.5	9.5	9.5	10.63	10.6	9.63	10.63	10.63
Casing Depth	115.8	49.0	38.0	55.3	317.2	29.7	161.0	221.2	217.8
Outside Diameter	4.5	4.5	4.5	4.5	7	4.25	4.25	7	7
Inside Diameter	4	4	4	4	.	4	4	6.54	6.54
Casing Material	SS304	SS304	SS304	SS304	STL	SS304	SS304	SF25	SF25
Monitored Interval									
Top-Depth	112.9	45.2	36.0	52.0	318.5	28.2	155.0	222.5	219.1
Midpoint-Depth	125.5	57.1	48.0	66.5	337.3	34.1	163.0	233.8	244.1
Pump Intake-Depth	123.60	59.40	48.20	65.50	657.80	33.90	166.40	68.60	263.00
Bottom of Screen-Depth	135.8	69.0	58.0	75.3	.	39.7	171.0	.	.
Bottom-Depth	138.0	69.0	60.0	81.0	356.0	39.9	171.0	245.0	269.0
Top-Elevation	965.73	900.56	895.86	883.12	680.59	888.77	761.98	791.67	790.71
Midpoint-Elevation	953.18	888.66	883.86	868.62	661.84	882.92	753.98	780.42	765.76
Pump Intake-Elevation	955.06	886.35	883.69	869.57	341.29	883.06	750.59	945.55	746.81
Bottom-Elevation	940.63	876.76	871.86	854.12	643.09	877.07	745.98	769.17	740.81
Screen Length	20	20	20	20	.	10	10	.	.
Screen Material	SS/sw	SS/sw	SS/sw	SS/sw	.	SS/sw	SS/ppk	.	.
Slot Size	0.01	0.01	0.01	0.01	.	0.01	0.01	.	.
Open-Hole Length	.	.	.	.	37.5	.	.	22.5	49.9
Open-Hole Diameter	.	.	.	.	6.25	.	.	6.25	6.25

APPENDIX C: MONITORING WELL CONSTRUCTION DETAILS, CY 2011

Well Number Hydrogeologic Regime Functional Area	GW-618 EF EXP-E	GW-623 BC BG	GW-627 BC BG	GW-633 EF RG	GW-639 BC EMWMF	GW-648 BC RS	GW-653 BC BG	GW-656 EF T0134	GW-658 EF FF
General Information									
Date Installed	03/15/90	08/02/90	12/11/89	05/03/90	06/15/90	09/17/90	08/10/90	07/19/90	08/31/90
Total Depth Drilled	37.0	349.0	270.0	15.0	125.5	80.1	39.0	21.5	19.1
East Coordinate	54,738	44,138	42,774	53,100	45,260	49,888	42,317	57,439	62,146
North Coordinate	29,798	29,388	29,505	30,145	29,626	29,088	29,660	29,895	29,638
Measuring Point	TOWW	TOC	TOWW	TOWW	TOWW	TOC	TOWW	TOWW	TOWW
Measuring Point Elevation	985.14	925.21	943.51	996.43	940.95	1,029.20	931.84	954.79	944.81
Ground Surface Elevation	982.64	922.01	940.39	996.66	937.98	1,026.50	928.85	954.90	942.04
Tag Depth-(TOC)	38.30	277.93	270.96	15.15	129.64	82.47	41.53	20.60	20.64
Geologic Information									
Hydrostratigraphic Unit	AQF	AQT	AQT	AQT	AQT	AQF	AQT	AQT	AQT
Geologic Formation	Cmn	Cn	Cn	Cn	Cn	Cmn	Cn	Cn	Cn
Aquifer Zone	WT	BDR	BDR	WT	BDR	WT	WT	WT	WT
Weathered Rock-Depth	25.0	16.0	3.0	8.5	3.0	49.5	3.5	12.0	1.5
Fresh Rock-Depth	27.0	38.0	43.0	.	20.0	.	35.0	.	.
Conductor Casing									
Casing Depth	27.5	218.0	47.5	.	31.0	64.5	.	.	3.5
Outside Diameter	10.75	7	11.75	.	11.75	10.75	.	.	10.75
Inside Diameter	10	6.54	11	.	11	10	.	.	10
Casing Material	SJ55	SJ55	SJ55	.	SJ55	SJ55	.	.	SJ55
Well Casing									
Borehole Depth	37.0	274.5	254.0	15.0	95.5	80.1	39.0	21.5	19.1
Borehole Diameter	9.5	6	10.63	10.5	10	9.5	9.5	9.5	9.5
Casing Depth	26.7	244.0	252.7	5.0	94.5	70.1	29.0	10.7	8.8
Outside Diameter	4.5	2.37	7	4.5	7	4.5	4.5	4.5	4.5
Inside Diameter	4.25	2	6.54	4	6.54	4.25	4.25	4.25	4.25
Casing Material	SS304	SS304	SF25	PVC	SF25	SS304	SS304	SS304	SS304
Monitored Interval									
Top-Depth	26.0	238.1	254.0	3.5	95.5	65.0	26.3	8.3	6.9
Midpoint-Depth	31.5	256.2	262.0	9.3	110.5	72.6	32.7	14.9	13.0
Pump Intake-Depth	32.50	.	255.90	12.20	.	.	33.50	18.10	13.80
Bottom of Screen-Depth	37.0	274.2	.	15.0	.	80.1	39.0	20.7	18.8
Bottom-Depth	37.0	274.2	270.0	15.0	125.5	80.1	39.0	21.5	19.1
Top-Elevation	956.64	683.91	686.39	993.16	842.48	961.50	902.55	946.60	935.14
Midpoint-Elevation	951.14	665.86	678.39	987.41	827.48	953.95	896.20	940.00	929.04
Pump Intake-Elevation	950.14	.	684.51	984.43	.	.	895.34	936.79	928.21
Bottom-Elevation	945.64	647.81	670.39	981.66	812.48	946.40	889.85	933.40	922.94
Screen Length	10.3	30.2	.	10	.	10	10	10	10
Screen Material	SS/sw	SS/sw	.	PVC/sl	.	SS/sw	SS/sw	SS/sw	SS/sw
Slot Size	0.01	0.01	.	0.01	.	0.01	0.01	0.01	0.01
Open-Hole Length	.	.	16	.	30	.	.	.	.
Open-Hole Diameter	.	.	6.25	.	6.25	.	.	.	.

APPENDIX C: MONITORING WELL CONSTRUCTION DETAILS, CY 2011

Well Number Hydrogeologic Regime Functional Area	GW-683 BC EXP-A	GW-684 BC EXP-A	GW-686 EF CPT	GW-690 EF CPT	GW-691 EF CPT	GW-692 EF CPT	GW-698 EF B8110	GW-700 EF B8110	GW-703 BC EXP-B
General Information									
Date Installed	12/03/90	10/09/90	10/18/90	10/24/90	10/24/90	10/25/90	11/02/90	10/03/90	12/07/90
Total Depth Drilled	197.5	129.6	17.0	53.0	20.0	53.0	75.0	31.0	182.0
East Coordinate	41,552	41,354	55,956	55,990	55,983	56,001	56,804	56,828	44,931
North Coordinate	28,282	28,525	29,540	29,787	29,794	29,653	29,277	29,453	28,806
Measuring Point	TOWW	TOWW	TOC	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW
Measuring Point Elevation	972.23	898.83	963.76	967.36	968.59	964.38	970.09	960.18	955.29
Ground Surface Elevation	969.45	895.53	964.43	967.71	968.09	964.55	970.09	957.78	951.80
Tag Depth-(TOC)	199.83	132.21	16.23	53.25	20.39	53.05	74.88	33.19	185.29
Geologic Information									
Hydrostratigraphic Unit	AQF	AQF	AQF	AQF	AQF	AQF	AQF	AQF	AQF
Geologic Formation	OCK	Cmn	Cmn	Cmn	Cmn	Cmn	Cmn	Cmn	Cmn
Aquifer Zone	BDR	BDR	WT	BDR	WT	BDR	BDR	WT	BDR
Weathered Rock-Depth	22.0	.	17.0	24.0	20.0	23.0	42.0	31.0	7.0
Fresh Rock-Depth	26.0	9.5	.	.	.	.	.	.	10.0
Conductor Casing									
Casing Depth	82.0	87.0	.	26.0	.	25.0	42.0	.	.
Outside Diameter	11.75	11.75	.	10.5	.	10.5	10.5	.	.
Inside Diameter	11	11	.	10	.	10	10	.	.
Casing Material	SJ55	SJ55	.	PVC40	.	PVC40	PVC40	.	.
Well Casing									
Borehole Depth	197.5	129.6	16.0	53.0	20.0	53.0	75.0	31.0	135.0
Borehole Diameter	10.63	10.5	12	8.5	12	8.5	8.5	12	10.63
Casing Depth	146.0	113.8	6.0	42.8	10.0	43.0	65.0	21.0	132.8
Outside Diameter	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	7
Inside Diameter	4.25	4.25	4.25	4.25	4.25	4.25	4.25	4.25	6.54
Casing Material	SS304	SS304	SS304	SS304	SS304	SS304	SS304	SS304	SF25
Monitored Interval									
Top-Depth	133.9	106.4	4.0	40.8	8.0	41.0	63.0	19.0	133.8
Midpoint-Depth	165.4	118.0	10.0	46.8	14.0	47.0	69.0	25.0	157.9
Pump Intake-Depth	171.20	119.70	15.67	48.40	14.50	48.20	71.00	26.10	158.50
Bottom of Screen-Depth	196.8	128.4	16.0	52.8	20.0	53.0	75.0	31.0	.
Bottom-Depth	196.8	129.6	16.0	52.8	20.0	53.0	75.0	31.0	182.0
Top-Elevation	835.55	789.13	960.43	926.91	960.09	923.55	907.09	938.78	818.00
Midpoint-Elevation	804.10	777.53	954.43	920.91	954.09	917.55	901.09	932.78	793.90
Pump Intake-Elevation	798.23	775.83	948.76	919.36	953.59	916.38	899.09	931.68	793.29
Bottom-Elevation	772.65	765.93	948.43	914.91	948.09	911.55	895.09	926.78	769.80
Screen Length	50.8	14.6	10	10	10	10	10	10	.
Screen Material	SS/ppk	SS/ppk	SS/sw	SS/sw	SS/sw	SS/sw	SS/sw	SS/sw	.
Slot Size	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	.
Open-Hole Length	.	.	.	.	.	.	.	.	48.2
Open-Hole Diameter	.	.	.	.	.	.	.	.	6.25

APPENDIX C: MONITORING WELL CONSTRUCTION DETAILS, CY 2011

Well Number Hydrogeologic Regime Functional Area	GW-704 BC EXP-B	GW-706 BC EXP-B	GW-709 CR LII	GW-712 BC EXP-W	GW-713 BC EXP-W	GW-714 BC EXP-W	GW-722 EF EXP-J	GW-724 BC EXP-C	GW-725 BC EXP-C
General Information									
Date Installed	12/20/90	01/27/91	04/05/91	06/20/91	01/13/92	01/24/92	08/09/91	08/12/91	08/27/91
Total Depth Drilled	256.0	182.5	80.6	457.5	315.2	145.0	644.3	301.6	142.5
East Coordinate	44,935	44,944	52,372	36,507	36,434	36,435	64,926	48,995	48,989
North Coordinate	28,845	28,946	25,344	28,233	28,236	28,422	28,532	29,198	29,405
Measuring Point	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW	TOC	TOWW	TOWW
Measuring Point Elevation	945.33	929.47	906.81	877.89	881.43	875.88	953.71	979.75	961.63
Ground Surface Elevation	941.99	925.78	903.84	873.61	877.83	872.30	951.04	976.62	958.26
Tag Depth-(TOC)	258.65	185.79	83.52	460.53	318.39	146.90	642.68	293.60	145.42
Geologic Information									
Hydrostratigraphic Unit	AQF	AQF	AQF	AQF	AQF	AQF	AQF	AQF	AQF
Geologic Formation	Cmn	Cmn	Ock	Ock	Cmn	Cmn	Cmn	Cmn	Cmn
Aquifer Zone	BDR	BDR	BDR	BDR	BDR	BDR	BDR	BDR	BDR
Weathered Rock-Depth	16.0	17.0	39.0	12.0	26.8	27.0	54.0	33.5	14.0
Fresh Rock-Depth	23.0	27.0	43.0	66.0	63.8	35.0	73.0	40.0	17.5
Conductor Casing									
Casing Depth	21.0	40.3	50.0	44.8	80.2	40.5	56.2	40.0	21.0
Outside Diameter	11.75	11.75	11.75	11.75	.	11.75	10.75	11.75	11.75
Inside Diameter	11	11	11	11	.	11	10	11	11
Casing Material	SJ55	SJ55	SJ55	SJ55	SJ55	SJ55	SJ55	SJ55	SJ55
Well Casing									
Borehole Depth	246.0	157.0	80.6	441.5	305.0	115.1	75.0	289.6	132.5
Borehole Diameter	10.63	10.6	10.6	10.6	10.6	10.6	6	10.6	10.6
Casing Depth	243.5	155.1	70.4	440.2	303.7	113.8	74.5	288.3	131.2
Outside Diameter	7	7	4.25	7	7	7	4.5	7	7
Inside Diameter	6.54	6.54	4	6.54	6.54	6.54	4	6.54	6.54
Casing Material	SF25	SF25	SS304	SF25	SF25	SF25	SJ55	SF25	SF25
Monitored Interval									
Top-Depth	244.5	156.1	68.7	441.5	305.0	115.1	74.5	289.6	132.5
Midpoint-Depth	250.3	169.3	74.7	449.5	310.1	130.1	359.4	295.6	137.5
Pump Intake-Depth	250.20	174.80	75.50	446.20	307.40	138.40	.	294.40	137.10
Bottom of Screen-Depth	.	.	80.4	.	.	.	.	.	.
Bottom-Depth	256.0	182.5	80.6	457.5	315.2	145.0	644.3	301.6	142.5
Top-Elevation	697.49	769.68	835.14	432.11	572.83	757.20	876.54	687.02	825.76
Midpoint-Elevation	691.74	756.48	829.19	424.11	567.73	742.25	591.64	681.02	820.76
Pump Intake-Elevation	691.83	750.97	828.31	427.39	570.43	733.88	.	682.25	821.13
Bottom-Elevation	685.99	743.28	823.24	416.11	562.63	727.30	306.74	675.02	815.76
Screen Length	.	.	10	.	.	.	.	.	.
Screen Material	.	.	SS/sw	.	.	.	.	.	.
Slot Size	.	.	0.01	.	.	.	.	.	.
Open-Hole Length	11.5	26.4	.	16	10.2	29.9	569.8	12	10
Open-Hole Diameter	6.5	6.25	.	6.25	6.25	6.25	3.5	6.25	6.25

APPENDIX C: MONITORING WELL CONSTRUCTION DETAILS, CY 2011

Well Number Hydrogeologic Regime Functional Area	GW-729 BC BG	GW-731 CR CRSDB	GW-732 CR CRSDB	GW-733 EF EXP-J	GW-735 EF EXP-J	GW-738 BC EXP-C	GW-740 BC EXP-C	GW-744 EF GRIDK1	GW-747 EF GRIDK2
General Information									
Date Installed	08/12/92	09/12/91	09/11/91	10/02/91	10/30/91	11/21/91	12/20/91	01/08/92	01/28/92
Total Depth Drilled	1361.0	180.4	190.6	256.5	83.0	90.1	190.0	69.5	73.3
East Coordinate	43,657	63,863	64,268	65,067	64,872	49,026	49,055	64,324	64,570
North Coordinate	28,501	27,464	27,717	28,447	28,867	29,150	29,027	30,282	29,730
Measuring Point	TOC	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW	TOC
Measuring Point Elevation	1,004.48	1,049.38	1,064.29	959.84	924.46	983.31	1,020.25	907.43	911.06
Ground Surface Elevation	1,002.24	1,045.75	1,060.65	955.69	921.34	980.36	1,016.95	905.05	911.68
Tag Depth-(TOC)	1363.24	178.53	192.84	259.93	81.81	91.78	192.67	69.28	75.7
Geologic Information									
Hydrostratigraphic Unit	AQF	AQF	AQF	AQF	AQT	AQF	AQF	AQT	AQT
Geologic Formation	Cn	OCK	OCK	Cmn	Cn	Cmn	Cmn	Cpv	Cm
Aquifer Zone	BDR	BDR	BDR	BDR	BDR	BDR	BDR	BDR	BDR
Weathered Rock-Depth	7.0	95.4	85.0	42.5	19.0	12.0	38.1	9.6	3.9
Fresh Rock-Depth	SJ55	129.4	96.0	47.1	77.5	15.1	45.1	14.6	5.4
Conductor Casing									
Casing Depth	164.9	122.0	100.7	51.8	25.5	16.5	46.9	27.6	17.2
Outside Diameter	7	11.75	11.75	11.75	11.75	11.75	11.75	10.75	10.75
Inside Diameter	6.54	11	11	11	11	11	11	10	10
Casing Material	SJ55	SJ55	SJ55	SJ55	SJ55	SJ55	SJ55	SJ55	SJ55
Well Casing									
Borehole Depth	1361.0	175.4	189.5	240.1	83.0	90.1	165.6	69.5	73.3
Borehole Diameter	3.5	10.6	10.6	10.6	10.6	10.6	10.6	9.87	9.87
Casing Depth	281.5	165.2	179.3	238.8	67.9	67.3	164.3	57.0	62.6
Outside Diameter	4.5	4.5	4.5	7	4.5	4.5	7	4.5	4.5
Inside Diameter	4	4.25	4.25	6.54	4.25	4.25	6.54	4.25	4.25
Casing Material	Steel/?	SS304	SS304	SF25	SS304	SS304	SF25	SS304	SS304
Monitored Interval									
Top-Depth	281.5	164.0	178.3	240.1	67.5	63.5	165.6	55.0	60.8
Midpoint-Depth	821.3	171.4	184.2	248.3	73.4	75.8	177.8	62.3	66.9
Pump Intake-Depth	.	169.90	184.40	248.90	847.76	78.60	183.70	65.10	62.0
Bottom of Screen-Depth	1079.5	175.2	189.3	.	77.9	87.3	.	66.9	72.5
Bottom-Depth	1361.0	178.7	190.0	256.5	79.2	88.0	190.0	69.5	73.0
Top-Elevation	720.74	881.75	882.35	715.59	853.84	916.86	851.35	850.05	844.28
Midpoint-Elevation	180.99	874.40	876.50	707.39	847.99	904.61	839.15	842.80	838.18
Pump Intake-Elevation	.	875.88	876.29	706.84	73.58	901.81	833.25	839.93	843.06
Bottom-Elevation	-358.76	867.05	870.65	699.19	842.14	892.36	826.95	835.55	832.08
Screen Length	.	10	10	.	10	20	.	9.9	9.9
Screen Material	.	SS/sw	SS/sw	.	SS/sw	SS/sw	.	SS/sw	SS/sw
Slot Size	.	0.01	0.01	.	0.01	0.01	.	0.01	0.01
Open-Hole Length	1079.5	.	.	16.4	.	.	24.4	.	.
Open-Hole Diameter	3.5	.	.	6.25	.	.	6.25	.	.

APPENDIX C: MONITORING WELL CONSTRUCTION DETAILS, CY 2011

Well Number Hydrogeologic Regime Functional Area	GW-750 EF EXP-J	GW-757 CR LII	GW-762 EF GRIDJ3	GW-763 EF GRIDJ3	GW-765 EF GRIDE1	GW-769 EF GRIDG3	GW-770 EF GRIDG3	GW-775 EF GRIDH3	GW-776 EF GRIDH3
General Information									
Date Installed	02/06/92	04/24/92	05/15/92	05/13/92	05/13/92	06/04/92	06/04/92	07/16/92	07/21/92
Total Depth Drilled	72.8	166.5	60.2	17.0	32.5	61.4	20.0	60.5	24.0
East Coordinate	64,835	53,303	63,193	63,220	58,482	60,230	60,255	61,278	61,309
North Coordinate	28,975	25,410	29,115	29,117	31,026	29,510	29,505	29,272	29,271
Measuring Point	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW
Measuring Point Elevation	919.03	961.64	915.56	915.03	1,008.54	944.43	944.72	931.35	931.25
Ground Surface Elevation	915.96	958.65	911.85	911.38	1,005.53	941.53	941.67	931.48	931.44
Tag Depth-(TOC)	75.49	168.54	62.04	20.41	35.05	62.73	21.68	55.98	21.92
Geologic Information									
Hydrostratigraphic Unit	AQT	AQF	AQT	AQT	AQT	AQT	AQT	AQT	AQT
Geologic Formation	Cn	OCK	Cn	Cn	Crg	Cn	Cn	Cn	Cn
Aquifer Zone	BDR	BDR	BDR	WT	WT	BDR	WT	BDR	WT
Weathered Rock-Depth	18.5	29.5	12.0	17.0	24.5	14.2	12.0	.	14.5
Fresh Rock-Depth	24.8	48.0	14.5	.	.	.	16.5	16.7	19.3
Conductor Casing									
Casing Depth	21.7	46.8	19.4	.	.	17.2	.	16.7	.
Outside Diameter	11.75	10.75	11.75	.	.	11.75	.	11.75	.
Inside Diameter	11	10.25	11	.	.	11	.	11	.
Casing Material	SJ55	SJ55	SJ55	.	NONE	SJ55	.	SJ55	NONE
Well Casing									
Borehole Depth	72.8	166.5	60.2	17.0	32.5	61.4	20.0	60.5	24.0
Borehole Diameter	10.6	9.62	9.87	8	9.87	10.62	10.62	10.62	9.87
Casing Depth	62.4	135.5	48.2	5.2	21.2	49.4	8.5	46.3	12.3
Outside Diameter	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Inside Diameter	4.25	4.25	4.25	4.25	4.25	4.25	4.25	4.25	4.25
Casing Material	SS304	SS304	SS304	SS304	SS304	SS304	SS304	SS304	SS304
Monitored Interval									
Top-Depth	61.2	134.0	46.4	4.0	19.9	48.2	7.5	45.0	10.6
Midpoint-Depth	67.0	150.3	52.6	10.0	26.2	54.3	13.3	50.7	16.8
Pump Intake-Depth	848.33	155.00	.	11.80	978.54	54.90	13.60	880.35	914.25
Bottom of Screen-Depth	72.3	165.5	58.1	15.2	31.5	59.3	18.4	56.2	22.2
Bottom-Depth	72.7	166.5	58.7	16.0	32.4	60.3	19.0	56.4	23.0
Top-Elevation	854.76	824.65	865.45	907.38	985.63	893.33	934.17	886.48	920.84
Midpoint-Elevation	849.01	808.40	859.30	901.38	979.38	887.28	928.42	880.78	914.64
Pump Intake-Elevation	67.63	803.64	.	899.63	26.99	886.63	928.02	51.13	17.19
Bottom-Elevation	843.26	792.15	853.15	895.38	973.13	881.23	922.67	875.08	908.44
Screen Length	9.9	30	9.9	10	10.3	9.9	9.9	9.9	9.9
Screen Material	SS/sw	SS/sw	SS/sw	SS/sw	SS/sw	SS/sw	SS/sw	SS/sw	SS/sw
Slot Size	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Open-Hole Length	.	.	.	.	.	.	.	.	.
Open-Hole Diameter	.	.	.	.	.	.	.	.	.

APPENDIX C: MONITORING WELL CONSTRUCTION DETAILS, CY 2011

Well Number	GW-779	GW-781	GW-782	GW-783	GW-791	GW-796	GW-797	GW-798	GW-799
Hydrogeologic Regime	EF	EF	EF	EF	EF	CR	CR	CR	CR
Functional Area	GRIDF2	GRIDE3	GRIDE3	GRIDE3	GRIDD2	LV	LV	CDLVII	LV
General Information									
Date Installed	08/02/92	08/10/92	08/12/92	08/13/92	09/21/92	03/04/93	03/16/93	03/18/93	03/25/93
Total Depth Drilled	63.1	69.6	36.0	16.3	70.6	139.7	134.1	135.5	92.0
East Coordinate	59,247	58,118	58,099	58,113	57,423	58,206	58,550	60,310	59,961
North Coordinate	30,226	29,711	29,719	29,734	30,483	27,924	27,447	27,265	26,746
Measuring Point	TOC	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW
Measuring Point Elevation	963.09	947.89	947.73	948.49	992.13	1,052.62	1,060.00	1,006.00	981.29
Ground Surface Elevation	959.73	944.66	944.48	945.81	988.51	1,048.80	1,056.10	1,002.42	978.10
Tag Depth-(TOC)	65.35	71.07	38.23	17.98	72.45	139.82	135.71	134.00	97.58
Geologic Information									
Hydrostratigraphic Unit	AQT	AQT	AQT	AQT	AQT	AQF	AQF	AQF	AQF
Geologic Formation	Cm	Cn	Cn	Cn	Cm	OCk	OCk	OCk	OCk
Aquifer Zone	BDR	BDR	BDR	WT	BDR	BDR	BDR	BDR	BDR
Weathered Rock-Depth	7.2	0.9	1.0	1.0	14.7	102.0	67.1	94.4	60.8
Fresh Rock-Depth	18.2	14.0	7.5	8.5	26.0	103.0	89.0	95.8	62.8
Conductor Casing									
Casing Depth	23.3	23.8	.	.	31.5	107.6	95.0	99.7	65.0
Outside Diameter	10.75	10.75	.	.	10.75	10.75	10.75	10.75	10.75
Inside Diameter	10	10	.	.	10	10	10	10	10
Casing Material	SJ55	SJ55	.	.	SJ55	SJ55	SJ55	SJ55	SJ55
Well Casing									
Borehole Depth	63.1	69.6	36.0	16.3	70.6	139.7	134.1	135.5	92.0
Borehole Diameter	9.87	9.87	9.87	9.87	9.87	9.5	9.5	9.5	9.5
Casing Depth	52.1	57.8	25.0	4.2	59.0	126.5	123.5	124.5	81.0
Outside Diameter	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Inside Diameter	4.25	4.25	4.25	4.25	4.25	4.25	4.25	4.25	4.25
Casing Material	SS304	SS304	SS304	SS304	SS304	SS304	SS304	SS304	SS304
Monitored Interval									
Top-Depth	50.7	56.0	23.8	3.6	57.5	122.9	118.0	122.0	78.7
Midpoint-Depth	56.8	62.7	29.9	10.0	64.1	129.7	126.1	128.7	85.4
Pump Intake-Depth	.	62.80	29.80	10.30	63.80	131.20	128.10	125.90	84.80
Bottom of Screen-Depth	62.0	68.0	34.9	13.9	68.9	136.4	133.4	134.4	90.9
Bottom-Depth	62.9	69.3	35.9	16.3	70.6	136.5	134.1	135.4	92.0
Top-Elevation	909.03	888.66	920.68	942.21	931.01	925.90	938.10	880.42	899.40
Midpoint-Elevation	902.93	882.01	914.63	935.86	924.46	919.10	930.05	873.72	892.75
Pump Intake-Elevation	.	881.89	914.73	935.49	924.73	917.62	928.00	876.50	893.29
Bottom-Elevation	896.83	875.36	908.58	929.51	917.91	912.30	922.00	867.02	886.10
Screen Length	9.9	10.2	9.9	9.7	9.9	9.9	9.9	9.9	9.9
Screen Material	SS/sw	SS/sw	SS/sw	SS/sw	SS/sw	SS/sw	SS/sw	SS/sw	SS/sw
Slot Size	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Open-Hole Length	.	.	.	.	.	.	.	.	.
Open-Hole Diameter	.	.	.	.	.	.	.	.	.

APPENDIX C: MONITORING WELL CONSTRUCTION DETAILS, CY 2011

Well Number Hydrogeologic Regime Functional Area	GW-801 CR LV	GW-802 EF FF	GW-816 EF EXP-SR	GW-820 EF B9201-2	GW-831 CR FCAP	GW-832 EF NHP	GW-916 BC EMWMF	GW-917 BC EMWMF	GW-918 BC EMWMF
General Information									
Date Installed	07/01/93	06/25/93	06/02/94	.	07/30/96	05/09/96	01/29/01	01/22/01	02/02/01
Total Depth Drilled	188.9	26.5	16.1	17.3	200.0	11.9	36.0	51.0	75.0
East Coordinate	58,780	62,217	64,031	59,773	56,593	64,134	48,276	47,914	47,549
North Coordinate	26,808	29,655	31,582	29,175	26,654	29,142	31,186	30,463	31,672
Measuring Point	TOWW	TOC	TOWW	TOWW	TOWW	TOC	TOWW	TOWW	TOWW
Measuring Point Elevation	1,097.16	941.83	898.42	929.57	1,091.29	906.18	1,002.85	997.10	1,067.96
Ground Surface Elevation	1,093.82	942.30	894.56	929.67	1,088.04	906.83	1,000.00	994.00	1,065.00
Tag Depth-(TOC)	190.92	25.42	17.99	17.18	198.06	10.36	.	.	.
Geologic Information									
Hydrostratigraphic Unit	AQF	AQT	AQT	AQF	AQF	AQF	AQT	AQT	AQT
Geologic Formation	OCK	Cn	Cr	Cmn	OCK	Cmn	Cc	Cm	Cpv
Aquifer Zone	BDR	WT	WT	WT	BDR	WT	WT	WT	WT
Weathered Rock-Depth	112.5	10.0	.	.	134.8	.	10.0	21.0	.
Fresh Rock-Depth	113.4	15.0	.	.	140.8	.	15.0	27.0	30.0
Conductor Casing									
Casing Depth	115.4	.	.	.	138.3	.	.	.	.
Outside Diameter	10.75	.	.	.	10.75	.	.	.	.
Inside Diameter	10	.	.	.	10	.	.	.	.
Casing Material	SJ55	.	.	.	STL	.	.	.	.
Well Casing									
Borehole Depth	188.9	26.5	15.8	.	200.0	11.9	.	.	.
Borehole Diameter	9.87	10.62	10	.	9.87	12	.	.	.
Casing Depth	178.1	15.5	4.2	.	183.2	5.9	.	20.0	20.0
Outside Diameter	4.5	4.5	4.5	4.5	4.5	6.63	.	2.37	.
Inside Diameter	4.25	4	4.25	4	4.25	6	.	2.07	.
Casing Material	SS304	PVC40	SS304	PVC	SS304	PVC	.	SS304	SS304
Monitored Interval									
Top-Depth	175.8	13.3	2.9	.	182.0	4.0	13.0	18.0	18.0
Midpoint-Depth	182.4	19.9	9.4	.	190.8	7.9	24.5	34.5	25.5
Pump Intake-Depth	177.70	.	11.10	15.60	188.80	.	.	.	.
Bottom of Screen-Depth	188.0	25.5	13.6	.	193.6	10.9	35.0	50.0	30.0
Bottom-Depth	188.9	26.5	15.8	17.3	199.6	11.8	36.0	51.0	33.0
Top-Elevation	918.02	929.00	891.66	.	906.04	902.83	.	.	.
Midpoint-Elevation	911.47	922.40	885.21	.	897.24	898.93	.	.	.
Pump Intake-Elevation	916.16	.	883.42	914.07	899.29	.	975.35	959.60	1039.46
Bottom-Elevation	904.92	915.80	878.76	912.37	888.44	895.03	.	.	.
Screen Length	9.9	10	9.4	.	10.4	5	20	30	10
Screen Material	SS/sw	PVC/sl	SS/sw	.	SS/sw	PVC/sl	SS/sw	SS/sw	SS/sw
Slot Size	0.01	0.01	0.01	.	0.01	0.02	0.01	0.01	0.01
Open-Hole Length	.	.	.	.	.	.	.	.	.
Open-Hole Diameter	.	.	.	.	.	.	.	.	.

APPENDIX C: MONITORING WELL CONSTRUCTION DETAILS, CY 2011

Well Number Hydrogeologic Regime Functional Area	GW-920 BC EMWMF	GW-921 BC EMWMF	GW-922 BC EMWMF	GW-923 BC EMWMF	GW-924 BC EMWMF	GW-925 BC EMWMF	GW-926 BC EMWMF	GW-927 BC EMWMF	GW-930 EF GRIDD1
General Information									
Date Installed	01/16/01	01/31/01	01/17/01	02/01/01	01/29/01	02/05/01	02/01/01	02/01/01	12/21/09
Total Depth Drilled	55.0	50.0	46.0	102.0	54.0	170.0	145.0	172.0	41.5
East Coordinate	47,375	47,139	47,147	48,184	46,300	47,128	46,290	47,906	57,053
North Coordinate	30,193	30,350	30,024	30,822	30,185	30,349	30,185	30,463	31,424
Measuring Point	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW
Measuring Point Elevation	967.43	971.29	956.91	1,016.73	968.90	971.14	968.94	997.19	1,005.62
Ground Surface Elevation	965.00	968.00	955.00	1,013.00	966.00	968.00	966.00	994.00	1,002.47
Tag Depth-(TOC)	.	.	.	.	.	.	.	.	.
Geologic Information									
Hydrostratigraphic Unit	AQT	AQT	AQT	AQT	AQT	AQT	AQT	AQT	AQT
Geologic Formation	Cn	Cm	Cn	Cm	Cn	Cm	Cn	Cm	Crt
Aquifer Zone	BDR	BDR	BDR	WT	WT	BDR	BDR	BDR	BDR
Weathered Rock-Depth	.	.	10.0	.	21.8	.	15.0	25.0	21.0
Fresh Rock-Depth	12.0	13.0	13.0	62.0	22.0	15.0	18.0	30.0	23.0
Conductor Casing									
Casing Depth	.	.	.	.	.	.	.	.	.
Outside Diameter	.	.	.	.	.	.	.	.	.
Inside Diameter	.	.	.	.	.	.	.	.	.
Casing Material	.	.	.	.	.	.	.	.	.
Well Casing									
Borehole Depth	.	.	.	.	.	.	.	.	41.5
Borehole Diameter	.	.	.	.	.	.	.	.	.
Casing Depth	24.0	18.0	25.0	40.0	23.0	97.0	113.0	60.0	31.0
Outside Diameter	2.37	2.37	2.37	2.37	2.37	2.37	2.37	2.37	4.37
Inside Diameter	2.07	2.07	2.07	2.07	2.07	2.07	2.07	2.07	4
Casing Material	SS304	SS304	SS304	SS304	SS304	SS304	SS304	SS304	SS304
Monitored Interval									
Top-Depth	22.0	16.0	23.0	36.0	21.0	92.0	103.0	57.0	28.0
Midpoint-Depth	38.5	33.0	34.5	55.5	37.5	120.0	124.0	74.5	34.8
Pump Intake-Depth	.	.	.	.	.	.	.	.	.
Bottom of Screen-Depth	54.0	48.0	45.0	70.0	53.0	147.0	143.0	90.0	.
Bottom-Depth	55.0	50.0	46.0	75.0	54.0	148.0	145.0	92.0	41.5
Top-Elevation	.	.	.	.	.	.	.	.	974.47
Midpoint-Elevation	.	.	.	.	.	.	.	.	967.72
Pump Intake-Elevation	925.93	935.29	919.41	958.23	928.40	848.14	841.94	919.69	.
Bottom-Elevation	.	.	.	.	.	.	.	.	960.97
Screen Length	30	30	20	30	30	50	30	30	10
Screen Material	SS/sw	SS/sw	SS/sw	SS/sw	SS/sw	SS/sw	SS/sw	SS/sw	SS/sw
Slot Size	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Open-Hole Length	.	.	.	.	.	.	.	.	.
Open-Hole Diameter	.	.	.	.	.	.	.	.	.

APPENDIX C: MONITORING WELL CONSTRUCTION DETAILS, CY 2011

Well Number Hydrogeologic Regime Functional Area	GW-959 EF B9201-2	GW-960 EF GridF2	GW-961 BC EMWMF	GW-964 BC EMWMF	GW-965 BC EMWMF
General Information					
Date Installed	03/11/05	07/28/06	09/09/10	03/14/11	03/14/11
Total Depth Drilled	9.0	25.4	27.0	32.0	72.0
East Coordinate	60,189	59,228	46,092	46,606	46,606
North Coordinate	29,115	30,212	30,347	30,282	30,282
Measuring Point	TOWW	TOC	TOWW	TOWW	TOWW
Measuring Point Elevation	927.69	963.26	963.57	977.69	977.91
Ground Surface Elevation	928.32	959.88	961.08	977.80	975.91
Tag Depth-(TOC)	.	.			
Geologic Information					
Hydrostratigraphic Unit	AQF	AQT	AQT	AQT	AQT
Geologic Formation	Cmn	Cn	Cn	Cm	Cm
Aquifer Zone	WT	WT	WT	WT	BDR
Weathered Rock-Depth	.	17.0	1.0	10.5	10.5
Fresh Rock-Depth	.	17.2	9.0	21.5	20.0
Conductor Casing					
Casing Depth	.	.	.	.	.
Outside Diameter	.	.	.	.	.
Inside Diameter	.	.	.	.	.
Casing Material	.	.	.	.	.
Well Casing					
Borehole Depth	9.0	25.4	25.5		
Borehole Diameter	7.5	.	6	6	6
Casing Depth	3.4	14.6	5.3	10.9	51.8
Outside Diameter	4.5	4.5	2.38	2.4	2.4
Inside Diameter	4.25	4	2.16	2	2
Casing Material	SS304	PVC	SS304	SS316	SS316
Monitored Interval					
Top-Depth	2.4	12.2	3.4	7.9	47.5
Midpoint-Depth	5.4	18.8	14.5	19.9	59.5
Pump Intake-Depth	8.13	.	.	.	.
Bottom of Screen-Depth	8.4	24.6	25.3	30.9	71.8
Bottom-Depth	9.0	25.4	25.5	31.9	72.0
Top-Elevation	925.92	947.68	957.68	969.90	928.41
Midpoint-Elevation	922.92	941.08	946.63	957.90	916.41
Pump Intake-Elevation	920.19	.	.	.	.
Bottom-Elevation	919.32	934.48	935.58	945.90	903.91
Screen Length	5	10	20	20	20
Screen Material	SS/sw	PVC/sl	SS/sw	SS/sw	SS/sw
Slot Size	0.01	0.01	0.01	0.01	0.01
Open-Hole Length	.	.	.	.	.
Open-Hole Diameter	.	.	.	.	.

APPENDIX D

CY 2011 MONITORING DATA FOR THE BEAR CREEK HYDROGEOLOGIC REGIME

EXPLANATION

Sampling Point:

- BCK - Bear Creek Kilometer
- EMW-VWUNDER - outfall for an underdrain installed to lower the water table and relieve hydrostatic pressure beneath the EMWMF liner.
- GW - Monitoring Well
- NT - Northern Tributary (Bear Creek)
- SS - South Side (of Bear Creek, spring sampling station)

Location:

- BG - Bear Creek Burial Grounds
- EMWMF - Environmental Management Waste Management Facility
- EXP - Exit Pathway Monitoring Location:
 - Maynardville Limestone Picket (-A, -B, -C, -W)
 - Spring or Surface Water Location (-SW)
- OLF - Oil Landfarm
- RS - Rust Spoil Area
- S3 - S-3 Site
- SPI - Spoil Area I

Monitoring Program:

- B/U - managed by Bechtel Jacobs Company LLC through July and by URS | CH2M Oak Ridge LLC thereafter
- GWPP - managed by Y-12 Groundwater Protection Program

Sample Type:

- Dup - Field duplicate sample
- F - Filtered sample (metals)
- NP - No purge (low recovery well, clear stagnant groundwater only)
- PDB - Passive diffusion bag sample

Units:

- ft - feet (elevations are above mean sea level and depths are below grade)
- µg/L - micrograms per liter
- m/L - milligrams per liter
- mV - millivolts
- µmho/cm - micromhos per centimeter
- NTU - Nephelometric Turbidity Units
- pCi/L - picoCuries per liter
- ppm - parts per million

EXPLANATION (continued)

Only the analytes that were detected above the program reporting limits in at least one sample are included in this appendix. Additionally, results that are below the reporting limits are replaced with missing values (e.g., "<") to emphasize the detected results. The first three sections of this appendix (D.1, D.2, and D.3) include results for all locations except those at the EMWMF, and results for that site are presented in the fourth section (D.4).

The following sections describe the reporting limits and data qualifiers for each sub-appendix. A comprehensive list of the GWPP analytes, analytical methods, and reporting limits is provided in Appendix B, Table B.5.

D.1 Field Measurements, Miscellaneous Analytes, Major Ions, and Trace Metals:

Results for all of the field measurements, miscellaneous analytes, and major ions are included in this appendix. The reporting limits for the major ions are shown in the following summary.

Analyte	Reporting Limit (µg/L)		Analyte	Reporting Limit (µg/L)	
	GWPP	B/U		GWPP	B/U
Cations			Anions		
Calcium	0.2	0.01	Bicarbonate	1.0	NS
Magnesium	0.2	0.05	Carbonate	1.0	NS
Potassium	2.0	0.025	Chloride	0.2	0.1
Sodium	0.2	0.01	Fluoride	0.1	0.05
			Nitrate (as Nitrogen)	0.05	0.1
			Sulfate	0.25	0.1
Note: "NS" - not specified.					

The Y-12 GWPP sampling and analysis plan (SAP) for CY 2011 (B&W Y-12 2010) specifies trace metal reporting limits and analytical methods that are appropriate for DOE Order monitoring. The laboratories subcontracted by monitoring programs managed by BJC/UCOR may use reporting limits (sometimes reporting estimated values) that are lower than the GWPP reporting limits for the metals. For this report, the analytical methods for metals used by BJC/UCOR monitoring programs (EPA-7470, SW846-6010B, SW846-6020, and ASTM-D5174-M) are considered to be functionally equivalent to the methods used by the GWPP (Table B.5). To retain the highest quality data for DOE Order monitoring purposes and to standardize reporting limits for trace metal results obtained from all sources, the GWPP reporting limits were given precedence over the BJC/UCOR reporting limits (BJC 2010a) shown on the following page. The trace metals shown in bold typeface below were detected in at least one groundwater or surface water sample collected during CY 2011 and are presented in Appendix D.1.

EXPLANATION (continued)

Analyte	Reporting Limit (µg/L)		Analyte	Reporting Limit (µg/L)	
	GWPP	B/U		GWPP	B/U
Aluminum	0.2	0.05*	Lithium	0.01	0.01
Antimony	0.0025	0.003	Manganese	0.005	0.005
Arsenic	0.005	0.005	Mercury	0.00005	0.0002
Barium	0.004	0.005	Molybdenum	0.05	NS
Beryllium	0.0005	0.001	Nickel	0.005	0.01
Boron	0.1	0.01*	Selenium	0.01	0.0025*
Cadmium	0.0025	0.00013*	Silver	0.02	0.0015*
Chromium	0.01	0.005*	Strontium	0.005	0.005
Cobalt	0.02	0.005*	Thallium	0.0005	0.001
Copper	0.02	0.005*	Thorium	0.2	NS
Iron	0.05	0.01*	Uranium	0.0005	0.004
Lead	0.0005	0.002	Vanadium	0.02	0.01*
			Zinc	0.05	0.01*
Note: * - the GWPP reporting limit is used instead of the B/U reporting limit; "NS" - not specified.					

To evaluate the lowest possible mercury concentrations in surface water and potential groundwater contributions, monitoring by BJC/UCOR included the following results that are not presented in Appendix D.1.

Sampling Location	Mercury Concentration (mg/L) by Method EPA-1631	
	February 2011	August 2011
GW-683	<0.0000002	0.0000014
GW-684	<0.0000002	0.000008
BCK-04.60	0.0000106	0.0000135
BCK-09.20	0.0000014	0.0000037
BCK-11.54	0.0000049	0.000004
BCK-12.34	0.0000076	0.0000731
NT-03	0.0000123	0.0000136
NT-08	0.0000023	.
SS-4	0.0000047	0.0000172
SS-5	0.0000006	0.0000047
Note: The only result that exceeds the Y-12 GWPP reporting limit is shown in bold typeface.		

The following symbols and data qualifiers are used in Appendix D.1:

- . - Not analyzed or not applicable
- < - Analyzed but not detected at the project reporting level
- J - Positively identified; estimated concentration
- Q - Result is inconsistent with historical measurements for the location

EXPLANATION (continued)

D.2 Volatile Organic Compounds:

The Y-12 GWPP reporting limits for volatile organic compounds (Table B.5) and those used for monitoring programs managed by BJC/UCOR are contract-required quantitation limits. Results below the quantitation limit and above the instrument detection limit are reported as estimated quantities. Therefore, non-detected results are assumed to equal zero for all compounds.

As summarized below, 25 compounds were detected in the CY 2011 groundwater and surface water samples collected in the Bear Creek Regime. Results for these compounds are grouped by similar chemical composition (e.g., chloroethenes) in Appendix D.2.

Compound	No. Detected	Maximum (µg/L)	Compound	No. Detected	Maximum (µg/L)
Trichloroethene	42	2,600	Methylene chloride	5	14
cis-1,2-Dichloroethene	33	4,300	Ethylbenzene	5	7
1,1-Dichloroethene	27	250	Styrene	4	7
Tetrachloroethene	26	1,000	Acetonitrile	3	41
1,1-Dichloroethane	23	2,100	2-Butanone	3	29
Benzene	15	830	Chloroethane	3	19
Vinyl chloride	15	460	Toluene	3	19
1,1,1-Trichloroethane	9	190	Chlorobenzene	2	12
Acetone	9	140	Total Xylene	2	7
1,1,2-Trichloro-1,2,2-trifluoroethane	9	130	1,2-Dichloropropane	2	1.4
trans-1,2-Dichloroethene	7	24	1,2-Dichloroethane	2	1.1
Acrylonitrile	6	47	Carbon tetrachloride	1	4 J
Chloroform	5	34			

The following symbols and data qualifiers are used in Appendix D.2.

- . - Not analyzed
- < - Analyzed but not detected (also false-positive results)
- J - Positively identified, estimated concentration below the contract-required quantitation limit

EXPLANATION (continued)

D.3 Radiological Analytes:

Reporting limits for radiological analytes are sample-specific and analyte-specific minimum detectable activities that are reported with each result. The following summary shows the primary radiological analytes relevant to DOE Order monitoring collected during CY 2011 in the Bear Creek Regime.

Analyte	No. of Results	No. Detected	Analyte	No. of Results	No. Detected
Gross Alpha	73	24	Strontium-89/90*	2	2
Gross Beta	73	44	Technetium-99	38	12
Americium-241	2	0	Uranium-234*	22	19
Neptunium-237	2	2	Uranium-235*	22	9
Total Radium Alpha	2	2	Uranium-238	22	16
Note: * = Reported by B/U laboratories in Appendix D.3 as equivalent GWPP analytes: Sr-90 = Sr-89/90; U-233/234 = U-234; U-235/236 = U-235.					

Gross alpha and gross beta results are presented on the first two pages of Appendix D.3, followed by results for the primary isotopes shown above (pages D.3-3 through D.3-6).

The following notes and qualifiers apply to Appendix D.3:

- Activity - Result in picoCuries per liter (pCi/L)
- TPU - Total propagated uncertainty (two standard deviations); calculation includes the counting error (instrument uncertainty) as reported previously, plus other sources of uncertainty (e.g., volumetric, chemical yield)
- MDA - Minimum detectable activity
 - . - Not analyzed or not applicable (TPU is not presented when the result is <MDA)
 - < - Analyzed but less than the MDA (not detected)
- R - Result is above the MDA but below the TPU

EXPLANATION (continued)

D.4 Monitoring data for the EMWMF:

As with previous tables in Appendix D, only the analytes that were detected above the program reporting limits in at least one sample are included. Results for all field measurements and major cations are presented, along with results for 16 metals and four volatile organic compounds.

The following notes and qualifiers apply to Appendix D.4:

- . - Not analyzed or not applicable (duplicate field measurements)
- < - Analyzed but not detected at the program reporting level
- J - Positively identified; estimated concentration
- Q - Result is inconsistent with historical measurements for the location
- R - Unusable result (duplicate results differ by more than an order of magnitude)
- Activity - Result in picoCuries per liter (pCi/L)
- TPU - Total propagated uncertainty (two standard deviations); calculation includes the counting error (instrument uncertainty) as reported previously, plus other sources of uncertainty (e.g., volumetric, chemical yield)
- MDA - Minimum detectable activity
- * - Field measurements obtained on a previous date, as shown below:

Sampling Location	Date Sampled	Field Measurements	Sampling Location	Date Sampled	Field Measurements
GW-363	05/02/11	05/03/11	GW-922	02/07/11	02/08/11
GW-363	08/24/11	08/25/11	GW-922	11/07/11	11/08/11
GW-363	11/15/11	11/16/11	GW-923	02/07/11	02/08/11
GW-639	02/09/11	02/11/11	GW-923	05/02/11	05/03/11
GW-639	05/02/11	05/03/11	GW-923	08/22/11	08/23/11
GW-639	08/24/11	08/25/11	GW-923	11/07/11	11/08/11
GW-639	11/15/11	11/16/11	GW-925	02/07/11	02/08/11
GW-916	02/07/11	02/08/11	GW-925	05/02/11	05/03/11
GW-917	02/07/11	02/08/11	GW-925	08/24/11	08/25/11
GW-917	08/22/11	08/23/11	GW-925	11/14/11	11/15/11
GW-917	11/07/11	11/08/11	GW-927	02/07/11	02/08/11
GW-920	02/07/11	02/08/11	GW-927	08/22/11	08/23/11
GW-920	11/07/11	11/08/11	GW-961	11/09/11	11/10/11
GW-921	02/07/11	02/08/11	GW-964	08/24/11	08/25/11
GW-921	05/02/11	05/03/11	GW-964	11/14/11	11/15/11
GW-921	11/07/11	11/08/11	GW-965	11/14/11	11/15/11

EXPLANATION (continued)

Quarterly monitoring at the EMWMF includes analyses for an extensive list of isotopes with low detection limits. The radiological data obtained for sampling locations at the EMWMF are summarized below (84 results were reported for each isotope).

Analyte	No. Detected	Max. (pCi/L)	Analyte	No. Detected	Max. (pCi/L)
Actinium-227*	2	0.33	Plutonium-239/240	2	0.39
Americium-241	5	0.53	Plutonium-241	0	.
Americium-243	9	0.86	Plutonium-242	0	.
Carbon-14	0	.	Plutonium-244	3	0.93
Cesium-137	1	4.27	Potassium-40	7	73.7
Chlorine-36	2	4.32	Radium-226	29	3.06
Cobalt-60	0	.	Radium-228	6	3.53
Curium-242	0	.	Strontium-90	12	5.59
Curium-243/244	2	0.33	Technetium-99	23	8.36
Curium-245	8	0.87	Thorium-227	2	0.33
Curium-246*	8	0.87	Thorium-228	9	1.15
Curium-247	0	.	Thorium-229	3	1.12
Curium-248	2	0.2	Thorium-230	55	1.67
Europium-152	0	.	Thorium-231+234*	17	1.74
Europium-154	0	.	Thorium-232	8	1.42
Europium-155	1	11.3	Tritium	2	1110
Iodine-129	0	.	Uranium-232	3	0.36
Neptunium-237	2	0.9	Uranium-233/234	43	17.9
Nickel-63	2	28.4	Uranium-235/236	2	1.45
Plutonium-236	0	.	Uranium-238	17	1.74
Plutonium-238	0	.	Yttrium-90*	12	5.59

Results for the isotopes that exceed the MDA (shown above as detected) are presented after the primary isotopic data (beginning on page D.4-10).

* The results for these isotopes are not presented because they are identical to the ones that are included (shown in bold typeface): **Thorium-227** for Actinium-227*; **Curium-245** for Curium-246*; **Strontium-90** for Yttrium-90*; and **Uranium-238** for Thorium-231+234*. The pairs of results are identical because the isotopes are in secular equilibrium, with the parent isotope having the longer half-life.

EXPLANATION (continued)

Additional Analytes Not Presented in Appendix D.4 tables:

As shown below, one semivolatile organic compound and five pesticides were detected in at least one sample from several of the locations at the Environmental Management Waste Management Facility.

Sampling Location	Date Sampled	Compound	Result (µg/L)
Semivolatile Organics GW-923	05/03/11	Bis(2-ethylhexyl)phthalate	3.45 J
Pesticides			
GW-916	11/10/11	beta-BHC	0.012 J
GW-922	04/26/11	beta-BHC	0.019 J
EMW-VWEIR	11/21/11	4,4'-DDE	0.012 J
EMWNT-03A	11/21/11	Heptachlor	0.014 J
EMWNT-03A	11/21/11	beta-BHC	0.024 J
EMWNT-05	11/21/11	Heptachlor	0.013 J
EMWNT-05	11/21/11	alpha-BHC	0.017 J
EMWNT-05	11/21/11	beta-BHC	0.018 J
EMWNT-05	11/21/11	Aldrin	0.016 J
EMWNT-05	11/21/11	Heptachlor	0.016 J

Because the concentrations are very low (estimated values) and are detected in only one sample from a location, these results are probably analytical artifacts.

APPENDIX D.1

FIELD MEASUREMENTS, MISCELLANEOUS ANALYTES, MAJOR IONS, AND TRACE METALS

APPENDIX D.1: CY 2011 MONITORING DATA FOR THE BEAR CREEK HYDROGEOLOGIC REGIME
Field Measurements, Miscellaneous Analytes, Major Ions, and Trace Metals

Sampling Point	GW-008		GW-014	GW-046		GW-058	GW-071		GW-077	
Functional Area	OLF		BG	BG		BG	BG		BG	
Date Sampled	01/04/11	07/07/11	01/25/11	01/05/11	07/14/11	01/26/11	01/19/11	08/22/11	02/22/11	08/03/11
Program	B/U	B/U	GWPP	B/U	B/U	GWPP	GWPP	GWPP	B/U	B/U
Sample Type							NP	NP		
Field Measurements										
Time Sampled	14:10	14:00	14:50	15:00	15:30	10:20	9:55	9:30	10:35	10:30
Measuring Point Elev. (ft)	965.39	965.39	934.50	921.17	921.17	913.30	928.90	928.90	919.30	919.30
Depth to Water (ft)	13.45	14.91	6.00	3.55	4.84	23.00	8.00	10.00	9.43	11.35
Groundwater Elevation (ft)	951.94	950.48	928.50	917.62	916.33	890.30	920.90	918.90	909.87	907.95
Conductivity (µmho/cm)	145	105	516	184	183	960	1,746	1,728	312	291
Dissolved Oxygen (ppm)	1.09	0.23	1.98	0.43	0.24	4.43	0.26	0.28	1.37	1.42
Oxidation/Reduction (mV)	93	-11	108	106	-53	162	-251	-276	-48	69
Temperature (degrees C)	15.8	17.7	11.4	14.1	19.72	12.2	12.6	19.4	13	19
Turbidity (NTU)	5	3	.	8	4	.	.	.	2	3
pH	5.85	5.36	6.75	4.74	5.36	6.77	10.21	10.2	7.72	7.52
Miscellaneous Analytes										
Dissolved Solids (mg/L)	.	.	252	.	.	673	.	.	210	220
Suspended Solids (mg/L)	.	.	<	.	.	5	.	.	<	<
Major Ions (mg/L)										
Calcium	14	9	89.2	.	.	110	.	.	.	.
Magnesium	7.3	5.4	13	.	.	26.9	.	.	.	.
Potassium	0.99	0.55	<	.	.	2.75	.	.	.	.
Sodium	2.5	2.3	8.96	.	.	73.3 Q	.	.	.	.
Bicarbonate	.	.	266	.	.	248	.	.	.	.
Carbonate	.	.	<	.	.	<	.	.	.	.
Chloride	.	.	3.45	.	.	170 Q	.	.	.	.
Fluoride	.	.	<	.	.	0.175	.	.	.	.
Nitrate as N	.	.	<	.	.	9.53	.	.	.	.
Sulfate	.	.	7.29	.	.	23.8	.	.	.	.
Charge balance error (%)	.	.	.	.	.	.	.	.	.	.
Trace Metals (mg/L)										
Aluminum	<	<	<	.	.	3.31	.	.	.	.
Arsenic	<	<	<	.	.	<	0.00968	0.00852	.	.
Barium	0.11	0.084	0.418	.	.	0.122	.	.	.	.
Beryllium	<	<	<	.	.	<	.	.	.	.
Boron	<	<	2.74	.	.	<	.	.	.	.
Cadmium	<	<	<	.	.	<	<	<	.	.
Chromium	<	<	0.00746	.	.	0.0191	0.00266	<	.	.
Cobalt	0.031	0.022	<	.	.	<	.	.	.	.
Iron	4.7	4.3	<	.	.	2.01	.	.	.	.
Lead	<	<	0.00156	.	.	0.00422	0.0011	0.000915	.	.
Lithium	<	<	0.0219	.	.	0.0108	.	.	.	.
Manganese	2.9	2.1	0.0846	.	.	0.0422	.	.	.	.
Mercury	<	<	<	.	.	<	.	.	.	.
Molybdenum	.	.	<	.	.	<	.	.	.	.
Nickel	0.03	0.026	0.0125	.	.	0.0412	<	<	.	.
Strontium	0.038	0.025	0.296	.	.	0.203	.	.	.	.
Uranium	<	<	0.00148	<	<	0.0389	<	<	<	<
Zinc	<	<	<	.	.	<	.	.	.	.

APPENDIX D.1: CY 2011 MONITORING DATA FOR THE BEAR CREEK HYDROGEOLOGIC REGIME
Field Measurements, Miscellaneous Analytes, Major Ions, and Trace Metals

Sampling Point	GW-078		GW-079		GW-080				GW-082	GW-085	
Functional Area	BG		BG		BG				BG	OLF	
Date Sampled	02/22/11	08/03/11	02/22/11	08/03/11	02/22/11		08/03/11		08/23/11	02/07/11	
Program	B/U	B/U	B/U	B/U	B/U	B/U	B/U	B/U	GWPP	GWPP	GWPP
Sample Type						Dup		Dup			Dup
Field Measurements											
Time Sampled	12:40	13:25	14:10	15:15	13:40		15:40		10:00	9:35	9:35
Measuring Point Elev. (ft)	918.10	918.10	981.20	981.20	981.00		981.00		964.00	983.57	983.57
Depth to Water (ft)	8.35	10.26	21.54	22.96	23.00		23.00		22.00	14.00	14.00
Groundwater Elevation (ft)	909.75	907.84	959.66	958.24	958.00		958.00		942.00	969.57	969.57
Conductivity (µmho/cm)	353	360	225	193	195		223		950	597	597
Dissolved Oxygen (ppm)	5.6	2.74	0.57	0.97	3.55		3.69		0.61	2.24	2.24
Oxidation/Reduction (mV)	-43	104	-53	134	-3		109		-8	112	112
Temperature (degrees C)	13.4	18.8	14.6	16.9	14.4		18.6		18.2	15.6	15.6
Turbidity (NTU)	1	2	2	1	6		18				
pH	7.76	5.12	8.15	7.21	6.89		6.73		6.72	6.78	6.78
Miscellaneous Analytes											
Dissolved Solids (mg/L)	230	240	140	140	78	86	110	97		265	283
Suspended Solids (mg/L)	5.2	<	<	<	10	9.2	18	11		7	6
Major Ions (mg/L)											
Calcium										97	92
Magnesium										6.36	6.25
Potassium										<	<
Sodium										6.9	6.68
Bicarbonate										197	194
Carbonate										<	<
Chloride										3.24	2.86
Fluoride										<	<
Nitrate as N										19.5	17.8
Sulfate										7	6.96
Charge balance error (%)											
Trace Metals (mg/L)											
Aluminum										<	0.24
Arsenic										<	<
Barium										0.262	0.257
Beryllium										<	<
Boron										<	<
Cadmium										<	<
Chromium										<	<
Cobalt										<	<
Iron										0.482	0.159
Lead										<	<
Lithium										0.0127	0.0128
Manganese										0.00792	0.00867
Mercury										<	<
Molybdenum										<	<
Nickel										<	<
Strontium										0.233	0.228
Uranium	<	<	<	<	<	<	<	<		<	<
Zinc										0.0809	<

APPENDIX D.1: CY 2011 MONITORING DATA FOR THE BEAR CREEK HYDROGEOLOGIC REGIME
Field Measurements, Miscellaneous Analytes, Major Ions, and Trace Metals

Sampling Point	GW-098	GW-100	GW-101	GW-122	GW-127	GW-134-05	GW-134-11	GW-134-15	GW-134-18
Functional Area	OLF	S3	S3	S3	S3	S3	S3	S3	S3
Date Sampled	02/07/11	02/01/11	02/01/11	08/08/11	08/08/11	06/02/11	06/07/11	06/07/11	06/08/11
Program	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP
Sample Type									
Field Measurements									
Time Sampled	14:45	15:25	9:55	8:45	10:35	14:06	9:47	14:36	10:05
Measuring Point Elev. (ft)	945.95	987.40	1,007.40	1,007.20	1,005.90	.	.	.	.
Depth to Water (ft)	12.00	6.00	9.00	18.00	15.00	.	.	.	.
Groundwater Elevation (ft)	933.95	981.40	998.40	989.20	990.90	.	.	.	.
Conductivity (µmho/cm)	1,363	1,807	1,021	2,650	1,185	11,930	11,950	11,480	10,090
Dissolved Oxygen (ppm)	0.28	1.31	0.4	0.42	0.46	.	.	.	.
Oxidation/Reduction (mV)	2	127	-27	183	172	.	.	.	.
Temperature (degrees C)	15.1	12.1	12.9	21.8	20.8	22.2	19.8	21.4	19.3
Turbidity (NTU)	.	.	.	.	.	.	.	.	.
pH	6.28	6.69	6.83	6.64	6.46	6.9	7	7.01	7.2
Miscellaneous Analytes									
Dissolved Solids (mg/L)	811	10 Q	641	1,790	690	10,300	8,480	10,300	8,560
Suspended Solids (mg/L)	29	<	3	1	<	<	<	3	<
Major Ions (mg/L)									
Calcium	238	306	160	267	158	73.1	64.8	66.7	48.5
Magnesium	28	21.7	24.8	80.1	25.7	21.1	20.4	20.4	14.2
Potassium	4.63	2.78	2.54	18.1	2.42	15.8	15.9	15.9	16.3
Sodium	27.7	8.04	17	82.8	58.8	2,930	2,830	2,840	2,360
Bicarbonate	590	267	414	441	401	1,520	1,480	1,460	1,060
Carbonate	<	<	<	<	<	<	<	<	<
Chloride	94.3	298	36	80	127	201	215	208	162
Fluoride	<	<	0.267	<	0.383	1.62	1.66	0.147	1.53
Nitrate as N	<	22.6	7.42	159	<	1,420	728	1,480	1240
Sulfate	20.3	23.1	22.6	23.9	43.2	13.8	14.1	14.5	14
Charge balance error (%)	.	.	.	2.3	0.4	-1.7	18.7	-4.5	-3.6
Trace Metals (mg/L)									
Aluminum	<	<	<	<	<	<	<	<	<
Arsenic	<	<	<	<	<	<	<	<	<
Barium	0.518	0.654	0.626	0.541	0.017	2.99	2.81	2.71	2.9
Beryllium	<	<	<	<	<	<	<	<	<
Boron	0.184	<	<	0.419	<	0.638	0.647	0.61	0.698
Cadmium	<	<	<	<	0.00308	<	<	<	<
Chromium	<	0.0497	0.00576	<	0.00932	<	<	<	<
Cobalt	<	<	<	<	<	<	<	<	<
Iron	0.396	0.241	4.56	0.253	<	<	<	<	0.116
Lead	0.0048	<	<	<	<	0.000565	0.00199	<	0.00118
Lithium	0.038	0.0164	<	0.144	<	1.41	1.32	1.34	1.25
Manganese	0.826	0.0256	4.12	0.0626	1.72	0.0165	0.0215	0.0173	0.0109
Mercury	<	<	<	<	<	<	<	<	<
Molybdenum	<	<	<	<	<	<	<	<	<
Nickel	0.0371	0.0586	<	<	0.00751	<	<	<	<
Strontium	0.961	0.547	0.642	8.32	0.341	9.03	8.75	8.71	6.51
Uranium	0.00198	0.0015	0.00304	0.00241	0.019	0.00312	0.00232	0.00293	0.00352
Zinc	<	0.413	0.405	<	0.344	0.286	4.02 Q	0.195	<

APPENDIX D.1: CY 2011 MONITORING DATA FOR THE BEAR CREEK HYDROGEOLOGIC REGIME
Field Measurements, Miscellaneous Analytes, Major Ions, and Trace Metals

Sampling Point	GW-134-21	GW-134-33	GW-134-35	GW-134-36		GW-225	GW-229		GW-236
Functional Area	S3	S3	S3	S3		OLF	OLF		S3
Date Sampled	06/02/11	05/26/11	06/02/11	05/25/11		02/10/11	02/08/11		08/04/11
Program	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP
Sample Type					Dup			Dup	
Field Measurements									
Time Sampled	10:45	9:32	8:54	10:38	10:38	10:25	9:15	9:15	9:55
Measuring Point Elev. (ft)	.	.	.	.	.	943.11	949.00	949.00	983.21
Depth to Water (ft)	.	.	.	.	.	12.00	17.00	17.00	12.00
Groundwater Elevation (ft)	.	.	.	.	.	931.11	932.00	932.00	971.21
Conductivity (µmho/cm)	4,841	636	864	621	621	1,164	1,626	1,626	519
Dissolved Oxygen (ppm)	.	.	.	.	.	0.17	0.41	0.41	0.12
Oxidation/Reduction (mV)	.	.	.	.	.	175	-32	-32	228
Temperature (degrees C)	21.4	18.4	20.8	24.7	24.7	9.3	13.7	13.7	17.2
Turbidity (NTU)	.	.	.	.	.	.	.	.	.
pH	6.9	6.9	6.9	7.1	7.1	7.13	6.26	6.26	5.22
Miscellaneous Analytes									
Dissolved Solids (mg/L)	3,850	523	619	464	471	629	816	804	346
Suspended Solids (mg/L)	<	<	<	<	3	2	25	9	2
Major Ions (mg/L)									
Calcium	10.7	131	146	112	117	126	198	195	67.3
Magnesium	2.75	17.3	24.7	10.2	10.3	49.3	34.6	34.6	9.41
Potassium	8.17	5.36	4.24	6.61	6.41	2.97	13.2	13	2.4
Sodium	1,150	12.3	11.5	10.6	11.2	27.5	73.1	73.6	13.3
Bicarbonate	801	237	274	235	226	264	656	686	72.7
Carbonate	<	<	<	<	<	<	<	<	<
Chloride	42.2	19.5	19.4	19.5	19.9	77.9	128	128	19.9
Fluoride	1.87	<	<	<	<	0.459	<	<	<
Nitrate as N	474	32.6	41.2	24.4	24.5	40.5	<	<	10.2
Sulfate	24.7	14	16	11.8	11.7	40.9	12.4	12.5	90.5
Charge balance error (%)	-0.6	4.4	3.3	.	0.3	.	.	.	1.6
Trace Metals (mg/L)									
Aluminum	<	<	<	<	<	<	<	<	<
Arsenic	<	<	<	<	<	<	0.0109	0.0085	<
Barium	0.541	0.169	0.242	0.0785	0.0832	0.183	1.34	1.34	0.0441
Beryllium	<	<	<	<	<	<	<	<	<
Boron	0.895	<	<	<	<	0.127	3.46	3.46	<
Cadmium	<	<	<	<	<	<	<	<	0.00133
Chromium	<	0.00396	<	<	0.00383	<	<	<	<
Cobalt	<	<	<	<	<	<	<	<	<
Iron	<	0.0702	<	0.572	0.851	0.345	21	20.9	<
Lead	<	<	<	<	<	<	<	<	<
Lithium	0.66	0.0105	<	0.0142	0.0139	0.0195	0.102	0.103	<
Manganese	<	0.0696	0.0569	0.115	0.126	0.0389	4.76	4.73	1.25
Mercury	<	<	<	<	<	<	<	<	<
Molybdenum	0.0394	<	<	<	<	<	<	<	<
Nickel	<	0.00733	<	0.00652	0.0175	<	0.0558	0.0555	0.0107
Strontium	1.36	0.43	0.506	0.346	0.391	1.6	0.594	0.594	0.151
Uranium	0.00402	<	<	<	<	0.00211	0.12	0.122	0.00565
Zinc	<	<	<	<	<	<	<	<	<

APPENDIX D.1: CY 2011 MONITORING DATA FOR THE BEAR CREEK HYDROGEOLOGIC REGIME
Field Measurements, Miscellaneous Analytes, Major Ions, and Trace Metals

Sampling Point	GW-246		GW-276		GW-289	GW-315	GW-365	GW-526	GW-537	GW-601	GW-615
Functional Area	S3		S3		BG	SPI	OLF	S3	OLF	OLF	S3
Date Sampled	08/08/11		01/11/11	07/11/11	08/23/11	02/14/11	02/08/11	01/27/11	08/24/11	02/09/11	02/02/11
Program	GWPP	GWPP	B/U	B/U	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP
Sample Type		Dup									
Field Measurements											
Time Sampled	14:00	14:00	14:20	10:45	14:15	10:20	14:10	10:50	9:20	14:10	10:05
Measuring Point Elev. (ft)	1,009.19	1,009.19	1,001.57	1,001.57	948.73	1,047.45	935.58	998.25	976.65	1,002.80	1,017.55
Depth to Water (ft)	14.00	14.00	5.66	7.65	19.00	58.00	8.00	13.00	8.00	66.00	13.00
Groundwater Elevation (ft)	995.19	995.19	995.91	993.92	929.73	989.45	927.58	985.25	968.65	936.80	1,004.55
Conductivity (µmho/cm)	18,380	18,380	678	955	378	795	1,256	10,800	3,040	965	56,800
Dissolved Oxygen (ppm)	0.32	0.32	2.8	0.76	0.26	0.48	0.34	0.37	0.11	0.85	0.61
Oxidation/Reduction (mV)	302	302	386	29	134	90	-84	100	178	135	107
Temperature (degrees C)	21.7	21.7	13.9	23.3	18.9	14.5	11.8	5.9	16.3	9.1	3.6
Turbidity (NTU)	.	.	10	1	.	.	.	.	.	.	.
pH	4.48	4.48	3.86	4.24	6.42	7.05	6.86	8.18	6.63	7.28	6.01
Miscellaneous Analytes											
Dissolved Solids (mg/L)	17,600	17,700	.	.	138	475	666	.	.	.	62,200
Suspended Solids (mg/L)	<	1	.	.	<	<	6	.	.	.	17
Major Ions (mg/L)											
Calcium	2,450	2,680	39	56	54.2	140	179	.	.	.	10,700
Magnesium	576	602	6.9	9.7	6.76	15.5	48.4	.	.	.	2,470
Potassium	<	<	5.9	7.4 J	<	3.91	5.06	.	.	.	130
Sodium	497	512	71	85	5.93	7.92	23.1	.	.	.	2,790
Bicarbonate	31.2	30	.	.	142	305	515	.	.	.	201
Carbonate	<	<	.	.	<	<	<	.	.	.	<
Chloride	289	285	.	.	2.16	13	86	30	16.4	77.3	128
Fluoride	12.4	12.4	.	.	<	<	<	.	.	.	0.108
Nitrate as N	2,799	2,819	10	11	0.209	4.11	<	1240	302	15.6	11,599
Sulfate	26.5	26.2	.	.	9.67	77.4	30.5	2.09	6.32	74.7	3.44
Charge balance error (%)	.	-2.9	.	.	6.1	.	.	.	.	.	.
Trace Metals (mg/L)											
Aluminum	46.6	49	2.8	3	<	<	<	.	.	.	<
Arsenic	<	<	<	<	<	<	<	.	.	.	<
Barium	4.61	4.82	0.092	0.12	0.125	0.0616	0.404	.	.	.	406
Beryllium	0.0268	0.0272	0.0032	0.0037	<	<	<	.	.	.	<
Boron	<	<	<	<	<	<	0.26	.	.	.	1.34
Cadmium	0.367	0.356	0.013	0.014	<	<	<	.	.	.	0.0151
Chromium	<	<	<	0.024	<	<	<	.	.	.	<
Cobalt	0.489	0.541	0.067	0.068	<	<	<	.	.	.	<
Iron	<	<	<	0.22	<	<	29.2	.	.	.	1.12
Lead	<	0.0318	<	<	0.00108	<	0.00067	.	.	.	<
Lithium	0.586	0.612	0.012	0.014	0.0123	<	0.0476	.	.	.	1.24
Manganese	107	115	2.5	3	<	0.0713	0.256	.	.	.	21.3
Mercury	0.0004	0.00042	<	<	<	<	<	.	.	.	<
Molybdenum	<	<	.	.	<	<	<	.	.	.	<
Nickel	4.5	4.44	0.15	0.21	<	<	0.0376	.	.	.	0.204
Strontium	9.7	10.1	0.086	0.13	0.103	0.215	1.8	.	.	.	350
Uranium	0.416	0.401	0.41	0.38	<	0.00313	0.00096	.	.	.	1.05
Zinc	<	<	<	<	<	<	<	.	.	.	<

APPENDIX D.1: CY 2011 MONITORING DATA FOR THE BEAR CREEK HYDROGEOLOGIC REGIME
Field Measurements, Miscellaneous Analytes, Major Ions, and Trace Metals

Sampling Point	GW-616	GW-623	GW-627		GW-653	GW-683		GW-684		GW-703
Functional Area	S3	BG	BG		BG	EXP-A		EXP-A		EXP-B
Date Sampled	08/09/11	01/24/11	01/19/11	08/22/11	01/18/11	02/23/11	08/03/11	02/23/11	08/03/11	02/14/11
Program	GWPP	GWPP	GWPP	GWPP	GWPP	B/U	B/U	B/U	B/U	GWPP
Sample Type		NP								
Field Measurements										
Time Sampled	9:50	13:55	14:55	15:25	10:50	14:10	10:45	10:20	15:00	14:10
Measuring Point Elev. (ft)	1,011.81	925.21	943.51	943.51	931.84	972.23	972.23	898.83	898.83	955.29
Depth to Water (ft)	10.00	5.00	24.00	25.00	24.00	88.91	89.09	15.62	15.79	42.00
Groundwater Elevation (ft)	1,001.81	920.21	919.51	918.51	907.84	883.32	883.14	883.21	883.04	913.29
Conductivity (µmho/cm)	2,370	1,448	1,409	1,392	128	371	324	398	404	717
Dissolved Oxygen (ppm)	0.2	0.32	0.8	0.37	5.84	3.73	5.64	0.63	0.4	0.55
Oxidation/Reduction (mV)	70	-110	-120	-77	268	161	135	184	53	106
Temperature (degrees C)	21.7	13.8	7.7	24.9	12.7	13.4	14.34	12.2	16.03	14.4
Turbidity (NTU)	.	.	.	.	.	2	3	1	2	.
pH	9.77	9.39	9.47	9.31	4.7	7.55	8.46	7.7	9.61	7.29
Miscellaneous Analytes										
Dissolved Solids (mg/L)	1,660	.	.	.	27	250	240	270	310	378
Suspended Solids (mg/L)	<	.	.	.	2	<	<	<	<	1
Major Ions (mg/L)										
Calcium	1.79	.	.	.	2.07	57	48	68	66	84.2
Magnesium	0.658	.	.	.	1.12	24	25	18	20	30.1
Potassium	4.28	.	.	.	<	0.55	<	3.4	3.6	5.83
Sodium	460	.	.	.	2.09	4.2	1.1	6.9	8.3	14.4
Bicarbonate	46	.	.	.	13	210	200	230	220	241
Carbonate	79.4	.	.	.	<	<	<	<	<	<
Chloride	16.8	.	.	.	1.17	10	2.6	18	18	27
Fluoride	0.775	.	.	.	<	<	<	<	<	<
Nitrate as N	248	.	.	.	<	1.6	0.23	1.1	2.4	15.8
Sulfate	17.7	.	.	.	1.44	19	18	13	13	25.4
Charge balance error (%)	-2.2	.	.	.	.	0.3	0.4	-1.8	0	.
Trace Metals (mg/L)										
Aluminum	<	.	.	.	<	<	<	<	<	<
Arsenic	<	.	.	.	<	<	<	<	<	<
Barium	0.129	.	.	.	0.0331	0.14	0.15	0.093	0.1	0.108
Beryllium	<	.	.	.	<	<	<	<	<	<
Boron	0.906	.	.	.	<	<	<	<	<	<
Cadmium	<	.	.	.	<	<	<	<	<	<
Chromium	0.0055	.	.	.	0.00329	<	<	<	<	<
Cobalt	<	.	.	.	<	<	<	<	<	<
Iron	0.508	.	.	.	<	<	<	<	<	0.234
Lead	0.00506	.	.	.	<	<	<	<	<	<
Lithium	0.269	.	.	.	<	<	<	0.015	0.017	0.0211
Manganese	0.00702	.	.	.	<	<	<	0.049	0.022	0.0581
Mercury	<	.	.	.	<	<	<	<	<	<
Molybdenum	<	.	.	.	<	.	.	.	.	<
Nickel	<	.	.	.	<	0.051	<	<	<	<
Strontium	0.26	.	.	.	0.0192	0.15	0.17	0.16	0.16	0.263
Uranium	<	.	.	.	<	0.011	0.0046	0.018	0.017	0.0146
Zinc	0.308	.	.	.	<	<	<	<	<	<

APPENDIX D.1: CY 2011 MONITORING DATA FOR THE BEAR CREEK HYDROGEOLOGIC REGIME
Field Measurements, Miscellaneous Analytes, Major Ions, and Trace Metals

Sampling Point	GW-704		GW-706		GW-712		GW-713			
Functional Area	EXP-B		EXP-B		EXP-W		EXP-W			
Date Sampled	02/23/11	08/04/11	02/17/11	08/04/11	01/05/11	07/07/11	01/13/11		07/07/11	
Program	B/U	B/U	B/U	B/U	B/U	B/U	B/U	B/U	B/U	B/U
Sample Type								Dup		Dup
Field Measurements										
Time Sampled	9:50	11:45	10:20	10:00	10:50	11:00	12:30	.	12:20	.
Measuring Point Elev. (ft)	945.33	945.33	929.47	929.47	877.89	877.89	881.43	.	881.43	.
Depth to Water (ft)	35.08	36.52	16.18	17.91	31.90	35.01	37.09	.	37.72	.
Groundwater Elevation (ft)	910.25	908.81	913.29	911.56	845.99	842.88	844.34	.	843.71	.
Conductivity (µmho/cm)	403	334	659	673	380	480	403	.	523	.
Dissolved Oxygen (ppm)	0.55	0.3	0.2	0.27	0.72	0.71	3.68	.	6.41	.
Oxidation/Reduction (mV)	-74	-178	88	34	47	49	-80	.	-125	.
Temperature (degrees C)	11.6	15.8	12.8	17.27	10	20	6.1	.	17.1	.
Turbidity (NTU)	1	7	2	3	4	7	3	.	4	.
pH	8.27	7.99	7.46	6.92	7.44	6.7	9.16	.	7.35	.
Miscellaneous Analytes										
Dissolved Solids (mg/L)	310	230	450	480	.	.	.	.	.	.
Suspended Solids (mg/L)	<	<	<	<	.	.	.	.	.	.
Major Ions (mg/L)										
Calcium	58	19	110	110	59	53	43	45	18	22
Magnesium	30	29	21	22	35	34	35	36	26	30
Potassium	6.6 J	16	6.5 J	5.3	1.7	1.4	2.6	2.6	2.4	2.8
Sodium	13 J	14	21 J	21	7.1	6.4 J	11	11	9.5	10
Bicarbonate	190	160	270	260	.	.	.	.	.	.
Carbonate	<	<	<	<	.	.	.	.	.	.
Chloride	29	29	51	45	.	.	.	.	.	.
Fluoride	<	<	<	<	.	.	.	.	.	.
Nitrate as N	9.6	4.5	15	12	0.051	<	<	<	<	<
Sulfate	22	21	26	23	.	.	.	.	.	.
Charge balance error (%)	2.8	-4.6	-0.9	3.4	.	.	.	.	.	.
Trace Metals (mg/L)										
Aluminum	<	<	<	<	<	<	<	<	<	<
Arsenic	<	<	<	<	<	<	<	<	<	<
Barium	0.084	0.034	0.14	0.14	0.035	0.03	0.026	0.027	0.012	0.016
Beryllium	<	<	<	<	<	<	<	<	<	<
Boron	<	<	0.1	0.1	<	<	<	<	<	<
Cadmium	<	<	<	<	<	<	<	<	<	<
Chromium	<	<	<	<	<	<	<	<	<	<
Cobalt	<	<	<	<	<	<	<	<	<	<
Iron	0.48	0.25	<	<	0.51	0.67	1.8	2	0.56	0.88
Lead	<	<	<	<	<	<	<	<	<	<
Lithium	0.016 J	0.03	0.015 J	0.012	<	<	<	<	0.01	0.01
Manganese	0.022 J	0.007	0.013 J	<	0.052	0.12	0.19	0.2	0.067	0.095
Mercury	.	.	.	.	.	.	.	.	.	.
Molybdenum	.	.	.	.	.	.	.	.	.	.
Nickel	<	<	<	<	<	<	<	<	<	<
Strontium	0.22	0.085	0.34	0.28	0.68	0.6	0.71	0.75	0.33	0.41
Uranium	0.0096	0.0045	0.059	0.057	<	<	<	<	<	<
Zinc	<	<	<	<	<	<	<	<	<	<

APPENDIX D.1: CY 2011 MONITORING DATA FOR THE BEAR CREEK HYDROGEOLOGIC REGIME
Field Measurements, Miscellaneous Analytes, Major Ions, and Trace Metals

Sampling Point	GW-714		GW-724	GW-725	GW-729-18	GW-729-22	GW-729-26	GW-729-30	GW-729-34
Functional Area	EXP-W		EXP-C	EXP-C	BG	BG	BG	BG	BG
Date Sampled	01/05/11	07/06/11	02/16/11	02/17/11	06/13/11	06/23/11	06/23/11	06/27/11	06/28/11
Program	B/U	B/U	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP
Sample Type									
Field Measurements									
Time Sampled	12:20	15:30	10:50	9:55	13:28	9:19	14:10	10:14	15:38
Measuring Point Elev. (ft)	875.88	875.88	979.75	961.63	1,004.48	1,004.48	1,004.48	1,004.48	1,004.48
Depth to Water (ft)	27.18	30.89	32.00	11.00	.	.	.	.	.
Groundwater Elevation (ft)	848.70	844.99	947.75	950.63	1,004.48	1,004.48	1,004.48	1,004.48	1,004.48
Conductivity (µmho/cm)	370	504	858	1,015	49,650	54,200	39,470	17,050	2,043
Dissolved Oxygen (ppm)	1.01	2.39	1.21	0.14	.	.	.	.	.
Oxidation/Reduction (mV)	143	65	111	47	.	.	.	.	.
Temperature (degrees C)	9.9	20.9	13.7	13.4	17.2	16	16.5	16.5	16
Turbidity (NTU)	8	6	.	.	.	.	.	.	.
pH	7.11	7.43	7.11	6.84	6.6	6.2	6.5	7.3	7.2
Miscellaneous Analytes									
Dissolved Solids (mg/L)	.	.	.	518	37,800	37,000	26,600	10,400	845
Suspended Solids (mg/L)	.	.	.	8	49	27	14.5	3	4.5
Major Ions (mg/L)									
Calcium	65	63	.	143	1,130	1,150	560	118	13.7
Magnesium	25	26	.	21.1	311	333	184	44.2	6.31
Potassium	1.4	1.1	.	2.94	68.2	78.4	69.1	34.9	5.54
Sodium	5.9	5.7	.	23.6	11,300	12,100	9,090	3,860	305
Bicarbonate	.	.	.	358	344	139	86.2	225	150
Carbonate	.	.	.	<	<	<	<	<	3.89
Chloride	.	.	80	57.4	20,900	22,200	15,400	6,440	353
Fluoride	.	.	.	0.248	0.404	0.396	0.483	0.855	2.18
Nitrate as N	0.61	0.16	13.1	8.84	<	<	<	<	<
Sulfate	.	.	31.4	39.7	9.24	150	34.2	45.2	72.6
Charge balance error (%)	.	.	.	.	-1.8	-1.5	0.4	-2.4	-0.2
Trace Metals (mg/L)									
Aluminum	<	<	.	<	<	<	<	<	<
Arsenic	<	<	.	<	<	<	<	<	<
Barium	0.091	0.084	.	0.184	37.2	42	17.9	2.07	0.0765
Beryllium	<	<	.	<	<	<	0.00212	<	<
Boron	<	<	.	<	0.806	0.911	1.4	2.02	1.48
Cadmium	<	<	.	<	<	<	<	<	<
Chromium	<	<	.	<	<	<	<	<	<
Cobalt	<	<	.	<	<	<	<	<	<
Iron	<	0.39	.	3.11	20.1	11.5	4.81	1.42	0.481
Lead	<	<	.	<	<	<	<	<	0.0303
Lithium	<	<	.	<	6.3	7.53	6.92	3.04	0.161
Manganese	0.0093	0.047	.	0.854	0.809	0.389	0.132	0.0431	0.0355
Mercury	.	.	.	<	<	<	<	<	<
Molybdenum	.	.	.	<	<	<	<	<	<
Nickel	<	<	.	<	<	<	<	<	<
Strontium	0.36	0.33	.	0.303	187	184	95.1	18.5	1.18
Uranium	<	<	.	0.0141	<	<	<	<	<
Zinc	<	<	.	<	0.71	0.443	0.383	0.231	1.83

APPENDIX D.1: CY 2011 MONITORING DATA FOR THE BEAR CREEK HYDROGEOLOGIC REGIME
Field Measurements, Miscellaneous Analytes, Major Ions, and Trace Metals

Sampling Point	GW-729-39	GW-729-44	GW-738	GW-740		BCK-03.30	BCK-04.55	
Functional Area	BG	BG	EXP-C	EXP-C		EXP-SW	EXP-SW	
Date Sampled	06/27/11	06/29/11	02/16/11	02/16/11	02/16/11	12/13/11	07/26/11	
Program	GWPP	GWPP	GWPP	GWPP	GWPP	B/U	GWPP	GWPP
Sample Type					Dup			Dup
Field Measurements								
Time Sampled	14:09	9:30	9:10	14:25	14:25	11:00	9:10	9:10
Measuring Point Elev. (ft)	1,004.48	1,004.48	983.31	1,020.25	1,020.25	.	.	.
Depth to Water (ft)	.	.	30.00	73.00	73.00	.	.	.
Groundwater Elevation (ft)	1,004.48	1,004.48	953.31	947.25	947.25	.	.	.
Conductivity (µmho/cm)	694	490	875	554	554	.	359	359
Dissolved Oxygen (ppm)	.	.	0.73	2.03	2.03	.	4.46	4.46
Oxidation/Reduction (mV)	.	.	220	139	139	.	206	206
Temperature (degrees C)	17.1	16.2	11.7	13.3	13.3	.	23.6	23.6
Turbidity (NTU)	.	.	.	.	.	.	.	.
pH	7.7	7.3	6.77	7.13	7.13	.	7.18	7.18
Miscellaneous Analytes								
Dissolved Solids (mg/L)	346	285	492	.	.	.	183	193
Suspended Solids (mg/L)	13	1	2	.	.	.	3	<
Major Ions (mg/L)								
Calcium	34.6	62.4	140	.	.	.	48.7	47.4
Magnesium	18.1	27.5	22	.	.	.	17.2	17.5
Potassium	2.97	<	3.03	.	.	.	<	<
Sodium	67.3	3.95	8.99	.	.	.	7.13	6.63
Bicarbonate	142	231	372	.	.	.	180	182
Carbonate	<	<	<	.	.	.	<	<
Chloride	159	8.03	17	.	.	.	11.7	13.3
Fluoride	0.858	0.218	<	.	.	.	<	<
Nitrate as N	<	4.32	9.12	.	.	.	0.252	0.349
Sulfate	2.2	12.1	33.2	.	.	.	6.02	7.62
Charge balance error (%)	-8.8	1.2	.	.	.	.	.	-0.1
Trace Metals (mg/L)								
Aluminum	<	<	<	.	.	.	<	<
Arsenic	<	<	<	.	.	.	<	<
Barium	0.272	0.111	0.0617	.	.	.	0.0634	0.0617
Beryllium	<	<	<	.	.	.	<	<
Boron	<	<	<	.	.	.	<	<
Cadmium	<	<	<	.	.	.	<	<
Chromium	<	<	<	.	.	.	<	<
Cobalt	<	<	<	.	.	.	<	<
Iron	0.623	0.0502	<	.	.	.	0.264	0.328
Lead	<	0.00053	<	.	.	.	<	<
Lithium	0.0315	<	<	.	.	.	<	<
Manganese	0.023	0.0461	0.0503	.	.	.	0.188	0.23
Mercury	<	<	<	.	.	<	<	<
Molybdenum	<	<	<	.	.	.	<	<
Nickel	<	<	<	.	.	.	<	<
Strontium	1.01	0.242	0.149	.	.	.	0.074	0.0668
Uranium	<	<	0.00342	.	.	.	0.0141	0.0109
Zinc	0.161	0.267	<	.	.	.	<	<

APPENDIX D.1: CY 2011 MONITORING DATA FOR THE BEAR CREEK HYDROGEOLOGIC REGIME
Field Measurements, Miscellaneous Analytes, Major Ions, and Trace Metals

Sampling Point	BCK-04.60			BCK-09.20			BCK-09.40	BCK-11.54		
Functional Area	EXP-SW			EXP-SW			EXP-SW	EXP-SW		
Date Sampled	02/22/11	08/02/11	12/13/11	02/22/11	08/02/11	12/13/11	07/26/11	02/22/11	08/02/11	12/13/11
Program	B/U	B/U	B/U	B/U	B/U	B/U	GWPP	B/U	B/U	B/U
Sample Type										
Field Measurements										
Time Sampled	9:45	9:35	10:30	10:00	9:20	10:15	13:30	10:45	8:35	9:15
Measuring Point Elev. (ft)	.	.	.	.	.	.	.	.	.	.
Depth to Water (ft)	.	.	.	.	.	.	.	.	.	.
Groundwater Elevation (ft)	.	.	.	.	.	.	.	.	.	.
Conductivity (µmho/cm)	.	.	.	.	.	.	542	.	.	.
Dissolved Oxygen (ppm)	.	.	.	.	.	.	4.93	.	.	.
Oxidation/Reduction (mV)	.	.	.	.	.	.	165	.	.	.
Temperature (degrees C)	.	.	.	.	.	.	18.7	.	.	.
Turbidity (NTU)	.	.	.	.	.	.	.	.	.	.
pH	.	.	.	.	.	.	7.3	.	.	.
Miscellaneous Analytes										
Dissolved Solids (mg/L)	.	.	.	.	.	.	309	.	.	.
Suspended Solids (mg/L)	.	.	.	.	.	.	6	.	.	.
Major Ions (mg/L)										
Calcium	.	.	.	.	.	.	77.2	.	.	.
Magnesium	.	.	.	.	.	.	17.7	.	.	.
Potassium	.	.	.	.	.	.	2.03	.	.	.
Sodium	.	.	.	.	.	.	13	.	.	.
Bicarbonate	.	.	.	.	.	.	219	.	.	.
Carbonate	.	.	.	.	.	.	<	.	.	.
Chloride	.	.	.	.	.	.	23.6	.	.	.
Fluoride	.	.	.	.	.	.	0.191	.	.	.
Nitrate as N	.	.	.	.	.	3	5.14	.	.	.
Sulfate	.	.	.	.	.	.	22.1	.	.	.
Charge balance error (%)	.	.	.	.	.	.	0.4	.	.	.
Trace Metals (mg/L)										
Aluminum	.	.	.	.	.	.	0.343	.	.	.
Arsenic	.	.	.	.	.	.	<	.	.	.
Barium	.	.	.	.	.	.	0.0965	.	.	.
Beryllium	.	.	.	.	.	.	<	.	.	.
Boron	.	.	.	.	.	.	0.116	.	.	.
Cadmium	.	.	.	.	.	.	<	.	.	.
Chromium	.	.	.	.	.	.	<	.	.	.
Cobalt	.	.	.	.	.	.	<	.	.	.
Iron	.	.	.	.	.	.	0.252	.	.	.
Lead	.	.	.	.	.	.	<	.	.	.
Lithium	.	.	.	.	.	.	0.0169	.	.	.
Manganese	.	.	.	.	.	.	0.0324	.	.	.
Mercury	<	<	<	<	<	<	<	<	<	<
Molybdenum	.	.	.	.	.	.	<	.	.	.
Nickel	.	.	.	.	.	.	<	.	.	.
Strontium	.	.	.	.	.	.	0.153	.	.	.
Uranium	.	.	.	.	.	.	0.05	.	.	.
Zinc	.	.	.	.	.	.	<	.	.	.

APPENDIX D.1: CY 2011 MONITORING DATA FOR THE BEAR CREEK HYDROGEOLOGIC REGIME
Field Measurements, Miscellaneous Analytes, Major Ions, and Trace Metals

Sampling Point	BCK-11.97	BCK-12.34				NT-01			
Functional Area	EXP-SW	EXP-SW				EXP-SW			
Date Sampled	07/25/11	02/22/11	03/08/11	08/02/11	12/13/11	01/17/11		05/10/11	
Program	GWPP	B/U	B/U	B/U	B/U	B/U	B/U	B/U	B/U
Sample Type							Dup		Dup
Field Measurements									
Time Sampled	14:10	11:10	10:29	8:00	8:45	10:20	.	8:55	.
Measuring Point Elev. (ft)	.	.	.	.	.	.	.	.	.
Depth to Water (ft)	.	.	.	.	.	.	.	.	.
Groundwater Elevation (ft)	.	.	.	.	.	.	.	.	.
Conductivity (µmho/cm)	1,142	.	492	.	622	.	.	.	.
Dissolved Oxygen (ppm)	4.19	.	8.11	.	9.42	.	.	.	.
Oxidation/Reduction (mV)	217	.	132.2	.	100.2	.	.	.	.
Temperature (degrees C)	26	.	10.31	.	12.44	.	.	.	.
Turbidity (NTU)	.	.	15	.	5	.	.	.	.
pH	7.37	.	6.25	.	6.52	.	.	.	.
Miscellaneous Analytes									
Dissolved Solids (mg/L)	862	.	.	.	.	.	.	.	.
Suspended Solids (mg/L)	23	.	.	.	.	.	.	.	.
Major Ions (mg/L)									
Calcium	152	.	87	.	120	170	170	130	130
Magnesium	23	.	11	.	15	22	22	18	18
Potassium	4.22	.	2	.	2.3	3	3	2.4	2.4
Sodium	49.3	.	23 J	.	25 J	23	23	17	16
Bicarbonate	246	.	.	.	.	.	.	.	.
Carbonate	<	.	.	.	.	.	.	.	.
Chloride	92	.	.	.	.	.	.	.	.
Fluoride	0.596	.	.	.	.	.	.	.	.
Nitrate as N	43.3	.	.	.	.	.	.	.	.
Sulfate	39.9	.	.	.	.	.	.	.	.
Charge balance error (%)	1.1	.	.	.	.	.	.	.	.
Trace Metals (mg/L)									
Aluminum	0.495	.	0.21	.	<	0.59	0.56	0.32	0.35
Arsenic	<	.	<	.	<	<	<	<	<
Barium	0.2	.	0.1	.	0.13	0.28	0.28	0.25	0.25
Beryllium	<	.	<	.	<	<	<	<	<
Boron	<	.	<	.	<	<	<	<	<
Cadmium	<	.	<	.	<	0.016	0.016	0.0082	0.0075
Chromium	<	.	<	.	<	<	<	<	<
Cobalt	<	.	<	.	<	<	<	<	<
Iron	0.386	.	0.22	.	0.17	0.15	0.13	0.38	0.41
Lead	<	.	<	.	<	<	<	<	<
Lithium	0.0126	.	<	.	<	0.012	0.012	0.011	0.011
Manganese	0.101	.	0.4	.	0.52	3.2	3.2	1.6	1.6
Mercury	<	<	.	0.0000731	<	.	.	.	.
Molybdenum	<	.	.	.	.	.	.	.	.
Nickel	<	.	<	.	<	0.058	0.058	0.029	0.028
Strontium	0.437	.	0.21	.	0.3	0.43	0.43	0.33	0.33
Uranium	0.267	.	0.1	.	0.18	0.011	0.011	0.009	0.0091
Zinc	<	.	<	.	<	<	<	<	<

APPENDIX D.1: CY 2011 MONITORING DATA FOR THE BEAR CREEK HYDROGEOLOGIC REGIME
Field Measurements, Miscellaneous Analytes, Major Ions, and Trace Metals

Sampling Point	NT-01					NT-03		
Functional Area	EXP-SW					EXP-SW		
Date Sampled	07/14/11		07/26/11	10/18/11		02/22/11	08/02/11	12/13/11
Program	B/U	B/U	GWPP	B/U	B/U	B/U	B/U	B/U
Sample Type		Dup			Dup			
Field Measurements								
Time Sampled	8:45	8:45	14:30	8:40	8:40	10:55	8:20	9:05
Measuring Point Elev. (ft)	.	.	.	.	.	.	.	.
Depth to Water (ft)	.	.	.	.	.	.	.	.
Groundwater Elevation (ft)	.	.	.	.	.	.	.	.
Conductivity (µmho/cm)	.	.	3,410	.	.	.	.	.
Dissolved Oxygen (ppm)	.	.	4.29	.	.	.	.	.
Oxidation/Reduction (mV)	.	.	190	.	.	.	.	.
Temperature (degrees C)	.	.	25.5	.	.	.	.	.
Turbidity (NTU)	.	.	.	.	.	.	.	.
pH	.	.	6.72	.	.	.	.	.
Miscellaneous Analytes								
Dissolved Solids (mg/L)	.	.	3,540	.	.	.	.	.
Suspended Solids (mg/L)	.	.	2	.	.	.	.	.
Major Ions (mg/L)								
Calcium	380	390	498	410	420	.	.	.
Magnesium	48	50	68.8	51	51	.	.	.
Potassium	7.8	8	9.3	9.1	9.2	.	.	.
Sodium	53 J	54	75.3	57	58	.	.	.
Bicarbonate	.	.	255	240	240	.	.	.
Carbonate	.	.	<	<	<	.	.	.
Chloride	.	.	52.1	45	46	.	.	.
Fluoride	.	.	1.62	1.4	1.4	.	.	.
Nitrate as N	.	.	364	270	280	.	.	.
Sulfate	.	.	38.3	37	38	.	.	.
Charge balance error (%)	.	.	0.9	2.2		.	.	.
Trace Metals (mg/L)								
Aluminum	<	0.42	0.251	0.45	0.44	.	.	.
Arsenic	<	<	<	<	<	.	.	.
Barium	0.65	0.7	1.02	0.68	0.68	.	.	.
Beryllium	<	<	<	<	<	.	.	.
Boron	0.5	0.51	0.428	0.24	0.24	.	.	.
Cadmium	0.029	0.032	0.0427	0.037	0.038	.	.	.
Chromium	<	0.011	<	<	<	.	.	.
Cobalt	<	<	<	<	<	.	.	.
Iron	<	0.18	<	<	<	.	.	.
Lead	<	<	<	<	<	.	.	.
Lithium	0.07	0.072	0.0604	0.032	0.032	.	.	.
Manganese	5.4	6.3	8.72	7.1	7.2	.	.	.
Mercury	.	.	<	.	.	<	<	<
Molybdenum	.	.	<	.	.	.	.	.
Nickel	0.092	0.42	0.156	0.13	0.13	.	.	.
Strontium	0.95	0.97	1.33	1.1	1.1	.	.	.
Uranium	0.04	0.04	0.0539	0.04	0.04	.	.	.
Zinc	<	<	<	<	<	.	.	.

APPENDIX D.1: CY 2011 MONITORING DATA FOR THE BEAR CREEK HYDROGEOLOGIC REGIME
Field Measurements, Miscellaneous Analytes, Major Ions, and Trace Metals

Sampling Point	NT-07		NT-08			SS-4			
Functional Area	EXP-SW		EXP-SW			EXP-SW			
Date Sampled	02/15/11	08/15/11	02/15/11	02/22/11	12/13/11	02/22/11	07/26/11	08/02/11	12/13/11
Program	B/U	B/U	B/U	B/U	B/U	B/U	GWPP	B/U	B/U
Sample Type									
Field Measurements									
Time Sampled	13:55	9:55	14:15	10:15	10:05	10:35	14:00	8:50	9:36
Measuring Point Elev. (ft)	.	.	.	.	.	.	.	.	.
Depth to Water (ft)	.	.	.	.	.	.	.	.	.
Groundwater Elevation (ft)	.	.	.	.	.	.	.	.	.
Conductivity (µmho/cm)	228	612	228	.	.	.	817	.	.
Dissolved Oxygen (ppm)	11.98	4.18	10.97	.	.	.	1.68	.	.
Oxidation/Reduction (mV)	92.5	26.9	90	.	.	.	188	.	.
Temperature (degrees C)	12.03	21.89	11.49	.	.	.	17.3	.	.
Turbidity (NTU)	2	15	4	.	.	.	.	.	.
pH	6.95	7.65	7.18	.	.	.	6.94	.	.
Miscellaneous Analytes									
Dissolved Solids (mg/L)	230	370	170	.	.	.	455	.	.
Suspended Solids (mg/L)	<	7	4.8	.	.	.	4	.	.
Major Ions (mg/L)									
Calcium	59	94	48	.	.	.	115	.	.
Magnesium	10	14	4.6	.	.	.	25.4	.	.
Potassium	1.3	2.8	0.91	.	.	.	3.22	.	.
Sodium	5.7	8.5	3.5	.	.	.	27.4	.	.
Bicarbonate	160	220	130	.	.	.	273	.	.
Carbonate	<	<	<	.	.	.	<	.	.
Chloride	26	62	9.6	.	.	.	49.5	.	.
Fluoride	<	<	<	.	.	.	0.262	.	.
Nitrate as N	0.12	<	5.2	.	.	.	15.7	.	.
Sulfate	18	8	10	.	.	.	25.2	.	.
Charge balance error (%)	-3.2	-0.2	-7.8	.	.	.	3.4	.	.
Trace Metals (mg/L)									
Aluminum	<	<	<	.	.	.	<	.	.
Arsenic	<	<	<	.	.	.	<	.	.
Barium	0.05	0.095	0.071	.	.	.	0.17	.	.
Beryllium	<	<	<	.	.	.	<	.	.
Boron	0.33	0.34	0.41	.	.	.	0.145	.	.
Cadmium	<	<	<	.	.	.	<	.	.
Chromium	<	<	<	.	.	.	<	.	.
Cobalt	<	<	<	.	.	.	<	.	.
Iron	<	1.3	0.17	.	.	.	0.103	.	.
Lead	<	<	<	.	.	.	<	.	.
Lithium	0.057	0.048	0.072	.	.	.	0.016	.	.
Manganese	0.12	1.6	0.1	.	.	.	0.00783	.	.
Mercury	.	.	.	<	<	<	<	<	<
Molybdenum	.	.	.	.	.	.	<	.	.
Nickel	<	0.011	<	.	.	.	<	.	.
Strontium	0.12	0.19	0.1	.	.	.	0.282	.	.
Uranium	0.02	0.012	0.25	.	.	.	0.0732	.	.
Zinc	<	<	<	.	.	.	<	.	.

APPENDIX D.1: CY 2011 MONITORING DATA FOR THE BEAR CREEK HYDROGEOLOGIC REGIME
Field Measurements, Miscellaneous Analytes, Major Ions, and Trace Metals

Sampling Point	SS-5					SS-6	
Functional Area	EXP-SW					EXP-SW	
Date Sampled	02/22/11	07/25/11	08/02/11	10/18/11	12/13/11	01/12/11	07/07/11
Program	B/U	GWPP	B/U	B/U	B/U	B/U	B/U
Sample Type							
Field Measurements							
Time Sampled	10:25	13:20	9:05	10:20	9:52	13:45	11:00
Measuring Point Elev. (ft)	.	.	.	.	.	.	.
Depth to Water (ft)	.	.	.	.	.	.	.
Groundwater Elevation (ft)	.	.	.	.	.	.	.
Conductivity (µmho/cm)	.	547	.	477	.	221	408
Dissolved Oxygen (ppm)	.	3.07	.	3.76	.	9.45	6.46
Oxidation/Reduction (mV)	.	238	.	77	.	20.3	93.7
Temperature (degrees C)	.	18.5	.	15.42	.	10.35	17.78
Turbidity (NTU)	.	.	.	5	.	7	11
pH	.	6.9	.	7.7	.	8.02	6.9
Miscellaneous Analytes							
Dissolved Solids (mg/L)	.	290	.	.	.	.	.
Suspended Solids (mg/L)	.	2	.	.	.	.	.
Major Ions (mg/L)							
Calcium	.	72.8	.	.	.	41	55
Magnesium	.	17.8	.	.	.	16	19
Potassium	.	2.29	.	.	.	<	<
Sodium	.	12.6	.	.	.	3.1	6
Bicarbonate	.	211	.	210	.	.	.
Carbonate	.	<	.	<	.	.	.
Chloride	.	23.4	.	23	.	.	.
Fluoride	.	0.183	.	<	.	.	.
Nitrate as N	.	4.07	.	7.6	.	0.37	1
Sulfate	.	23.1	.	28	.	.	.
Charge balance error (%)	.	0.4	.	.	.	.	.
Trace Metals (mg/L)							
Aluminum	.	<	.	.	.	<	<
Arsenic	.	<	.	.	.	<	<
Barium	.	0.0903	.	.	.	0.06	0.078
Beryllium	.	<	.	.	.	<	<
Boron	.	<	.	.	.	<	<
Cadmium	.	<	.	.	.	<	<
Chromium	.	<	.	.	.	<	<
Cobalt	.	<	.	.	.	<	<
Iron	.	0.0712	.	.	.	<	0.21
Lead	.	<	.	.	.	<	<
Lithium	.	<	.	.	.	<	<
Manganese	.	0.00733	.	.	.	<	0.031
Mercury	<	<	<	.	<	.	.
Molybdenum	.	<	.	.	.	.	.
Nickel	.	<	.	.	.	<	<
Strontium	.	0.142	.	.	.	0.047	0.078
Uranium	.	0.0327	.	.	.	<	0.0084
Zinc	.	<	.	.	.	<	<

APPENDIX D.2

VOLATILE ORGANIC COMPOUNDS

APPENDIX D.2: CY 2011 MONITORING DATA FOR THE BEAR CREEK HYDROGEOLOGIC REGIME
Volatile Organic Compounds

Sampling Point	GW-008		GW-014	GW-046		GW-053	GW-058	GW-068	GW-071	
Functional Area	OLF		BG	BG		BG	BG	BG	BG	
Date Sampled	01/04/11	07/07/11	01/25/11	01/05/11	07/14/11	02/09/11	01/26/11	02/09/11	01/19/11	08/22/11
Program	B/U	B/U	GWPP	B/U	B/U	GWPP	GWPP	GWPP	GWPP	GWPP
Sample Type						PDB		PDB	NP	NP
Chloroethenes (µg/L)										
Tetrachloroethene	47	44	18	650	1,000	<	<	<	300	270
Trichloroethene	13	8.7	150	980	560	<	<	87	49	32
cis-1,2-Dichloroethene	26	22	820	4,300	1,200	7	<	2,000	23	21
trans-1,2-Dichloroethene	<	<	3 J	24	<	<	<	3 J	<	<
1,1-Dichloroethene	7.8	6.3	45	60	54	<	<	250	65	55
Vinyl chloride	<	<	180	460	270	<	<	460	<	<
Chloroethanes (µg/L)										
1,1,1-Trichloroethane	<	<	<	28	22	<	<	<	190	84
1,2-Dichloroethane	<	<	<	<	<	<	<	<	<	<
1,1-Dichloroethane	14	14	190	150	210	3 J	<	970	2,100	1,600
Chloroethane	<	<	7	<	<	<	<	<	17	19
Chloromethanes (µg/L)										
Carbon tetrachloride	<	<	<	<	<	<	<	<	<	<
Chloroform	<	<	<	<	<	<	<	<	<	<
Methylene chloride	<	<	<	<	<	<	<	3 J	<	<
Petrol. Hydrocarb. (µg/L)										
Benzene	1.3	1.2	<	38	100	<	<	140	830	760
Ethylbenzene	<	<	<	<	<	<	<	<	2 J	2 J
Toluene	<	<	<	<	<	<	<	7	19	19
Total Xylene	<	<	<	<	<	<	<	<	6	7
Miscellaneous (µg/L)										
1,1,2-Trichloro-1,2,2-trifluoroethane	.	.	<	.	.	<	<	<	130	98
1,2-Dichloropropane	1.3	1.4	<	<	<	<	<	<	<	<
2-Butanone	<	<	<	<	<	<	<	<	<	<
Acetone	<	<	<	<	<	.	<	.	13	<
Acetonitrile	.	.	<	.	.	.	<	.	<	<
Acrylonitrile	.	.	<	.	.	.	<	.	<	<
Chlorobenzene	<	<	<	<	<	<	<	<	<	<
Styrene	<	<	<	<	<	.	<	.	<	<

APPENDIX D.2: CY 2011 MONITORING DATA FOR THE BEAR CREEK HYDROGEOLOGIC REGIME
Volatile Organic Compounds

Sampling Point	GW-077		GW-078		GW-079		GW-080			
Functional Area	BG		BG		BG		BG			
Date Sampled	02/22/11	08/03/11	02/22/11	08/03/11	02/22/11	08/03/11	02/22/11		08/03/11	
Program	B/U	B/U	B/U	B/U	B/U	B/U	B/U	B/U	B/U	B/U
Sample Type								Dup		Dup
Chloroethenes (µg/L)										
Tetrachloroethene	<	<	<	<	<	<	<	<	<	<
Trichloroethene	<	<	<	<	<	<	<	<	<	<
cis-1,2-Dichloroethene	<	<	<	<	<	<	<	<	<	<
trans-1,2-Dichloroethene	<	<	<	<	<	<	<	<	<	<
1,1-Dichloroethene	<	<	<	<	<	<	<	<	<	<
Vinyl chloride	<	<	<	<	<	<	<	<	<	<
Chloroethanes (µg/L)										
1,1,1-Trichloroethane	<	<	<	<	<	<	<	<	<	<
1,2-Dichloroethane	<	<	<	<	<	<	<	<	<	<
1,1-Dichloroethane	<	<	<	<	<	<	<	<	<	<
Chloroethane	<	<	<	<	<	<	<	<	<	<
Chloromethanes (µg/L)										
Carbon tetrachloride	<	<	<	<	<	<	<	<	<	<
Chloroform	<	<	<	<	<	<	<	<	<	<
Methylene chloride	<	<	<	<	<	<	<	<	<	<
Petrol. Hydrocarb. (µg/L)										
Benzene	<	<	<	<	<	<	<	<	<	<
Ethylbenzene	<	<	<	<	<	<	<	<	<	<
Toluene	<	<	<	<	<	<	<	<	<	<
Total Xylene	<	<	<	<	<	<	<	<	<	<
Miscellaneous (µg/L)										
1,1,2-Trichloro-1,2,2-trifluoroethane	.	.	.	.	.	.	.	.	.	.
1,2-Dichloropropane	<	<	<	<	<	<	<	<	<	<
2-Butanone	<	<	<	<	<	<	<	<	<	<
Acetone	<	<	<	<	<	<	<	<	<	<
Acetonitrile	.	.	.	.	.	.	.	.	.	.
Acrylonitrile	.	.	.	.	.	.	.	.	.	.
Chlorobenzene	<	<	<	<	<	<	<	<	<	<
Styrene	<	<	<	<	<	<	<	<	<	<

APPENDIX D.2: CY 2011 MONITORING DATA FOR THE BEAR CREEK HYDROGEOLOGIC REGIME
Volatile Organic Compounds

Sampling Point	GW-082	GW-085		GW-098	GW-100	GW-101	GW-122	GW-127	GW-134-05
Functional Area	BG	OLF		OLF	S3	S3	S3	S3	S3
Date Sampled	08/23/11	02/07/11		02/07/11	02/01/11	02/01/11	08/08/11	08/08/11	06/02/11
Program	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP
Sample Type			Dup						
Chloroethenes (µg/L)									
Tetrachloroethene	<	<	<	<	<	<	<	<	<
Trichloroethene	2 J	<	<	6	<	<	<	<	<
cis-1,2-Dichloroethene	430	<	<	2 J	<	<	<	<	<
trans-1,2-Dichloroethene	<	<	<	<	<	<	<	<	<
1,1-Dichloroethene	6	<	<	<	<	<	<	<	<
Vinyl chloride	140	<	<	<	<	<	<	<	<
Chloroethanes (µg/L)									
1,1,1-Trichloroethane	<	<	<	<	<	<	<	<	<
1,2-Dichloroethane	<	<	<	<	<	<	<	<	<
1,1-Dichloroethane	120	<	<	<	<	<	<	<	<
Chloroethane	<	<	<	<	<	<	<	<	<
Chloromethanes (µg/L)									
Carbon tetrachloride	<	<	<	<	<	<	<	<	<
Chloroform	<	<	<	<	<	<	<	<	<
Methylene chloride	<	<	<	<	<	<	<	<	<
Petrol. Hydrocarb. (µg/L)									
Benzene	6	<	<	<	<	<	<	<	<
Ethylbenzene	<	<	<	<	<	<	<	<	<
Toluene	<	<	<	<	<	<	<	<	<
Total Xylene	<	<	<	<	<	<	<	<	<
Miscellaneous (µg/L)									
1,1,2-Trichloro-1,2,2-trifluoroethane	<	<	<	<	<	<	<	<	<
1,2-Dichloropropane	<	<	<	<	<	<	<	<	<
2-Butanone	<	<	<	<	<	<	<	<	<
Acetone	<	<	<	<	<	<	<	<	<
Acetonitrile	<	<	<	<	<	<	<	<	<
Acrylonitrile	<	<	<	<	<	<	<	<	<
Chlorobenzene	<	<	<	<	<	<	<	<	<
Styrene	<	<	<	<	<	<	<	<	<

APPENDIX D.2: CY 2011 MONITORING DATA FOR THE BEAR CREEK HYDROGEOLOGIC REGIME
Volatile Organic Compounds

Sampling Point	GW-134-11	GW-134-15	GW-134-18	GW-134-21	GW-134-33	GW-134-35	GW-134-36	
Functional Area	S3	S3	S3	S3	S3	S3	S3	
Date Sampled	06/07/11	06/07/11	06/08/11	06/02/11	05/26/11	06/02/11	05/25/11	
Program	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP
Sample Type								Dup
Chloroethenes (µg/L)								
Tetrachloroethene	<	<	<	<	7	14	<	<
Trichloroethene	<	<	<	<	3 J	7	<	<
cis-1,2-Dichloroethene	<	<	<	<	<	4 J	<	<
trans-1,2-Dichloroethene	<	<	<	<	<	<	<	<
1,1-Dichloroethene	<	<	<	<	<	<	<	<
Vinyl chloride	<	<	<	<	<	<	<	<
Chloroethanes (µg/L)								
1,1,1-Trichloroethane	<	<	<	<	<	<	<	<
1,2-Dichloroethane	<	<	<	<	<	<	<	<
1,1-Dichloroethane	<	<	<	<	<	<	<	<
Chloroethane	<	<	<	<	<	<	<	<
Chloromethanes (µg/L)								
Carbon tetrachloride	<	<	<	<	<	<	<	<
Chloroform	<	<	<	<	<	<	<	<
Methylene chloride	<	<	<	<	<	<	<	<
Petrol. Hydrocarb. (µg/L)								
Benzene	<	<	<	<	<	<	<	<
Ethylbenzene	<	<	<	<	<	<	<	<
Toluene	<	<	<	<	<	<	<	<
Total Xylene	<	<	<	<	<	<	<	<
Miscellaneous (µg/L)								
1,1,2-Trichloro-1,2,2-trifluoroethane	<	<	<	<	<	<	<	<
1,2-Dichloropropane	<	<	<	<	<	<	<	<
2-Butanone	<	<	<	<	<	<	<	<
Acetone	<	<	<	<	<	<	<	<
Acetonitrile	<	<	<	<	<	<	<	<
Acrylonitrile	<	<	<	<	<	<	<	<
Chlorobenzene	<	<	<	<	<	<	<	<
Styrene	<	<	<	<	<	<	<	<

APPENDIX D.2: CY 2011 MONITORING DATA FOR THE BEAR CREEK HYDROGEOLOGIC REGIME
Volatile Organic Compounds

Sampling Point	GW-225	GW-229		GW-236	GW-242	GW-246		GW-276		GW-289
Functional Area	OLF	OLF		S3	BG	S3		S3		BG
Date Sampled	02/10/11	02/08/11		08/04/11	08/24/11	08/08/11		01/11/11	07/11/11	08/23/11
Program	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP	B/U	B/U	GWPP
Sample Type			Dup		PDB		Dup			
Chloroethenes (µg/L)										
Tetrachloroethene	<	<	<	<	<	110	120	4.4	6.2	670
Trichloroethene	290	3 J	3 J	<	<	2 J	2 J	<	<	22
cis-1,2-Dichloroethene	3 J	210	210	<	42	<	<	<	<	10
trans-1,2-Dichloroethene	<	<	<	<	<	<	<	<	<	<
1,1-Dichloroethene	3 J	26	27	<	<	3 J	3 J	<	<	<
Vinyl chloride	<	62	65	<	18	<	<	<	<	<
Chloroethanes (µg/L)										
1,1,1-Trichloroethane	<	<	<	<	<	<	<	<	<	<
1,2-Dichloroethane	<	<	<	<	<	<	<	<	<	<
1,1-Dichloroethane	<	8	8	<	3 J	<	<	<	<	<
Chloroethane	<	<	<	<	<	<	<	<	<	<
Chloromethanes (µg/L)										
Carbon tetrachloride	4 J	<	<	<	<	<	<	<	<	<
Chloroform	<	<	<	<	<	30	34	<	<	<
Methylene chloride	<	<	<	<	<	14	14	<	<	<
Petrol. Hydrocarb. (µg/L)										
Benzene	<	9	10	<	<	<	<	<	<	<
Ethylbenzene	<	<	<	<	<	<	<	<	<	<
Toluene	<	<	<	<	<	<	<	<	<	<
Total Xylene	<	<	<	<	<	<	<	<	<	<
Miscellaneous (µg/L)										
1,1,2-Trichloro-1,2,2-trifluoroethane	<	17	16	<	8	45	52	.	.	<
1,2-Dichloropropane	<	<	<	<	<	<	<	<	<	<
2-Butanone	<	<	<	<	<	<	<	<	<	<
Acetone	<	<	<	<	.	5 J	6 J	<	<	<
Acetonitrile	<	<	<	<	.	11	10	.	.	<
Acrylonitrile	<	<	<	<	.	<	<	.	.	<
Chlorobenzene	<	11	12	<	<	<	<	<	<	<
Styrene	<	<	<	<	.	<	<	<	<	<

APPENDIX D.2: CY 2011 MONITORING DATA FOR THE BEAR CREEK HYDROGEOLOGIC REGIME
Volatile Organic Compounds

Sampling Point	GW-307	GW-315	GW-365	GW-601	GW-615	GW-616	GW-623	GW-627		GW-653
Functional Area	RS	SPI	OLF	OLF	S3	S3	BG	BG		BG
Date Sampled	02/09/11	02/14/11	02/08/11	02/09/11	02/02/11	08/09/11	01/24/11	01/19/11	08/22/11	01/18/11
Program	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP
Sample Type	PDB						NP			
Chloroethenes (µg/L)										
Tetrachloroethene	<	5	<	5 J	<	<	690	670	780	10
Trichloroethene	11	2 J	3 J	69	<	<	2600	250	290	12
cis-1,2-Dichloroethene	3 J	<	34	<	<	<	190	43	50	75
trans-1,2-Dichloroethene	<	<	<	<	<	<	7	5 J	5	<
1,1-Dichloroethene	<	<	11	<	<	<	80	42	46	3 J
Vinyl chloride	<	<	4	<	<	<	58	59	64	<
Chloroethanes (µg/L)										
1,1,1-Trichloroethane	<	<	<	<	<	<	<	<	<	<
1,2-Dichloroethane	<	<	<	<	<	<	<	<	<	<
1,1-Dichloroethane	<	<	5 J	<	<	<	1100	120	120	5
Chloroethane	<	<	<	<	<	<	<	<	<	<
Chloromethanes (µg/L)										
Carbon tetrachloride	<	<	<	<	<	<	<	<	<	<
Chloroform	<	<	<	<	<	<	<	<	<	<
Methylene chloride	<	<	<	<	4 J	<	12	<	<	<
Petrol. Hydrocarb. (µg/L)										
Benzene	<	<	<	<	<	<	2 J	<	<	<
Ethylbenzene	<	<	<	<	<	<	<	<	<	<
Toluene	<	<	<	<	<	<	<	<	<	<
Total Xylene	<	<	<	<	<	<	<	<	<	<
Miscellaneous (µg/L)										
1,1,2-Trichloro-1,2,2-trifluoroethane	<	<	<	<	<	<	<	<	<	<
1,2-Dichloropropane	<	<	<	<	<	<	<	<	<	<
2-Butanone	<	<	<	<	<	<	<	<	<	<
Acetone	.	<	<	<	<	<	<	<	<	<
Acetonitrile	.	<	<	<	41	<	<	<	<	<
Acrylonitrile	.	<	<	<	<	<	<	<	<	<
Chlorobenzene	<	<	<	<	<	<	<	<	<	<
Styrene	.	<	<	<	<	<	<	<	<	<

APPENDIX D.2: CY 2011 MONITORING DATA FOR THE BEAR CREEK HYDROGEOLOGIC REGIME
Volatile Organic Compounds

Sampling Point	GW-683		GW-684		GW-703	GW-704		GW-706	
Functional Area	EXP-A		EXP-A		EXP-B	EXP-B		EXP-B	
Date Sampled	02/23/11	08/03/11	02/23/11	08/03/11	02/14/11	02/23/11	08/04/11	02/17/11	08/04/11
Program	B/U	B/U	B/U	B/U	GWPP	B/U	B/U	B/U	B/U
Sample Type									
Chloroethenes (µg/L)									
Tetrachloroethene	<	<	<	<	<	<	<	<	0.43 J
Trichloroethene	<	<	<	<	11	26	21	13	7.6
cis-1,2-Dichloroethene	<	<	<	0.43 J	9	4.6	4.3	29	15
trans-1,2-Dichloroethene	<	<	<	<	<	<	<	<	<
1,1-Dichloroethene	<	<	<	<	<	2.1	1.7	4.6	2.3
Vinyl chloride	<	<	<	<	<	<	<	<	<
Chloroethanes (µg/L)									
1,1,1-Trichloroethane	<	<	<	<	<	<	<	1	0.64 J
1,2-Dichloroethane	<	<	<	<	<	<	<	<	<
1,1-Dichloroethane	<	<	<	<	<	<	0.46 J	<	0.38 J
Chloroethane	<	<	<	<	<	<	<	<	<
Chloromethanes (µg/L)									
Carbon tetrachloride	<	<	<	<	<	<	<	<	<
Chloroform	<	<	<	<	<	<	<	<	<
Methylene chloride	<	<	<	<	<	<	<	<	<
Petrol. Hydrocarb. (µg/L)									
Benzene	<	<	<	<	<	<	<	<	<
Ethylbenzene	<	<	<	<	<	<	<	<	<
Toluene	<	<	<	<	<	<	<	<	<
Total Xylene	<	<	<	<	<	<	<	<	<
Miscellaneous (µg/L)									
1,1,2-Trichloro-1,2,2-trifluoroethane	.	.	.	.	<	.	.	.	.
1,2-Dichloropropane	<	<	<	<	<	<	<	<	<
2-Butanone	<	<	<	<	<	<	<	<	<
Acetone	<	<	<	<	<	<	<	<	<
Acetonitrile	.	.	.	.	<	.	.	.	.
Acrylonitrile	.	.	.	.	<	.	.	.	.
Chlorobenzene	<	<	<	<	<	<	<	<	<
Styrene	<	<	<	<	<	<	<	<	<

APPENDIX D.2: CY 2011 MONITORING DATA FOR THE BEAR CREEK HYDROGEOLOGIC REGIME
Volatile Organic Compounds

Sampling Point	GW-712		GW-713				GW-714		GW-724	GW-725
Functional Area	EXP-W		EXP-W				EXP-W		EXP-C	EXP-C
Date Sampled	01/05/11	07/07/11	01/13/11		07/07/11		01/05/11	07/06/11	02/16/11	02/17/11
Program	B/U	B/U	B/U	B/U	B/U	B/U	B/U	B/U	GWPP	GWPP
Sample Type				Dup		Dup				
Chloroethenes (µg/L)										
Tetrachloroethene	<	<	<	<	<	<	<	<	3 J	<
Trichloroethene	<	<	<	<	<	<	<	<	73	8
cis-1,2-Dichloroethene	<	<	<	<	<	<	<	<	<	<
trans-1,2-Dichloroethene	<	<	<	<	<	<	<	<	<	<
1,1-Dichloroethene	<	<	<	<	<	<	<	<	<	<
Vinyl chloride	<	<	<	<	<	<	<	<	<	<
Chloroethanes (µg/L)										
1,1,1-Trichloroethane	<	<	<	<	<	<	<	<	<	<
1,2-Dichloroethane	<	<	<	<	<	<	<	<	<	<
1,1-Dichloroethane	<	<	<	<	<	<	<	<	<	<
Chloroethane	<	<	<	<	<	<	<	<	<	<
Chloromethanes (µg/L)										
Carbon tetrachloride	<	<	<	<	<	<	<	<	<	<
Chloroform	<	<	<	<	<	<	<	<	<	<
Methylene chloride	<	<	<	<	<	<	<	<	<	<
Petrol. Hydrocarb. (µg/L)										
Benzene	<	<	<	<	<	<	<	<	<	<
Ethylbenzene	<	<	<	<	<	<	<	<	<	<
Toluene	<	<	<	<	<	<	<	<	<	<
Total Xylene	<	<	<	<	<	<	<	<	<	<
Miscellaneous (µg/L)										
1,1,2-Trichloro-1,2,2-trifluoroethane	.	.	.	.	.	.	.	.	.	<
1,2-Dichloropropane	<	<	<	<	<	<	<	<	<	<
2-Butanone	<	<	<	<	<	<	<	<	<	<
Acetone	<	<	<	<	<	<	<	<	<	<
Acetonitrile	.	.	.	.	.	.	.	.	.	<
Acrylonitrile	.	.	.	.	.	.	.	.	.	<
Chlorobenzene	<	<	<	<	<	<	<	<	<	<
Styrene	<	<	<	<	<	<	<	<	<	<

APPENDIX D.2: CY 2011 MONITORING DATA FOR THE BEAR CREEK HYDROGEOLOGIC REGIME
Volatile Organic Compounds

Sampling Point	GW-729-18	GW-729-22	GW-729-26	GW-729-30	GW-729-34	GW-729-39	GW-729-44
Functional Area	BG	BG	BG	BG	BG	BG	BG
Date Sampled	06/13/11	06/23/11	06/23/11	06/27/11	06/28/11	06/27/11	06/29/11
Program	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP
Sample Type							
Chloroethenes (µg/L)							
Tetrachloroethene	<	<	<	<	<	<	<
Trichloroethene	<	<	<	<	<	4 J	13
cis-1,2-Dichloroethene	<	<	<	<	<	<	<
trans-1,2-Dichloroethene	<	<	<	<	<	<	<
1,1-Dichloroethene	<	<	<	<	<	<	<
Vinyl chloride	<	<	<	<	<	<	<
Chloroethanes (µg/L)							
1,1,1-Trichloroethane	<	<	<	<	<	<	<
1,2-Dichloroethane	<	<	<	<	<	<	<
1,1-Dichloroethane	<	<	<	<	<	<	<
Chloroethane	<	<	<	<	<	<	<
Chloromethanes (µg/L)							
Carbon tetrachloride	<	<	<	<	<	<	<
Chloroform	<	<	<	<	<	<	<
Methylene chloride	<	<	<	<	<	<	<
Petrol. Hydrocarb. (µg/L)							
Benzene	4 J	3 J	<	<	22	<	<
Ethylbenzene	<	<	7	4 J	3 J	<	<
Toluene	<	<	<	<	<	<	<
Total Xylene	<	<	<	<	<	<	<
Miscellaneous (µg/L)							
1,1,2-Trichloro-1,2,2-trifluoroethane	<	<	<	<	<	<	<
1,2-Dichloropropane	<	<	<	<	<	<	<
2-Butanone	29	5	<	<	5	<	<
Acetone	140	54	5 J	13	61	13	<
Acetonitrile	<	<	<	<	<	<	<
Acrylonitrile	17	15	47	27	13	8	<
Chlorobenzene	<	<	<	<	<	<	<
Styrene	<	<	7	4 J	4 J	2 J	<

APPENDIX D.2: CY 2011 MONITORING DATA FOR THE BEAR CREEK HYDROGEOLOGIC REGIME
Volatile Organic Compounds

Sampling Point	GW-738	GW-740		BCK-04.55		BCK-09.40	BCK-11.97	NT-01
Functional Area	EXP-C	EXP-C		EXP-SW		EXP-SW	EXP-SW	EXP-SW
Date Sampled	02/16/11	02/16/11		07/26/11		07/26/11	07/25/11	07/26/11
Program	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP
Sample Type			Dup		Dup			
Chloroethenes (µg/L)								
Tetrachloroethene	<	<	<	<	<	<	<	48
Trichloroethene	14	40	42	<	<	<	<	<
cis-1,2-Dichloroethene	<	<	<	<	<	<	<	<
trans-1,2-Dichloroethene	<	<	<	<	<	<	<	<
1,1-Dichloroethene	<	<	<	<	<	<	<	<
Vinyl chloride	<	<	<	<	<	<	<	<
Chloroethanes (µg/L)								
1,1,1-Trichloroethane	<	<	<	<	<	<	<	<
1,2-Dichloroethane	<	<	<	<	<	<	<	<
1,1-Dichloroethane	<	<	<	<	<	<	<	<
Chloroethane	<	<	<	<	<	<	<	<
Chloromethanes (µg/L)								
Carbon tetrachloride	<	<	<	<	<	<	<	<
Chloroform	<	<	<	<	<	<	<	<
Methylene chloride	<	<	<	<	<	<	<	<
Petrol. Hydrocarb. (µg/L)								
Benzene	<	<	<	<	<	<	<	<
Ethylbenzene	<	<	<	<	<	<	<	<
Toluene	<	<	<	<	<	<	<	<
Total Xylene	<	<	<	<	<	<	<	<
Miscellaneous (µg/L)								
1,1,2-Trichloro-1,2,2-trifluoroethane	<	<	<	<	<	<	<	3 J
1,2-Dichloropropane	<	<	<	<	<	<	<	<
2-Butanone	<	<	<	<	<	<	<	<
Acetone	<	<	<	<	<	<	<	<
Acetonitrile	<	<	<	<	<	<	<	<
Acrylonitrile	<	<	<	<	<	<	<	<
Chlorobenzene	<	<	<	<	<	<	<	<
Styrene	<	<	<	<	<	<	<	<

APPENDIX D.2: CY 2011 MONITORING DATA FOR THE BEAR CREEK HYDROGEOLOGIC REGIME
Volatile Organic Compounds

Sampling Point	NT-07		NT-08	SS-4	SS-5	SS-6	
Functional Area	EXP-SW		EXP-SW	EXP-SW	EXP-SW	EXP-SW	
Date Sampled	02/15/11	08/15/11	02/15/11	07/26/11	07/25/11	01/12/11	07/07/11
Program	B/U	B/U	B/U	GWPP	GWPP	B/U	B/U
Sample Type							
Chloroethenes (µg/L)							
Tetrachloroethene	81	15	25	<	<	<	<
Trichloroethene	72	33	25	7	<	<	<
cis-1,2-Dichloroethene	230	300	96	17	<	<	<
trans-1,2-Dichloroethene	<	1	<	<	<	<	<
1,1-Dichloroethene	15	15	3.7	3 J	<	<	<
Vinyl chloride	24	32	2.3	<	<	<	<
Chloroethanes (µg/L)							
1,1,1-Trichloroethane	5.9	5.3	1.3	<	<	<	<
1,2-Dichloroethane	<	1.1	1	<	<	<	<
1,1-Dichloroethane	39	75	8.1	<	<	<	<
Chloroethane	<	<	<	<	<	<	<
Chloromethanes (µg/L)							
Carbon tetrachloride	<	<	<	<	<	<	<
Chloroform	4.6	3.5	1.5	<	<	<	<
Methylene chloride	<	<	<	<	<	<	<
Petrol. Hydrocarb. (µg/L)							
Benzene	<	3.3	<	<	<	<	<
Ethylbenzene	<	<	<	<	<	<	<
Toluene	<	<	<	<	<	<	<
Total Xylene	<	<	<	<	<	<	<
Miscellaneous (µg/L)							
1,1,2-Trichloro-1,2,2-trifluoroethane	.	.	.	3 J	<	.	.
1,2-Dichloropropane	<	<	<	<	<	<	<
2-Butanone	<	<	<	<	<	<	<
Acetone	<	<	<	<	<	<	<
Acetonitrile	.	.	.	<	<	.	.
Acrylonitrile	.	.	.	<	<	.	.
Chlorobenzene	<	<	<	<	<	<	<
Styrene	<	<	<	<	<	<	<

APPENDIX D.3

RADIOLOGICAL ANALYTES

APPENDIX D.3: CY 2011 MONITORING DATA FOR THE BEAR CREEK HYDROGEOLOGIC REGIME
Radiological Analytes: Gross Alpha and Gross Beta Activity

Sampling Point	Functional Area	Date Sampled	Program	Sample Type	Gross Alpha (pCi/L)			Gross Beta (pCi/L)		
					Activity	TPU	MDA	Activity	TPU	MDA
GW-008	OLF	01/04/11	B/U		<	.	3.48	<	.	4.03
		07/07/11	B/U		<	.	1.88	<	.	3.35
GW-014	BG	01/25/11	GWPP		<	.	4.4	<	.	7.7
GW-046	BG	01/05/11	B/U		<	.	3.01	<	.	3.79
		07/14/11	B/U		<	.	1.66	5.36	1.68	2.65
GW-058	BG	01/26/11	GWPP		20	5.5	5.1	32	5.6	6.8
GW-085	OLF	02/07/11	GWPP		<	.	5.1	13	4.4	7.1
			GWPP	Dup	<	.	4.6	14	4.7	8.1
GW-098	OLF	02/07/11	GWPP		<	.	4.1	<	.	7.8
GW-100	S3	02/01/11	GWPP		<	.	4.5	<	.	7.2
GW-101	S3	02/01/11	GWPP		<	.	5.6	<	.	8.1
GW-122	S3	08/08/11	GWPP		3.8 R	7.8	1.9	19	4.4	3.9
GW-127	S3	08/08/11	GWPP		8.7	4.5	1.2	5.5	2.4	2.5
GW-134-05	S3	06/02/11	GWPP		<	.	98	<	.	81
GW-134-11	S3	06/07/11	GWPP		<	.	22	<	.	20
GW-134-15	S3	06/07/11	GWPP		<	.	15	<	.	20
GW-134-18	S3	06/08/11	GWPP		<	.	18	<	.	19
GW-134-21	S3	06/02/11	GWPP		<	.	53	<	.	85
GW-134-33	S3	05/26/11	GWPP		<	.	5	64	7.7	8.4
GW-134-35	S3	06/02/11	GWPP		<	.	5	82	7.9	7.1
GW-134-36	S3	05/25/11	GWPP		4.2	3.4	2	36	5.9	7.4
			GWPP	Dup	<	.	4.5	37	6.3	8.8
GW-225	OLF	02/10/11	GWPP		<	.	4.6	24	5.9	9.1
GW-229	OLF	02/08/11	GWPP		36	8.3	8.5	53	7.3	8.4
			GWPP	Dup	26	7.5	8	51	7.3	8.7
GW-236	S3	08/04/11	GWPP		<	.	4.6	20	5.2	7.9
GW-246	S3	08/08/11	GWPP		98	80	29	14,000	120	42
			GWPP	Dup	220	71	25	15,000	120	48
GW-276	S3	01/11/11	B/U		131	22	2.5	196	31.8	5.03
		07/11/11	B/U		125	20.7	2.03	209	33.7	4.22
GW-289	BG	08/23/11	GWPP		<	.	3.9	17	4.4	6
GW-315	SPI	02/14/11	GWPP		<	.	4.4	12	5	8.4
GW-365	OLF	02/08/11	GWPP		<	.	6.3	<	.	7.9
GW-526	S3	01/27/11	GWPP		<	.	66	<	.	75
GW-537	OLF	08/24/11	GWPP		<	.	7.4	140	7.5	5.9
GW-615	S3	02/02/11	GWPP		440	250	310	520	220	360
GW-616	S3	08/09/11	GWPP		<	.	13	29	21	20
GW-653	BG	01/18/11	GWPP		<	.	3.2	<	.	7.7
GW-683	EXP-A	02/23/11	B/U		5.16	2.26	2.47	7.54	2.55	3.9
		08/03/11	B/U		<	.	2.32	3.92	2	3.72
GW-684	EXP-A	02/23/11	B/U		3.9	2.03	2.61	14.1	3.47	4.01
		08/03/11	B/U		6.27	2.49	2.65	15.4	3.67	3.99
GW-703	EXP-B	02/14/11	GWPP		18	5.1	3.1	50	7	7.8
GW-704	EXP-B	02/23/11	B/U		3.11	1.61	2.36	10.4	2.58	3.19
		08/04/11	B/U		<	.	2.72	20.3	4.37	3.94
GW-706	EXP-B	02/17/11	B/U		20.6	4.46	2.51	35.2	6.47	4.33
		08/04/11	B/U		<	.	3.27	<	.	4.48

APPENDIX D.3: CY 2011 MONITORING DATA FOR THE BEAR CREEK HYDROGEOLOGIC REGIME
Radiological Analytes: Gross Alpha and Gross Beta Activity

Sampling Point	Functional Area	Date Sampled	Program	Sample Type	Gross Alpha (pCi/L)			Gross Beta (pCi/L)		
					Activity	TPU	MDA	Activity	TPU	MDA
GW-712	EXP-W	01/05/11	B/U		<	.	2.93	<	.	4.06
		07/07/11	B/U		1.94	1.21	1.89	<	.	3.58
GW-713	EXP-W	01/13/11	B/U		<	.	2.37	4.36	2.05	3.74
			B/U	Dup	<	.	2.61	3.91	2	3.73
		07/07/11	B/U		<	.	2.68	<	.	4.81
			B/U	Dup	<	.	2.67	<	.	4.92
GW-714	EXP-W	01/05/11	B/U		<	.	3.04	4.69	2.11	3.75
		07/06/11	B/U		<	.	2.79	<	.	4.66
GW-725	EXP-C	02/17/11	GWPP		10	4.4	3.4	16	5.1	8.3
GW-729-18	BG	06/13/11	GWPP		<	.	170	<	.	240
GW-729-22	BG	06/23/11	GWPP		<	.	120	<	.	180
GW-729-26	BG	06/23/11	GWPP		170 R	340	110	<	.	200
GW-729-30	BG	06/27/11	GWPP		21 R	84	18	83	42	31
GW-729-34	BG	06/28/11	GWPP		<	.	9.1	<	.	10
GW-729-39	BG	06/27/11	GWPP		<	.	2.8	<	.	5.5
GW-729-44	BG	06/29/11	GWPP		<	.	3.1	<	.	5.8
GW-738	EXP-C	02/16/11	GWPP		<	.	5.6	30	5.8	8
BCK-04.55	EXP-SW	07/26/11	GWPP		4.5	3.5	3.8	<	.	12
			GWPP	Dup	<	.	6.4	<	.	11
BCK-09.40	EXP-SW	07/26/11	GWPP		20	5.3	5	19	5.5	8.5
BCK-11.97	EXP-SW	07/25/11	GWPP		97	9.8	5.4	160	11	9
NT-01	EXP-SW	07/26/11	GWPP		<	.	16	1,000	38	18
SS-4	EXP-SW	07/26/11	GWPP		42	6.5	4	55	7.7	10
SS-5	EXP-SW	07/25/11	GWPP		23	5.2	5.1	14	5	8
SS-6	EXP-SW	01/12/11	B/U		<	.	3.06	4.01	2.1	3.92
		07/07/11	B/U		4.57	1.54	1.55	5.91	2.05	3.4

APPENDIX D.3: CY 2011 MONITORING DATA FOR THE BEAR CREEK HYDROGEOLOGIC REGIME
Radiological Analytes: Isotopic Analyses

Sampling Point	GW-046						GW-100			GW-101		
Functional Area	BG						S3			S3		
Date Sampled	01/05/11			07/14/11			02/01/11			02/01/11		
Program	B/U			B/U			GWPP			GWPP		
Sample Type												
Result (pCi/L)	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA
Gross Alpha	<	.	3.01	<	.	1.66	<	.	4.5	<	.	5.6
Gross Beta	<	.	3.79	5.36	1.68	2.65	<	.	7.2	<	.	8.1
Americium-241	.	.	.	.	.	.	.	.	.	.	.	.
Neptunium-237	.	.	.	.	.	.	.	.	.	.	.	.
Total Radium Alpha	.	.	.	.	.	.	.	.	.	.	.	.
Strontium-89/90	.	.	.	.	.	.	.	.	.	.	.	.
Technetium-99	<	.	6.31	<	.	11.1	<	.	16	<	.	17
Uranium-234	<	.	0.375	<	.	0.405	.	.	.	.	.	.
Uranium-235	<	.	0.339	<	.	0.329	.	.	.	.	.	.
Uranium-238	<	.	0.391	<	.	0.35	.	.	.	.	.	.

Sampling Point	GW-122			GW-127			GW-134-05			GW-134-11		
Functional Area	S3			S3			S3			S3		
Date Sampled	08/08/11			08/08/11			06/02/11			06/07/11		
Program	GWPP			GWPP			GWPP			GWPP		
Sample Type												
Result (pCi/L)	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA
Gross Alpha	<	.	1.9	8.7	4.5	1.2	<	.	98	<	.	22
Gross Beta	19	4.4	3.9	5.5	2.4	2.5	<	.	81	<	.	20
Americium-241	.	.	.	.	.	.	.	.	.	.	.	.
Neptunium-237	.	.	.	.	.	.	.	.	.	.	.	.
Total Radium Alpha	.	.	.	.	.	.	.	.	.	.	.	.
Strontium-89/90	.	.	.	.	.	.	.	.	.	.	.	.
Technetium-99	<	.	15	<	.	14	<	.	19	<	.	22
Uranium-234	.	.	.	.	.	.	.	.	.	.	.	.
Uranium-235	.	.	.	.	.	.	.	.	.	.	.	.
Uranium-238	.	.	.	.	.	.	.	.	.	.	.	.

Sampling Point	GW-134-15			GW-134-18			GW-134-21			GW-134-33		
Functional Area	S3			S3			S3			S3		
Date Sampled	06/07/11			06/08/11			06/02/11			05/26/11		
Program	GWPP			GWPP			GWPP			GWPP		
Sample Type												
Result (pCi/L)	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA
Gross Alpha	<	.	15	<	.	18	<	.	53	<	.	5
Gross Beta	<	.	20	<	.	19	<	.	85	64	7.7	8.4
Americium-241	.	.	.	.	.	.	.	.	.	.	.	.
Neptunium-237	.	.	.	.	.	.	.	.	.	.	.	.
Total Radium Alpha	.	.	.	.	.	.	.	.	.	.	.	.
Strontium-89/90	.	.	.	.	.	.	.	.	.	.	.	.
Technetium-99	<	.	19	<	.	20	<	.	19	110	11	14
Uranium-234	.	.	.	.	.	.	.	.	.	.	.	.
Uranium-235	.	.	.	.	.	.	.	.	.	.	.	.
Uranium-238	.	.	.	.	.	.	.	.	.	.	.	.

APPENDIX D.3: CY 2011 MONITORING DATA FOR THE BEAR CREEK HYDROGEOLOGIC REGIME
Radiological Analytes: Isotopic Analyses

Sampling Point	GW-134-35			GW-134-36						GW-225		
Functional Area	S3			S3						OLF		
Date Sampled	06/02/11			05/25/11						02/10/11		
Program	GWPP			GWPP						GWPP		
Sample Type				Dup								
Result (pCi/L)	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA
Gross Alpha	<	.	5	4.2	3.4	2	<	.	4.5	<	.	4.6
Gross Beta	82	7.9	7.1	36	5.9	7.4	37	6.3	8.8	24	5.9	9.1
Americium-241	.	.	.	.	.	.	.	.	.	.	.	.
Neptunium-237	.	.	.	.	.	.	.	.	.	.	.	.
Total Radium Alpha	.	.	.	.	.	.	.	.	.	.	.	.
Strontium-89/90	.	.	.	.	.	.	.	.	.	.	.	.
Technetium-99	180	15	20	82	9.9	14	89	10	14	58	9.2	13
Uranium-234	.	.	.	.	.	.	.	.	.	.	.	.
Uranium-235	.	.	.	.	.	.	.	.	.	.	.	.
Uranium-238	.	.	.	.	.	.	.	.	.	.	.	.

Sampling Point	GW-229						GW-236			GW-276		
Functional Area	OLF						S3			S3		
Date Sampled	02/08/11						08/04/11			01/11/11		
Program	GWPP						GWPP			B/U		
Sample Type	Dup											
Result (pCi/L)	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA
Gross Alpha	36	8.3	8.5	26	7.5	8	<	.	4.6	131	22	2.5
Gross Beta	53	7.3	8.4	51	7.3	8.7	20	5.2	7.9	196	31.8	5.03
Americium-241	.	.	.	.	.	.	.	.	.	<	.	0.0621
Neptunium-237	.	.	.	.	.	.	.	.	.	16.6	6.66	0.313
Total Radium Alpha	.	.	.	.	.	.	.	.	.	0.233	0.135	0.172
Strontium-89/90	.	.	.	.	.	.	.	.	.	3.41	1.34	2
Technetium-99	<	.	14	14	8.2	13	23	9.3	15	128	21.8	6.78
Uranium-234	.	.	.	.	.	.	.	.	.	65.5	11.2	0.208
Uranium-235	.	.	.	.	.	.	.	.	.	6.31	1.35	0.261
Uranium-238	.	.	.	.	.	.	.	.	.	136	22.9	0.184

Sampling Point	GW-276			GW-315			GW-526			GW-537		
Functional Area	S3			SPI			S3			OLF		
Date Sampled	07/11/11			02/14/11			01/27/11			08/24/11		
Program	B/U			GWPP			GWPP			GWPP		
Sample Type												
Result (pCi/L)	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA
Gross Alpha	125	20.7	2.03	<	.	4.4	<	.	66	<	.	7.4
Gross Beta	209	33.7	4.22	12	5	8.4	<	.	75	140	7.5	5.9
Americium-241	<	.	0.0922	.	.	.	.	.	.	.	.	.
Neptunium-237	11.1	4.59	0.298	.	.	.	.	.	.	.	.	.
Total Radium Alpha	0.558	0.181	0.123	.	.	.	.	.	.	.	.	.
Strontium-89/90	5.93	1.75	1.69	.	.	.	.	.	.	.	.	.
Technetium-99	148	25.6	10.6	<	.	15	<	.	16	230	9.7	11
Uranium-234	77.6	12.7	0.161	.	.	.	.	.	.	.	.	.
Uranium-235	7.64	1.55	0.161	.	.	.	.	.	.	.	.	.
Uranium-238	165	26.6	0.218	.	.	.	.	.	.	.	.	.

APPENDIX D.3: CY 2011 MONITORING DATA FOR THE BEAR CREEK HYDROGEOLOGIC REGIME
Radiological Analytes: Isotopic Analyses

Sampling Point	GW-683						GW-684					
Functional Area	EXP-A						EXP-A					
Date Sampled	02/23/11			08/03/11			02/23/11			08/03/11		
Program	B/U			B/U			B/U			B/U		
Sample Type												
Result (pCi/L)	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA
Gross Alpha	5.16	2.26	2.47	<	.	2.32	3.9	2.03	2.61	6.27	2.49	2.65
Gross Beta	7.54	2.55	3.9	3.92	2	3.72	14.1	3.47	4.01	15.4	3.67	3.99
Americium-241	.	.	.	.	.	.	.	.	.	.	.	.
Neptunium-237	.	.	.	.	.	.	.	.	.	.	.	.
Total Radium Alpha	.	.	.	.	.	.	.	.	.	.	.	.
Strontium-89/90	.	.	.	.	.	.	.	.	.	.	.	.
Technetium-99	<	.	11.1	<	.	10.8	13.2	7.5	11.5	12.5	6.89	10.5
Uranium-234	2.81	0.828	0.396	1.72	0.598	0.369	3.8	1.04	0.451	3.75	0.974	0.455
Uranium-235	<	.	0.327	<	.	0.465	0.4	0.3	0.355	0.551	0.31	0.242
Uranium-238	4.34	1.1	0.353	1.54	0.558	0.328	5.45	1.32	0.355	5.64	1.29	0.322

Sampling Point	GW-704						GW-706					
Functional Area	EXP-B						EXP-B					
Date Sampled	02/23/11			08/04/11			02/17/11			08/04/11		
Program	B/U			B/U			B/U			B/U		
Sample Type												
Result (pCi/L)	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA
Gross Alpha	3.11	1.61	2.36	<	.	2.72	20.6	4.46	2.51	<	.	3.27
Gross Beta	10.4	2.58	3.19	20.3	4.37	3.94	35.2	6.47	4.33	<	.	4.48
Americium-241	.	.	.	.	.	.	.	.	.	.	.	.
Neptunium-237	.	.	.	.	.	.	.	.	.	.	.	.
Total Radium Alpha	.	.	.	.	.	.	.	.	.	.	.	.
Strontium-89/90	.	.	.	.	.	.	.	.	.	.	.	.
Technetium-99	<	.	11.1	<	.	10.6	51.2	11.6	11.5	52.8	11.2	10
Uranium-234	1.47	0.537	0.368	1.8	0.639	0.534	10.1	1.99	0.401	10.8	2.16	0.45
Uranium-235	<	.	0.312	<	.	0.47	0.932	0.411	0.34	0.637	0.351	0.315
Uranium-238	2.16	0.664	0.265	1.98	0.652	0.354	19.3	3.45	0.227	18.5	3.38	0.315

Sampling Point	GW-712						GW-713					
Functional Area	EXP-W						EXP-W					
Date Sampled	01/05/11			07/07/11			01/13/11					
Program	B/U			B/U			B/U					
Sample Type										Dup		
Result (pCi/L)	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA
Gross Alpha	<	.	2.93	1.94	1.21	1.89	<	.	2.37	<	.	2.61
Gross Beta	<	.	4.06	<	.	3.58	4.36	2.05	3.74	3.91	2	3.73
Americium-241	.	.	.	.	.	.	.	.	.	.	.	.
Neptunium-237	.	.	.	.	.	.	.	.	.	.	.	.
Total Radium Alpha	.	.	.	.	.	.	.	.	.	.	.	.
Strontium-89/90	.	.	.	.	.	.	.	.	.	.	.	.
Technetium-99	<	.	6.28	<	.	11	<	.	6.62	<	.	6.92
Uranium-234	0.752	0.386	0.342	0.321	0.249	0.317	<	.	0.584	<	.	0.576
Uranium-235	<	.	0.257	<	.	0.317	<	.	0.439	<	.	0.296
Uranium-238	<	.	0.342	<	.	0.269	<	.	0.383	<	.	0.393

APPENDIX D.3: CY 2011 MONITORING DATA FOR THE BEAR CREEK HYDROGEOLOGIC REGIME
Radiological Analytes: Isotopic Analyses

Sampling Point	GW-713						GW-714					
Functional Area	EXP-W						EXP-W					
Date Sampled	07/07/11						01/05/11			07/06/11		
Program	B/U						B/U			B/U		
Sample Type				Dup								
Result (pCi/L)	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA
Gross Alpha	<	.	2.68	<	.	2.67	<	.	3.04	<	.	2.79
Gross Beta	<	.	4.81	<	.	4.92	4.69	2.11	3.75	<	.	4.66
Americium-241	.	.	.	.	.	.	.	.	.	.	.	.
Neptunium-237	.	.	.	.	.	.	.	.	.	.	.	.
Total Radium Alpha	.	.	.	.	.	.	.	.	.	.	.	.
Strontium-89/90	.	.	.	.	.	.	.	.	.	.	.	.
Technetium-99	<	.	10.5	<	.	10.8	<	.	6.24	<	.	11
Uranium-234	0.744	0.369	0.33	0.559	0.348	0.329	0.813	0.401	0.395	1.7	0.585	0.357
Uranium-235	<	.	0.288	<	.	0.329	<	.	0.342	0.449	0.297	0.357
Uranium-238	<	.	0.262	<	.	0.291	0.92	0.41	0.272	0.835	0.387	0.269

Sampling Point	NT-07						SS-6					
Functional Area	EXP-SW						EXP-SW					
Date Sampled	02/15/11			08/15/11			01/12/11			07/07/11		
Program	B/U			B/U			B/U			B/U		
Sample Type												
Result (pCi/L)	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA
Gross Alpha	.	.	.	.	.	.	<	.	3.06	4.57	1.54	1.55
Gross Beta	.	.	.	.	.	.	4.01	2.1	3.92	5.91	2.05	3.4
Americium-241	.	.	.	.	.	.	.	.	.	.	.	.
Neptunium-237	.	.	.	.	.	.	.	.	.	.	.	.
Total Radium Alpha	.	.	.	.	.	.	.	.	.	.	.	.
Strontium-89/90	.	.	.	.	.	.	.	.	.	.	.	.
Technetium-99	.	.	.	.	.	.	<	.	6.63	<	.	10.5
Uranium-234	5.12	1.2	0.325	3.08	0.872	0.611	1.01	0.452	0.398	2.05	0.687	0.279
Uranium-235	0.502	0.29	0.105	<	.	0.421	<	.	0.274	0.283	0.241	0.279
Uranium-238	6.93	1.5	0.244	3.99	1.01	0.421	1.3	0.498	0.202	3.02	0.876	0.279

APPENDIX D.4

MONITORING DATA FOR THE EMWMF

APPENDIX D.4: CY 2011 MONITORING DATA FOR THE BEAR CREEK HYDROGEOLOGIC REGIME
Monitoring Data for the EMWMF: Field Measurements, Major Cations, Trace Metals, and Organics

Sampling Point	GW-363				GW-639				GW-916	
Date Sampled	02/11/11	05/03/11	08/25/11	11/16/11	02/11/11	05/03/11	08/25/11	11/16/11	02/08/11	05/04/11
Program	B/U	B/U	B/U	B/U	B/U	B/U	B/U	B/U	B/U	B/U
Sample Type										
Field Measurements										
Time Sampled	10:30	9:30	11:05	8:40	10:00	8:30	9:50	9:40	13:30	14:40
Measuring Point Elev. (ft)	957.91	957.91	957.91	957.91	940.95	940.95	940.95	940.95	1,002.85	1,002.85
Depth to Water (ft)	4.44	4.40	5.67	4.85	10.20	10.35	11.32	12.01	4.76	4.09
Groundwater Elevation (ft)	953.47	953.51	952.24	953.06	930.75	930.60	929.63	928.94	998.09	998.76
Conductivity (µmho/cm)	419	399	447	443	673	749	797	834	298	274
Dissolved Oxygen (ppm)	2.31	3.36	2.09	4.03	3.8	2.72	2.08	1.33	2.46	2.95
Oxidation/Reduction (mV)	99	38	31	127	-27	78	97	28	-9	251
Temperature (degrees C)	14.5	18	21.5	18.7	12.3	17.1	17.3	16.8	14.3	13.9
Turbidity (NTU)	14	8	9	5	6	10	2	6	22	1
pH	9.33	9.16	8.6	8.76	7.93	9.26	9	8.93	8.05	7.1
Major Ions (mg/L)										
Calcium	1.29	1.14	1.09	1.12	0.942	0.826	0.84	0.84	43.1	35.7
Magnesium	0.499	0.438	0.422	0.438	0.268	0.238	0.232	0.242	6.99	5.84
Potassium	1.35	1.19	1.17	1.32	1.56	1.56	1.54	1.64	3.52	2.9
Sodium	118	111	109	104	212	203	197	191	32	24.6
Trace Metals (mg/L)										
Aluminum	<	<	<	<	<	<	<	<	0.53	1.47
Arsenic	<	<	<	<	<	<	<	<	<	<
Barium	0.0503	0.0481	0.0454	0.0445	0.0638	0.062	0.0596	0.058	0.132	0.117
Beryllium	<	<	<	<	<	<	<	<	<	<
Boron	0.342	0.321	0.321	0.312	0.621	0.595	0.586	0.565	<	<
Chromium	<	<	<	<	<	<	<	<	<	<
Copper	<	<	<	<	<	<	<	<	<	<
Iron	0.073	0.0766	<	0.0524	0.221	0.142	0.0738	0.053	0.514	1.33
Lead	<	<	<	<	<	<	<	<	<	<
Lithium	0.0357	0.0384	0.0372	0.0373	0.076	0.084	0.082	0.0812	0.0598	0.044
Manganese	<	<	<	<	<	<	<	<	0.0878	0.162
Mercury	<0.000088 J	<	<	<	<0.000089 J	<	<	<	<	<
Nickel	<	<	<	<	<	<	<	<	<	<
Strontium	0.0734	0.068	0.0666	0.0648	0.0976	0.0892	0.0872	0.0858	1.18	0.944
Thallium	<	<	<	<	<	<	<	<	<	<
Vanadium	<	<	<	<	<	<	<	<	<	<
Zinc	<	<	<	<	<	<	<	<	<	<
Chloroethenes (µg/L)										
cis-1,2-Dichloroethene	<	<	<	<	<	<	<	<	<	<
Toluene	<	<	<	<	<	<	<	<	<	<

APPENDIX D.4: CY 2011 MONITORING DATA FOR THE BEAR CREEK HYDROGEOLOGIC REGIME
Monitoring Data for the EMWMF: Field Measurements, Major Cations, Trace Metals, and Organics

Sampling Point	GW-916		GW-917					GW-918	
Date Sampled	08/25/11	11/10/11	02/08/11	04/26/11	08/23/11		11/08/11	02/09/11	05/04/11
Program	B/U	B/U	B/U	B/U	B/U	B/U	B/U	B/U	B/U
Sample Type						Dup			
Field Measurements									
Time Sampled	10:20	10:20	10:30	14:00	10:10	.	13:50	9:20	9:30
Measuring Point Elev. (ft)	1,002.85	1,002.85	997.10	997.10	997.10	.	997.10	1,067.96	1,067.96
Depth to Water (ft)	8.06	4.85	20.02	18.14	21.05	.	20.88	5.82	4.63
Groundwater Elevation (ft)	994.79	998.00	977.08	978.96	976.05	.	976.22	1,062.14	1,063.33
Conductivity (µmho/cm)	301	301	393	470	571	.	560	99	90
Dissolved Oxygen (ppm)	3.17	2.53	1.3	1.21	0.77	.	0.76	6.13	5.8
Oxidation/Reduction (mV)	-105	15	127	70	83	.	75	183	405
Temperature (degrees C)	16.5	14.9	11.4	17.1	16.8	.	16.58	13.7	14.5
Turbidity (NTU)	2	7	2	12	5	.	3	3	13
pH	7.02	7.13	6.81	6.62	5.45	.	6.72	6.29	6.46
Major Ions (mg/L)									
Calcium	36.3	41.3	80.6	86.3	103	101	93.4	11.1	9.92
Magnesium	5.36	6.3	10.6	10.5	11.6	11.2	10.9	4.61	3.98
Potassium	3.23	3.5	1.47	1.34	1.33	1.31	1.38	1.99	1.79
Sodium	26.2	26.9	11.2	11.7	12.7	12.5	12.4	4.92	4.22
Trace Metals (mg/L)									
Aluminum	0.4	0.677	0.495	<	<	<	<	<	0.305
Arsenic	<	<	<	<	<	<	<	<	<
Barium	0.157	0.148	0.233	0.223	0.23	0.227	0.22	0.119	0.114
Beryllium	<	<	<	<	<	<	<	<	<
Boron	<	<	<	<	<	<	<	<	<
Chromium	<	<	<	<	<	<	<	<	<
Copper	<	<	<	<	<	<	<	<	<
Iron	0.406	0.66	4.79	0.248	0.159	0.125	0.261	<	0.194
Lead	<	<	<	<	<	<	<	<	<
Lithium	0.0612	0.0592	0.0205	0.0201	0.0211	0.0207	0.0195	0.0106	<
Manganese	0.117	0.106	0.0989	0.0498	0.0538	0.0516	0.0398	<	<
Mercury	<	<	<	<	<	<	<	<	<
Nickel	<	<	<	<	<	<	<	<	<
Strontium	0.982	1.12	0.161	0.167	0.19	0.188	0.177	0.0496	0.0453
Thallium	<	<	<	<	<	<	<	<	<
Vanadium	<	<	<	<	<	<	<	<	<
Zinc	<	<	<	<	<	<	<	<	<
Chloroethenes (µg/L)									
cis-1,2-Dichloroethene	<	<	<	<	<	<	<	<	<
Toluene	<	<	<	<	<	<	<	<	<

APPENDIX D.4: CY 2011 MONITORING DATA FOR THE BEAR CREEK HYDROGEOLOGIC REGIME
Monitoring Data for the EMWMF: Field Measurements, Major Cations, Trace Metals, and Organics

Sampling Point	GW-918		GW-920				GW-921			
Date Sampled	08/24/11	11/08/11	02/08/11	04/26/11	08/22/11	11/08/11	02/08/11	05/03/11	08/24/11	11/08/11
Program	B/U	B/U	B/U	B/U	B/U	B/U	B/U	B/U	B/U	B/U
Sample Type										
Field Measurements										
Time Sampled	9:40	9:25	9:00	10:00	13:45	10:40	14:30	9:00	14:10	14:20
Measuring Point Elev. (ft)	1,067.96	1,067.96	967.43	967.43	967.43	967.43	971.29	971.29	971.29	971.29
Depth to Water (ft)	5.80	5.77	6.45	6.70	8.53	6.77	6.09	5.83	7.08	6.13
Groundwater Elevation (ft)	1,062.16	1,062.19	960.98	960.73	958.90	960.66	965.20	965.46	964.21	965.16
Conductivity (µmho/cm)	96	111	278	345	298	288	354	361	416	362
Dissolved Oxygen (ppm)	6.02	4.48	1.15	0.84	1.21	1.09	0.73	1.1	1.71	1.35
Oxidation/Reduction (mV)	203	16	-21	3	-117	-61	-42	79	-118	-91
Temperature (degrees C)	15.5	15	14.1	18	17	16.5	15.9	17.4	18.6	17
Turbidity (NTU)	35	28	8	5	2	2	1	5	1	1
pH	6.33	6.61	7.64	7.45	6.92	8.31	8	7.4	7.11	8.76
Major Ions (mg/L)										
Calcium	8.75	9.78	52.8	50.5	48.8	53.9	48.7	49.5	43.4	51
Magnesium	3.59	3.95	8.34	8	7.7	8.16	13.7	12.3	12.6	12.7
Potassium	1.88	1.89	1.52	1.59	1.57	1.64	2.9	2.67	2.76	2.78
Sodium	3.95	4.24	5.73	5.79	5.6	5.88	26.4	24.6	24.9	24.7
Trace Metals (mg/L)										
Aluminum	1.01	0.548	<	<	<	<	<	<	<	<
Arsenic	<	<	<	<	<	<	<	<	<	<
Barium	0.107	0.11	0.243	0.249	0.252	0.262	0.319	0.312	0.327	0.325
Beryllium	<	<	<	<	<	<	<	<	<	<
Boron	<	<	<	<	<	<	<	<	<	<
Chromium	<	<	<	<	<	<	<	<	<	<
Copper	<	<	<	<	<	<	<	<	<	<
Iron	0.574	0.372	0.98	0.133	0.182	0.455	<	0.0836	<	<
Lead	<	<	<	<	<	<	<	<	<	<
Lithium	0.0121	0.0108	<	0.0111	<	<	0.024	0.0244	0.0249	0.0247
Manganese	0.00898	0.00673	0.0896	0.0286	0.0366	0.0505	0.00726	0.00816	0.00758	0.00734
Mercury	<	<	<	<	<	<	<	<	<	<
Nickel	<	<	<	<	<	<	<	<	<	<
Strontium	0.0395	0.0426	0.419	0.432	0.432	0.434	1.34	1.2	1.35	1.28
Thallium	<	<	<	<	<	<	<	<	<	<
Vanadium	<	<	<	<	<	<	<	<	<	<
Zinc	<	<	<	<	<	<	<	<	<	<
Chloroethenes (µg/L)										
cis-1,2-Dichloroethene	<	<	<	<	<	<	<	<	<	<
Toluene	<	<	<	<	<	<	<	<	<	<

APPENDIX D.4: CY 2011 MONITORING DATA FOR THE BEAR CREEK HYDROGEOLOGIC REGIME
Monitoring Data for the EMWMF: Field Measurements, Major Cations, Trace Metals, and Organics

Sampling Point	GW-922					GW-923					
Date Sampled	02/08/11		04/26/11	08/22/11	11/08/11	02/08/11		05/03/11		08/23/11	
Program	B/U	B/U	B/U	B/U	B/U	B/U	B/U	B/U	B/U	B/U	B/U
Sample Type		Dup					F		F		F
Field Measurements											
Time Sampled	10:30	.	10:00	15:00	9:40	9:30	.	9:00	.	16:00	.
Measuring Point Elev. (ft)	956.91	.	956.91	956.91	956.91	1,016.73	.	1,016.73	.	1,016.73	.
Depth to Water (ft)	5.00	.	4.91	5.25	5.04	28.30	.	26.63	.	33.17	.
Groundwater Elevation (ft)	951.91	.	952.00	951.66	951.87	988.43	.	990.10	.	983.56	.
Conductivity (µmho/cm)	272	.	281	301	275	249	.	197	.	319	.
Dissolved Oxygen (ppm)	0.58	.	1.49	1.87	219	4.44	.	4.84	.	2.21	.
Oxidation/Reduction (mV)	-35	.	-58	-112	-35	136	.	152	.	-10	.
Temperature (degrees C)	14.7	.	18.5	17.6	16.2	13.1	.	15.6	.	16.3	.
Turbidity (NTU)	1	.	5	2	1	206	.	99	.	326	.
pH	7.68	.	7.55	7.04	7.79	7.15	.	7.25	.	6.28	.
Major Ions (mg/L)											
Calcium	44.6	45.8	42.9	42.9	43.3	48.3	45.8	33.8	34.8	42.8	47.7
Magnesium	10.2	10.2	9.14	9.35	9.68	18	12.9	10.7	10.5	17	12.8
Potassium	2.81	2.89	2.67	2.71	2.93	7.86	1.97	2.5	1.88	9.16	2.2
Sodium	9.1	9.4	8.61	8.59	9.42	6.44	6	4.12	4.33	4.14	4.68
Trace Metals (mg/L)											
Aluminum	<	<	<	<	<	30.7	<	2.64	<	39.4	<
Arsenic	<	<	<	<	<	0.0071	<	<	<	0.00822	<
Barium	0.718	0.738	0.68	0.698	0.717	0.558	0.146	0.152	0.131	0.574	0.151
Beryllium	<	<	<	<	<	0.0014	<	<	<	0.00153	<
Boron	<	<	<	<	<	<	<	<	<	<	<
Chromium	<	<	<	<	<	0.0782	<	<	<	0.0708	<
Copper	<	<	<	<	<	0.0424	<	<	<	0.046	<
Iron	0.14	0.138	0.223	0.0818	0.0892	24.5	<	1.77	<	28.3	<
Lead	<	<	<	<	<	0.0267	<	<	<	0.0267	<
Lithium	0.0137	0.0115	0.0129	0.0122	0.0118	0.0394	<	<	<	0.0526	<
Manganese	0.0279	0.0276	0.0261	0.0216	0.0152	0.508	<	0.03	<	0.401	0.0164
Mercury	<	<	<	<	<	<	<	<	0.000072 J	<	<
Nickel	<	<	<	<	<	0.0607	<	<	<	0.055	<
Strontium	0.802	0.826	0.73	0.782	0.83	0.108	0.0826	0.0664	0.0673	0.101	0.0852
Thallium	<	<	<	<	<	<	<	<	<	<	<
Vanadium	<	<	<	<	<	0.0404	<	<	<	0.0486	<
Zinc	<	<	<	<	<	0.0742	<	<	<	0.0983	<
Chloroethenes (µg/L)											
cis-1,2-Dichloroethene	<	<	<	<	<	<	.	<	.	<	.
Toluene	<	<	<	<	<	<	.	<	.	<	.

APPENDIX D.4: CY 2011 MONITORING DATA FOR THE BEAR CREEK HYDROGEOLOGIC REGIME
Monitoring Data for the EMWMF: Field Measurements, Major Cations, Trace Metals, and Organics

Sampling Point	GW-923	GW-924				GW-925			
Date Sampled	11/08/11	02/09/11	05/02/11	08/23/11	11/07/11	02/08/11	05/03/11	08/25/11	11/15/11
Program	B/U	B/U	B/U	B/U	B/U	B/U	B/U	B/U	B/U
Sample Type									
Field Measurements									
Time Sampled	8:55	14:00	14:10	15:10	13:00	14:40	9:50	10:00	9:10
Measuring Point Elev. (ft)	1,016.73	968.90	968.90	968.90	968.90	971.14	971.14	971.14	971.14
Depth to Water (ft)	25.84	9.04	9.41	11.31	9.31	4.23	3.75	4.87	4.55
Groundwater Elevation (ft)	990.89	959.86	959.49	957.59	959.59	966.91	967.39	966.27	966.59
Conductivity (µmho/cm)	306	291	268	299	339	505	592	603	582
Dissolved Oxygen (ppm)	5.35	0.9	0.17	0.9	3.35	2.58	1.86	0.92	2.16
Oxidation/Reduction (mV)	119	90	83	100	-23	-108	85	53	-25
Temperature (degrees C)	15.4	14.9	19.5	17.39	17.5	15.2	19.2	17.2	16
Turbidity (NTU)	160	1	2	8	3	2	5	9	4
pH	7	7.4	7.4	7.54	7.55	9.71	9.5	9.63	8.72
Major Ions (mg/L)									
Calcium	.	55	51.4	52.4	56.7	3.67	6.14	1.86	1.95
Magnesium	.	4.71	4.26	4.34	4.47	1.3	2.2	0.888	0.939
Potassium	.	0.982	0.956	0.786	0.78	1.9	2.1	1.58	1.59
Sodium	.	5.62	5.1	5.11	5.2	162	148	138	134
Trace Metals (mg/L)									
Aluminum	.	<	<	<	<	1.4	0.978	0.336	0.44
Arsenic	.	<	<	<	<	<	<	<	<
Barium	.	0.285	0.283	0.276	0.304	0.183	0.171	0.146	0.144
Beryllium	.	<	<	<	<	<	<	<	<
Boron	.	<	<	<	<	0.296	0.252	0.234	0.218
Chromium	.	<	<	<	<	<	<	<	<
Copper	.	<	<	<	<	<	0.0538 Q	<	<
Iron	.	0.0544	0.0576	0.0784	0.0595	0.922	0.492	0.14	0.178
Lead	.	<	<	<	<	0.0034	0.236 Q	<	<
Lithium	.	0.0118	0.0112	0.0101	<	0.0459	0.0499	0.0498	0.048
Manganese	.	0.035	0.0293	0.0353	0.0281	0.0255	0.0128	<	<
Mercury	.	<	<	<	<	<	<	<	<
Nickel	.	<	<	<	<	<	<	<	<
Strontium	.	0.102	0.0931	0.0958	0.0934	0.228	0.224	0.198	0.194
Thallium	.	<	<	<	<	<	<	<	<
Vanadium	.	<	<	<	<	<	<	<	<
Zinc	.	<	<	<	<	<	0.103 Q	<	<
Chloroethenes (µg/L)									
cis-1,2-Dichloroethene	<	<	<	<	<	<	<	<	<
Toluene	<	<	<	<	<	<	<	<	<

APPENDIX D.4: CY 2011 MONITORING DATA FOR THE BEAR CREEK HYDROGEOLOGIC REGIME
Monitoring Data for the EMWMF: Field Measurements, Major Cations, Trace Metals, and Organics

Sampling Point	GW-926					GW-927			
Date Sampled	02/10/11	04/28/11	08/23/11	11/09/11		02/08/11	04/26/11	08/23/11	11/08/11
Program	B/U	B/U	B/U	B/U	B/U	B/U	B/U	B/U	B/U
Sample Type					Dup				
Field Measurements									
Time Sampled	14:30	15:00	14:20	14:10	.	11:30	15:15	15:00	14:40
Measuring Point Elev. (ft)	968.94	968.94	968.94	968.94	.	997.19	997.19	997.19	997.19
Depth to Water (ft)	8.11	7.44	8.84	8.19	.	16.25	13.33	17.87	16.90
Groundwater Elevation (ft)	960.83	961.50	960.10	960.75	.	980.94	983.86	979.32	980.29
Conductivity (µmho/cm)	289	276	293	278	.	367	440	409	395
Dissolved Oxygen (ppm)	1.28	0.3	1.1	3.25	.	1.12	1.12	0.47	1.07
Oxidation/Reduction (mV)	-40	95	-118	-118	.	-68	-46	-129	-162
Temperature (degrees C)	13.6	15.4	17	15.9	.	14.2	17.8	16.9	16.9
Turbidity (NTU)	1	2	1	1	.	1	7	1	5
pH	7.68	7.61	7.42	8.04	.	7.38	7.2	7.33	7.72
Major Ions (mg/L)									
Calcium	43	40.6	40.5	39.1	42.3	79.2	70.8	71.5	74
Magnesium	11	10.1	10.1	9.46	10.2	8.07	7.12	7.04	7.34
Potassium	2.11	2.02	2.05	1.86	2.04	0.938	0.904	0.902	0.916
Sodium	10.6	10.2	10.8	9.48	10.3	8.43	7.88	7.7	8.24
Trace Metals (mg/L)									
Aluminum	<	<	<	<	<	<	<	<	<
Arsenic	<	<	<	<	<	<	<	<	<
Barium	0.229	0.22	0.237	0.208	0.227	0.221	0.207	0.212	0.213
Beryllium	<	<	<	<	<	<	<	<	<
Boron	<	<	<	<	<	<	<	<	<
Chromium	<	<	<	<	<	<	<	<	<
Copper	<	<	<	<	<	<	<	<	<
Iron	0.205	0.102	0.125	0.115	0.122	0.183	0.116	0.15	0.131
Lead	<	<	<	<	<	<	<	<	<
Lithium	<	0.0122	0.0123	0.0107	0.0113	0.0177	0.0168	0.0168	0.0157
Manganese	0.0181	0.0146	0.013	0.0125	0.0139	0.0259	0.0204	0.0353	0.0242
Mercury	<	<	<	<	<	<	<	<	<
Nickel	<	<	<	<	<	<	<	<	<
Strontium	0.784	0.714	0.736	0.67	0.726	0.131	0.116	0.118	0.121
Thallium	<	<	<	<	<	<	<	<	<
Vanadium	<	<	<	<	<	<	<	<	<
Zinc	<	<	<	<	<	<	<	<	<
Chloroethenes (µg/L)									
cis-1,2-Dichloroethene	<	<	<	<	<	<	<	<	<
Toluene	<	<	<	<	<	<	<	<	<

APPENDIX D.4: CY 2011 MONITORING DATA FOR THE BEAR CREEK HYDROGEOLOGIC REGIME
Monitoring Data for the EMWMF: Field Measurements, Major Cations, Trace Metals, and Organics

Sampling Point	GW-961								
Date Sampled	02/09/11		05/04/11			08/25/11		11/10/11	
Program	B/U	B/U	B/U	B/U	B/U	B/U	B/U	B/U	B/U
Sample Type		F		Dup	F		F		F
Field Measurements									
Time Sampled	15:00	.	14:30	.	.	15:20	.	8:50	.
Measuring Point Elev. (ft)	963.57	.	963.57	.	.	963.57	.	963.57	.
Depth to Water (ft)	13.50	.	12.73	.	.	13.48	.	12.90	.
Groundwater Elevation (ft)	950.07	.	950.84	.	.	950.09	.	950.67	.
Conductivity (µmho/cm)	230	.	178	.	.	220	.	199	.
Dissolved Oxygen (ppm)	1.2	.	1.91	.	.	1.6	.	1.65	.
Oxidation/Reduction (mV)	169	.	262	.	.	42	.	15	.
Temperature (degrees C)	14.5	.	15.3	.	.	17.9	.	16.9	.
Turbidity (NTU)	21	.	83	.	.	2	.	5	.
pH	6	.	5.92	.	.	5.43	.	6.83	.
Major Ions (mg/L)									
Calcium	33.1	43.9	46.7	37	35.9	30.3	33.6	34.6	35.1
Magnesium	5.94	5.6	6.14	5.42	5.24	5.5	5.47	5.58	5.52
Potassium	1.29	0.831	1.27	0.753	0.713	1.38	0.744	0.905	0.762
Sodium	8.29	8.46	7.78	7.82	7.64	7.5	7.5	7.71	7.7
Trace Metals (mg/L)									
Aluminum	1.64	<	1.42 R	<R	<	2.14	<	0.446	<
Arsenic	<	<	<	<	<	<	<	<	<
Barium	0.122	0.126	0.14	0.12	0.117	0.117	0.104	0.114	0.11
Beryllium	<	<	<	<	<	<	<	<	<
Boron	<	<	<	<	<	<	<	<	<
Chromium	<	<	<	<	<	<	<	<	<
Copper	<	<	<	<	<	<	<	<	<
Iron	1.55	<	1.41 R	<R	<	1.76	<	0.404	<
Lead	0.00371	<	0.00208	<	<	0.00269 J	<	<	<
Lithium	0.0106	<	0.011	<	<	0.0121	0.0114	0.0107	0.0104
Manganese	0.203	0.146	0.298	0.0962	0.0897	0.178	0.0967	0.102	0.0798
Mercury	<	<	<	0.000101	0.000071 J	<	<	<	<
Nickel	<	<	<	<	<	<	<	<	<
Strontium	0.0682	0.0799	0.0827	0.0712	0.0694	0.0627	0.0647	0.0659	0.0644
Thallium	<	<	<	<	<	<	<	<	<
Vanadium	<	<	<	<	<	<	<	<	<
Zinc	<	<	<	<	<	<	<	<	<
Chloroethenes (µg/L)									
cis-1,2-Dichloroethene	<	.	<	<	.	<	.	<	.
Toluene	<	.	<	<	.	<	.	<	.

APPENDIX D.4: CY 2011 MONITORING DATA FOR THE BEAR CREEK HYDROGEOLOGIC REGIME
Monitoring Data for the EMWMF: Field Measurements, Major Cations, Trace Metals, and Organics

Sampling Point	GW-964			GW-965			EMWNT-03A			
Date Sampled	08/25/11	11/15/11		08/25/11	11/15/11		02/07/11	04/11/11	09/08/11	11/21/11
Program	B/U	B/U	B/U	B/U	B/U	B/U	B/U	B/U	B/U	B/U
Sample Type			F			F				
Field Measurements										
Time Sampled	9:10	9:25	.	15:40	14:00	.	14:40	10:40	10:45	11:50
Measuring Point Elev. (ft)	977.69	977.69	.	977.91	977.91	.	.	.	.	.
Depth to Water (ft)	14.52	14.25	.	14.06	14.25	.	.	.	.	.
Groundwater Elevation (ft)	963.17	963.44	.	963.85	963.66	.	.	.	.	.
Conductivity (µmho/cm)	244	263	.	273	317	.	115	140	222	122
Dissolved Oxygen (ppm)	1.2	1.28	.	7.96	1.38	.	8.52	5.92	4.86	6.84
Oxidation/Reduction (mV)	178	115	.	-51	139	.	32.2	51.2	117.6	80.8
Temperature (degrees C)	17	17.1	.	17.8	17.72	.	10.4	19.84	19.95	15.7
Turbidity (NTU)	213	2	.	37	20	.	13	14	23	130
pH	6.56	6.14	.	7.28	7.18	.	7.16	7.26	6.78	7.06
Major Ions (mg/L)										
Calcium	41	41.4	38.6	49.6	53.2	48	19.1	17.4	29.1	20.1
Magnesium	3.7	3.96	3.91	5.1	5.77	4.73	4.65	4.41	7	7.45
Potassium	1.15	0.898	0.674	1.37	1.96	0.778	1.31	1.56	1.83	2.87
Sodium	6.48	6.72	6.93	5.31	5.34	5.26	3.35	2.73	2.96	2.29
Trace Metals (mg/L)										
Aluminum	1.76	1	<	1.59	3.34	<	0.706	0.893	1.35	3.63
Arsenic	<	<	<	<	<	<	<	<	<	<
Barium	0.0995	0.0952	0.0706	0.27	0.288	0.238	0.0355	0.0414	0.0511	0.0724
Beryllium	<	<	<	<	<	<	<	<	<	<
Boron	<	<	<	<	<	<	<	<	<	<
Chromium	<	<	<	<	<	<	<	<	<	<
Copper	<	<	<	<	<	<	<	<	<	<
Iron	1.46	0.715	<	1.32	2.79	<	1.11	1.45	1.02	3.61
Lead	0.00347 J	0.00359 J	<	0.00318 J	0.00415 J	<	<	<	<	<
Lithium	<	<	<	<	0.0112	<	<	<	<	<
Manganese	0.122	0.049	<	0.181	0.186	0.0584	0.178	0.299	0.0277	0.261
Mercury	<	<	<	<	<	<	<	<	<	<
Nickel	<	<	<	<	<	<	<	<	<	<
Strontium	0.0615	0.0578	0.055	0.0896	0.0876	0.0802	0.0409	0.0426	0.0571	0.0389
Thallium	<	<	<	<	<	<	<	<	<	<
Vanadium	<	<	<	<	<	<	<	<	<	<
Zinc	<	<	<	<	<	<	<	<	<	<
Chloroethenes (µg/L)										
cis-1,2-Dichloroethene	<	<	.	<	<	.	<	<	<	<
Toluene	<	<	.	0.547 J	<	.	<	<	<	<

APPENDIX D.4: CY 2011 MONITORING DATA FOR THE BEAR CREEK HYDROGEOLOGIC REGIME
Monitoring Data for the EMWMF: Field Measurements, Major Cations, Trace Metals, and Organics

Sampling Point	NT-04				EMWNT-05				
Date Sampled	02/07/11	04/11/11	08/30/11	11/21/11	02/07/11	04/11/11	09/08/11	11/21/11	
Program	B/U	B/U	B/U	B/U	B/U	B/U	B/U	B/U	B/U
Sample Type									Dup
Field Measurements									
Time Sampled	10:10	9:20	9:00	9:35	13:40	10:00	10:00	10:35	.
Measuring Point Elev. (ft)	.	.	.	.	.	.	.	.	.
Depth to Water (ft)	.	.	.	.	.	.	.	.	.
Groundwater Elevation (ft)	.	.	.	.	.	.	.	.	.
Conductivity (µmho/cm)	434	622	578	563	199	183	245	202	.
Dissolved Oxygen (ppm)	7.79	6.24	5.79	5.2	9.18	8.47	5.63	6.88	.
Oxidation/Reduction (mV)	24.7	49.2	93	3.2	-45.3	-49.1	25.6	77.18	.
Temperature (degrees C)	6.41	16.48	20.1	15.09	10.47	17.61	19.75	15.43	.
Turbidity (NTU)	2	4	13	4	12	18	72	128	.
pH	7.69	8.5	8.5	6.94	7.54	8.63	6.18	7.14	.
Major Ions (mg/L)									
Calcium	108	110	95.6	99.9	28.8	20.7	29.6	30	31
Magnesium	19.4	20	17.8	18.2	8.86	7	9.24	12	12.3
Potassium	1.88	1.6	2.34	2.04	1.62	1.92	2.27	3.63	3.54
Sodium	11.7	10.7	9.36	8.04	4.49	2.98	3.49	2.59	2.63
Trace Metals (mg/L)									
Aluminum	<	<	0.284	<	0.248	1.03	0.456	3.84	3.7
Arsenic	<	<	<	<	<	<	<	<	<
Barium	0.457	0.445	0.399	0.461	0.0607	0.0652	0.0769	0.0959	0.0996
Beryllium	<	<	<	<	<	<	<	<	<
Boron	<	<	<	<	<	<	<	<	<
Chromium	<	<	<	<	<	<	<	<	<
Copper	<	<	<	<	<	<	<	<	<
Iron	0.61	0.671	0.51	0.271	2.08	2.11	1.03	4.66	4.5
Lead	<	<	<	<	<	<	<	0.00325 J	0.00323 J
Lithium	<	<	<	<	<	<	<	0.0107 J	<
Manganese	0.629	1.14	0.166	0.479	0.732	0.455	0.38	0.425	0.425
Mercury	<	<	<	<	<	<	<	<	<
Nickel	<	<	<	<	<	<	<	<	<
Strontium	0.25	0.271	0.238	0.232	0.0648	0.048	0.0593	0.0514	0.0537
Thallium	<	<	<	<	0.00204 J	<	<	<	<
Vanadium	<	<	<	<	<	<	<	<	<
Zinc	<	<	<	<	<	<	<	<	<
Chloroethenes (µg/L)									
cis-1,2-Dichloroethene	5 J	2.65 J	<	<	<	<	<	<	<
Toluene	<	<	<	<	<	<	<	<	<

APPENDIX D.4: CY 2011 MONITORING DATA FOR THE BEAR CREEK HYDROGEOLOGIC REGIME
Monitoring Data for the EMWMF: Field Measurements, Major Cations, Trace Metals, and Organics

Sampling Point	EMW-VWEIR				EMW-VWUNDER			
Date Sampled	02/07/11	04/11/11	09/08/11	11/21/11	02/09/11	05/04/11	08/29/11	11/09/11
Program	B/U	B/U	B/U	B/U	B/U	B/U	B/U	B/U
Sample Type								
Field Measurements								
Time Sampled	9:40	8:50	9:35	8:50	14:00	14:00	9:30	13:40
Measuring Point Elev. (ft)	.	.	.	.	.	.	.	.
Depth to Water (ft)	.	.	.	.	.	.	.	.
Groundwater Elevation (ft)	.	.	.	.	.	.	.	.
Conductivity (µmho/cm)	315	196	79	160	396	421	434	427
Dissolved Oxygen (ppm)	9.12	12.1	8.41	7.3	7.91	3.65	1.58	3
Oxidation/Reduction (mV)	137	120.1	86.9	146.7	141	454	103	-14
Temperature (degrees C)	7.31	20.06	19.64	14.61	12.8	16.78	18.4	18.23
Turbidity (NTU)	24	14	146	225	1	2	1	4
pH	8.22	8.91	7.22	6.68	6.68	6.33	6.06	7.63
Major Ions (mg/L)								
Calcium	56.6	20.7	19.4	25.9	74.2	78.1	68.9	75
Magnesium	9.96	6.51	7.36	7.86	11.1	11.6	9.44	11.3
Potassium	4.09	2.49	7.36	4.94	2.25	2.08	1.9	2.3
Sodium	9.92	3.33	2.9	2.06	9.88	9.84	8.98	9.96
Trace Metals (mg/L)								
Aluminum	0.612	0.474	27.1 Q	10.6	<	<	<	<
Arsenic	<	<	0.0104	<	<	<	<	<
Barium	0.0703	0.0436	0.207	0.102	0.0912	0.104	0.106	0.0902
Beryllium	<	<	0.00112	<	<	<	<	<
Boron	<	<	<	<	<	<	<	<
Chromium	<	<	0.0272	0.0114	<	<	<	<
Copper	<	<	0.02	<	<	<	<	<
Iron	0.56	0.355	22.4	7.96	<	<	<	<
Lead	<	<	0.0172	0.00569 J	<	<	<	<
Lithium	<	<	0.0171 J	<	<	<	<	<
Manganese	0.109	0.072	0.355	0.0976	<	<	0.62	<
Mercury	<	<	<	<	<	<	<	<
Nickel	<	<	0.021	<	<	<	<	<
Strontium	0.167	0.0551	0.0591	0.0547	0.2	0.213	0.18	0.201
Thallium	<	<	<	<	<	<	<	<
Vanadium	<	<	0.0424	<	<	<	<	<
Zinc	<	<	0.0723	<	<	<	<	<
Chloroethenes (µg/L)								
cis-1,2-Dichloroethene	<	<	<	<	<	<	<	<
Toluene	<	<	<	<	<	<	<	<

APPENDIX D.4: CY 2011 MONITORING DATA FOR THE BEAR CREEK HYDROGEOLOGIC REGIME
Monitoring Data for the EMWMF: Radiological Analytes

Sampling Point	Date Sampled	Isotope	Result (pCi/L)		
			Activity	TPU	MDA
GW-363	05/03/11	Americium-241	0.38	0.25	0.16
GW-363	05/03/11	Curium-245	0.27	0.25	0.14
GW-363	05/03/11	Curium-246	0.27	0.25	0.14
GW-363	08/25/11	Neptunium-237	0.31	0.23	0.19
GW-363	05/03/11	Plutonium-239/240	0.39	0.35	0.37
GW-363	11/16/11	Radium-226	0.13	0.12	0.13
GW-363	05/03/11	Strontium-90	2.31	0.82	1.37
GW-363	05/03/11	Thorium-230	0.34	0.25	0.24
GW-363	05/03/11	Uranium-233/234	0.26	0.18	0.08
GW-363	08/25/11	Uranium-233/234	0.13	0.12	0.13
GW-363	05/03/11	Yttrium-90	2.31	0.82	1.37

GW-639	08/25/11	Americium-243	0.26	0.21	0.18
GW-639	08/25/11	Curium-245	0.26	0.21	0.19
GW-639	08/25/11	Curium-246	0.26	0.21	0.19
GW-639	05/03/11	Strontium-90	1.5	0.65	1.15
GW-639	08/25/11	Technetium-99	3.13	1.8	2.94
GW-639	08/25/11	Thorium-230	0.16	0.13	0.07
GW-639	02/11/11	Thorium-231+234	0.18	0.14	0.11
GW-639	02/11/11	Uranium-233/234	0.45	0.22	0.06
GW-639	05/03/11	Uranium-233/234	0.59	0.44	0.34
GW-639	11/16/11	Uranium-233/234	0.28	0.16	0.11
GW-639	02/11/11	Uranium-238	0.18	0.14	0.11
GW-639	05/03/11	Yttrium-90	1.5	0.65	1.15

GW-916	02/08/11	Americium-243	0.21	0.18	0.16
GW-916	05/04/11	Radium-226	0.18	0.14	0.18
GW-916	11/10/11	Radium-226	0.2	0.15	0.14
GW-916	08/25/11	Technetium-99	3.2	1.84	3
GW-916	05/04/11	Thorium-230	0.35	0.27	0.24
GW-916	08/25/11	Thorium-230	0.18	0.15	0.14
GW-916	11/10/11	Thorium-230	0.16	0.13	0.11
GW-916	08/25/11	Uranium-232	0.08	0.07	0.07
GW-916	02/08/11	Uranium-233/234	0.17	0.15	0.17
GW-916	08/25/11	Uranium-233/234	0.15	0.12	0.12

GW-917	04/26/11	Curium-243/244	0.33	0.27	0.27
GW-917	02/08/11	Plutonium-244	0.19	0.15	0.12
GW-917	02/08/11	Radium-226	0.22	0.17	0.19
GW-917	08/23/11	Radium-226	0.21	0.15	0.11
GW-917 D	08/23/11	Radium-226	0.16	0.14	0.16
GW-917	11/08/11	Radium-226	0.26	0.17	0.13
GW-917	08/23/11	Technetium-99	3.14	1.8	2.94
GW-917 D	08/23/11	Technetium-99	3.18	1.83	2.98
GW-917	02/08/11	Thorium-230	0.24	0.2	0.2
GW-917	04/26/11	Thorium-230	0.44	0.37	0.42
GW-917	08/23/11	Thorium-230	0.57	0.29	0.18
GW-917 D	08/23/11	Thorium-230	0.84	0.4	0.23
GW-917	04/26/11	Uranium-233/234	0.16	0.13	0.11
GW-917	08/23/11	Uranium-233/234	0.24	0.16	0.14
GW-917 D	08/23/11	Uranium-233/234	0.23	0.18	0.19

GW-918	05/04/11	Actinium-227	0.28	0.24	0.22
GW-918	02/09/11	Strontium-90	1.56	0.59	1
GW-918	05/04/11	Strontium-90	1.54	0.67	1.16
GW-918	08/24/11	Strontium-90	1.34	0.66	1.19
GW-918	08/24/11	Technetium-99	3.33	1.91	3.13
GW-918	05/04/11	Thorium-227	0.28	0.24	0.22
GW-918	02/09/11	Thorium-230	0.32	0.21	0.16
GW-918	08/24/11	Thorium-230	0.27	0.18	0.11
GW-918	11/08/11	Thorium-230	0.27	0.19	0.17

APPENDIX D.4: CY 2011 MONITORING DATA FOR THE BEAR CREEK HYDROGEOLOGIC REGIME
Monitoring Data for the EMWMF: Radiological Analytes

Sampling Point	Date Sampled	Isotope	Result (pCi/L)		
			Activity	TPU	MDA
GW-918	02/09/11	Uranium-233/234	0.16	0.12	0.06
GW-918	05/04/11	Uranium-233/234	0.15	0.13	0.07
GW-918	08/24/11	Uranium-233/234	0.18	0.15	0.13
GW-918	02/09/11	Yttrium-90	1.56	0.59	1
GW-918	05/04/11	Yttrium-90	1.54	0.67	1.16
GW-918	08/24/11	Yttrium-90	1.34	0.66	1.19

GW-920	04/26/11	Americium-241	0.32	0.23	0.22
GW-920	08/22/11	Nickel-63	24.2	12.98	20.8
GW-920	02/08/11	Radium-226	0.2	0.14	0.06
GW-920	08/22/11	Radium-226	0.16	0.14	0.15
GW-920	08/22/11	Technetium-99	3.23	1.85	3.03
GW-920	04/26/11	Thorium-230	0.33	0.23	0.18
GW-920	08/22/11	Thorium-230	0.65	0.35	0.28
GW-920	02/08/11	Thorium-231+234	0.12	0.11	0.11
GW-920	02/08/11	Uranium-233/234	0.2	0.15	0.18
GW-920	02/08/11	Uranium-238	0.12	0.11	0.11

GW-921	05/03/11	Neptunium-237	0.9	0.49	0.33
GW-921	08/24/11	Radium-226	0.13	0.12	0.13
GW-921	11/08/11	Radium-226	0.2	0.16	0.18
GW-921	11/08/11	Radium-228	1.35 Q	0.53	0.77
GW-921	08/24/11	Technetium-99	3.16	1.81	2.96
GW-921	08/24/11	Thorium-230	0.31	0.19	0.11
GW-921	11/08/11	Thorium-230	0.41	0.21	0.13
GW-921	02/08/11	Uranium-233/234	0.14	0.12	0.07
GW-921	11/08/11	Uranium-233/234	0.14	0.12	0.1

GW-922	02/08/11	Americium-243	0.19	0.17	0.18
GW-922	02/08/11	Radium-226	0.13	0.12	0.07
GW-922	02/08/11	Thorium-230	0.24	0.17	0.15
GW-922	04/26/11	Thorium-230	0.3	0.24	0.21
GW-922	08/22/11	Thorium-230	1.42	0.58	0.2
GW-922	11/08/11	Thorium-230	0.24	0.19	0.17
GW-922	04/26/11	Uranium-233/234	0.2	0.15	0.14

GW-923	02/09/11	Radium-226	0.46	0.24	0.2
GW-923	05/04/11	Radium-226	0.18	0.13	0.14
GW-923	08/24/11	Radium-226	3.06 Q	1.06	0.49
GW-923	08/24/11	Strontium-90	5.59 Q	1.2	1.44
GW-923	08/24/11	Technetium-99	4.99	1.97	3.12
GW-923	02/09/11	Thorium-228	0.2	0.18	0.19
GW-923	08/24/11	Thorium-228	1.15	0.66	0.64
GW-923	02/09/11	Thorium-230	0.41	0.26	0.19
GW-923	05/04/11	Thorium-230	0.34	0.23	0.21
GW-923	08/24/11	Thorium-230	1.4	0.7	0.31
GW-923	02/09/11	Thorium-231+234	0.27	0.17	0.06
GW-923	05/04/11	Thorium-231+234	0.3	0.18	0.12
GW-923	08/24/11	Thorium-231+234	1.14	0.6	0.43
GW-923	08/24/11	Thorium-232	1.42	0.71	0.46
GW-923	02/08/11	Tritium	349	147.54	238
GW-923	02/09/11	Uranium-233/234	0.49	0.24	0.17
GW-923	05/04/11	Uranium-233/234	0.25	0.17	0.14
GW-923	08/24/11	Uranium-233/234	1.4	0.66	0.34
GW-923	02/09/11	Uranium-238	0.27	0.17	0.06
GW-923	05/04/11	Uranium-238	0.3	0.18	0.12
GW-923	08/24/11	Uranium-238	1.14	0.6	0.43
GW-923	08/24/11	Yttrium-90	5.59 Q	1.2	1.44

APPENDIX D.4: CY 2011 MONITORING DATA FOR THE BEAR CREEK HYDROGEOLOGIC REGIME
Monitoring Data for the EMWMF: Radiological Analytes

Sampling Point	Date Sampled	Isotope	Result (pCi/L)		
			Activity	TPU	MDA
GW-924	05/02/11	Actinium-227	0.33	0.3	0.31
GW-924	05/02/11	Plutonium-244	0.93	0.57	0.39
GW-924	05/02/11	Potassium-40	43.2	31.61	32
GW-924	08/23/11	Potassium-40	30.4	29.23	26.9
GW-924	11/07/11	Potassium-40	42.6	33.03	36.2
GW-924	08/23/11	Technetium-99	3.11	1.79	2.92
GW-924	05/02/11	Thorium-227	0.33	0.3	0.31
GW-924	08/23/11	Thorium-230	0.22	0.17	0.16
GW-924	11/07/11	Thorium-230	0.32	0.22	0.14

GW-925	08/25/11	Americium-243	0.86 Q	0.41	0.26
GW-925	11/15/11	Americium-243	0.21	0.17	0.18
GW-925	08/25/11	Curium-243/244	0.28	0.21	0.21
GW-925	08/25/11	Curium-245	0.87 Q	0.41	0.26
GW-925	11/15/11	Curium-245	0.21	0.17	0.18
GW-925	08/25/11	Curium-246	0.87 Q	0.41	0.26
GW-925	11/15/11	Curium-246	0.21	0.17	0.18
GW-925	08/25/11	Curium-248	0.2	0.19	0.2
GW-925	02/08/11	Radium-226	0.15	0.13	0.13
GW-925	08/25/11	Radium-226	0.19	0.15	0.14
GW-925	11/15/11	Radium-226	0.14	0.12	0.12
GW-925	02/08/11	Radium-228	0.69	0.38	0.65
GW-925	11/15/11	Radium-228	0.86	0.48	0.82
GW-925	05/03/11	Strontium-90	2.16	0.74	1.21
GW-925	08/25/11	Technetium-99	3.28	1.88	3.08
GW-925	02/08/11	Thorium-230	0.77	0.37	0.18
GW-925	05/03/11	Thorium-230	0.4	0.29	0.21
GW-925	08/25/11	Thorium-230	0.42	0.23	0.17
GW-925	11/15/11	Thorium-230	0.15	0.12	0.11
GW-925	02/08/11	Thorium-232	0.28	0.21	0.18
GW-925	05/03/11	Thorium-232	0.27	0.23	0.12
GW-925	02/08/11	Uranium-233/234	0.24	0.16	0.16
GW-925	05/03/11	Uranium-233/234	0.51	0.23	0.11
GW-925	11/15/11	Uranium-233/234	0.29	0.17	0.11
GW-925	05/03/11	Yttrium-90	2.16	0.74	1.21

GW-926	02/10/11	Cesium-137	4.27	3.84	3.29
GW-926 D	11/09/11	Potassium-40	39	30.57	34
GW-926	02/10/11	Radium-226	0.26	0.18	0.18
GW-926	08/23/11	Radium-226	0.12	0.11	0.1
GW-926	08/23/11	Technetium-99	4.69	1.85	2.93
GW-926	11/09/11	Thorium-229	1.12	0.7	0.12
GW-926	04/28/11	Thorium-230	0.18	0.16	0.17
GW-926	08/23/11	Thorium-230	0.21	0.18	0.18
GW-926	11/09/11	Thorium-230	0.46	0.26	0.15
GW-926 D	11/09/11	Thorium-230	0.41	0.28	0.17
GW-926	04/28/11	Uranium-233/234	0.23	0.16	0.12
GW-926	08/23/11	Uranium-233/234	0.23	0.17	0.13

GW-927	04/26/11	Chlorine-36	2.55	1.82	2.4
GW-927	02/08/11	Curium-248	0.2	0.19	0.19
GW-927	02/08/11	Radium-226	0.15	0.13	0.11
GW-927	08/23/11	Technetium-99	4.98	1.97	3.12
GW-927	08/23/11	Thorium-230	0.31	0.19	0.13
GW-927	11/08/11	Thorium-230	0.21	0.18	0.19
GW-927	02/08/11	Uranium-232	0.21	0.14	0.11

APPENDIX D.4: CY 2011 MONITORING DATA FOR THE BEAR CREEK HYDROGEOLOGIC REGIME
Monitoring Data for the EMWMF: Radiological Analytes

Sampling Point	Date Sampled	Isotope	Result (pCi/L)		
			Activity	TPU	MDA
GW-961 D	05/04/11	Americium-243	0.77	0.53	0.48
GW-961	05/04/11	Radium-226	0.17	0.12	0.11
GW-961	05/04/11	Radium-228	2.24 Q	0.84	1.22
GW-961 D	05/04/11	Strontium-90	1.63	0.68	1.19
GW-961	11/10/11	Strontium-90	1.6	0.79	1.44
GW-961	08/25/11	Technetium-99	3.36	1.93	3.15
GW-961	05/04/11	Thorium-228	0.27	0.22	0.25
GW-961 D	05/04/11	Thorium-230	0.36	0.28	0.21
GW-961	08/25/11	Thorium-231+234	0.17	0.16	0.17
GW-961	08/25/11	Uranium-238	0.17	0.16	0.17
GW-961 D	05/04/11	Yttrium-90	1.63	0.68	1.19
GW-961	11/10/11	Yttrium-90	1.6	0.79	1.44

GW-964	08/25/11	Radium-226	0.27	0.16	0.1
GW-964	11/15/11	Radium-226	0.24	0.16	0.13
GW-964	11/15/11	Strontium-90	1.37	0.74	1.36
GW-964	08/25/11	Technetium-99	4.74	1.87	2.96
GW-964	08/25/11	Thorium-228	0.2	0.16	0.19
GW-964	11/15/11	Thorium-228	0.27	0.18	0.16
GW-964	08/25/11	Thorium-230	0.49	0.26	0.23
GW-964	11/15/11	Thorium-230	0.31	0.19	0.16
GW-964	08/25/11	Thorium-232	0.26	0.17	0.15
GW-964	11/15/11	Thorium-232	0.23	0.17	0.16
GW-964	08/25/11	Uranium-233/234	0.23	0.16	0.14
GW-964	11/15/11	Yttrium-90	1.37	0.74	1.36

GW-965	08/25/11	Radium-226	0.23	0.16	0.14
GW-965	11/15/11	Radium-226	0.15	0.13	0.12
GW-965	08/25/11	Technetium-99	3.1	1.78	2.91
GW-965	11/15/11	Thorium-228	0.21	0.19	0.18
GW-965	11/15/11	Thorium-229	0.25	0.04	0.13
GW-965	08/25/11	Thorium-230	0.13	0.12	0.12
GW-965	11/15/11	Thorium-230	0.45	0.29	0.17
GW-965	08/25/11	Thorium-231+234	0.14	0.13	0.12
GW-965	08/25/11	Uranium-232	0.36	0.11	0.09
GW-965	08/25/11	Uranium-233/234	0.29	0.19	0.17
GW-965	08/25/11	Uranium-238	0.14	0.13	0.12

EMWNT-03A	11/21/11	Potassium-40	32.7	25.43	32.6
EMWNT-03A	02/07/11	Technetium-99	4.96	2.59	4.18
EMWNT-03A	04/11/11	Technetium-99	5.06	2.78	4.49
EMWNT-03A	02/07/11	Thorium-230	0.22	0.18	0.18
EMWNT-03A	04/11/11	Thorium-230	0.42	0.25	0.19
EMWNT-03A	09/08/11	Thorium-230	0.77	0.38	0.22
EMWNT-03A	11/21/11	Thorium-230	0.3	0.19	0.16
EMWNT-03A	09/08/11	Uranium-233/234	0.5	0.37	0.31
EMWNT-03A	11/21/11	Uranium-233/234	0.44	0.37	0.32

NT-04	08/30/11	Chlorine-36	4.32	2.38	2.92
NT-04	08/30/11	Curium-245	0.19	0.16	0.16
NT-04	08/30/11	Curium-246	0.19	0.16	0.16
NT-04	04/11/11	Nickel-63	28.4	11.19	17.2
NT-04	04/11/11	Plutonium-244	0.21	0.18	0.2
NT-04	08/30/11	Radium-226	1.09 Q	0.64	0.33
NT-04	02/07/11	Technetium-99	6.62	2.67	4.18
NT-04	04/11/11	Technetium-99	4.83	2.65	4.3

APPENDIX D.4: CY 2011 MONITORING DATA FOR THE BEAR CREEK HYDROGEOLOGIC REGIME
Monitoring Data for the EMWMF: Radiological Analytes

Sampling Point	Date Sampled	Isotope	Result (pCi/L)		
			Activity	TPU	MDA
NT-04	02/07/11	Thorium-229	0.28	0.19	0.09
NT-04	02/07/11	Thorium-230	0.2	0.17	0.19
NT-04	04/11/11	Thorium-230	0.3	0.21	0.17
NT-04	11/21/11	Thorium-230	0.33	0.28	0.3
NT-04	02/07/11	Thorium-231+234	1.15	0.54	0.25
NT-04	04/11/11	Thorium-231+234	1.41	0.57	0.13
NT-04	08/30/11	Thorium-231+234	0.61	0.35	0.24
NT-04	04/11/11	Tritium	1110 Q	179.15	252
NT-04	02/07/11	Uranium-233/234	1.37	0.61	0.45
NT-04	04/11/11	Uranium-233/234	0.73	0.4	0.13
NT-04	08/30/11	Uranium-233/234	0.7	0.37	0.24
NT-04	11/21/11	Uranium-233/234	0.85	0.59	0.6
NT-04	02/07/11	Uranium-238	1.15	0.54	0.25
NT-04	04/11/11	Uranium-238	1.41	0.57	0.13
NT-04	08/30/11	Uranium-238	0.61	0.35	0.24
<hr/>					
EMWNT-05	02/07/11	Americium-241	0.53	0.34	0.38
EMWNT-05	04/11/11	Americium-241	0.19	0.16	0.15
EMWNT-05	09/08/11	Americium-241	0.14	0.13	0.14
EMWNT-05	04/11/11	Americium-243	0.2	0.19	0.19
EMWNT-05 D	11/21/11	Americium-243	0.19	0.17	0.16
EMWNT-05 D	11/21/11	Curium-245	0.2	0.17	0.17
EMWNT-05 D	11/21/11	Curium-246	0.2	0.17	0.17
EMWNT-05	11/21/11	Radium-228	2.08 Q	0.82	1.47
EMWNT-05 D	11/21/11	Radium-228	3.53 Q	0.83	1.15
EMWNT-05 D	11/21/11	Strontium-90	1.36	0.7	1.26
EMWNT-05	02/07/11	Technetium-99	6.66	2.68	4.21
EMWNT-05	04/11/11	Technetium-99	4.91	2.7	4.37
EMWNT-05	11/21/11	Thorium-228	0.14	0.13	0.12
EMWNT-05	04/11/11	Thorium-230	0.52	0.31	0.17
EMWNT-05	11/21/11	Thorium-230	0.58	0.28	0.12
EMWNT-05 D	11/21/11	Thorium-230	0.21	0.16	0.15
EMWNT-05	09/08/11	Thorium-231+234	0.43	0.28	0.26
EMWNT-05	11/21/11	Thorium-231+234	0.58	0.36	0.22
EMWNT-05	11/21/11	Thorium-232	0.22	0.17	0.17
EMWNT-05	09/08/11	Uranium-233/234	0.59	0.32	0.21
EMWNT-05	11/21/11	Uranium-233/234	0.35	0.28	0.28
EMWNT-05	09/08/11	Uranium-235/236	0.51	0.34	0.25
EMWNT-05	09/08/11	Uranium-238	0.43	0.28	0.26
EMWNT-05	11/21/11	Uranium-238	0.58	0.36	0.22
EMWNT-05 D	11/21/11	Yttrium-90	1.36	0.7	1.26
<hr/>					
EMW-VWEIR	11/21/11	Americium-243	0.18	0.16	0.17
EMW-VWEIR	11/21/11	Curium-245	0.19	0.16	0.17
EMW-VWEIR	11/21/11	Curium-246	0.19	0.16	0.17
EMW-VWEIR	04/11/11	Europium-155	11.3	6.92	6.8
EMW-VWEIR	09/08/11	Plutonium-239/240	0.28	0.2	0.15
EMW-VWEIR	02/07/11	Potassium-40	53.2	34.39	30.2
EMW-VWEIR	09/08/11	Radium-226	0.7	0.5	0.39
EMW-VWEIR	02/07/11	Strontium-90	2.3	0.73	1.16
EMW-VWEIR	02/07/11	Technetium-99	8.36	2.77	4.22
EMW-VWEIR	09/08/11	Technetium-99	4.89	2.75	4.46
EMW-VWEIR	09/08/11	Thorium-228	0.63	0.43	0.38
EMW-VWEIR	11/21/11	Thorium-228	0.39	0.25	0.19
EMW-VWEIR	04/11/11	Thorium-230	0.21	0.18	0.09
EMW-VWEIR	09/08/11	Thorium-230	1.67	0.75	0.32
EMW-VWEIR	11/21/11	Thorium-230	0.5	0.29	0.15
EMW-VWEIR	02/07/11	Thorium-231+234	1.74	0.63	0.12
EMW-VWEIR	04/11/11	Thorium-231+234	0.56	0.4	0.44
EMW-VWEIR	09/08/11	Thorium-232	0.49	0.36	0.27
EMW-VWEIR	11/21/11	Thorium-232	0.32	0.23	0.22

APPENDIX D.4: CY 2011 MONITORING DATA FOR THE BEAR CREEK HYDROGEOLOGIC REGIME
Monitoring Data for the EMWMF: Radiological Analytes

Sampling Point	Date Sampled	Isotope	Result (pCi/L)		
			Activity	TPU	MDA
EMW-VWEIR	02/07/11	Uranium-233/234	17.9	3.41	0.22
EMW-VWEIR	04/11/11	Uranium-233/234	1.8	0.72	0.4
EMW-VWEIR	09/08/11	Uranium-233/234	0.83	0.46	0.39
EMW-VWEIR	11/21/11	Uranium-233/234	1	0.49	0.23
EMW-VWEIR	02/07/11	Uranium-235/236	1.45	0.63	0.15
EMW-VWEIR	02/07/11	Uranium-238	1.74	0.63	0.12
EMW-VWEIR	04/11/11	Uranium-238	0.56	0.4	0.44
EMW-VWEIR	02/07/11	Yttrium-90	2.3	0.73	1.16
EMW-VWUNDER	11/09/11	Curium-245	0.14	0.13	0.14
EMW-VWUNDER	11/09/11	Curium-246	0.14	0.13	0.14
EMW-VWUNDER	02/09/11	Potassium-40	73.7	33.14	42.5
EMW-VWUNDER	08/29/11	Radium-226	0.34	0.2	0.13
EMW-VWUNDER	08/29/11	Thorium-230	0.57	0.29	0.16
EMW-VWUNDER	11/09/11	Thorium-230	0.25	0.18	0.17
EMW-VWUNDER	02/09/11	Thorium-231+234	0.15	0.12	0.07
EMW-VWUNDER	05/04/11	Thorium-231+234	0.19	0.14	0.15
EMW-VWUNDER	08/29/11	Thorium-231+234	0.15	0.13	0.14
EMW-VWUNDER	02/09/11	Uranium-233/234	0.2	0.14	0.07
EMW-VWUNDER	05/04/11	Uranium-233/234	0.36	0.2	0.18
EMW-VWUNDER	08/29/11	Uranium-233/234	0.13	0.12	0.11
EMW-VWUNDER	11/09/11	Uranium-233/234	0.28	0.18	0.14
EMW-VWUNDER	02/09/11	Uranium-238	0.15	0.12	0.07
EMW-VWUNDER	05/04/11	Uranium-238	0.19	0.14	0.15
EMW-VWUNDER	08/29/11	Uranium-238	0.15	0.13	0.14

APPENDIX E

**CY 2011 MONITORING DATA FOR THE
UPPER EAST FORK POPLAR CREEK HYDROGEOLOGIC REGIME**

EXPLANATION

Sampling Point:

200A6	-	Surface water location in storm drain near the outfall to Upper East Fork Poplar Creek
GHK	-	Gum Hollow Branch Kilometer (surface water sampling location)
GW	-	Groundwater monitoring well (also hyphenated numbers [e.g., 55-3A])
NPR	-	North of Pine Ridge near the Scarboro Community (surface water sampling location)
SCR	-	Spring sampling location in Union Valley
SP	-	Spring sampling location in the Y-12 Complex
STATION	-	Surface water sampling location in Upper East Fork Poplar Creek

Location:

B8110	-	Building 81-10
B9201-2	-	Building 9201-2
B9201-5	-	Building 9201-5
CPT	-	Coal Pile Trench
EXP-E	-	Exit Pathway Picket E
EXP-I	-	Exit Pathway Picket I
EXP-J	-	Exit Pathway Picket J
EXP-SR	-	Along Scarboro Road in the gap through Pine Ridge
EXP-SW	-	Surface water or spring sampling station
EXP-UV	-	East of the Oak Ridge Reservation boundary in Union Valley
FF	-	Fuel Facility (Building 9754-2)
GRID	-	Comprehensive Groundwater Monitoring Plan Grid Location (MMES 1990b)
NHP	-	New Hope Pond
RG	-	Rust Garage Area
S2	-	S-2 Site
S3	-	S-3 Site
SY	-	Y-12 Salvage Yard
T0134	-	Tank 0134-U
T2331	-	Tank 2331-U
UOV	-	Uranium Oxide Vault
WCPA	-	Waste Coolant Processing Area
Y-12	-	Y-12 Complex

Monitoring Program:

B/U	-	managed by Bechtel Jacobs Company LLC or URS CH2M Oak Ridge LLC
GWPP	-	managed by the Y-12 Groundwater Protection Program

Sample Type:

Dup	-	field duplicate sample
NP	-	sample collected without purging the well (no purge method)
PDB	-	passive diffusion bag sample

EXPLANATION (continued)

Units:

ft	-	feet (elevations are above mean sea level and depths are below grade)
µg/L	-	micrograms per liter
mg/L	-	milligrams per liter
mV	-	millivolts
µmho/cm	-	micromhos per centimeter
NTU	-	nephelometric turbidity units
pCi/L	-	picoCuries per liter
ppm	-	parts per million

Only analytes detected above reporting limits in at least one sample are included in this appendix. Additionally, results that are below the reporting limits are replaced with missing values (e.g., “ < ”) to emphasize the detected results. The following sections describe the analytes, reporting limits, and data qualifiers for each subappendix. A comprehensive list of the GWPP analytes, analytical methods, and reporting limits is provided in Appendix B, Table B.5.

E.1 Field Measurements, Miscellaneous Analytes, Major Ions, and Trace Metals:

Results for all of the field measurements, miscellaneous analytes, and major ions are included in this appendix. The reporting limits for the major ions are shown in the following summary.

Analyte	Reporting Limit (mg/L)		Analyte	Reporting Limit (mg/L)	
	GWPP	B/U		GWPP	B/U
Cations			Anions		
Calcium	0.2	0.01	Bicarbonate	1.0	NS
Magnesium	0.2	0.05	Carbonate	1.0	NS
Potassium	2.0	0.025	Chloride	0.2	0.1
Sodium	0.2	0.01	Fluoride	0.1	0.05
			Nitrate (as Nitrogen)	0.05	0.1
			Sulfate	0.25	0.1
Note: “NS” = not specified.					

EXPLANATION (continued)

The Y-12 GWPP SAP (B&W Y-12 2010) specifies analytical methods and reporting limits for trace metals that are appropriate for DOE Order monitoring. The laboratories subcontracted for the monitoring programs managed by BJC/UCOR may use reporting limits (sometimes reporting estimated values) that are lower than the GWPP reporting limits for the metals. For this report, the analytical methods for metals used by BJC/UCOR monitoring programs (EPA-7470, SW846-6010B, SW846-6020, and ASTM-D5174-M) are considered to be functionally equivalent to the methods used by the GWPP (Table B.5). To retain the highest quality data for DOE Order monitoring purposes and to standardize reporting limits for trace metal results obtained from all sources, the GWPP reporting limits were given precedence over the BJC/UCOR reporting limits (BJC 2009a) shown below. The trace metals shown in bold typeface below have at least one result that exceeds the reporting limit and are presented in Appendix E.1.

Analyte	Reporting Limit (mg/L)		Analyte	Reporting Limit (mg/L)	
	GWPP	B/U		GWPP	B/U
Aluminum	0.2	0.05*	Lithium	0.01	0.01
Antimony	0.0025	0.003	Manganese	0.005	0.005
Arsenic	0.005	0.005	Mercury	0.00005	0.0002
Barium	0.004	0.005	Molybdenum	0.05	NS
Beryllium	0.0005	0.001	Nickel	0.005	0.01
Boron	0.1	0.01*	Selenium	0.01	0.0025*
Cadmium	0.0025	0.00013*	Silver	0.02	0.0015*
Chromium	0.01	0.005*	Strontium	0.005	0.005
Cobalt		0.005*	Thallium	0.0005	0.001
Copper	0.02	0.005*	Thorium	0.2	NA
Iron	0.02	0.01*	Uranium	0.0005	0.004
Lead	0.05	0.002	Vanadium	0.02	0.01*
	0.0005		Zinc	0.05	0.01*
Note: * - the GWPP reporting limit is used instead of the B/U reporting limit; "NS" - not specified.					

The following symbols and qualifiers are used in Appendix E.1:

- . - Not analyzed or not applicable
- < - Analyzed but not detected at the project reporting level
- J - Positively identified; estimated concentration
- Q - Result is inconsistent with historical measurements for the location
- R - Result does not meet data quality objectives (e.g., duplicated dissolved solids results at well 55-3B)

EXPLANATION (continued)

E.2 Volatile Organic Compounds:

The Y-12 GWPP reporting limits for volatile organic compounds (Table B.5) and those used for monitoring programs managed by BJC/UCOR are contract-required quantitation limits. Results below the quantitation limit and above the instrument detection limit are reported as estimated quantities. Therefore, non-detected results are assumed to equal zero for all compounds.

As summarized below, 26 compounds were detected in the CY 2011 groundwater samples collected in the East Fork Regime. Results for these compounds are grouped by similar chemical composition (e.g., chloroethenes) in Appendix E.2.

Compound	No. Detected	Maximum (µg/L)	Compound	No. Detected	Maximum (µg/L)
Tetrachloroethene	81	150,000	1,4-Dichlorobenzene	4	2 J
Trichloroethene	72	17,000	Acetone	4	13
cis-1,2-Dichloroethene	65	4,000	Ethylbenzene	3	320
Chloroform	42	140	1,1,1-Trichloroethane	3	42
Carbon tetrachloride	37	1,200	Styrene	2	5 J
1,1-Dichloroethene	33	380 J	2-Butanone	2	21
Vinyl chloride	31	1,100	2-Hexanone	2	17
trans-1,2-Dichloroethene	24	78	4-Methyl-2-pentanone	2	6
1,1-Dichloroethane	22	41	Bromoform	2	5
1,1,2-Trichloro-1,2,2-trifluoroethane	14	3,600	1,2-Dichlorobenzene	1	2,400
Benzene	11	7,200	1,2-Dichloroethane	1	430
Total Xylene	6	4,800	Bromomethane	1	1
Toluene	6	2,000	Chlorobenzene	1	1.1
Methylene chloride	6	55	Carbon disulfide	1	1

Also presented in Appendix E.2 are results for volatile organic gases (ethane, ethylene, and methane) as natural attenuation indicators for groundwater samples collected from nine wells in the East Fork Regime.

The following symbols and data qualifiers are used in Appendix E.2.

- . - Not analyzed
- < - Analyzed but not detected
- J - Positively identified, estimated concentration below the contract-required quantitation limit
- Q - Result is inconsistent with historical measurements for the location

EXPLANATION (continued)

E.3 Radiological Analytes:

Reporting limits for radiological analytes are sample-specific and analyte-specific minimum detectable activities that are reported with each result. The following summary shows the radiological analytes reported for at least one groundwater sample collected during CY 2011 in the East Fork Regime.

Analyte	No. of Results	No. Detected	Analyte	No. of Results	No. Detected
Gross Alpha	107	27	Uranium-234*	16	16
Gross Beta	107	36	Uranium-235*	16	8
Technetium-99	28	7	Uranium-238	16	14
Note: * = Reported by B/U laboratories in Appendix E.3 as equivalent GWPP analytes: U-233/234 = U-234; U-235/236 = U-235.					

Results for gross alpha and gross beta are presented in the first four pages of Appendix E.3, followed by the results for the isotopes. The following notes and qualifiers apply to Appendix E.3:

- Result - Activity in picoCuries per liter (pCi/L)
- TPU - Total propagated uncertainty (two standard deviations); calculation includes the counting error (instrument uncertainty) as reported previously, plus other sources of uncertainty (e.g., volumetric, chemical yield)
- MDA - Minimum detectable activity
 - . - Not analyzed or not applicable (TPU is not presented when the result is <MDA)
 - < - Analyzed but less than the MDA (not detected)

APPENDIX E.1

FIELD MEASUREMENTS, MISCELLANEOUS ANALYTES, MAJOR IONS, AND TRACE METALS

APPENDIX E.1: CY 2011 MONITORING DATA FOR THE UPPER EAST FORK POPLAR CREEK HYDROGEOLOGIC REGIME
Field Measurements, Miscellaneous Analytes, Major Ions, and Trace Metals

Sampling Point	55-2A	55-2B	55-2C	55-3A		55-3B			55-3C	55-3C	56-1A
Functional Area	GRIDB3	GRIDB3	GRIDB3	B9201-5		B9201-5			B9201-5	B9201-5	Y12
Date Sampled	04/27/11	04/26/11	04/26/11	04/27/11	10/17/11	04/28/11	10/17/11		04/27/11	10/18/11	05/02/11
Program	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP
Sample Type	NP							Dup	NP	NP	
Field Measurements											
Time Sampled	14:00	14:05	10:00	10:25	9:50	10:10	14:20	14:20	14:50	8:55	9:15
Measuring Point Elev. (ft)	976.74	977.42	977.02	972.46	972.46	973.32	973.32	973.32	974.34	974.34	969.25
Depth to Water (ft)	8.00	8.00	8.00	12.00	12.13	12.00	13.01	13.01	13.00	13.95	8.00
Groundwater Elevation (ft)	968.74	969.42	969.02	960.46	960.33	961.32	960.31	960.31	961.34	960.39	961.25
Conductivity (µmho/cm)	2,370	2,680	2,600	745	673	440	417	417	465	494	906
Dissolved Oxygen (ppm)	1.49	0.15	0.74	3.92	1.41	1.43	0.48	0.48	2.3	2.76	0.64
Iron (++)	.	.	.	.	.	.	.	.	.	.	.
Manganese (++)	.	.	.	.	.	.	.	.	.	.	.
Oxidation/Reduction (mV)	161	163	133	187	157	161	-50	-50	156	215	167
Temperature (degrees C)	17.9	18.4	19.8	16.9	20.9	17.4	20.9	20.9	19	19	18.6
Turbidity (NTU)	.	.	.	.	.	.	.	.	.	.	.
pH	6.56	6.26	6.74	7	6.87	7.46	7.42	7.42	7.33	7.01	7.5
Miscellaneous Analytes											
Dissolved Solids (mg/L)	1,780	2,520	2,080	440	398	216	<R	71R	219	313	640
Suspended Solids (mg/L)	<	1.5	<	1	<	<	<	<	2.5	<	3
Major Ions (mg/L)											
Calcium	391	426	287	117	113	63.6	63.9	64.2	63.8	72.2	121
Magnesium	23.2	34.4	49.6	16.3	15.4	12.3	12.8	12.5	13.2	16.4	21.3
Potassium	3.3	3.31	15.9	3.2	3.64	4.3	4.46	4.37	6.17	7.39	3.13
Sodium	10.5	12	114	9.31	9.65	4.07	4.05	3.93	9.29	13.2	44.3 Q
Bicarbonate	203	151	213	153	172	155	158	149	169	174	115
Carbonate	<	<	<	<	<	<	<	<	<	<	<
Chloride	15.9	16.9	15.5	13.7	12.3	26.4	27.2	27.1	19.6	16.6	179 Q
Fluoride	<	<	<	<	<	<	<	<	<	<	0.314
Nitrate as N	227	299	272	1.71	1.5	0.054	<	<	0.116	0.417	0.361
Sulfate	20.9	20	16.1	190	158	35.7	34.1	35.2	45.1	74.7	90.7
Charge balance error (%)	1.9	-1.1	-1.4	0.9	1.6	-1.3	-0.4	.	-0.5	1.6	2.7
Trace Metals (mg/L)											
Aluminum	<	<	<	<	<	<	<	<	<	<	<
Barium	0.173	1.01	1.48	0.038	0.041	0.259	0.241	0.236	0.142	0.156	0.104
Beryllium	<	<	<	<	<	<	<	<	<	<	<
Boron	<	<	0.103	0.133	0.138	<	<	<	<	0.101	<
Cadmium	<	<	<	<	<	<	<	<	<	<	<
Chromium	<	<	<	0.00542	0.00376	0.00283	<	<	0.00381	<	0.022
Cobalt	<	<	<	<	<	<	<	<	<	<	<
Copper	<	<	<	<	<	<	<	<	<	<	<
Iron	<	<	<	<	<	<	0.0984	0.0938	0.119	<	0.185
Lead	<	<	<	<	<	<	<	<	<	<	<
Lithium	<	0.0228	0.066	<	<	0.0152	0.0161	0.0167	0.0175	0.02	0.0164
Manganese	0.172	0.484	0.438	<	0.00537	0.00832	0.0377	0.0364	0.0226	0.0292	0.0227
Mercury	<	<	<	<	<	<	<	<	<	<	<
Nickel	0.0128	0.00944	<	0.0143	0.0124	<	<	<	<	<	0.242
Selenium	<	0.0109	0.0148	<	<	<	<	<	<	<	<
Strontium	0.837	1.32	6.4	0.269	0.292	0.686	0.708	0.699	1.23	1.58	0.685
Thallium	<	<	<	<	<	<	<	<	<	<	<
Uranium	0.00362	<	0.00052	0.00068	0.00063	<	<	<	<	<	0.00226
Zinc	<	<	<	<	<	0.103	<	<	0.151	<	0.136

APPENDIX E.1: CY 2011 MONITORING DATA FOR THE UPPER EAST FORK POPLAR CREEK HYDROGEOLOGIC REGIME
Field Measurements, Miscellaneous Analytes, Major Ions, and Trace Metals

Sampling Point	56-1C	56-2C	56-3B		56-4A	GW-108		GW-151		GW-153
Functional Area	Y12	GRIDC3	Y12		Y12	S3		NHP		NHP
Date Sampled	05/02/11	05/05/11	05/05/11		04/28/11	01/20/11	07/19/11	02/23/11	08/04/11	08/25/11
Program	GWPP	GWPP	GWPP	GWPP	GWPP	B/U	B/U	B/U	B/U	GWPP
Sample Type				Dup	NP					
Field Measurements										
Time Sampled	14:20	14:30	9:00	9:00	13:25	9:50	9:45	16:00	15:00	10:45
Measuring Point Elev. (ft)	969.49	965.11	964.33	964.33	962.07	999.00	999.00	916.17	916.17	921.68
Depth to Water (ft)	7.00	9.00	11.00	11.00	10.00	6.84	6.20	15.72	15.74	20.74
Groundwater Elevation (ft)	962.49	956.11	953.33	953.33	952.07	992.16	992.80	900.45	900.43	900.94
Conductivity (µmho/cm)	401	592	487	487	184	39,156	37,199	484	505	470
Dissolved Oxygen (ppm)	1.02	0.95	3.03	3.03	4.94	2.08	0.44	1.71	0.55	2.3
Iron (++)	.	.	.	.	.	.	.	.	.	.
Manganese (++)	.	.	.	.	.	.	.	.	.	.
Oxidation/Reduction (mV)	175	138	163	163	189	76	51	158	-66	173
Temperature (degrees C)	22.5	20.2	16.7	16.7	18.1	16.9	22.6	16.1	19.4	17
Turbidity (NTU)	.	.	.	.	.	7	2	1	3	.
pH	7.6	8.3	7.1	7.1	6.85	5.08	5.4	7.3	6.98	7.36
Miscellaneous Analytes										
Dissolved Solids (mg/L)	159	325	199	203	71	.	.	300	340	194
Suspended Solids (mg/L)	1	1	1	2	2	.	.	<	<	<
Major Ions (mg/L)										
Calcium	28.6	4.83	88.1	86.7	24.7	8,800	8,900	63	63	52
Magnesium	8.33	1.37	4.29	4.25	3.09	840	910	28	29	22.4
Potassium	3.55	4.06	<	<	<	34	29 J	1.8	1.9	<
Sodium	46.9	117	5.92	5.85	5.66	460	490 J	6.9	7.4	8.93
Bicarbonate	192	223	188	189	66.6	760	760	240	240	185
Carbonate	<	10.3	<	<	<	<	<	<	<	<
Chloride	5.39	23.6	13.9	13.9	2.1	170	180	22	23	15.9
Fluoride	0.322	0.483	0.136	0.137	<	<	<	<	<	0.167
Nitrate as N	<	<	0.371	0.373	1.32	7,700	6,600	0.085	0.7	0.894
Sulfate	11.3	23.7	34.1	33.9	11.5	<	<	24	24	13.8
Charge balance error (%)	0.0	-2.6	.	0.7	0.3	-3.7	4.8	-1.1	-0.8	3.4
Trace Metals (mg/L)										
Aluminum	<	<	<	<	0.562	<	<	<	<	<
Barium	0.267	0.114	0.0851	0.0841	0.0368	59	59	0.19	0.2	0.0497
Beryllium	<	<	<	<	<	0.0016	<	<	<	<
Boron	0.138	1.1	0.109	0.11	<	<	<	<	<	<
Cadmium	<	0.00184	<	<	<	<	<	<	<	<
Chromium	0.00322	0.00314	0.00284	0.00316	0.03	0.015	<	<	<	<
Cobalt	<	<	<	<	<	0.15	0.15	<	<	<
Copper	<	<	<	<	<	<	<	<	<	<
Iron	<	<	<	<	0.312	<	<	<	<	<
Lead	<	<	<	<	<	0.0038	<	<	<	<
Lithium	0.0205	0.0763	<	<	<	0.32	0.41 J	<	<	<
Manganese	0.0874	0.0115	<	<	<	140	140	<	<	<
Mercury	<	<	<	<	<	<	<	.	.	<
Nickel	<	<	<	<	0.0108	0.11	0.16	<	<	<
Selenium	<	<	<	<	<	<	<	<	<	<
Strontium	0.852	0.279	0.118	0.116	0.0396	24	23	0.58	0.57	0.167
Thallium	<	<	<	<	<	<	<	<	<	<
Uranium	<	<	0.000645	0.000685	<	0.013	0.012	<	<	0.00118
Zinc	0.145	0.142	0.13	0.14	0.102	<	<	<	<	<

APPENDIX E.1: CY 2011 MONITORING DATA FOR THE UPPER EAST FORK POPLAR CREEK HYDROGEOLOGIC REGIME
Field Measurements, Miscellaneous Analytes, Major Ions, and Trace Metals

Sampling Point	GW-154		GW-169	GW-170				GW-171	GW-172	GW-193	
Functional Area	NHP		EXP-UV	EXP-UV		EXP-UV		EXP-UV	EXP-UV	T2331	
Date Sampled	02/24/11	08/04/11	03/01/11	03/01/11		08/09/11		02/28/11	02/28/11	01/26/11	07/14/11
Program	B/U	B/U	B/U	B/U	B/U	B/U	B/U	B/U	B/U	B/U	B/U
Sample Type					Dup		Dup				
Field Measurements											
Time Sampled	9:05	13:55	10:50	10:10	.	10:45	.	10:10	9:25	14:55	9:10
Measuring Point Elev. (ft)	911.70	911.70	932.12	932.64	.	932.64	.	920.72	926.69	934.17	934.17
Depth to Water (ft)	9.57	9.80	19.60	29.46	.	36.18	.	6.65	13.03	8.87	9.25
Groundwater Elevation (ft)	902.13	901.90	912.52	903.18	.	896.46	.	914.07	913.66	925.30	924.92
Conductivity (µmho/cm)	561	695	180	1,300	.	1,403	.	344	528	727	998
Dissolved Oxygen (ppm)	3.45	1.38	7.38	0.58	.	0.24	.	1.05	1.3	4.72	1.6
Iron (++)	.	.	.	.	.	.	.	0.66	0.13	.	.
Manganese (++)	.	.	.	.	.	.	.	4.3	0.7	.	.
Oxidation/Reduction (mV)	-5	41	128	-29	.	-111	.	-16	-43	169	-244
Temperature (degrees C)	13.1	25.3	13.6	13.4	.	15.9	.	16.5	14.6	14.4	24.41
Turbidity (NTU)	3	21	4	14	.	8	.	14	2	7	1
pH	7.01	5.29	6.04	11.59	.	11.98	.	6.79	7.66	7.32	7.28
Miscellaneous Analytes											
Dissolved Solids (mg/L)	430	450	130	330	330	370	370	230	360	.	.
Suspended Solids (mg/L)	20	32	<	18	19	16	16	13	<	.	.
Major Ions (mg/L)											
Calcium	130	170	40	120	120	140	140	.	.	.	.
Magnesium	18	19	2	3.4	3.4	5	4.4	.	.	.	.
Potassium	4.5	6.1	1.5	11	11	11	11	.	.	.	.
Sodium	5.9	9.7	0.66	5.5	5.5	5.8	5.7	.	.	.	.
Bicarbonate	.	.	100	<	<	<	<	.	.	.	.
Carbonate	.	.	<	82	88	62	66	.	.	.	.
Chloride	.	.	1.5	5.2	5.2	4.9	4.9	.	.	.	.
Fluoride	.	.	<	<	<	<	<	.	.	.	.
Nitrate as N	.	.	0.68	0.34	0.33	0.35	0.35	.	.	.	.
Sulfate	.	.	3.8	7.2	7.3	6.7	6.8	.	.	.	.
Charge balance error (%)	.	.	1.4	7.4	.	-16.6	.	.	.	.	.
Trace Metals (mg/L)											
Aluminum	<	0.32	<	0.45	0.44	0.85	0.78	.	.	.	.
Barium	0.086	0.16	0.021	0.15	0.15	0.16	0.16	.	.	.	.
Beryllium	<	<	<	<	<	<	<	.	.	.	.
Boron	<	0.11	<	<	<	<	<	.	.	.	.
Cadmium	<	<	<	<	<	<	<	.	.	.	.
Chromium	<	<	<	<	<	<	<	.	.	.	.
Cobalt	<	<	<	<	<	<	<	.	.	.	.
Copper	<	<	<	<	<	<	<	.	.	.	.
Iron	<	0.51	0.19	0.27	0.25	0.3	0.29	.	.	.	.
Lead	<	<	<	<	<	<	<	.	.	.	.
Lithium	<	<	<	0.028	0.027	0.03	0.029	.	.	.	.
Manganese	0.17	1.5	<	<	<	<	<	.	.	.	.
Mercury	.	.	.	.	.	.	.	.	.	.	.
Nickel	<	<	<	<	<	<	<	.	.	.	.
Selenium	<	<	<	<	<	<	<	.	.	.	.
Strontium	0.39	0.43	0.049	0.61	0.61	0.62	0.62	.	.	.	.
Thallium	<	<	<	<	<	<	<	.	.	.	.
Uranium	0.34	0.33	<	<	<	<	<	.	.	.	.
Zinc	<	<	<	<	<	<	<	.	.	.	.

APPENDIX E.1: CY 2011 MONITORING DATA FOR THE UPPER EAST FORK POPLAR CREEK HYDROGEOLOGIC REGIME
Field Measurements, Miscellaneous Analytes, Major Ions, and Trace Metals

Sampling Point	GW-204	GW-219	GW-223		GW-230	GW-240	GW-251	GW-253	GW-265	GW-268	GW-269
Functional Area	T0134	UOV	NHP		EXP-UV	NHP	S2	S2	SY	SY	SY
Date Sampled	02/23/11	02/21/11	02/24/11	08/08/11	02/28/11	08/25/11	02/21/11	03/01/11	04/25/11	04/27/11	04/19/11
Program	GWPP	GWPP	B/U	B/U	B/U	GWPP	GWPP	B/U	GWPP	GWPP	GWPP
Sample Type											
Field Measurements											
Time Sampled	9:25	14:00	10:30	15:50	10:00	9:40	10:15	10:30	9:20	8:55	11:10
Measuring Point Elev. (ft)	958.74	935.83	911.62	911.62	923.11	922.90	1,003.80	1,004.24	1,032.68	1,026.47	1,027.81
Depth to Water (ft)	9.00	10.00	9.71	10.00	10.26	21.00	17.00	2.02	9.00	12.00	15.00
Groundwater Elevation (ft)	949.74	925.83	901.91	901.62	912.85	901.90	986.80	1,002.22	1,023.68	1,014.47	1,012.81
Conductivity (µmho/cm)	312	662	744	737	896	490	696	3,737	409	387	171
Dissolved Oxygen (ppm)	2.94	2.33	0.38	0.32	0.68	2.3	0.23	1.82	1.44	2.15	1.19
Iron (++)	.	.	.	.	0.65	.	.	0.03	.	.	.
Manganese (++)	.	.	.	.	0.9	.	.	29.4	.	.	.
Oxidation/Reduction (mV)	200	202	-34	-32	-8	172	277	279	167	184	179
Temperature (degrees C)	12.2	16.8	15.38	18.1	14.3	17.6	14.8	11.2	17.8	18.1	19.7
Turbidity (NTU)	.	.	1	3	3	.	.	2	.	.	.
pH	7.62	7.07	6.91	8.89	6.66	7.19	6.33	4.94	6.42	7.16	5.75
Miscellaneous Analytes											
Dissolved Solids (mg/L)	215	.	480	520	580	185	388	2,900	253	161	69
Suspended Solids (mg/L)	2	.	<	<	<	<	4	<	<	8	6
Major Ions (mg/L)											
Calcium	43.7	.	110	100	.	55.6	86.5	470	45.8	58.2	17.2
Magnesium	6.23	.	15	15	.	19.4	9.32	99	7.52	5	2.58
Potassium	2.08	.	1.9	2	.	2.19	2.75	9.3 J	<	<	<
Sodium	4.59	.	35	39	.	11	8.25	100 J	14	6.89	9.24
Bicarbonate	115	.	230	220	.	195	163	66	141	174	65.3
Carbonate	<	.	<	<	.	<	<	<	<	<	<
Chloride	5.83	.	110	110	.	15.6	5.67	250	24.3	3.44	4.7
Fluoride	0.486	.	<	<	.	0.189	0.968	3.5	0.125	<	<
Nitrate as N	0.318	.	<	<	.	1.38	36.5	540	0.075	0.101	0.566
Sulfate	28.6	.	45	43	.	19.4	10.6	74	19.1	11.8	7.1
Charge balance error (%)	.	.	-2.0	-2.6	.	0.6	.	-14.7	-5.4	-2.8	-4.9
Trace Metals (mg/L)											
Aluminum	<	.	<	<	.	<	0.21	2.4	<	<	<
Barium	0.0649	.	0.36	0.35	.	0.0468	0.0759	0.19	0.255	0.104	0.0565
Beryllium	<	.	<	<	.	<	<	0.01	<	<	<
Boron	<	.	<	<	.	<	<	0.32	<	<	<
Cadmium	<	<	<	<	.	<	0.0892	3	<	<	<
Chromium	0.00729	0.01	<	<	.	<	<	<	<	<	0.00354
Cobalt	<	.	<	<	.	<	<	0.2	<	<	<
Copper	<	.	<	<	.	<	0.166	43	<	<	<
Iron	<	.	0.4	0.33	.	<	0.152	<	0.0572	0.342	<
Lead	<	<	<	<	.	<	<	0.017	0.0012	<	<
Lithium	0.135	.	<	<	.	<	<	0.054 J	<	<	0.0111
Manganese	<	.	0.62	0.57	.	<	2.51	39	<	0.0825	<
Mercury	<	.	.	.	.	<	<	.	<	<	<
Nickel	<	0.0126	<	<	.	<	0.0239	1.7	<	<	<
Selenium	<	<	<	<	.	<	<	<	<	<	<
Strontium	0.0948	.	0.28	0.27	.	0.083	0.174	0.69	0.153	0.206	0.044
Thallium	<	<	<	<	.	<	0.00128	0.0088	<	<	<
Uranium	0.0351	0.617	0.043	0.042	.	0.00357	0.00257	<	<	<	<
Zinc	<	.	<	<	.	<	0.053	4.3	<	<	<

APPENDIX E.1: CY 2011 MONITORING DATA FOR THE UPPER EAST FORK POPLAR CREEK HYDROGEOLOGIC REGIME
Field Measurements, Miscellaneous Analytes, Major Ions, and Trace Metals

Sampling Point	GW-270	GW-272	GW-274	GW-275	GW-281	GW-332	GW-380		GW-381	GW-382	
Functional Area	SY	SY	SY	SY	FF	WCPA	NHP		NHP	NHP	
Date Sampled	04/25/11	04/19/11	04/20/11	04/21/11	05/25/11	02/24/11	02/24/11	08/04/11	08/29/11	03/03/11	08/09/11
Program	GWPP	GWPP	GWPP	GWPP	B/U	GWPP	B/U	B/U	GWPP	B/U	B/U
Sample Type											
Field Measurements											
Time Sampled	14:00	14:50	13:25	9:05	15:30	10:30	10:55	13:05	9:25	14:05	12:20
Measuring Point Elev. (ft)	1,008.96	1,009.16	995.60	995.53	946.10	981.24	913.55	913.55	913.36	913.17	913.17
Depth to Water (ft)	2.00	6.00	4.00	4.00	5.31	11.00	10.20	11.23	11.00	10.15	11.51
Groundwater Elevation (ft)	1,006.96	1,003.16	991.60	991.53	940.79	970.24	903.35	902.32	902.36	903.02	901.66
Conductivity (µmho/cm)	1,341	5,750	9,790	47,500	445	246	355	454	723	570	731
Dissolved Oxygen (ppm)	0.97	0.54	0.19	0.75	1.7	1.97	5.89	2.29	0.17	1.35	1.92
Iron (++)	.	.	.	.	.	.	.	.	.	.	.
Manganese (++)	.	.	.	.	.	.	.	.	.	.	.
Oxidation/Reduction (mV)	150	89	184	205	-115	231	-21	-6	-148	73	46
Temperature (degrees C)	21.1	20.6	17.9	13.9	17.1	16	12.1	21.1	20.2	19.4	23.8
Turbidity (NTU)	.	.	.	.	1000	.	74	109	.	126	30
pH	7.2	6.73	5.61	6.57	6.89	5.7	6.9	6.38	7.24	8.49	7.07
Miscellaneous Analytes											
Dissolved Solids (mg/L)	904	4,320	8,790	49,400	.	204	240	260	.	360	440
Suspended Solids (mg/L)	2.5	3	2.5	1.5	.	<	9.8	9.6	.	7.4	<
Major Ions (mg/L)											
Calcium	181	993	1,760	10,600	.	32	45	47	.	86	91
Magnesium	32.9	142	263	1,440	.	4.52	17	19	.	24	26
Potassium	5.55	4.54	<	36.3	.	<	1.2	1.6	.	3.1	3.7
Sodium	13.6	16.3	211	131	.	7.23	19	15	.	19	22 J
Bicarbonate	204	103	622	55.3	.	81.5	150	180	.	270	270
Carbonate	<	<	<	<	.	<	<	<	.	<	<
Chloride	13.1	6.27	46	50.1	.	10.7	37	20	.	69	71
Fluoride	<	<	<	<	.	<	<	<	.	<	<
Nitrate as N	100	778	1,280	8940	.	2.38	2	1.6	.	0.48	0.44
Sulfate	50.3	9.12	3.17	12.1	.	13.1	28	21	.	5.2	5.3
Charge balance error (%)	-0.6	3.4	6.0	1.0	.	.	-2.9	-1.2	.	-2.2	1.3
Trace Metals (mg/L)											
Aluminum	<	<	<	<	.	<	<	<	.	<	<
Barium	0.146	2.63	10	161	.	0.129	0.032	0.039	.	0.53	0.56
Beryllium	<	<	<	<	.	<	<	<	.	<	<
Boron	<	<	<	<	.	<	<	<	.	<	<
Cadmium	<	<	0.00104	0.00084	.	<	<	<	.	<	<
Chromium	0.0169	<	<	<	.	0.00687	0.017	0.26	.	<	<
Cobalt	<	<	<	<	.	<	<	<	.	<	<
Copper	<	<	<	<	.	<	<	<	.	<	<
Iron	<	<	<	<	.	<	0.24	1.1	.	0.46	0.38 J
Lead	<	<	<	<	.	<	<	<	.	<	<
Lithium	0.0248	0.0424	0.0638	0.387	.	<	<	<	.	<	<
Manganese	0.0148	0.00783	47	1.82	.	<	0.0076	0.031	.	0.023	0.025
Mercury	<	<	1E-04	<	.	<	.	.	.	.	.
Nickel	<	0.0192	0.127	0.197	.	<	0.035	0.068	.	<	<
Selenium	<	<	<	<	.	<	<	<	.	<	<
Strontium	2.42	1.66	4.93	77.9	.	0.128	0.062	0.057	.	0.3	0.32
Thallium	<	<	<	<	.	<	<	<	.	<	<
Uranium	0.00126	0.00783	0.00863	0.00147	.	<	<	<	.	<	<
Zinc	<	<	<	<	.	<	<	<	.	<	<

APPENDIX E.1: CY 2011 MONITORING DATA FOR THE UPPER EAST FORK POPLAR CREEK HYDROGEOLOGIC REGIME
Field Measurements, Miscellaneous Analytes, Major Ions, and Trace Metals

Sampling Point	GW-383	GW-505	GW-508		GW-605				GW-606		GW-618
Functional Area	NHP	RG	RG		EXP-I				EXP-I		EXP-E
Date Sampled	11/02/11	10/18/11	10/18/11		01/11/11		07/06/11		01/11/11	07/06/11	03/28/11
Program	GWPP	GWPP	GWPP	GWPP	B/U	B/U	B/U	B/U	B/U	B/U	B/U
Sample Type				Dup		Dup		Dup			
Field Measurements											
Time Sampled	9:30	14:00	15:20	15:20	13:40	.	10:30	.	14:55	10:20	14:00
Measuring Point Elev. (ft)	908.77	1,015.19	1,010.74	1,010.74	919.06	.	919.06	.	919.59	919.59	985.14
Depth to Water (ft)	9.13	5.88	11.69	11.69	11.36	.	11.30	.	13.36	13.91	12.65
Groundwater Elevation (ft)	899.64	1,009.31	999.05	999.05	907.70	.	907.76	.	906.23	905.68	972.49
Conductivity (µmho/cm)	549	441	145	145	817	.	1,007	.	691	750	578
Dissolved Oxygen (ppm)	2.19	0.74	0.59	0.59	0.72	.	0.4	.	0.9	0.69	0.73
Iron (++)	.	.	.	.	.	.	.	.	.	.	0.13
Manganese (++)	.	.	.	.	.	.	.	.	.	.	1.1
Oxidation/Reduction (mV)	16	107	156	156	-12	.	149	.	-37	27	-56
Temperature (degrees C)	12.6	24.7	29.4	29.4	11.5	.	18.2	.	11.8	19.55	16.6
Turbidity (NTU)	.	.	.	.	0	.	15	.	1	1	1
pH	7	6.53	4.9	4.9	8.71	.	6.31	.	9.3	7.18	8.03
Miscellaneous Analytes											
Dissolved Solids (mg/L)	.	.	.	.	.	.	.	.	.	.	350
Suspended Solids (mg/L)	.	.	.	.	.	.	.	.	.	.	<
Major Ions (mg/L)											
Calcium	.	.	.	.	130	130	140	140	99	93	110
Magnesium	.	.	.	.	26	26	29	29	42	43	9
Potassium	.	.	.	.	3	2.9	3.6	3.6	3.6	3.4	3.4
Sodium	.	.	.	.	36	35	56	56	6.6	6.4	13 J
Bicarbonate	.	.	.	.	330	330	330	330	330	330	300
Carbonate	.	.	.	.	<	<	<	<	<	<	<
Chloride	.	.	.	.	92	91	160	160	20	21	21
Fluoride	.	.	.	.	<	<	<	<	<	<	<
Nitrate as N	.	.	.	.	0.12	0.12	0.078	0.086	11	9.2	0.03
Sulfate	.	.	.	.	36	36	39	40	70 J	72	16
Charge balance error (%)	.	.	.	.	1.6	.	-0.1	.	-3.6	-4.5	-0.3
Trace Metals (mg/L)											
Aluminum	.	.	.	.	<	<	<	<	<	<	<
Barium	.	.	.	.	0.062	0.061	0.081	0.082	0.16	0.16	0.035
Beryllium	.	.	.	.	<	<	<	<	<	<	<
Boron	.	.	.	.	<	<	0.1	0.1	<	<	<
Cadmium	.	<	.	.	<	<	<	<	<	<	<
Chromium	.	0.0166	.	.	<	<	0.061	0.066	<	<	<
Cobalt	.	.	.	.	<	<	<	<	<	<	<
Copper	.	.	.	.	<	<	<	<	<	<	<
Iron	.	.	.	.	0.14	0.14	3.6	3.7	<	<	0.2
Lead	.	<	.	.	<	<	<	<	<	<	<
Lithium	.	.	.	.	<	<	<	<	<	<	<
Manganese	.	.	.	.	0.24	0.23	0.44	0.44	0.011	0.012	1.1
Mercury	.	.	.	.	.	.	.	.	.	.	.
Nickel	.	0.00876	.	.	0.013	0.014	0.043	0.043	<	<	<
Selenium	.	<	.	.	<	<	<	<	<	<	<
Strontium	.	.	.	.	0.23	0.22	0.26	0.26	0.61	0.59	0.19
Thallium	.	<	.	.	<	<	<	<	<	<	<
Uranium	.	0.0265	.	.	0.14	0.15	0.16	0.15	0.0052	0.0054	<
Zinc	.	.	.	.	<	<	<	<	<	<	<

APPENDIX E.1: CY 2011 MONITORING DATA FOR THE UPPER EAST FORK POPLAR CREEK HYDROGEOLOGIC REGIME
Field Measurements, Miscellaneous Analytes, Major Ions, and Trace Metals

Sampling Point	GW-633	GW-658	GW-686	GW-690	GW-691		GW-692	GW-698		
Functional Area	RG	FF	CPT	CPT	CPT		CPT	B8110		
Date Sampled	03/01/11	05/24/11	05/09/11	05/09/11	05/11/11	10/25/11	05/03/11	05/12/11		10/19/11
Program	GWPP	B/U	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP
Sample Type									Dup	
Field Measurements										
Time Sampled	16:10	9:35	9:35	15:05	13:20	10:20	10:00	9:40	9:40	10:55
Measuring Point Elev. (ft)	996.43	944.81	963.76	967.36	968.59	968.59	964.38	970.09	970.09	970.09
Depth to Water (ft)	3.00	12.00	12.00	10.00	12.00	12.01	9.00	22.00	22.00	36.79
Groundwater Elevation (ft)	993.43	932.81	951.76	957.36	956.59	956.58	955.38	948.09	948.09	933.30
Conductivity (µmho/cm)	6,150	425	1,081	1,299	1,340	1,329	655	753	753	1,367
Dissolved Oxygen (ppm)	0.34	0.14	0.79	0.48	0.74	0.33	0.13	0.82	0.82	0.48
Iron (++)	.	.	.	.	.	.	.	.	.	.
Manganese (++)	.	.	.	.	.	.	.	.	.	.
Oxidation/Reduction (mV)	225	-200	129	111	140	188	-142	108	108	183
Temperature (degrees C)	15.5	19.8	18.3	20.9	21.6	20.7	19	18.6	18.6	17.5
Turbidity (NTU)	.	10	.	.	.	.	.	.	.	.
pH	5.48	6.18	6.7	6.8	6.4	5.99	7.6	6.8	6.8	6.82
Miscellaneous Analytes										
Dissolved Solids (mg/L)	4,840	.	696	851	986	1,100	356	415	368	1,200
Suspended Solids (mg/L)	1	.	2	1	<	<	1	<	<	<
Major Ions (mg/L)										
Calcium	1,060	.	192	245	221	237	91.3	92	92.8	201
Magnesium	107	.	27.8	24.3	41.3	47.3	17.1	33.5	33.9	60.7
Potassium	6.81	.	2.57	4.49	5.42	8.26	2.77	<	<	3.22
Sodium	91.8	.	15.7	8.8	14.4	10.2	9.62	8.19	8.26	20.3
Bicarbonate	327	.	329	259	147	70.8	99	284	295	284
Carbonate	<	.	<	<	<	<	<	<	<	<
Chloride	42.1	.	18.2	68.9	20.7	22.6	3.69	20	19.5	20
Fluoride	<	.	<	<	0.219	<	1.65	<	<	<
Nitrate as N	725	.	0.972	3.66	0.872	3.71	<	9.73	9.85	116
Sulfate	0.616	.	226	292	552	633	205	22.6	23.3	61.6
Charge balance error (%)	.	.	3.1	4.5	0.3	2.7	0.1	.	1.5	0.6
Trace Metals (mg/L)										
Aluminum	<	.	<	<	<	<	<	<	<	<
Barium	4.42	.	0.0552	0.0278	0.0201	0.0313	0.0207	0.0796	0.0803	0.157
Beryllium	<	.	<	<	<	0.000582	<	<	<	<
Boron	<	.	<	<	0.229	0.246	<	<	<	<
Cadmium	0.00072	.	<	<	<	<	<	<	<	<
Chromium	<	.	0.00934	0.00466	<	<	0.00306	0.00573	0.00549	<
Cobalt	<	.	<	<	<	<	<	<	<	<
Copper	<	.	<	<	<	<	<	<	<	<
Iron	<	.	<	<	<	<	0.224	<	<	<
Lead	<	.	<	<	0.000805	<	<	<	<	<
Lithium	0.138	.	<	<	<	<	0.0192	<	<	<
Manganese	5.36	.	0.124	0.0053	0.00718	2.08	0.256	<	0.00527	0.0716
Mercury	<	.	<	<	<	<	<	0.00145	0.00144	0.000408
Nickel	0.189	.	0.0103	0.0114	0.01	0.0336	<	<	<	<
Selenium	<	.	<	<	<	<	<	<	<	<
Strontium	2.38	.	0.417	0.333	0.647	0.66	0.236	0.138	0.14	0.522
Thallium	<	.	<	<	<	<	<	<	<	<
Uranium	0.00094	.	0.00118	<	0.000505	<	<	0.00093	0.000935	0.00109
Zinc	<	.	0.145	0.19	<	<	0.157	<	<	<

APPENDIX E.1: CY 2011 MONITORING DATA FOR THE UPPER EAST FORK POPLAR CREEK HYDROGEOLOGIC REGIME
Field Measurements, Miscellaneous Analytes, Major Ions, and Trace Metals

Sampling Point	GW-700		GW-722-14		GW-722-17		GW-722-20		GW-722-22	
Functional Area	B8110		EXP-J		EXP-J		EXP-J		EXP-J	
Date Sampled	08/29/11		03/15/11	07/19/11	03/15/11	07/20/11	03/15/11	07/20/11	03/15/11	07/19/11
Program	GWPP	GWPP	B/U	GWPP	B/U	GWPP	B/U	GWPP	B/U	GWPP
Sample Type		Dup								
Field Measurements										
Time Sampled	14:30	14:30	9:50	14:32	10:00	9:53	9:40	14:06	9:20	13:08
Measuring Point Elev. (ft)	960.18	960.18	953.71	953.71	953.71	953.71	953.71	953.71	953.71	953.71
Depth to Water (ft)	21.00	21.00	.	.	.	.	.	.	.	.
Groundwater Elevation (ft)	939.18	939.18	.	.	.	.	.	.	.	.
Conductivity (µmho/cm)	679	679	609	512	645	547	585	492	563	483
Dissolved Oxygen (ppm)	0.16	0.16	14.3	.	12.69	.	11.69	.	9.85	.
Iron (++)	.	.	.	.	.	.	.	.	.	.
Manganese (++)	.	.	.	.	.	.	.	.	.	.
Oxidation/Reduction (mV)	120	120	171	.	167	.	172	.	179	.
Temperature (degrees C)	19	19	14.2	21.1	14.4	20.1	14.1	20.1	13.32	20.1
Turbidity (NTU)	.	.	1	.	1	.	2	.	1	.
pH	6.57	6.57	7.26	7.07	7.41	7.05	7.43	7.2	7.43	7.25
Miscellaneous Analytes										
Dissolved Solids (mg/L)	404	410	.	217	.	233	.	227	.	211
Suspended Solids (mg/L)	<	<	.	1.5	.	<	.	1.5	.	<
Major Ions (mg/L)										
Calcium	121	116	.	61	.	46.8	.	54.4	.	59.8
Magnesium	10.3	9.66	.	29	.	28.3	.	30.5	.	29.2
Potassium	<	<	.	<	.	2.3	.	<	.	<
Sodium	13.8	13.1	.	16.1	.	34.5	.	14.7	.	13.2
Bicarbonate	246	246	.	269	.	219	.	249	.	266
Carbonate	<	<	.	<	.	<	.	<	.	<
Chloride	18	17.9	.	8.7	.	30.8	.	7.86	.	6.08
Fluoride	<	<	.	0.211	.	0.692	.	0.32	.	0.243
Nitrate as N	0.131	0.13	.	0.396	.	0.072	.	0.122	.	0.263
Sulfate	81.2	80.5	.	16.8	.	30.1	.	19.7	.	16.8
Charge balance error (%)	.	1.4	.	1.0	.	2.5	.	2.0	.	0.8
Trace Metals (mg/L)										
Aluminum	<	<	.	<	.	<	.	<	.	<
Barium	0.044	0.0417	.	0.121	.	0.117	.	0.086	.	0.102
Beryllium	<	<	.	<	.	<	.	<	.	<
Boron	<	<	.	0.121	.	0.156	.	0.114	.	0.108
Cadmium	<	<	.	<	.	<	.	<	.	<
Chromium	0.00568	0.00537	.	<	.	0.00298	.	<	.	<
Cobalt	<	<	.	<	.	<	.	<	.	<
Copper	<	<	.	<	.	<	.	<	.	<
Iron	<	<	.	<	.	0.0518	.	<	.	<
Lead	<	<	.	<	.	<	.	<	.	<
Lithium	<	<	.	0.0173	.	0.0296	.	0.0159	.	0.0152
Manganese	0.0732	0.0633	.	<	.	<	.	<	.	<
Mercury	<	<	.	<	.	<	.	<	.	<
Nickel	<	<	.	<	.	<	.	<	.	<
Selenium	<	<	.	<	.	<	.	<	.	<
Strontium	0.165	0.156	.	0.728	.	1.26	.	0.717	.	0.677
Thallium	<	<	.	<	.	<	.	<	.	<
Uranium	0.000715	0.000645	.	<	.	<	.	<	.	<
Zinc	<	<	.	<	.	0.251	.	0.0617	.	0.0887

APPENDIX E.1: CY 2011 MONITORING DATA FOR THE UPPER EAST FORK POPLAR CREEK HYDROGEOLOGIC REGIME
Field Measurements, Miscellaneous Analytes, Major Ions, and Trace Metals

Sampling Point	GW-722-33		GW-733		GW-735		GW-744	GW-747	GW-750
Functional Area	EXP-J		EXP-J		EXP-J		GRIDK1	GRIDK2	EXP-J
Date Sampled	03/15/11	07/19/11	01/11/11	07/06/11	08/01/11		08/16/11	08/15/11	08/01/11
Program	B/U	GWPP	B/U	B/U	GWPP	GWPP	GWPP	GWPP	GWPP
Sample Type						Dup			
Field Measurements									
Time Sampled	9:00	9:38	14:30	13:30	10:20	10:20	9:25	10:10	14:10
Measuring Point Elev. (ft)	953.71	953.71	959.84	959.84	924.46	924.46	907.43	911.06	919.03
Depth to Water (ft)	.	.	57.89	58.99	24.00	24.00	8.00	5.00	13.00
Groundwater Elevation (ft)	.	.	901.95	900.85	900.46	900.46	899.43	906.06	906.03
Conductivity (µmho/cm)	478	474	272	336	711	711	409	420	525
Dissolved Oxygen (ppm)	9.85	.	2.46	1.17	0.3	0.3	0.24	0.51	0.5
Iron (++)	.	.	.	.	.	.	.	.	.
Manganese (++)	.	.	.	.	.	.	.	.	.
Oxidation/Reduction (mV)	186	.	121	1.2	98	98	-186	-31	8
Temperature (degrees C)	14.4	21.8	8	23.61	18.6	18.6	20.3	21.3	20.9
Turbidity (NTU)	2	.	3	2	.	.	.	.	.
pH	7.31	6.97	6.85	7.64	6.81	6.81	7.44	7.28	7.07
Miscellaneous Analytes									
Dissolved Solids (mg/L)	.	219	.	.	438	392	339	183	395
Suspended Solids (mg/L)	.	<	.	.	<	<	<	1	<
Major Ions (mg/L)									
Calcium	.	86.4	.	.	139	134	52.7	43.1	87.1
Magnesium	.	13.6	.	.	10.6	10.3	12	11.3	12.5
Potassium	.	<	.	.	2.71	2.51	3.53	2.53	4.88
Sodium	.	2.93	.	.	4	3.82	37.7	32.4	6.36
Bicarbonate	.	236	.	.	321	320	236	210	243
Carbonate	.	<	.	.	<	<	<	<	<
Chloride	.	3.23	.	.	18.7	18.8	7.05	2.72	5.27
Fluoride	.	<	.	.	<	<	<	0.21	<
Nitrate as N	.	0.651	.	.	<	<	0.055	<	<
Sulfate	.	12.9	.	.	21.3	21.4	16.6	14.8	17
Charge balance error (%)	.	4.1	.	.	.	3.5	0.8	-0.4	3.7
Trace Metals (mg/L)									
Aluminum	.	<	.	.	<	<	<	<	<
Barium	.	0.0373	.	.	0.361	0.35	0.302	0.182	0.744
Beryllium	.	<	.	.	<	<	<	<	<
Boron	.	<	.	.	<	<	<	<	0.101
Cadmium	.	<	.	.	<	<	<	<	<
Chromium	.	<	.	.	0.00619	0.00606	<	0.00422	<
Cobalt	.	<	.	.	<	<	<	<	<
Copper	.	<	.	.	<	<	<	<	<
Iron	.	<	.	.	<	<	<	0.23	0.172
Lead	.	<	.	.	0.0011	<	<	<	<
Lithium	.	<	.	.	<	<	0.0286	0.0181	0.0113
Manganese	.	<	.	.	0.344	0.335	0.0158	0.0167	0.0577
Mercury	.	<	.	.	<	<	<	<	<
Nickel	.	<	.	.	<	<	<	<	<
Selenium	.	<	.	.	<	<	<	<	<
Strontium	.	0.0825	.	.	0.31	0.3	1.38	0.805	0.69
Thallium	.	<	.	.	<	<	<	<	<
Uranium	.	<	.	.	<	<	<	<	<
Zinc	.	0.055	.	.	<	<	0.244	0.337	<

APPENDIX E.1: CY 2011 MONITORING DATA FOR THE UPPER EAST FORK POPLAR CREEK HYDROGEOLOGIC REGIME
Field Measurements, Miscellaneous Analytes, Major Ions, and Trace Metals

Sampling Point	GW-762				GW-765	GW-769		GW-770	GW-776	GW-779
Functional Area	GRIDJ3				GRIDE1	GRIDG3		GRIDG3	GRIDH3	GRIDF2
Date Sampled	02/24/11		08/08/11		10/25/11	05/16/11	10/20/11	10/24/11	02/23/11	05/17/11
Program	B/U	B/U	B/U	B/U	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP
Sample Type		Dup		Dup						NP
Field Measurements										
Time Sampled	15:00	.	14:40	.	15:00	14:55	10:00	13:35	14:20	13:35
Measuring Point Elev. (ft)	915.56	.	915.56	.	1,008.54	944.43	944.43	944.72	931.25	963.09
Depth to Water (ft)	13.61	.	13.98	.	19.09	11.00	8.32	13.58	15.00	9.00
Groundwater Elevation (ft)	901.95	.	901.58	.	989.45	933.43	936.11	931.14	916.25	954.09
Conductivity (µmho/cm)	580	.	583	.	740	509	497	323	736	479
Dissolved Oxygen (ppm)	0.55	.	6.45	.	0.5	0.23	0.43	3.5	2.15	1
Iron (++)	.	.	.	.	.	.	.	.	.	.
Manganese (++)	.	.	.	.	.	.	.	.	.	.
Oxidation/Reduction (mV)	159	.	55	.	63	63	67	157	154	130
Temperature (degrees C)	17.09	.	20.4	.	21.7	18.9	19.3	23.3	17.6	15.3
Turbidity (NTU)	2	.	2	.	.	.	.	.	.	.
pH	7.13	.	6.91	.	6.84	7	7.14	6.83	7.05	9.36
Miscellaneous Analytes										
Dissolved Solids (mg/L)	350	350	380	380	377	263	417	144	503	256
Suspended Solids (mg/L)	<	<	<	<	<	<	<	1	10	<
Major Ions (mg/L)										
Calcium	82	83	80	79	133	87.6	87	58.9	108	2.83
Magnesium	23	23	24	24	14.1	9.45	10.3	5.19	7.3	2.18
Potassium	4	4.2	5.4	4.5	<	2.79	2.91	2.78	3.26	2.4
Sodium	12	12	12	12	11.1	6.97	7.65	5.39	22.3	96.8
Bicarbonate	270	270	270	260	343	214	229	155	192	120
Carbonate	<	<	<	<	<	<	<	<	<	96.9
Chloride	37	38	37	37	31.8	16.4	17.6	3.4	68.9	12.6
Fluoride	<	<	<	<	<	<	<	0.133	<	0.488
Nitrate as N	<	<	0.021	0.018	<	0.333	0.458	1.12	1.48	<
Sulfate	14	14	15	15	13.4	21.6	24.4	16.2	49.9	7.97
Charge balance error (%)	-0.9	.	-0.9	.	1.5	2.9	-0.2	0.7	.	-3.3
Trace Metals (mg/L)										
Aluminum	<	<	<	<	<	<	<	<	<	<
Barium	0.49	0.5	0.51	0.5	0.175	0.348	0.362	0.0642	0.104	0.212
Beryllium	<	<	<	<	<	<	<	<	<	<
Boron	<	<	<	<	<	<	<	<	<	0.178
Cadmium	<	<	<	<	<	<	<	<	<	<
Chromium	<	<	<	<	<	<	<	<	0.981	<
Cobalt	<	<	<	<	<	<	<	<	<	<
Copper	<	<	<	<	<	<	<	<	<	<
Iron	<	<	<	<	<	<	<	<	5.37	<
Lead	<	<	<	<	<	<	<	<	<	<
Lithium	0.012	0.012	0.018	0.015	0.0168	0.0156	0.0162	<	<	0.036
Manganese	0.042	0.042	0.04	0.039	0.34	0.00666	0.00592	<	0.0278	<
Mercury	.	.	.	.	<	<	<	<	<	<
Nickel	<	<	<	<	0.00683	<	<	<	0.513	<
Selenium	<	<	<	<	<	<	<	<	<	<
Strontium	0.71	0.72	0.7	0.69	0.189	0.363	0.371	0.0822	0.19	0.392
Thallium	<	<	<	<	<	<	<	<	<	<
Uranium	<	<	<	<	<	<	<	0.00092	<	<
Zinc	<	<	<	<	<	<	<	<	<	<

APPENDIX E.1: CY 2011 MONITORING DATA FOR THE UPPER EAST FORK POPLAR CREEK HYDROGEOLOGIC REGIME
Field Measurements, Miscellaneous Analytes, Major Ions, and Trace Metals

Sampling Point	GW-781	GW-782	GW-783	GW-791	GW-802	GW-816	GW-820		GW-832		GW-930
Functional Area	GRIDE3	GRIDE3	GRIDE3	GRIDD2	FF	EXP-SR	B9201-2		NHP		GRIDD1
Date Sampled	08/17/11	08/17/11	08/18/11	08/16/11	05/26/11	08/11/11	05/16/11		02/24/11	08/04/11	02/22/11
Program	GWPP	GWPP	GWPP	GWPP	B/U	GWPP	GWPP	GWPP	B/U	B/U	GWPP
Sample Type								Dup			
Field Measurements											
Time Sampled	9:10	14:30	9:15	14:10	15:20	9:15	10:45	10:45	13:55	10:45	14:10
Measuring Point Elev. (ft)	947.89	947.73	948.49	992.13	941.83	898.42	929.57	929.57	906.18	906.18	1,005.62
Depth to Water (ft)	9.00	10.00	11.00	24.00	6.64	12.00	10.00	10.00	6.72	7.01	10.00
Groundwater Elevation (ft)	938.89	937.73	937.49	968.13	935.19	886.42	919.57	919.57	899.46	899.17	995.62
Conductivity (µmho/cm)	440	652	755	317	812	511	507	507	340	384	325
Dissolved Oxygen (ppm)	1.11	0.58	1.28	1.18	2.36	0.13	0.36	0.36	4.76	2.08	0.36
Iron (++)	.	.	.	.	.	.	.	.	.	.	.
Manganese (++)	.	.	.	.	.	.	.	.	.	.	.
Oxidation/Reduction (mV)	139	147	53	20	-31	-54	24	24	-40	59	-1
Temperature (degrees C)	21.3	21.3	20.4	26.7	20.5	19.9	17.3	17.3	12.3	22.4	16.1
Turbidity (NTU)	.	.	.	.	9	.	.	.	64	19	.
pH	8.28	6.95	6.86	7.17	7.17	6.43	7.1	7.1	7.53	7.09	8.78
Miscellaneous Analytes											
Dissolved Solids (mg/L)	203	388	517	312	.	283	301	303	240	250	.
Suspended Solids (mg/L)	1	3	5	<	.	12	<	<	46	62	.
Major Ions (mg/L)											
Calcium	8.93	101	110	67.7	.	57.1	72.3	69.4	56	73	.
Magnesium	3.24	10.8	7.74	14.7	.	17.6	11.5	11.3	12	18	.
Potassium	5.08	3.11	2.14	2.16	.	5.14	2.3	2.31	1.7	2.2	.
Sodium	85.6	14.4	25.4	7.19	.	15.3	16	15.6	16	11	.
Bicarbonate	203	257	234	215	.	224	175	188	150	150	.
Carbonate	10.4	<	<	<	.	<	<	<	<	<	.
Chloride	6.7	45.6	75.7	9.41	.	26.1	24.2	24.6	35	16	.
Fluoride	<	<	<	<	.	0.118	0.214	0.212	<	<	.
Nitrate as N	0.14	0.499	0.539	<	.	<	<	<	1.4	1.6	.
Sulfate	9.5	21.3	23.4	11.4	.	4.4	34.1	34.8	24	32	.
Charge balance error (%)	-1.1	-2.0	-0.4	1.6	.	-2.1	.	1.7	-0.7	14.4	.
Trace Metals (mg/L)											
Aluminum	<	<	<	<	.	<	<	<	0.25	1.3	.
Barium	0.264	0.382	0.141	0.253	.	0.112	0.182	0.179	0.053	0.066	.
Beryllium	<	<	<	<	.	<	<	<	<	<	.
Boron	0.535	<	<	<	.	<	<	<	<	<	.
Cadmium	<	<	<	<	.	<	<	<	<	<	.
Chromium	0.00256	0.0956	0.162	<	.	0.00723	<	<	<	<	.
Cobalt	<	<	<	<	.	<	<	<	<	<	.
Copper	<	<	<	<	.	<	<	<	<	<	.
Iron	<	2.36	1.43	<	.	12.7	0.0742	0.0753	0.22	2	.
Lead	<	<	<	<	.	<	<	<	<	0.0038	.
Lithium	0.0662	0.0111	<	0.0131	.	<	<	<	0.014	0.015	.
Manganese	<	0.0159	0.0275	0.0179	.	1.3	0.406	0.389	0.018	0.058	.
Mercury	<	<	<	<	.	<	<	<	.	.	.
Nickel	<	0.124	0.483	<	.	<	<	<	<	<	.
Selenium	<	<	<	<	.	<	<	<	<	<	.
Strontium	0.518	0.59	0.249	0.423	.	0.0803	0.293	0.288	0.12	0.12	.
Thallium	<	<	<	<	.	<	<	<	<	<	.
Uranium	<	<	0.00126	<	.	<	<	<	0.0058	0.0048	.
Zinc	<	<	<	<	.	0.448	<	<	<	0.052	.

APPENDIX E.1: CY 2011 MONITORING DATA FOR THE UPPER EAST FORK POPLAR CREEK HYDROGEOLOGIC REGIME
Field Measurements, Miscellaneous Analytes, Major Ions, and Trace Metals

Sampling Point	GW-959	GW-960	GHK2.51WSW	NPR12.0SW	NPR23.0SW	SCR7.1SP	SCR7.8SP	SP-17
Functional Area	B9201-2	GRIDF2	EXP-SW	EXP-SW	EXP-SW	EXP-SW	EXP-SW	EXP-SW
Date Sampled	10/31/11	05/17/11	01/24/11	01/24/11	01/24/11	01/17/11	01/17/11	01/24/11
Program	GWPP	GWPP	GWPP	GWPP	GWPP	B/U	B/U	GWPP
Sample Type								
Field Measurements								
Time Sampled	9:45	15:25	9:55	10:55	10:25	10:45	10:55	13:10
Measuring Point Elev. (ft)	927.69	963.26	.	.	.	.	.	.
Depth to Water (ft)	3.55	14.00	.	.	.	.	.	.
Groundwater Elevation (ft)	924.14	949.26	.	.	.	.	.	.
Conductivity (µmho/cm)	478	1,211	195	137	141	448	359	536
Dissolved Oxygen (ppm)	2.2	0.47	7.63	7.89	8.05	14.25	9.58	3.34
Iron (++)	.	.	.	.	.	0	0	.
Manganese (++)	.	.	.	.	.	0	0	.
Oxidation/Reduction (mV)	163	98	172	165	169	178.2	163.8	174
Temperature (degrees C)	15.4	13.8	5.5	3.5	4.4	10.26	10.46	13.4
Turbidity (NTU)	.	.	.	.	.	4	2	.
pH	7.27	7.1	7.09	6.97	7.11	8.64	8.54	6.68
Miscellaneous Analytes								
Dissolved Solids (mg/L)	279	1,070	32	43	26	300	230	181
Suspended Solids (mg/L)	<	4	<	7	<	5.6	<	1
Major Ions (mg/L)								
Calcium	64.6	160	24.4	10.9	12.9	.	.	59.8
Magnesium	7.43	26.5	7.1	5.61	5.5	.	.	32.4
Potassium	3.28	4	2.04	2.66	2.26	.	.	<
Sodium	22.3	93 Q	1.89	3.46	2.39	.	.	2.4
Bicarbonate	158	190	71.2	51.7	54.3	.	.	244
Carbonate	<	<	<	<	.	.	.	<
Chloride	11.2	335 Q	0.723	0.858	0.711	.	.	4.44
Fluoride	0.393	0.102	<	<	<	.	.	<
Nitrate as N	<	0.207	<	<	<	.	.	8.14
Sulfate	74.1	38.9	18.8	9.8	11.3	.	.	5.2
Charge balance error (%)	-1.5	0.8	.	.	.	.	.	.
Trace Metals (mg/L)								
Aluminum	<	<	<	<	<	.	.	<
Barium	0.0789	0.278	0.0485	0.049	0.0427	.	.	0.146
Beryllium	<	<	<	<	<	.	.	<
Boron	<	<	<	<	<	.	.	<
Cadmium	<	<	<	<	<	.	.	<
Chromium	0.00352	0.00527	<	<	<	.	.	<
Cobalt	<	<	<	<	<	.	.	<
Copper	<	<	<	<	<	.	.	<
Iron	<	0.854	0.0943	0.0896	0.0769	.	.	<
Lead	<	0.00754	<	<	<	.	.	<
Lithium	<	<	<	<	<	.	.	<
Manganese	<	1.03	0.0281	0.0125	0.00947	.	.	0.00787
Mercury	<	<	<	<	<	.	.	<
Nickel	0.0178	0.00953	<	<	<	.	.	<
Selenium	<	<	<	<	<	.	.	<
Strontium	0.179	2.25	0.0759	0.051	0.0464	.	.	0.0424
Thallium	<	<	<	<	<	.	.	<
Uranium	0.000965	<	<	<	<	.	.	0.00088
Zinc	<	<	<	<	<	.	.	<

APPENDIX E.1: CY 2011 MONITORING DATA FOR THE UPPER EAST FORK POPLAR CREEK HYDROGEOLOGIC REGIME
Field Measurements, Miscellaneous Analytes, Major Ions, and Trace Metals

Sampling Point	200A6				STATION 8			
Functional Area	EXP-SW				EXP-SW			
Date Sampled	02/10/11	02/24/11	07/12/11	08/15/11	02/10/11	02/24/11	07/12/11	08/15/11
Program	B/U	B/U	B/U	B/U	B/U	B/U	B/U	B/U
Sample Type								
Field Measurements								
Time Sampled	14:40	10:30	15:15	8:45	15:00	10:15	15:00	9:05
Measuring Point Elev. (ft)	.	.	.	.	.	.	.	.
Depth to Water (ft)	.	.	.	.	.	.	.	.
Groundwater Elevation (ft)	.	.	.	.	.	.	.	.
Conductivity (µmho/cm)	514	285	352	532	288	346	333	343
Dissolved Oxygen (ppm)	6.54	8.01	6	5.32	10.16	8.34	6.4	7.16
Iron (++)	.	.	.	.	.	.	.	.
Manganese (++)	.	.	.	.	.	.	.	.
Oxidation/Reduction (mV)	41.9	123.5	180	197.8	35.6	96.8	136	189.5
Temperature (degrees C)	18.76	16.56	29.03	24.5	11.5	12.99	23.86	20.56
Turbidity (NTU)	3	11	6	58	3	42	7	16
pH	9.03	7.33	7.7	7.8	8.64	7.18	8.3	7.8
Miscellaneous Analytes								
Dissolved Solids (mg/L)	380	180	200	300	210	240	220	210
Suspended Solids (mg/L)	<	<	<	45	<	16	4.4	8.2
Major Ions (mg/L)								
Calcium	59	30	41	70	43	40	43	45
Magnesium	17	6.7	11	14	12	9.7	12	11
Potassium	2.8	1.1	1.4	3.3	1.8	1.7	1.6	1.6
Sodium	29	13	8.7	12	13	26	8.6	7.8
Bicarbonate	.	.	.	.	.	.	.	.
Carbonate	.	.	.	.	.	.	.	.
Chloride	.	.	.	.	.	.	.	.
Fluoride	.	.	.	.	.	.	.	.
Nitrate as N	.	.	.	.	.	.	.	.
Sulfate	.	.	.	.	.	.	.	.
Charge balance error (%)	.	.	.	.	.	.	.	.
Trace Metals (mg/L)								
Aluminum	<	0.2	<	1.5	<	0.3	<	<
Barium	0.05	0.035	0.042	0.087	0.04	0.044	0.042	0.041
Beryllium	<	<	<	<	<	<	<	<
Boron	<	<	<	<	0.16	<	0.11	<
Cadmium	<	<	<	<	<	<	<	<
Chromium	<	<	<	<	<	<	<	<
Cobalt	<	<	<	<	<	<	<	<
Copper	0.099	0.032	0.022	<	<	<	<	<
Iron	<	0.13	0.2	1.9	<	0.24	0.11	0.19
Lead	<	<	<	<	<	<	<	<
Lithium	0.012	1.8	<	0.034	0.041	0.092	0.032	<
Manganese	0.017	0.031	0.0066	0.23	0.038	0.071	0.057	0.069
Mercury	.	.	.	.	.	.	.	.
Nickel	<	<	<	<	<	<	<	<
Selenium	<	<	<	<	<	<	<	<
Strontium	0.18	0.082	0.12	0.18	0.13	0.11	0.12	0.12
Thallium	<	<	<	<	<	<	<	<
Uranium	0.0042	0.0075	<	0.11	0.011	0.026	0.0063	0.016
Zinc	0.14	0.14	<	0.056	<	<	<	<

APPENDIX E.2

VOLATILE ORGANIC COMPOUNDS

APPENDIX E.2: CY 2011 MONITORING DATA FOR THE UPPER EAST FORK POPLAR CREEK HYDROGEOLOGIC REGIME
Volatile Organic Compounds

Sampling Point	55-2A	55-2B	55-2C	55-3A		55-3B			55-3C	
Functional Area	GRIDB3	GRIDB3	GRIDB3	B9201-5		B9201-5			B9201-5	
Date Sampled	04/27/11	04/26/11	04/26/11	04/27/11	10/17/11	04/28/11	10/17/11		04/27/11	10/18/11
Program	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP
Sample Type	NP							Dup	NP	NP
Chloroethenes (µg/L)										
Tetrachloroethene	240	390	270	13,000	38,000	45,000	130,000	150,000	11,000	9,700
Trichloroethene	120	200	170	1,100	3,400	5,100	17,000	15,000	1,600	1,200
cis-1,2-Dichloroethene	300	400	480	1,000	2,600	1,400	4,000	3,600	1,500	1,200
trans-1,2-Dichloroethene	3 J	5	6	14	23	43	78	77	18	21
1,1-Dichloroethene	7	11	12	21	30	140	380 J	320 J	34	27
Vinyl chloride	6	11	9	25	55	110	1,100	1,000	110	83
Chloroethanes (µg/L)										
1,1,1-Trichloroethane	<	<	<	<	<	<	<	<	<	<
1,2-Dichloroethane	<	<	<	<	<	<	<	<	<	<
1,1-Dichloroethane	7	9	11	4 J	5	26	41	40	5	5 J
Chloromethanes (µg/L)										
Carbon tetrachloride	<	<	<	<	<	<	<	<	<	<
Chloroform	<	<	<	<	<	<	<	<	<	<
Methylene chloride	<	<	<	<	<	<	<	<	<	<
Petrol. Hydrocarb. (µg/L)										
Benzene	<	<	<	<	<	<	<	<	<	<
Ethylbenzene	<	<	<	<	<	<	<	<	<	<
Toluene	<	<	<	<	<	2 J	4 J	5 J	<	<
Total Xylene	<	<	<	<	<	<	4 J	5 J	<	<
Styrene	<	<	<	<	<	<	<	<	<	<
Miscellaneous (µg/L)										
1,1,2-Trichloro-1,2,2,2-trifluoroethane	170	260	170	13	29	<	<	<	4 J	7
Bromoform	<	<	<	<	<	<	<	<	<	<
Bromomethane	<	<	<	<	<	<	<	<	<	<
Carbon disulfide	<	<	<	<	<	<	<	<	<	<
Chlorobenzene	<	<	<	<	<	<	<	<	<	<
1,2-Dichlorobenzene	<	<	<	<	<	<	<	<	<	<
1,4-Dichlorobenzene	<	<	<	<	<	<	2 J	2 J	<	<
2-Butanone	<	<	<	<	<	<	<	<	<	<
2-Hexanone	<	<	<	<	<	<	<	<	<	<
4-Methyl-2-pentanone	<	<	<	<	<	<	<	<	<	<
Acetone	<	<	8 J	<	<	<	<	<	<	<
Natural Attenuation (µg/L)										
Ethane	.	.	.	.	.	.	.	.	.	.
Ethylene	.	.	.	.	.	.	.	.	.	.
Methane	.	.	.	.	.	.	.	.	.	.

APPENDIX E.2: CY 2011 MONITORING DATA FOR THE UPPER EAST FORK POPLAR CREEK HYDROGEOLOGIC REGIME
Volatile Organic Compounds

Sampling Point	56-1A	56-1C	56-2A	56-2B	56-2C	56-3A	56-3B		56-3C	56-4A
Functional Area	Y12	Y12	GRIDC3	GRIDC3	GRIDC3	Y12	Y12		Y12	Y12
Date Sampled	05/02/11	05/02/11	05/04/11	05/04/11	05/05/11	05/04/11	05/05/11		05/04/11	04/28/11
Program	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP
Sample Type			PDB	PDB		PDB		Dup	PDB	NP
Chloroethenes (µg/L)										
Tetrachloroethene	<	<	13	740	290	33	30	32	270	5 J
Trichloroethene	<	<	5	62	410	5	2 J	3 J	26	<
cis-1,2-Dichloroethene	<	<	7	78	1,400	8	3 J	4 J	47	<
trans-1,2-Dichloroethene	<	<	<	<	11	<	<	<	<	<
1,1-Dichloroethene	<	<	<	<	23	<	<	<	<	<
Vinyl chloride	<	<	<	<	78	<	<	<	<	<
Chloroethanes (µg/L)										
1,1,1-Trichloroethane	<	<	<	<	<	<	<	<	<	<
1,2-Dichloroethane	<	<	<	<	<	<	<	<	<	<
1,1-Dichloroethane	<	<	<	<	<	<	<	<	<	2 J
Chloromethanes (µg/L)										
Carbon tetrachloride	<	<	<	<	<	<	<	<	<	<
Chloroform	2 J	<	<	<	<	4 J	21	22	7	<
Methylene chloride	<	<	<	<	<	<	<	<	<	<
Petrol. Hydrocarb. (µg/L)										
Benzene	<	<	<	<	<	<	<	<	<	<
Ethylbenzene	<	<	<	<	<	<	<	<	<	<
Toluene	<	<	<	<	<	<	<	<	<	<
Total Xylene	<	<	<	<	<	<	<	<	<	<
Styrene	<	<	.	.	<	.	<	<	.	<
Miscellaneous (µg/L)										
1,1,2-Trichloro-1,2,2-trifluoroethane	<	<	<	<	<	<	<	<	<	<
Bromoform	<	<	<	<	<	<	<	<	<	<
Bromomethane	<	<	.	.	.	.	<	<	.	<
Carbon disulfide	<	<	.	.	.	.	<	<	.	<
Chlorobenzene	<	<	<	<	<	<	<	<	<	<
1,2-Dichlorobenzene	<	<	<	<	<	<	<	<	<	<
1,4-Dichlorobenzene	<	<	<	<	<	<	<	<	<	<
2-Butanone	<	<	<	<	<	<	<	<	<	<
2-Hexanone	<	<	.	.	<	.	<	<	.	<
4-Methyl-2-pentanone	<	<	.	.	<	.	<	<	.	<
Acetone	<	<	.	.	<	.	<	<	.	<
Natural Attenuation (µg/L)										
Ethane	.	.	.	.	.	.	.	.	.	.
Ethylene	.	.	.	.	.	.	.	.	.	.
Methane	.	.	.	.	.	.	.	.	.	.

APPENDIX E.2: CY 2011 MONITORING DATA FOR THE UPPER EAST FORK POPLAR CREEK HYDROGEOLOGIC REGIME
Volatile Organic Compounds

Sampling Point	GW-108		GW-151		GW-153	GW-154		GW-169
Functional Area	S3		NHP		NHP	NHP		EXP-UV
Date Sampled	01/20/11	07/19/11	02/23/11	08/04/11	08/25/11	02/24/11	08/04/11	03/01/11
Program	B/U	B/U	B/U	B/U	GWPP	B/U	B/U	B/U
Sample Type								
Chloroethenes (µg/L)								
Tetrachloroethene	9	8	770	640	3 J	<	<	<
Trichloroethene	4.8	3.5	140	120	<	<	<	<
cis-1,2-Dichloroethene	<	<	77	73	<	<	<	<
trans-1,2-Dichloroethene	<	<	<	0.72 J	<	<	<	<
1,1-Dichloroethene	1.8	1.4	2.3	1.8 J	<	<	<	<
Vinyl chloride	<	<	1.1	0.86 J	<	<	<	<
Chloroethanes (µg/L)								
1,1,1-Trichloroethane	<	<	<	<	<	<	<	<
1,2-Dichloroethane	<	<	<	<	<	<	<	<
1,1-Dichloroethane	<	<	<	0.71 J	<	<	<	<
Chloromethanes (µg/L)								
Carbon tetrachloride	<	<	1,200	1,100	99	<	<	<
Chloroform	39	34	66	64	4 J	<	<	<
Methylene chloride	54	55	<	<	<	<	<	<
Petrol. Hydrocarb. (µg/L)								
Benzene	1.9	1.8	<	<	<	<	<	<
Ethylbenzene	<	<	<	<	<	<	<	<
Toluene	<	<	<	<	<	<	<	<
Total Xylene	<	<	<	<	<	<	<	<
Styrene	<	<	<	<	<	<	<	<
Miscellaneous (µg/L)								
1,1,2-Trichloro-1,2,2-trifluoroethane	.	.	.	.	<	.	.	.
Bromoform	4.5	5.3	<	<	<	<	<	<
Bromomethane	<	1.2	<	<	<	<	<	<
Carbon disulfide	<	<	<	<	<	<	<	<
Chlorobenzene	<	<	<	<	<	<	<	<
1,2-Dichlorobenzene	<	<	<	<	<	<	<	<
1,4-Dichlorobenzene	.	.	.	.	<	.	.	.
2-Butanone	<	<	<	<	<	<	<	<
2-Hexanone	<	<	<	<	<	<	<	<
4-Methyl-2-pentanone	<	<	<	<	<	<	<	<
Acetone	<	<	<	<	<	<	<	<
Natural Attenuation (µg/L)								
Ethane	.	.	<	<	.	<	<	.
Ethylene	.	.	<	<	.	<	<	.
Methane	.	.	39	63	.	53	2	.

APPENDIX E.2: CY 2011 MONITORING DATA FOR THE UPPER EAST FORK POPLAR CREEK HYDROGEOLOGIC REGIME
Volatile Organic Compounds

Sampling Point	GW-170				GW-171	GW-172	GW-204	GW-220		
Functional Area	EXP-UV				EXP-UV	EXP-UV	T0134	NHP		
Date Sampled	03/01/11		08/09/11		02/28/11	02/28/11	02/23/11	02/15/11		08/25/11
Program	B/U	B/U	B/U	B/U	B/U	B/U	GWPP	GWPP	GWPP	GWPP
Sample Type		Dup		Dup				PDB	Dup	PDB
Chloroethenes (µg/L)										
Tetrachloroethene	<	1	3	2	<	<	<	360	330	450
Trichloroethene	1.4	1.5	1.5	1.3	<	<	<	130	130	100
cis-1,2-Dichloroethene	<	<	<	<	<	<	<	67	73	60
trans-1,2-Dichloroethene	<	<	<	<	<	<	<	<	<	<
1,1-Dichloroethene	<	<	<	<	<	<	<	<	<	<
Vinyl chloride	<	<	<	<	<	<	<	<	<	<
Chloroethanes (µg/L)										
1,1,1-Trichloroethane	<	<	<	<	<	<	<	<	<	<
1,2-Dichloroethane	<	<	<	<	<	<	<	<	<	<
1,1-Dichloroethane	<	<	<	<	<	<	<	<	<	<
Chloromethanes (µg/L)										
Carbon tetrachloride	2.1	2.3	1.9	1.9	<	<	<	900	910	720
Chloroform	<	<	<	<	<	<	<	75	77	59
Methylene chloride	<	<	<	<	<	<	<	<	<	<
Petrol. Hydrocarb. (µg/L)										
Benzene	1.2	1.2	1	1	<	<	<	<	<	<
Ethylbenzene	<	<	<	<	<	<	<	<	<	<
Toluene	<	<	<	<	<	<	<	<	<	<
Total Xylene	<	<	<	<	<	<	<	<	<	<
Styrene	<	<	<	<	<	<	<	.	.	.
Miscellaneous (µg/L)										
1,1,2-Trichloro-1,2,2-trifluoroethane	.	.	.	.	.	.	<	<	<	<
Bromoform	<	<	<	<	<	<	<	<	<	<
Bromomethane	<	<	<	<	<	<	<	.	.	.
Carbon disulfide	<	<	<	<	<	<	<	.	.	.
Chlorobenzene	<	<	<	<	<	<	<	<	<	<
1,2-Dichlorobenzene	<	<	<	<	<	<	<	<	<	<
1,4-Dichlorobenzene	.	.	.	.	.	.	<	<	<	<
2-Butanone	<	<	<	<	<	<	<	<	<	<
2-Hexanone	<	<	<	<	<	<	<	.	.	.
4-Methyl-2-pentanone	<	<	<	<	<	<	<	.	.	.
Acetone	<	<	<	<	<	<	<	.	.	.
Natural Attenuation (µg/L)										
Ethane	.	.	.	.	.	.	.	.	.	.
Ethylene	.	.	.	.	.	.	.	.	.	.
Methane	.	.	.	.	.	.	.	.	.	.

APPENDIX E.2: CY 2011 MONITORING DATA FOR THE UPPER EAST FORK POPLAR CREEK HYDROGEOLOGIC REGIME
Volatile Organic Compounds

Sampling Point	GW-223		GW-230	GW-240	GW-251	GW-253	GW-265	GW-268	GW-269	GW-270
Functional Area	NHP		EXP-UV	NHP	S2	S2	SY	SY	SY	SY
Date Sampled	02/24/11	08/08/11	02/28/11	08/25/11	02/21/11	03/01/11	04/25/11	04/27/11	04/19/11	04/25/11
Program	B/U	B/U	B/U	GWPP	GWPP	B/U	GWPP	GWPP	GWPP	GWPP
Sample Type										
Chloroethenes (µg/L)										
Tetrachloroethene	57	68	<	<	170	540	17	<	20	<
Trichloroethene	22	22	<	<	89	390	3 J	<	4 J	<
cis-1,2-Dichloroethene	43	43	7	<	10	220	<	7	52	<
trans-1,2-Dichloroethene	<	<	<	<	<	<	<	<	<	<
1,1-Dichloroethene	<	<	<	<	<	5.5	<	4 J	140	<
Vinyl chloride	3.4	2.7	1.7	<	<	99	<	<	<	<
Chloroethanes (µg/L)										
1,1,1-Trichloroethane	<	<	<	<	<	<	<	<	8	<
1,2-Dichloroethane	<	<	<	<	<	<	<	<	<	<
1,1-Dichloroethane	<	<	<	<	<	<	<	<	4 J	<
Chloromethanes (µg/L)										
Carbon tetrachloride	<	<	<	4 J	<	21	<	<	<	<
Chloroform	<	<	<	<	6	31	<	<	3 J	<
Methylene chloride	<	<	<	<	<	<	<	<	<	<
Petrol. Hydrocarb. (µg/L)										
Benzene	<	<	<	<	<	<	<	<	<	<
Ethylbenzene	<	<	<	<	<	<	<	<	<	<
Toluene	<	<	<	<	<	<	<	<	<	<
Total Xylene	<	<	<	<	<	<	<	<	<	<
Styrene	<	<	<	<	<	<	<	<	<	<
Miscellaneous (µg/L)										
1,1,2-Trichloro-1,2,2,2-trifluoroethane	.	.	.	<	<	.	<	<	20	<
Bromoform	<	<	<	<	<	<	<	<	<	<
Bromomethane	<	<	<	<	<	<	<	<	<	<
Carbon disulfide	<	<	<	<	<	1	<	<	<	<
Chlorobenzene	<	<	1.1	<	<	<	<	<	<	<
1,2-Dichlorobenzene	<	<	<	<	<	<	<	<	<	<
1,4-Dichlorobenzene	.	.	.	<	<	.	<	<	<	<
2-Butanone	<	<	<	<	<	<	<	<	<	<
2-Hexanone	<	<	<	<	<	<	<	<	<	<
4-Methyl-2-pentanone	<	<	<	<	<	<	<	<	<	<
Acetone	<	<	<	<	<	10	<	<	<	<
Natural Attenuation (µg/L)										
Ethane	<	<	.	.	.	<	.	.	.	.
Ethylene	<	<	.	.	.	<	.	.	.	.
Methane	96	60	.	.	.	9.8	.	.	.	.

APPENDIX E.2: CY 2011 MONITORING DATA FOR THE UPPER EAST FORK POPLAR CREEK HYDROGEOLOGIC REGIME
Volatile Organic Compounds

Sampling Point	GW-272	GW-274	GW-275	GW-281	GW-332	GW-337	GW-380		GW-381
Functional Area	SY	SY	SY	FF	WCPA	WCPA	NHP		NHP
Date Sampled	04/19/11	04/20/11	04/21/11	05/25/11	02/24/11	02/17/11	02/24/11	08/04/11	08/29/11
Program	GWPP	GWPP	GWPP	B/U	GWPP	GWPP	B/U	B/U	GWPP
Sample Type						PDB			
Chloroethenes (µg/L)									
Tetrachloroethene	<	1,100	<	<	860	330	<	0.42 J	3 J
Trichloroethene	<	9	<	<	180	360	<	<	<
cis-1,2-Dichloroethene	<	37	<	<	800	1,100	<	<	3 J
trans-1,2-Dichloroethene	<	<	<	<	9	11	<	<	<
1,1-Dichloroethene	<	<	<	<	20	43	<	<	<
Vinyl chloride	<	4	<	<	11	12	<	<	<
Chloroethanes (µg/L)									
1,1,1-Trichloroethane	<	<	<	<	4 J	42	<	<	<
1,2-Dichloroethane	<	<	<	<	<	<	<	<	<
1,1-Dichloroethane	<	<	<	<	19	32	<	<	<
Chloromethanes (µg/L)									
Carbon tetrachloride	<	<	<	<	<	<	<	<	14
Chloroform	<	13	<	<	<	<	1.4	0.79 J	2 J
Methylene chloride	<	21	<	<	<	<	<	<	<
Petrol. Hydrocarb. (µg/L)									
Benzene	<	190	<	<	<	<	<	<	<
Ethylbenzene	<	<	<	<	<	<	<	<	<
Toluene	<	<	<	<	<	<	<	<	<
Total Xylene	<	<	<	<	<	<	<	<	<
Styrene	<	<	<	<	<	.	<	<	<
Miscellaneous (µg/L)									
1,1,2-Trichloro-1,2,2-trifluoroethane	<	<	<	.	3,600	1,100	.	.	<
Bromoform	<	<	<	<	<	<	<	<	<
Bromomethane	<	<	<	<	<	.	<	<	<
Carbon disulfide	<	<	<	<	<	.	<	<	<
Chlorobenzene	<	<	<	<	<	<	<	<	<
1,2-Dichlorobenzene	<	<	<	<	<	<	<	<	<
1,4-Dichlorobenzene	<	<	<	.	<	<	.	.	<
2-Butanone	<	<	<	<	<	<	<	<	<
2-Hexanone	<	<	<	<	<	.	<	<	<
4-Methyl-2-pentanone	<	<	<	<	<	.	<	<	<
Acetone	<	<	<	<	<	.	<	<	<
Natural Attenuation (µg/L)									
Ethane	.	.	.	.	.	.	<	<	.
Ethylene	.	.	.	.	.	.	<	<	.
Methane	.	.	.	.	.	.	<	<	.

APPENDIX E.2: CY 2011 MONITORING DATA FOR THE UPPER EAST FORK POPLAR CREEK HYDROGEOLOGIC REGIME
Volatile Organic Compounds

Sampling Point	GW-382		GW-383			GW-508		GW-605			
Functional Area	NHP		NHP			RG		EXP-I			
Date Sampled	03/03/11	08/09/11	08/30/11	11/01/11	11/02/11	10/18/11		01/11/11		07/06/11	
Program	B/U	B/U	GWPP	GWPP	GWPP	GWPP	GWPP	B/U	B/U	B/U	B/U
Sample Type			PDB	PDB			Dup		Dup		Dup
Chloroethenes (µg/L)											
Tetrachloroethene	32	28	37 Q	150	360	<	<	78	79	90	89
Trichloroethene	7	5.8	14 Q	91	180	<	<	83	82	73	73
cis-1,2-Dichloroethene	7	6	840 Q	510	250	<	<	130	130	110	100
trans-1,2-Dichloroethene	<	<	5	4 J	2 J	<	<	1.3	1.3	<	<
1,1-Dichloroethene	<	<	5	5 J	3 J	<	<	1.4	1.4	<	<
Vinyl chloride	<	<	5	6	<	<	<	2	1.9	<	<
Chloroethanes (µg/L)											
1,1,1-Trichloroethane	<	<	<	<	<	<	<	<	<	<	<
1,2-Dichloroethane	<	<	<	<	<	<	<	<	<	<	<
1,1-Dichloroethane	<	<	<	<	<	<	<	<	<	<	<
Chloromethanes (µg/L)											
Carbon tetrachloride	550	510	<	<	<	<	<	48	48	41	43
Chloroform	140	120	<	<	<	<	<	13	13	9.2	9.9
Methylene chloride	<	1.4	<	<	<	<	<	<	<	<	<
Petrol. Hydrocarb. (µg/L)											
Benzene	<	<	<	<	<	460	540	<	<	<	<
Ethylbenzene	<	<	<	<	<	290	320	<	<	<	<
Toluene	<	<	<	<	<	930	1,100	<	<	<	<
Total Xylene	<	<	<	<	<	1,600	1,700	<	<	<	<
Styrene	<	<	.	.	<	4 J	5 J	<	<	<	<
Miscellaneous (µg/L)											
1,1,2-Trichloro-1,2,2-trifluoroethane	.	.	<	<	<	<	<	.	.	.	.
Bromoform	<	<	<	<	<	<	<	<	<	<	<
Bromomethane	<	<	.	.	.	<	<	<	<	<	<
Carbon disulfide	<	<	.	.	.	<	<	<	<	<	<
Chlorobenzene	<	<	<	<	<	<	<	<	<	<	<
1,2-Dichlorobenzene	<	<	<	<	<	<	<	<	<	<	<
1,4-Dichlorobenzene	.	.	<	<	<	<	<	.	.	.	.
2-Butanone	<	<	<	<	<	18	21	<	<	<	<
2-Hexanone	<	<	.	.	<	16	17	<	<	<	<
4-Methyl-2-pentanone	<	<	.	.	<	4 J	6	<	<	<	<
Acetone	<	<	.	.	<	13	13	<	<	<	<
Natural Attenuation (µg/L)											
Ethane	<	<	.	.	.	.	.	.	.	.	.
Ethylene	<	<	.	.	.	.	.	.	.	.	.
Methane	630	600	.	.	.	.	.	.	.	.	.

APPENDIX E.2: CY 2011 MONITORING DATA FOR THE UPPER EAST FORK POPLAR CREEK HYDROGEOLOGIC REGIME
Volatile Organic Compounds

Sampling Point	GW-606		GW-618	GW-633	GW-656	GW-658	GW-686	GW-690	GW-691	
Functional Area	EXP-I		EXP-E	RG	T0134	FF	CPT	CPT	CPT	
Date Sampled	01/11/11	07/06/11	03/28/11	03/01/11	08/30/11	05/24/11	05/09/11	05/09/11	05/11/11	10/25/11
Program	B/U	B/U	B/U	GWPP	GWPP	B/U	GWPP	GWPP	GWPP	GWPP
Sample Type					PDB					
Chloroethenes (µg/L)										
Tetrachloroethene	5	5	<	180	48	<	<	24	22	22
Trichloroethene	<	<	2.9	3 J	1,600	<	<	2 J	<	<
cis-1,2-Dichloroethene	<	<	10	5	130	<	5 J	2 J	<	<
trans-1,2-Dichloroethene	<	<	<	<	15	<	<	<	<	<
1,1-Dichloroethene	<	<	<	<	110	<	<	<	<	<
Vinyl chloride	<	<	<	<	4	<	<	<	<	<
Chloroethanes (µg/L)										
1,1,1-Trichloroethane	<	<	<	<	<	<	<	<	<	<
1,2-Dichloroethane	<	<	<	<	<	430	<	<	<	<
1,1-Dichloroethane	<	<	<	<	8	<	<	<	<	<
Chloromethanes (µg/L)										
Carbon tetrachloride	28	25	<	<	<	<	<	<	<	<
Chloroform	36	36	<	9	<	<	<	<	<	<
Methylene chloride	<	<	<	10	<	24	<	<	<	<
Petrol. Hydrocarb. (µg/L)										
Benzene	<	<	<	370	<	7,200	<	<	<	<
Ethylbenzene	<	<	<	<	<	260	<	<	<	<
Toluene	<	<	<	<	<	2,000	<	<	<	<
Total Xylene	<	<	<	9	<	4,800	<	<	<	<
Styrene	<	<	<	<	.	<	<	<	<	<
Miscellaneous (µg/L)										
1,1,2-Trichloro-1,2,2-trifluoroethane	.	.	.	<	7	.	<	<	<	<
Bromoform	<	<	<	<	<	<	<	<	<	<
Bromomethane	<	<	<	<	.	<	<	<	<	<
Carbon disulfide	<	<	<	<	.	<	<	<	<	<
Chlorobenzene	<	<	<	<	<	<	<	<	<	<
1,2-Dichlorobenzene	<	<	<	<	<	2,400	<	<	<	<
1,4-Dichlorobenzene	.	.	.	<	<	.	<	<	<	<
2-Butanone	<	<	<	<	<	<	<	<	<	<
2-Hexanone	<	<	<	<	.	<	<	<	<	<
4-Methyl-2-pentanone	<	<	<	<	.	<	<	<	<	<
Acetone	<	<	<	<	.	<	<	<	<	<
Natural Attenuation (µg/L)										
Ethane	.	.	<	.	.	.	.	.	.	.
Ethylene	.	.	<	.	.	.	.	.	.	.
Methane	.	.	18	.	.	.	.	.	.	.

APPENDIX E.2: CY 2011 MONITORING DATA FOR THE UPPER EAST FORK POPLAR CREEK HYDROGEOLOGIC REGIME
Volatile Organic Compounds

Sampling Point	GW-692	GW-698			GW-700		GW-722-14		GW-722-17	
Functional Area	CPT	B8110			B8110		EXP-J		EXP-J	
Date Sampled	05/03/11	05/12/11	10/19/11		08/29/11		03/15/11	07/19/11	03/15/11	07/20/11
Program	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP	B/U	GWPP	B/U	GWPP
Sample Type			Dup			Dup				
Chloroethenes (µg/L)										
Tetrachloroethene	<	17	18	130	48	50	3	<	5	3 J
Trichloroethene	<	51	51	430	9	9	1.1	<	1.3	<
cis-1,2-Dichloroethene	<	5 J	5 J	45	39	38	<	<	<	<
trans-1,2-Dichloroethene	<	<	<	<	<	<	<	<	<	<
1,1-Dichloroethene	<	<	<	<	<	<	<	<	<	<
Vinyl chloride	<	<	<	<	<	<	<	<	<	<
Chloroethanes (µg/L)										
1,1,1-Trichloroethane	<	<	<	<	<	<	<	<	<	<
1,2-Dichloroethane	<	<	<	<	<	<	<	<	<	<
1,1-Dichloroethane	<	<	<	<	<	<	<	<	<	<
Chloromethanes (µg/L)										
Carbon tetrachloride	<	<	<	<	<	<	18	14	34	33
Chloroform	<	<	<	8	<	<	2.1	<	6	5
Methylene chloride	<	<	<	<	<	<	<	<	<	<
Petrol. Hydrocarb. (µg/L)										
Benzene	<	<	<	<	<	<	<	<	<	<
Ethylbenzene	<	<	<	<	<	<	<	<	<	<
Toluene	<	<	<	<	<	<	<	<	<	<
Total Xylene	<	<	<	<	<	<	<	<	<	<
Styrene	<	<	<	<	<	<	<	<	<	<
Miscellaneous (µg/L)										
1,1,2-Trichloro-1,2,2-trifluoroethane	<	<	<	26	<	<	.	<	.	<
Bromoform	<	<	<	<	<	<	<	<	<	<
Bromomethane	<	<	<	<	<	<	<	<	<	<
Carbon disulfide	<	<	<	<	<	<	<	<	<	<
Chlorobenzene	<	<	<	<	<	<	<	<	<	<
1,2-Dichlorobenzene	<	<	<	<	<	<	<	<	<	<
1,4-Dichlorobenzene	<	<	<	<	<	<	.	<	.	<
2-Butanone	<	<	<	<	<	<	<	<	<	<
2-Hexanone	<	<	<	<	<	<	<	<	<	<
4-Methyl-2-pentanone	<	<	<	<	<	<	<	<	<	<
Acetone	<	<	<	<	<	<	<	<	<	<
Natural Attenuation (µg/L)										
Ethane	.	.	.	.	.	.	.	.	.	.
Ethylene	.	.	.	.	.	.	.	.	.	.
Methane	.	.	.	.	.	.	.	.	.	.

APPENDIX E.2: CY 2011 MONITORING DATA FOR THE UPPER EAST FORK POPLAR CREEK HYDROGEOLOGIC REGIME
Volatile Organic Compounds

Sampling Point	GW-722-20		GW-722-22		GW-722-33		GW-733		GW-735	
Functional Area	EXP-J		EXP-J		EXP-J		EXP-J		EXP-J	
Date Sampled	03/15/11	07/20/11	03/15/11	07/19/11	03/15/11	07/19/11	01/11/11	07/06/11	08/01/11	
Program	B/U	GWPP	B/U	GWPP	B/U	GWPP	B/U	B/U	GWPP	GWPP
Sample Type										Dup
Chloroethenes (µg/L)										
Tetrachloroethene	8	5	3	4 J	<	<	<	<	<	<
Trichloroethene	1.8	<	1.5	<	<	<	<	<	<	<
cis-1,2-Dichloroethene	<	<	<	<	<	<	<	<	<	<
trans-1,2-Dichloroethene	<	<	<	<	<	<	<	<	<	<
1,1-Dichloroethene	<	<	<	<	<	<	<	<	<	<
Vinyl chloride	<	<	<	<	<	<	<	<	<	<
Chloroethanes (µg/L)										
1,1,1-Trichloroethane	<	<	<	<	<	<	<	<	<	<
1,2-Dichloroethane	<	<	<	<	<	<	<	<	<	<
1,1-Dichloroethane	<	<	<	<	<	<	<	<	<	<
Chloromethanes (µg/L)										
Carbon tetrachloride	32	37	21	22	<	<	6.4	1.4	<	<
Chloroform	7.6	5	2	<	<	<	<	<	<	<
Methylene chloride	<	<	<	<	<	<	<	<	<	<
Petrol. Hydrocarb. (µg/L)										
Benzene	<	<	<	<	<	<	<	<	<	<
Ethylbenzene	<	<	<	<	<	<	<	<	<	<
Toluene	<	<	<	<	<	<	<	<	<	<
Total Xylene	<	<	<	<	<	<	<	<	<	<
Styrene	<	<	<	<	<	<	<	<	<	<
Miscellaneous (µg/L)										
1,1,2-Trichloro-1,2,2,2-trifluoroethane	.	<	.	<	.	<	.	.	<	<
Bromoform	<	<	<	<	<	<	<	<	<	<
Bromomethane	<	<	<	<	<	<	<	<	<	<
Carbon disulfide	<	<	<	<	<	<	<	<	<	<
Chlorobenzene	<	<	<	<	<	<	<	<	<	<
1,2-Dichlorobenzene	<	<	<	<	<	<	<	<	<	<
1,4-Dichlorobenzene	.	<	.	<	.	<	.	.	<	<
2-Butanone	<	<	<	<	<	<	<	<	<	<
2-Hexanone	<	<	<	<	<	<	<	<	<	<
4-Methyl-2-pentanone	<	<	<	<	<	<	<	<	<	<
Acetone	<	<	<	<	<	<	<	<	<	<
Natural Attenuation (µg/L)										
Ethane	.	.	.	.	.	.	.	.	.	.
Ethylene	.	.	.	.	.	.	.	.	.	.
Methane	.	.	.	.	.	.	.	.	.	.

APPENDIX E.2: CY 2011 MONITORING DATA FOR THE UPPER EAST FORK POPLAR CREEK HYDROGEOLOGIC REGIME
Volatile Organic Compounds

Sampling Point	GW-744	GW-747	GW-750	GW-762				GW-763	GW-765
Functional Area	GRIDK1	GRIDK2	EXP-J	GRIDJ3				GRIDJ3	GRIDE1
Date Sampled	08/16/11	08/15/11	08/01/11	02/24/11		08/08/11		08/11/11	10/25/11
Program	GWPP	GWPP	GWPP	B/U	B/U	B/U	B/U	GWPP	GWPP
Sample Type					Dup		Dup	PDB	
Chloroethenes (µg/L)									
Tetrachloroethene	<	<	<	2,300	2,300	2,500	3,300	<	<
Trichloroethene	<	<	<	240	230	210	210	<	<
cis-1,2-Dichloroethene	<	<	<	71	70	65	65	<	<
trans-1,2-Dichloroethene	<	<	<	<	<	<	<	<	<
1,1-Dichloroethene	<	<	<	59	58	53	54	<	<
Vinyl chloride	<	<	<	5.7	5.6	5.1	5.2	<	<
Chloroethanes (µg/L)									
1,1,1-Trichloroethane	<	<	<	<	<	<	<	<	<
1,2-Dichloroethane	<	<	<	<	<	<	<	<	<
1,1-Dichloroethane	<	<	<	14	13	13	13	<	<
Chloromethanes (µg/L)									
Carbon tetrachloride	<	<	<	<	<	<	<	<	<
Chloroform	<	<	<	<	<	<	<	<	<
Methylene chloride	<	<	<	<	<	<	<	<	<
Petrol. Hydrocarb. (µg/L)									
Benzene	<	<	<	<	<	<	<	<	<
Ethylbenzene	<	<	<	<	<	<	<	<	<
Toluene	<	<	<	<	<	<	<	<	<
Total Xylene	<	<	<	<	<	<	<	<	<
Styrene	<	<	<	<	<	<	<	.	<
Miscellaneous (µg/L)									
1,1,2-Trichloro-1,2,2-trifluoroethane	<	<	<	.	.	.	.	<	<
Bromoform	<	<	<	<	<	<	<	<	<
Bromomethane	<	<	<	<	<	<	<	.	<
Carbon disulfide	<	<	<	<	<	<	<	<	<
Chlorobenzene	<	<	<	<	<	<	<	<	<
1,2-Dichlorobenzene	<	<	<	<	<	<	<	<	<
1,4-Dichlorobenzene	<	<	<	.	.	.	.	<	<
2-Butanone	<	<	<	<	<	<	<	<	<
2-Hexanone	<	<	<	<	<	<	<	.	<
4-Methyl-2-pentanone	<	<	<	<	<	<	<	.	<
Acetone	<	<	<	<	<	<	<	.	<
Natural Attenuation (µg/L)									
Ethane	.	.	.	<	<	<	<	.	.
Ethylene	.	.	.	<	<	<	<	.	.
Methane	.	.	.	14	14	9.2	12	.	.

APPENDIX E.2: CY 2011 MONITORING DATA FOR THE UPPER EAST FORK POPLAR CREEK HYDROGEOLOGIC REGIME
Volatile Organic Compounds

Sampling Point	GW-769		GW-770	GW-775	GW-776	GW-779	GW-781	GW-782	GW-783	GW-791
Functional Area	GRIDG3		GRIDG3	GRIDH3	GRIDH3	GRIDF2	GRIDE3	GRIDE3	GRIDE3	GRIDD2
Date Sampled	05/16/11	10/20/11	10/24/11	02/10/11	02/23/11	05/17/11	08/17/11	08/17/11	08/18/11	08/16/11
Program	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP
Sample Type				PDB		NP				
Chloroethenes (µg/L)										
Tetrachloroethene	22	21	<	<	<	<	<	24	13	29
Trichloroethene	5 J	4 J	<	4 J	<	<	<	10	7	<
cis-1,2-Dichloroethene	4 J	3 J	<	<	<	<	<	12	8	<
trans-1,2-Dichloroethene	<	<	<	<	<	<	<	3 J	3 J	<
1,1-Dichloroethene	<	<	<	<	<	<	<	6	<	<
Vinyl chloride	<	<	<	<	<	<	<	<	<	<
Chloroethanes (µg/L)										
1,1,1-Trichloroethane	<	<	<	<	<	<	<	<	<	<
1,2-Dichloroethane	<	<	<	<	<	<	<	<	<	<
1,1-Dichloroethane	<	<	<	<	<	<	<	9	2 J	<
Chloromethanes (µg/L)										
Carbon tetrachloride	130	160	46	<	<	<	<	5	<	<
Chloroform	4 J	4 J	4 J	<	2 J	<	<	<	<	<
Methylene chloride	<	<	<	<	<	<	<	<	<	<
Petrol. Hydrocarb. (µg/L)										
Benzene	<	<	<	<	<	<	<	<	<	<
Ethylbenzene	<	<	<	<	<	<	<	<	<	<
Toluene	<	<	<	<	<	<	<	<	<	<
Total Xylene	<	<	<	<	<	<	<	<	<	<
Styrene	<	<	<	.	<	<	<	<	<	<
Miscellaneous (µg/L)										
1,1,2-Trichloro-1,2,2-trifluoroethane	<	<	<	<	<	<	<	<	<	<
Bromoform	<	<	<	<	<	<	<	<	<	<
Bromomethane	<	<	<	.	<	<	<	<	<	<
Carbon disulfide	<	<	<	.	<	<	<	<	<	<
Chlorobenzene	<	<	<	<	<	<	<	<	<	<
1,2-Dichlorobenzene	<	<	<	<	<	<	<	<	<	<
1,4-Dichlorobenzene	<	<	<	<	<	<	<	<	<	<
2-Butanone	<	<	<	<	<	<	<	<	<	<
2-Hexanone	<	<	<	.	<	<	<	<	<	<
4-Methyl-2-pentanone	<	<	<	.	<	<	<	<	<	<
Acetone	<	<	<	.	<	<	<	<	<	<
Natural Attenuation (µg/L)										
Ethane	.	.	.	.	.	.	.	.	.	.
Ethylene	.	.	.	.	.	.	.	.	.	.
Methane	.	.	.	.	.	.	.	.	.	.

APPENDIX E.2: CY 2011 MONITORING DATA FOR THE UPPER EAST FORK POPLAR CREEK HYDROGEOLOGIC REGIME
Volatile Organic Compounds

Sampling Point	GW-802	GW-816	GW-820		GW-832		GW-930	GW-959	GW-960
Functional Area	FF	EXP-SR	B9201-2		NHP		GRIDD1	B9201-2	GRIDF2
Date Sampled	05/26/11	08/11/11	05/16/11		02/24/11	08/04/11	02/22/11	10/31/11	05/17/11
Program	B/U	GWPP	GWPP	GWPP	B/U	B/U	GWPP	GWPP	GWPP
Sample Type				Dup					
Chloroethenes (µg/L)									
Tetrachloroethene	<	<	4,700	4,900	9	8	<	<	<
Trichloroethene	<	<	1,000	1,000	1.7	1.3	<	<	<
cis-1,2-Dichloroethene	<	<	1,000	1,000	1	0.9 J	<	3 J	<
trans-1,2-Dichloroethene	<	<	6	6	<	<	<	<	<
1,1-Dichloroethene	<	<	6	6	<	<	<	<	<
Vinyl chloride	<	<	100	91	<	<	<	<	<
Chloroethanes (µg/L)									
1,1,1-Trichloroethane	<	<	<	<	<	<	<	<	<
1,2-Dichloroethane	<	<	<	<	<	<	<	<	<
1,1-Dichloroethane	<	<	<	<	<	<	<	<	<
Chloromethanes (µg/L)									
Carbon tetrachloride	<	<	<	<	12	9.3	<	<	<
Chloroform	<	<	<	<	2.3	2	<	<	<
Methylene chloride	<	<	<	<	<	<	<	<	<
Petrol. Hydrocarb. (µg/L)									
Benzene	<	<	<	<	<	<	<	<	<
Ethylbenzene	<	<	<	<	<	<	<	<	<
Toluene	<	<	<	<	<	<	<	<	<
Total Xylene	<	<	<	<	<	<	<	<	<
Styrene	<	<	<	<	<	<	<	<	<
Miscellaneous (µg/L)									
1,1,2-Trichloro-1,2,2-trifluoroethane	.	<	37	35	.	.	<	<	<
Bromoform	<	<	<	<	<	<	<	<	<
Bromomethane	<	<	<	<	<	<	<	<	<
Carbon disulfide	<	<	<	<	<	<	<	<	<
Chlorobenzene	<	<	<	<	<	<	<	<	<
1,2-Dichlorobenzene	<	<	<	<	<	<	<	<	<
1,4-Dichlorobenzene	.	<	2 J	2 J	.	.	<	<	<
2-Butanone	<	<	<	<	<	<	<	<	<
2-Hexanone	<	<	<	<	<	<	<	<	<
4-Methyl-2-pentanone	<	<	<	<	<	<	<	<	<
Acetone	<	<	<	<	<	<	<	<	<
Natural Attenuation (µg/L)									
Ethane	.	.	.	.	<	<	.	.	.
Ethylene	.	.	.	.	<	<	.	.	.
Methane	.	.	.	.	<	<	.	.	.

APPENDIX E.2: CY 2011 MONITORING DATA FOR THE UPPER EAST FORK POPLAR CREEK HYDROGEOLOGIC REGIME
Volatile Organic Compounds

Sampling Point	GHK2.51WSW	NPR12.0SW	NPR23.0SW	SCR7.1SP	SCR7.8SP	SP-17
Functional Area	EXP-SW	EXP-SW	EXP-SW	EXP-SW	EXP-SW	EXP-SW
Date Sampled	01/24/11	01/24/11	01/24/11	01/17/11	01/17/11	01/24/11
Program	GWPP	GWPP	GWPP	B/U	B/U	GWPP
Sample Type						
Chloroethenes (µg/L)						
Tetrachloroethene	<	<	<	<	<	<
Trichloroethene	<	<	<	<	<	<
cis-1,2-Dichloroethene	<	<	<	<	<	<
trans-1,2-Dichloroethene	<	<	<	<	<	<
1,1-Dichloroethene	<	<	<	<	<	<
Vinyl chloride	<	<	<	<	<	<
Chloroethanes (µg/L)						
1,1,1-Trichloroethane	<	<	<	<	<	<
1,2-Dichloroethane	<	<	<	<	<	<
1,1-Dichloroethane	<	<	<	<	<	<
Chloromethanes (µg/L)						
Carbon tetrachloride	<	<	<	<	<	<
Chloroform	<	<	<	<	<	<
Methylene chloride	<	<	<	<	<	<
Petrol. Hydrocarb. (µg/L)						
Benzene	<	<	<	<	<	<
Ethylbenzene	<	<	<	<	<	<
Toluene	<	<	<	<	<	<
Total Xylene	<	<	<	<	<	<
Styrene	<	<	<	<	<	<
Miscellaneous (µg/L)						
1,1,2-Trichloro-1,2,2-trifluoroethane	<	<	<	.	.	<
Bromoform	<	<	<	<	<	<
Bromomethane	<	<	<	<	<	<
Carbon disulfide	<	<	<	<	<	<
Chlorobenzene	<	<	<	<	<	<
1,2-Dichlorobenzene	<	<	<	<	<	<
1,4-Dichlorobenzene	<	<	<	.	.	<
2-Butanone	<	<	<	<	<	<
2-Hexanone	<	<	<	<	<	<
4-Methyl-2-pentanone	<	<	<	<	<	<
Acetone	<	<	<	<	<	<
Natural Attenuation (µg/L)						
Ethane	.	.	.	.	.	.
Ethylene	.	.	.	.	.	.
Methane	.	.	.	.	.	.

APPENDIX E.3

RADIOLOGICAL ANALYTES

APPENDIX E.3: CY 2011 MONITORING DATA FOR THE UPPER EAST FORK POPLAR CREEK HYDROGEOLOGIC REGIME
Radiological Analytes: Gross Alpha and Gross Beta Activity

Sampling Point	Functional Area	Date Sampled	Program	Sample Type	Gross Alpha (pCi/L)			Gross Beta (pCi/L)		
					Activity	TPU	MDA	Activity	TPU	MDA
55-2A	GRIDB3	04/27/11	GWPP	NP	<	.	7.3	<	.	9.1
55-2B	GRIDB3	04/26/11	GWPP		<	.	12	34	10	16
55-2C	GRIDB3	04/26/11	GWPP		<	.	13	<	.	15
55-3A	B9201-5	04/27/11	GWPP		<	.	4.6	<	.	7
		10/17/11	GWPP		<	.	8.1	<	.	10
55-3B	B9201-5	04/28/11	GWPP		<	.	3.2	<	.	8
			GWPP		<	.	10	<	.	13
		10/17/11	GWPP	Dup	<	.	11	<	.	13
55-3C	B9201-5	04/27/11	GWPP	NP	<	.	2.5	<	.	8.9
		10/18/11	GWPP	NP	<	.	4.8	9	4.3	7.5
56-1A	Y12	05/02/11	GWPP		<	.	6	<	.	9.4
56-1C	Y12	05/02/11	GWPP		3.5	3.5	3.2	<	.	7.5
56-2C	GRIDC3	05/05/11	GWPP		<	.	6.8	<	.	8.6
56-3B	Y12	05/05/11	GWPP		<	.	5.1	<	.	8.3
			GWPP	Dup	<	.	6.4	<	.	9.4
56-4A	Y12	04/28/11	GWPP	NP	<	.	3.8	<	.	8.8
GW-108	S3	01/20/11	B/U		96.2	40.3	55.9	12,300	1,970	69.5
		07/19/11	B/U		101	46	64.6	13,100	2,110	120
GW-151	NHP	02/23/11	B/U		<	.	3.02	<	.	4.16
		08/04/11	B/U		<	.	1.7	<	.	2.69
GW-153	NHP	08/25/11	GWPP		<	.	3.2	<	.	7
GW-154	NHP	02/24/11	B/U		240	39.4	1.9	65.8	11.4	5.39
		08/04/11	B/U		267	43.8	2.92	94.8	16	6.36
GW-169	EXP-UV	03/01/11	B/U		<	.	3.16	<	.	3.94
			B/U		<	.	2.42	12.9	3.09	3.74
GW-170	EXP-UV	08/09/11	B/U	Dup	<	.	2.18	10.8	2.54	3.08
			B/U		<	.	2.06	12.7	3.02	3.58
			B/U	Dup	<	.	2.78	10.1	2.69	3.7
GW-204	T0134	02/23/11	GWPP		34	5.5	4	9.7	4.8	8
GW-219	UOV	02/21/11	GWPP		220	13	3	99	10	9.6
GW-223	NHP	02/24/11	B/U		11.4	3.28	3.02	8.05	2.53	3.87
		08/08/11	B/U		12.4	3.23	2.79	11	2.82	3.75
GW-240	NHP	08/25/11	GWPP		<	.	3.3	<	.	5.7
GW-251	S2	02/21/11	GWPP		6.4	4.1	4.1	<	.	9.5
GW-253	S2	03/01/11	B/U		15.1	3.88	3.78	16.2	4.34	5.35
GW-265	SY	04/25/11	GWPP		<	.	4.6	<	.	8.2
GW-268	SY	04/27/11	GWPP		<	.	4.5	<	.	8.3
GW-269	SY	04/19/11	GWPP		1.6 R	2.6	1.3	<	.	4
GW-270	SY	04/25/11	GWPP		<	.	3	<	.	8.9
GW-272	SY	04/19/11	GWPP		<	.	7.6	<	.	9.3
GW-274	SY	04/20/11	GWPP		<	.	17	2800	57	21
GW-275	SY	04/21/11	GWPP		210	210	130	<	.	270
GW-332	WCPA	02/24/11	GWPP		<	.	3.8	<	.	7.6
GW-380	NHP	02/24/11	B/U		5.05	2.36	2.96	7.91	2.6	3.89
		08/04/11	B/U		<	.	3.17	<	.	4
GW-382	NHP	03/03/11	B/U		<	.	2.11	5	2.2	3.97
		08/09/11	B/U		<	.	2.61	4.64	2.2	4.03

APPENDIX E.3: CY 2011 MONITORING DATA FOR THE UPPER EAST FORK POPLAR CREEK HYDROGEOLOGIC REGIME
Radiological Analytes: Gross Alpha and Gross Beta Activity

Sampling Point	Functional Area	Date Sampled	Program	Sample Type	Gross Alpha (pCi/L)			Gross Beta (pCi/L)		
					Activity	TPU	MDA	Activity	TPU	MDA
GW-505	RG	10/18/11	GWPP		28	5.4	4	<	.	8.9
GW-605	EXP-I	01/11/11	B/U		71	12.6	2.3	47.1	8.38	4.58
			B/U	Dup	75.2	13.3	2.28	41.4	7.48	4.43
		07/06/11	B/U		55.4	9.56	1.76	68.4	11.4	3.86
			B/U	Dup	53.4	9.25	1.97	67.7	11.3	3.94
GW-606	EXP-I	01/11/11	B/U		7.28	2.79	2.89	7.18	2.53	3.95
		07/06/11	B/U		6.26	2.44	3.35	4.86	2.46	4.64
GW-618	EXP-E	03/28/11	B/U		<	.	2	<	.	3.89
GW-633	RG	03/01/11	GWPP		<	.	27	1,400	57	28
GW-686	CPT	05/09/11	GWPP		<	.	5.5	<	.	7
GW-690	CPT	05/09/11	GWPP		<	.	5.4	<	.	7.3
GW-691	CPT	05/11/11	GWPP		<	.	5.5	<	.	7.2
		10/25/11	GWPP		<	.	9	<	.	14
GW-692	CPT	05/03/11	GWPP		<	.	4.3	<	.	7.1
GW-698	B8110	05/12/11	GWPP		<	.	5	<	.	7.6
			GWPP	Dup	<	.	3.9	<	.	7.4
		10/19/11	GWPP		<	.	5.9	<	.	8.5
GW-700	B8110	08/29/11	GWPP		4.4	3.9	4.1	<	.	8.9
			GWPP	Dup	<	.	6	<	.	8.7
GW-722-14	EXP-J	07/19/11	GWPP		<	.	4.1	<	.	7
GW-722-17	EXP-J	07/20/11	GWPP		<	.	3.2	<	.	7.6
GW-722-20	EXP-J	07/20/11	GWPP		<	.	3.7	<	.	8.1
GW-722-22	EXP-J	07/19/11	GWPP		<	.	4.1	<	.	8.2
GW-722-33	EXP-J	07/19/11	GWPP		<	.	4.6	<	.	9.6
GW-733	EXP-J	01/11/11	B/U		<	.	2.69	<	.	3.73
		07/06/11	B/U		<	.	2.87	<	.	4.83
GW-735	EXP-J	08/01/11	GWPP		<	.	4.2	<	.	6.7
			GWPP	Dup	<	.	5.3	<	.	9.7
GW-744	GRIDK1	08/16/11	GWPP		<	.	4	<	.	8
GW-747	GRIDK2	08/15/11	GWPP		<	.	3.3	<	.	9.8
GW-750	EXP-J	08/01/11	GWPP		4.3	3.5	0.86	11	4.3	7
GW-762	GRIDJ3	02/24/11	B/U		<	.	1.95	4.42	1.64	2.78
			B/U	Dup	<	.	2.93	<	.	4.07
		08/08/11	B/U		<	.	2.49	4.7	1.99	3.52
			B/U	Dup	<	.	2.33	5.97	2.12	3.51
GW-765	GRIDE1	10/25/11	GWPP		<	.	5.9	<	.	7.2
GW-769	GRIDG3	05/16/11	GWPP		<	.	4.3	<	.	7.6
		10/20/11	GWPP		<	.	7.2	15	6.1	11
GW-770	GRIDG3	10/24/11	GWPP		<	.	4.4	<	.	7.3
GW-776	GRIDH3	02/23/11	GWPP		<	.	5.9	<	.	7.9
GW-779	GRIDF2	05/17/11	GWPP	NP	<	.	5.2	<	.	7.5
GW-781	GRIDE3	08/17/11	GWPP		3.8 R	3.9	3.4	<	.	7.4
GW-782	GRIDE3	08/17/11	GWPP		10	4.3	3.9	<	.	7.9
GW-783	GRIDE3	08/18/11	GWPP		<	.	5.3	<	.	9.4
GW-791	GRIDD2	08/16/11	GWPP		<	.	4.9	<	.	8.8
GW-816	EXP-SR	08/11/11	GWPP		<	.	5.2	<	.	9.8
GW-820	B9201-2	05/16/11	GWPP		<	.	4.3	<	.	7.2
			GWPP	Dup	<	.	3.6	<	.	7.8

APPENDIX E.3: CY 2011 MONITORING DATA FOR THE UPPER EAST FORK POPLAR CREEK HYDROGEOLOGIC REGIME
Radiological Analytes: Gross Alpha and Gross Beta Activity

Sampling Point	Functional Area	Date Sampled	Program	Sample Type	Gross Alpha (pCi/L)			Gross Beta (pCi/L)		
					Activity	TPU	MDA	Activity	TPU	MDA
GW-832	NHP	02/24/11	B/U		<	.	2.58	5.69	2.29	3.88
		08/04/11	B/U		<	.	2.88	<	.	3.64
GW-959	B9201-2	10/31/11	GWPP		<	.	3.6	<	.	8.1
GW-960	GRIDF2	05/17/11	GWPP		<	.	7.8	<	.	9.7
GHK2.51WSW	EXP-SW	01/24/11	GWPP		<	.	5.2	<	.	8.6
NPR12.0SW	EXP-SW	01/24/11	GWPP		<	.	4.2	10	4.2	6.9
NPR23.0SW	EXP-SW	01/24/11	GWPP		<	.	3.6	<	.	7.9
SP-17	EXP-SW	01/24/11	GWPP		<	.	4.7	<	.	7.9
STATION 8	EXP-SW	02/10/11	B/U		<	.	2.66	<	.	4
		02/24/11	B/U		13.7	3.85	2.48	10.2	3.03	4.14
		07/12/11	B/U		<	.	2.78	6.62	2.24	3.7
		08/15/11	B/U		4.7	2.35	2.78	9.39	2.99	4.27

APPENDIX E.3: CY 2010 MONITORING DATA FOR THE UPPER EAST FORK POPLAR CREEK HYDROGEOLOGIC REGIME
Radiological Analytes: Isotopic Analyses

Sampling Point	55-2A			55-2B			55-2C			55-3A		
Functional Area	GRIDB3			GRIDB3			GRIDB3			B9201-5		
Date Sampled	04/27/11			04/26/11			04/26/11			04/27/11		
Program	GWPP			GWPP			GWPP			GWPP		
Sample Type												
Result (pCi/L)	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA
Gross Alpha	<	.	7.3	<	.	12	<	.	13	<	.	4.6
Gross Beta	<	.	9.1	34	10	16	<	.	15	<	.	7
Technetium-99	12	6.7	11	47	7.2	11	<	.	11	<	.	11
Uranium-234	.	.	.	.	.	.	.	.	.	.	.	.
Uranium-235	.	.	.	.	.	.	.	.	.	.	.	.
Uranium-238	.	.	.	.	.	.	.	.	.	.	.	.

Sampling Point	55-3A			55-3B								
Functional Area	B9201-5			B9201-5								
Date Sampled	10/17/11			04/28/11			10/17/11					
Program	GWPP			GWPP			GWPP					
Sample Type							Dup					
Result (pCi/L)	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA
Gross Alpha	<	.	8.1	<	.	3.2	<	.	10	<	.	11
Gross Beta	<	.	10	<	.	8	<	.	13	<	.	13
Technetium-99	<	.	15	<	.	11	<	.	15	<	.	15
Uranium-234	.	.	.	.	.	.	.	.	.	.	.	.
Uranium-235	.	.	.	.	.	.	.	.	.	.	.	.
Uranium-238	.	.	.	.	.	.	.	.	.	.	.	.

Sampling Point	55-3C						GW-108					
Functional Area	B9201-5						S3					
Date Sampled	04/27/11			10/18/11			01/20/11			07/19/11		
Program	GWPP			GWPP			B/U			B/U		
Sample Type												
Result (pCi/L)	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA
Gross Alpha	<	.	2.5	<	.	4.8	96.2	40.3	55.9	101	46	64.6
Gross Beta	<	.	8.9	9	4.3	7.5	12,300	1,970	69.5	13,100	2,110	120
Technetium-99	<	.	11	<	.	15	31,000	4,970	387	30,400	4,850	59.9
Uranium-234	.	.	.	.	.	.	.	.	.	.	.	.
Uranium-235	.	.	.	.	.	.	.	.	.	.	.	.
Uranium-238	.	.	.	.	.	.	.	.	.	.	.	.

Sampling Point	GW-151						GW-154					
Functional Area	NHP						NHP					
Date Sampled	02/23/11			08/04/11			02/24/11			08/04/11		
Program	B/U			B/U			B/U			B/U		
Sample Type												
Result (pCi/L)	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA
Gross Alpha	<	.	3.02	<	.	1.7	240	39.4	1.9	267	43.8	2.92
Gross Beta	<	.	4.16	<	.	2.69	65.8	11.4	5.39	94.8	16	6.36
Technetium-99	.	.	.	.	.	.	.	.	.	.	.	.
Uranium-234	0.492	0.294	0.268	0.457	0.32	0.419	273	43.2	0.32	322	51	0.34
Uranium-235	<	.	0.293	<	.	0.401	16.5	3.03	0.2	13.8	2.7	0.251
Uranium-238	<	.	0.237	<	.	0.255	111	17.9	0.103	118	19.1	0.34

APPENDIX E.3: CY 2010 MONITORING DATA FOR THE UPPER EAST FORK POPLAR CREEK HYDROGEOLOGIC REGIME
Radiological Analytes: Isotopic Analyses

Sampling Point	GW-193						GW-204			GW-219		
Functional Area	T2331						T0134			UOV		
Date Sampled	01/26/11			07/14/11			02/23/11			02/21/11		
Program	B/U			B/U			GWPP			GWPP		
Sample Type												
Result (pCi/L)	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA
Gross Alpha	.	.	.	.	.	.	34	5.5	4	220	13	3
Gross Beta	.	.	.	.	.	.	9.7	4.8	8	99	10	9.6
Technetium-99	<	.	10.8	<	.	10.6	.	.	.	.	.	.
Uranium-234	.	.	.	.	.	.	15	1.6	0.3	31	3.2	0.3
Uranium-235	.	.	.	.	.	.	1.1	0.24	0.15	2.9	0.49	0.17
Uranium-238	.	.	.	.	.	.	10	1.1	0.13	230	22	0.15

Sampling Point	GW-223						GW-265			GW-268		
Functional Area	NHP						SY			SY		
Date Sampled	02/24/11			08/08/11			04/25/11			04/27/11		
Program	B/U			B/U			GWPP			GWPP		
Sample Type												
Result (pCi/L)	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA
Gross Alpha	11.4	3.28	3.02	12.4	3.23	2.79	<	.	4.6	<	.	4.5
Gross Beta	8.05	2.53	3.87	11	2.82	3.75	<	.	8.2	<	.	8.3
Technetium-99	.	.	.	.	.	.	<	.	11	<	.	11
Uranium-234	6.75	1.49	0.361	5.64	1.27	0.381	.	.	.	.	.	.
Uranium-235	0.383	0.28	0.339	<	.	0.381	.	.	.	.	.	.
Uranium-238	15.1	2.85	0.361	14.4	2.68	0.364	.	.	.	.	.	.

Sampling Point	GW-269			GW-270			GW-272			GW-274		
Functional Area	SY			SY			SY			SY		
Date Sampled	04/19/11			04/25/11			04/19/11			04/20/11		
Program	GWPP			GWPP			GWPP			GWPP		
Sample Type												
Result (pCi/L)	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA
Gross Alpha	<	.	1.3	<	.	3	<	.	7.6	<	.	17
Gross Beta	<	.	4	<	.	8.9	<	.	9.3	2,800	57	21
Technetium-99	<	.	12	<	.	11	<	.	13	4,700	51	21
Uranium-234	.	.	.	.	.	.	.	.	.	5	0.81	0.77
Uranium-235	.	.	.	.	.	.	.	.	.	<	.	0.31
Uranium-238	.	.	.	.	.	.	.	.	.	3.2	0.59	0.42

Sampling Point	GW-275			GW-332			GW-505			GW-605		
Functional Area	SY			WCPA			RG			EXP-I		
Date Sampled	04/21/11			02/24/11			10/18/11			01/11/11		
Program	GWPP			GWPP			GWPP			B/U		
Sample Type												
Result (pCi/L)	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA
Gross Alpha	210	210	130	<	.	3.8	28	5.4	4	71	12.6	2.3
Gross Beta	<	.	270	<	.	7.6	<	.	8.9	47.1	8.38	4.58
Technetium-99	13	7.1	11	14	8.9	14	<	.	15	<	.	6.47
Uranium-234	0.93	0.23	0.28	.	.	.	.	.	.	.	.	.
Uranium-235	<	.	0.13	.	.	.	.	.	.	.	.	.
Uranium-238	0.34	0.13	0.17	.	.	.	.	.	.	.	.	.

APPENDIX E.3: CY 2010 MONITORING DATA FOR THE UPPER EAST FORK POPLAR CREEK HYDROGEOLOGIC REGIME
Radiological Analytes: Isotopic Analyses

Sampling Point	GW-605									GW-606		
Functional Area	EXP-I									EXP-I		
Date Sampled	01/11/11			07/06/11						01/11/11		
Program	B/U			B/U						B/U		
Sample Type	Dup			Dup								
Result (pCi/L)	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA
Gross Alpha	75.2	13.3	2.28	55.4	9.56	1.76	53.4	9.25	1.97	7.28	2.79	2.89
Gross Beta	41.4	7.48	4.43	68.4	11.4	3.86	67.7	11.3	3.94	7.18	2.53	3.95
Technetium-99	<	.	6.54	<	.	9.66	<	.	10.5	<	.	6.32
Uranium-234	.	.	.	.	.	.	.	.	.	.	.	.
Uranium-235	.	.	.	.	.	.	.	.	.	.	.	.
Uranium-238	.	.	.	.	.	.	.	.	.	.	.	.

Sampling Point	GW-606			GW-733						GW-832		
Functional Area	EXP-I			EXP-J						NHP		
Date Sampled	07/06/11			01/11/11			07/06/11			02/24/11		
Program	B/U			B/U			B/U			B/U		
Sample Type												
Result (pCi/L)	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA
Gross Alpha	6.26	2.44	3.35	<	.	2.69	<	.	2.87	<	.	2.58
Gross Beta	4.86	2.46	4.64	<	.	3.73	<	.	4.83	5.69	2.29	3.88
Technetium-99	<	.	10.7	<	.	6.34	<	.	11.3	.	.	.
Uranium-234	.	.	.	.	.	.	.	.	.	1.04	0.471	0.456
Uranium-235	.	.	.	.	.	.	.	.	.	<	.	0.41
Uranium-238	.	.	.	.	.	.	.	.	.	1.71	0.59	0.282

Sampling Point	GW-832			STATION 8								
Functional Area	NHP			EXP-SW								
Date Sampled	08/04/11			02/10/11			02/24/11			07/12/11		
Program	B/U			B/U			B/U			B/U		
Sample Type												
Result (pCi/L)	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA
Gross Alpha	<	.	2.88	<	.	2.66	13.7	3.85	2.48	<	.	2.78
Gross Beta	<	.	3.64	<	.	4	10.2	3.03	4.14	6.62	2.24	3.7
Technetium-99	.	.	.	.	.	.	.	.	.	.	.	.
Uranium-234	1.58	0.575	0.319	2.04	0.65	0.273	8.15	1.73	0.389	1.4	0.514	0.317
Uranium-235	<	.	0.291	0.246	0.209	0.242	0.486	0.311	0.321	0.337	0.233	0.192
Uranium-238	1.3	0.514	0.319	3.24	0.872	0.242	10.2	2.06	0.368	2.36	0.695	0.214

Sampling Point	STATION 8		
Functional Area	EXP-SW		
Date Sampled	8/15/2011		
Program	B/U		
Sample Type			
Result (pCi/L)	Activity	TPU	MDA
Gross Alpha	4.7	2.35	2.78
Gross Beta	9.39	2.99	4.27
Technetium-99	.	.	.
Uranium-234	1.7	0.614	0.455
Uranium-235	<	.	0.385
Uranium-238	5.62	1.31	0.455

APPENDIX F

CY 2011 MONITORING DATA FOR THE CHESTNUT RIDGE HYDROGEOLOGIC REGIME

EXPLANATION

Sampling Point:

- GW - Groundwater monitoring well (e.g., GW-141; one exception is 1090)
- KHB - Kerr Hollow Branch
- MCK - McCoy Branch Kilometer
- S17 - Surface water station in SCR5
- SCR - South Chestnut Ridge (tributary prefix for spring and surface water sampling locations)

Location:

- CDLVII - Construction/Demolition Landfill VII
- CRBAWP - Former Chestnut Ridge Borrow Area Waste Pile
- CRSDB - Chestnut Ridge Sediment Disposal Basin
- CRSP - Chestnut Ridge Security Pits
- ECRWP - East Chestnut Ridge Waste Pile
- EXP-SW - Exit Pathway (spring or surface water sampling location)
- FCAP - Filled Coal Ash Pond
- KHQ - Kerr Hollow Quarry
- LII - Industrial Landfill II
- LIV - Industrial Landfill IV
- LV - Industrial Landfill V
- UNCS - United Nuclear Corporation Site

Monitoring Program:

- B/U - managed by Bechtel Jacobs Company LLC through July and by URS | CH2M Oak Ridge LLC thereafter
- GWPP - managed by the Y-12 Groundwater Protection Program

Sample Type:

- Dup - field duplicate sample
- F - filtered in the field (metals results)
- PDB - passive diffusion bag sample
- Verify - verification sample; GW-298 was re-sampled to verify trichloroethene detection

Units:

- ft - feet (elevations are above mean sea level and depths are below grade)
- µg/L - micrograms per liter
- mg/L - milligrams per liter
- mV - millivolts
- µmho/cm - micromhos per centimeter
- NTU - Nephelometric Turbidity Units
- pCi/L - picoCuries per liter
- ppm - parts per million

EXPLANATION (continued)

Only analytes detected above the program reporting limits in at least one sample are presented in this appendix. Additionally, results that are below the reporting limits are replaced with values (e.g., "<") to emphasize the detected results. The following sections describe the reporting limits and data qualifiers for each subsection of the appendix. A comprehensive list of the Y-12 GWPP analytes, analytical methods, and reporting limits is provided in Appendix B, Table B.5.

F.1 Field Measurements, Miscellaneous Analytes, Major Ions, Trace Metals, and Volatile Organic Compounds:

Results for all of the field measurements, miscellaneous analytes, and major ions are included in this appendix. The reporting limits for the major ions are shown in the following summary.

Analyte	Reporting Limit (mg/L)		Analyte	Reporting Limit (mg/L)	
	GWPP	B/U		GWPP	B/U
Cations			Anions		
Calcium	0.2	0.01	Bicarbonate	1.0	NS
Magnesium	0.2	0.05	Carbonate	1.0	NS
Potassium	2.0	0.025	Chloride	0.2	0.1
Sodium	0.2	0.01	Fluoride	0.1	0.05
			Nitrate (as Nitrogen)	0.05	0.1
			Sulfate	0.25	0.1
Note: NS = not specified					

The Y-12 GWPP SAP (B&W Y-12 2010) specifies analytical methods and reporting limits for trace metals that are appropriate for DOE Order monitoring. Some of the laboratories used for the monitoring programs managed by BJC/UCOR report metals results (often as estimated values) that are lower than the GWPP reporting limits for the metals. For this report, the analytical methods for metals used by BJC/UCOR monitoring programs (EPA-7470, SW846-6010B, SW846-6020, and ASTM-D5174-M) are considered to be functionally equivalent to the methods used by the GWPP (Table B.5). To retain the highest quality data for DOE Order monitoring purposes and to standardize reporting limits for trace metal results obtained from all sources, the GWPP reporting limits were given precedence over the BJC/UCOR reporting limits (BJC 2010a) shown below. Results for the trace metals shown in bold typeface below are presented in Appendix F.1 because the metal was detected at a level above the associated reporting limit in at least one groundwater or surface water sample.

EXPLANATION (continued)

Analyte	Reporting Limit (mg/L)		Analyte	Reporting Limit (mg/L)	
	GWPP	B/U		GWPP	B/U
Aluminum	0.2	0.05*	Lithium	0.01	0.01
Antimony	0.0025	0.003	Manganese	0.005	0.005
Arsenic	0.005	0.005	Mercury	0.00005	0.0002
Barium	0.004	0.005	Molybdenum	0.05	NS
Beryllium	0.0005	0.001	Nickel	0.005	0.01
Boron	0.1	0.01*	Selenium	0.01	0.0025*
Cadmium	0.0025	0.00013*	Silver	0.02	0.0015*
Chromium	0.01	0.005*	Strontium	0.005	0.005
Cobalt	0.02	0.005*	Thallium	0.0005	0.001
Copper	0.02	0.005*	Thorium	0.2	NS
Iron	0.05	0.01*	Uranium	0.0005	0.004
Lead	0.0005	0.002	Vanadium	0.02	0.01*
			Zinc	0.05	0.01*
Note: * - the GWPP reporting limit is used instead of the B/U reporting limit; "NS" - not specified.					

To evaluate the lowest possible mercury concentrations in surface water in McCoy Branch downstream of the FCAP, monitoring by BJC/UCOR included the following results that are not presented in Appendix F.1.

Surface Water Station	Mercury Concentration (mg/L) by Method EPA-1631	
	03/20/11	08/23/11
MCK 2.0	0.0000029	0.0000015
MCK 1.4	0.0000017	0.0000018

EXPLANATION (continued)

The reporting limits for volatile organic compounds shown in Table B.5 and those used for monitoring programs managed by BJC/UCOR are contract-required quantitation limits. Results below the quantitation limit and above the instrument detection limit are reported as estimated quantities. Therefore, non-detected results are assumed to equal zero for all compounds.

As summarized below, seven compounds were detected in groundwater samples collected in the Chestnut Ridge Regime during CY 2011. Results for these compounds are grouped by similar chemical composition (e.g., chloroethenes) in Appendix F.1.

Compound	No. Detected	Maximum (µg/L)	Compound	No. Detected	Maximum (µg/L)
1,1-Dichloroethene	9	34	Tetrachloroethene	6	13
1,1-Dichloroethane	8	57	cis-1,2-Dichloroethene	1	9.38
1,1,1-Trichloroethane	8	20	Trichloroethene	1	2
Trichlorofluoromethane	7	19			

The following symbols and data qualifiers are used for results in Appendix F.1:

- . - Not analyzed
- < - Analyzed but not detected at the project reporting level
- J - Positively identified; estimated concentration

EXPLANATION (continued)

F.2 Radiological Analytes:

Reporting limits for radiological analytes are sample-specific and analyte-specific minimum detectable activities that are reported with each result. The following summary shows the radiological analytes reported for at least one groundwater sample collected during CY 2011 in the Chestnut Ridge Regime.

Analyte	No. of Results	No. Detected	Analyte	No. of Results	No. Detected
Gross Alpha	82	19	Strontium-89/90	8	2
Gross Beta	72	26	Technetium-99	2	0
Cesium-137	4	0	Uranium-234	8	5
Cobalt-60	4	0	Uranium-235	8	0
Potassium-40	4	0	Uranium-238	8	0
Note: * = Reported by B/U laboratories in Appendix F.3 as equivalent GWPP analytes: U-233/234 = U-234; U-235/236 = U-235.					

Results for gross alpha and gross beta are presented in the first two pages of Appendix F.3, followed by results for the isotopes. The following notes and qualifiers apply to this appendix:

- Result - Activity in picoCuries per liter (pCi/L)
- TPU - Total propagated uncertainty (two standard deviations); calculation includes the counting error (instrument uncertainty) plus other sources of uncertainty (e.g., volumetric, chemical yield)
- MDA - Minimum detectable activity
- . - Not analyzed or not applicable (TPU is not presented when the result is <MDA)
- < - Analyzed but less than the MDA

APPENDIX F.1

FIELD MEASUREMENTS, MISCELLANEOUS ANALYTES, MAJOR IONS, TRACE METALS, AND VOLATILE ORGANIC COMPOUNDS

APPENDIX F.1: CY 2011 MONITORING DATA FOR THE CHESTNUT RIDGE HYDROGEOLOGIC REGIME
Field Measurements, Miscellaneous Analytes, Major Ions, Trace Metals, and Volatile Organic Compounds

Sampling Point	1090		GW-141		GW-143	GW-144	GW-145	GW-156		GW-159
Functional Area	UNCS		LIV		KHQ	KHQ	KHQ	CRSDB		CRSDB
Date Sampled	03/03/11	08/08/11	01/27/11	07/25/11	01/06/11	01/06/11	01/06/11	01/12/11		01/12/11
Program	B/U	B/U	B/U	B/U	B/U	B/U	B/U	B/U	B/U	B/U
Sample Type									Dup	
Field Measurements										
Time Sampled	15:00	14:30	10:30	9:45	14:15	10:20	10:30	15:00	.	13:20
Measuring Point Elev. (ft)	1,104.48	1,104.48	1,186.23	1,186.23	913.98	913.54	840.24	1,049.28	.	1,051.38
Depth to Water (ft)	44.48	56.58	95.50	96.27	78.34	78.15	19.75	142.85	.	116.90
Groundwater Elevation (ft)	1,060.00	1,047.90	1,090.73	1,089.96	835.64	835.39	820.49	906.43	.	934.48
Conductivity (µmho/cm)	478	480	338	326	358	297	388	540	.	318
Dissolved Oxygen (ppm)	2.28	1.77	7.6	7.63	3.23	5.59	2.43	5.46	.	3.32
Oxidation/Reduction (mV)	164	-33	124	81	-93	117	-3	199	.	168
Temperature (degrees C)	16.9	18.3	11.8	19.1	10.5	13.1	9.5	10.5	.	12
Turbidity (NTU)	3	3	8	5	1	3	1	8	.	4
pH	6.53	6.29	6.14	7.73	7.71	7.23	8.42	6.69	.	7.35
Miscellaneous Analytes										
Dissolved Solids (mg/L)	270	300	193	179	240	200	270	350	360	190
Suspended Solids (mg/L)	<	<	<	<	<	<	<	<	<	<
Major Ions (mg/L)										
Calcium	55	56	42	41.6	31	54	45	71	71	43
Magnesium	31	33	26	23.4	26	17	36	42	42	25
Potassium	0.61	0.58	<	<	17	1.1	11	18	19	0.71
Sodium	6	6.8	<	<	21	<	3.8	3.9	3.9	<
Bicarbonate	260	270	205	200	.	.	.	.	.	.
Carbonate	<	<	<	<	.	.	.	.	.	.
Chloride	16	17	<	<	.	.	.	.	.	.
Fluoride	<	<	<	<	.	.	.	.	.	.
Nitrate as N	0.76	0.73	<	<	.	.	.	.	.	.
Sulfate	3.6	3.7	<	<	.	.	.	.	.	.
Charge balance error (%)	-1.8	-1.6	1.7	0	.	.	.	.	.	.
Trace Metals (mg/L)										
Aluminum	<	<	<	<	<	<	<	<	<	<
Arsenic	<	<	<	<	<	<	<	<	<	<
Barium	0.024	0.026	0.0151	0.0152	0.053	0.049	0.094	0.033	0.033	0.01
Boron	<	<	<	<	0.89	<	0.24	<	<	<
Chromium	<	<	<	0.0364	<	<	<	<	<	<
Iron	<	<	<	<	0.71	<	<	<	<	<
Lithium	<	<	.	.	0.24	0.012	0.084	<	<	<
Manganese	<	<	<	<	0.012	<	0.01	<	<	<
Nickel	<	<	<	0.0131	<	<	<	<	<	<
Strontium	0.021	0.022	0.013	0.0143	3.1	0.097	6.9	0.023	0.023	0.015
Uranium	<	<	<	<	<	<	0.01	<	<	<
Zinc	<	<	<	<	<	<	<	<	<	<
Chloroethenes (µg/L)										
Tetrachloroethene	.	.	<	<	<	<	<	.	.	.
Trichloroethene	.	.	<	<	<	<	<	.	.	.
cis-1,2-Dichloroethene	.	.	<	<	<	<	<	.	.	.
1,1-Dichloroethene	.	.	<	<	<	<	<	.	.	.
Chloroethanes (µg/L)										
1,1,1-Trichloroethane	.	.	<	<	<	<	<	.	.	.
1,1-Dichloroethane	.	.	<	<	<	<	<	.	.	.
Freon (µg/L)										
Trichlorofluoromethane	.	.	<	<	.	.	.	.	.	.

APPENDIX F.1: CY 2011 MONITORING DATA FOR THE CHESTNUT RIDGE HYDROGEOLOGIC REGIME
Field Measurements, Miscellaneous Analytes, Major Ions, Trace Metals, and Volatile Organic Compounds

Sampling Point	GW-161		GW-174	GW-175		GW-176	GW-177		GW-180
Functional Area	ECRWP		CRSP	CRSP		CRSP	CRSP		CRSP
Date Sampled	01/12/11	07/12/11	08/09/11	08/10/11		08/09/11	01/13/11	07/13/11	08/09/11
Program	B/U	B/U	GWPP	GWPP	GWPP	GWPP	B/U	B/U	GWPP
Sample Type			PDB		Dup	PDB			PDB
Field Measurements									
Time Sampled	13:05	10:10	12:55	9:35	9:35	13:10	11:20	15:40	13:28
Measuring Point Elev. (ft)	1,093.54	1,093.54	.	1,084.19	1,084.19	.	1,158.20	1,158.20	.
Depth to Water (ft)	158.17	160.05	.	123.00	123.00	.	117.00	118.00	.
Groundwater Elevation (ft)	935.37	933.49	.	961.19	961.19	.	1,041.20	1,040.20	.
Conductivity (µmho/cm)	322	329	.	491	491	.	326	445	.
Dissolved Oxygen (ppm)	1.95	0.68	.	3.44	3.44	.	2.93	1.88	.
Oxidation/Reduction (mV)	-51	-46	.	176	176	.	90.4	102	.
Temperature (degrees C)	12.8	15.8	.	22	22	.	10.25	23.3	.
Turbidity (NTU)	22	4	.	.	.	.	2	2	.
pH	8.52	7.27	.	7.3	7.3	.	7.46	7.45	.
Miscellaneous Analytes									
Dissolved Solids (mg/L)	.	.	.	.	.	.	210	240	.
Suspended Solids (mg/L)	.	.	.	.	.	.	<	<	.
Major Ions (mg/L)									
Calcium	40	42	.	.	.	.	49	49	.
Magnesium	24	26	.	.	.	.	28	29	.
Potassium	2.7	2.4	.	.	.	.	1.8	1.4	.
Sodium	2.1	2	.	.	.	.	0.74	0.77	.
Bicarbonate	210	210	.	.	.	.	.	.	.
Carbonate	<	<	.	.	.	.	.	.	.
Chloride	2.7	2.6	.	.	.	.	.	.	.
Fluoride	<	<	.	.	.	.	.	.	.
Nitrate as N	0.094	0.22	.	.	.	.	.	.	.
Sulfate	1.5	1.7	.	.	.	.	.	.	.
Charge balance error (%)	-2.2	0.7	.	.	.	.	.	.	.
Trace Metals (mg/L)									
Aluminum	<	<	.	.	.	.	<	<	.
Arsenic	<	<	.	.	.	.	<	<	.
Barium	0.0076	0.011	.	.	.	.	0.016	0.019	.
Boron	<	<	.	.	.	.	<	<	.
Chromium	<	<	.	.	.	.	<	<	.
Iron	0.67	0.4	.	.	.	.	<	<	.
Lithium	<	<	.	.	.	.	<	<	.
Manganese	<	0.017	.	.	.	.	<	<	.
Nickel	<	<	.	.	.	.	<	<	.
Strontium	0.013	0.015	.	.	.	.	0.014	0.016	.
Uranium	<	<	.	.	.	.	<	<	.
Zinc	<	<	.	.	.	.	<	<	.
Chloroethenes (µg/L)									
Tetrachloroethene	<	<	<	2 J	2 J	<	<	<	13
Trichloroethene	<	<	<	<	<	<	<	<	<
cis-1,2-Dichloroethene	<	<	<	<	<	<	<	<	<
1,1-Dichloroethene	<	<	<	<	<	23	7.2	2.8	<
Chloroethanes (µg/L)									
1,1,1-Trichloroethane	<	<	<	<	<	20	5.8	2	<
1,1-Dichloroethane	<	<	<	<	<	43	31	12	<
Freon (µg/L)									
Trichlorofluoromethane	.	.	5 J	3 J	2 J	<	.	.	3 J

APPENDIX F.1: CY 2011 MONITORING DATA FOR THE CHESTNUT RIDGE HYDROGEOLOGIC REGIME
Field Measurements, Miscellaneous Analytes, Major Ions, Trace Metals, and Volatile Organic Compounds

Sampling Point	GW-203		GW-205				GW-217		GW-221	
Functional Area	UNCS		UNCS				LIV		UNCS	
Date Sampled	03/02/11	08/08/11	01/19/11	03/02/11	07/27/11	08/08/11	01/19/11	07/19/11	03/02/11	08/08/11
Program	B/U	B/U	B/U	B/U	B/U	B/U	B/U	B/U	B/U	B/U
Sample Type										
Field Measurements										
Time Sampled	14:20	10:20	14:00	15:40	9:30	12:00	10:10	14:30	15:40	10:50
Measuring Point Elev. (ft)	1,105.45	1,105.45	1,104.14	1,104.14	1,104.14	1,104.14	1,177.03	1,177.03	1,106.16	1,106.16
Depth to Water (ft)	79.01	74.46	75.96	75.61	71.66	72.69	108.13	112.18	80.80	75.72
Groundwater Elevation (ft)	1,026.44	1,030.99	1,028.18	1,028.53	1,032.48	1,031.45	1,068.90	1,064.85	1,025.36	1,030.44
Conductivity (µmho/cm)	300	251	250	255	291	274	257	377	264	295
Dissolved Oxygen (ppm)	3.9	4.57	3.24	3.48	6.78	2.68	7.93	3.1	4.55	4.93
Oxidation/Reduction (mV)	120	-24	50	133	-125	109	72	59	108	65
Temperature (degrees C)	16.8	18.9	13	17.7	20	21.52	8.8	24.6	16	20.1
Turbidity (NTU)	2	2	1	7	4	4	3	1	1	1
pH	7.62	7.08	8.6	8.59	8.6	9.41	7.1	7.84	7.56	7.28
Miscellaneous Analytes										
Dissolved Solids (mg/L)	160	150	.	140	.	140	185	174	140	180
Suspended Solids (mg/L)	<	<	.	<	.	<	<	<	<	<
Major Ions (mg/L)										
Calcium	36	32	.	37	.	16	40	38.6	31	35
Magnesium	19	18	.	22	.	22	22.5	22.2	18	21
Potassium	0.54	<	.	2.6	.	12	<	<	0.53	0.57
Sodium	<	<	.	0.96	.	2.3	4.19	3.77	<	0.51
Bicarbonate	180	150	.	150	.	130	195	186	150	170
Carbonate	<	<	.	<	.	<	<	<	<	<
Chloride	2.4	2	.	2.2	.	2.3	<	<	1.4	1.6
Fluoride	<	<	.	<	.	<	<	<	<	<
Nitrate as N	0.53	0.99	.	0.33	.	0.15	<	<	0.49	0.43
Sulfate	1.9	1	.	3.6	.	3	<	<	1.7	1.5
Charge balance error (%)	-5.2	-1.1	.	8.7	.	4.4	1.7	2.6	-1.1	0.1
Trace Metals (mg/L)										
Aluminum	<	<	.	<	.	<	<	<	<	<
Arsenic	<	<	.	<	.	<	<	<	<	<
Barium	0.011	0.0073	.	0.016	.	0.0067	0.0353	0.0332	0.0062	0.0076
Boron	<	<	.	<	.	<	<	<	<	<
Chromium	<	<	.	<	.	<	<	<	<	<
Iron	<	<	.	<	.	<	<	<	<	<
Lithium	<	<	.	<	.	0.028	.	.	<	<
Manganese	<	<	.	<	.	<	<	<	<	<
Nickel	<	<	.	<	.	<	<	<	<	<
Strontium	0.0099	0.008	.	0.011	.	0.0055	0.018	0.0172	0.0071	0.0082
Uranium	<	<	.	<	.	<	<	<	<	<
Zinc	<	<	.	<	.	<	<	<	<	<
Chloroethenes (µg/L)										
Tetrachloroethene	.	.	<	.	<	.	<	<	.	.
Trichloroethene	.	.	<	.	<	.	<	<	.	.
cis-1,2-Dichloroethene	.	.	<	.	<	.	<	<	.	.
1,1-Dichloroethene	.	.	<	.	<	.	<	<	.	.
Chloroethanes (µg/L)										
1,1,1-Trichloroethane	.	.	<	.	<	.	<	<	.	.
1,1-Dichloroethane	.	.	<	.	<	.	<	<	.	.
Freon (µg/L)										
Trichlorofluoromethane	.	.	<	.	<	.	<	<	.	.

APPENDIX F.1: CY 2011 MONITORING DATA FOR THE CHESTNUT RIDGE HYDROGEOLOGIC REGIME
Field Measurements, Miscellaneous Analytes, Major Ions, Trace Metals, and Volatile Organic Compounds

Sampling Point	GW-231		GW-294				GW-296	
Functional Area	KHQ		ECRWP				ECRWP	
Date Sampled	01/06/11		01/13/11		07/13/11		01/13/11	07/11/11
Program	B/U	B/U	B/U	B/U	B/U	B/U	B/U	B/U
Sample Type		Dup		Dup		Dup		
Field Measurements								
Time Sampled	14:20	.	12:30	.	11:45	.	9:55	15:20
Measuring Point Elev. (ft)	849.67	.	1,083.60	.	1,083.60	.	1,090.99	1,090.99
Depth to Water (ft)	11.69	.	95.99	.	98.05	.	117.81	118.55
Groundwater Elevation (ft)	837.98	.	987.61	.	985.55	.	973.18	972.44
Conductivity (µmho/cm)	305	.	340	.	441	.	372	379
Dissolved Oxygen (ppm)	4.62	.	8.46	.	6.83	.	5.09	7.62
Oxidation/Reduction (mV)	53	.	169	.	25	.	94	20
Temperature (degrees C)	12	.	6.5	.	19.2	.	12.71	16.2
Turbidity (NTU)	2	.	7	.	4	.	1	4
pH	8.19	.	6.94	.	7.19	.	7.32	7.33
Miscellaneous Analytes								
Dissolved Solids (mg/L)	200	200	.	.	.	.	.	.
Suspended Solids (mg/L)	<	<	.	.	.	.	.	.
Major Ions (mg/L)								
Calcium	46	47	52	53	55	57	52	50
Magnesium	22	23	30	31	33	34	30	30
Potassium	0.9	0.9	0.72	0.74	0.76	0.84	<	<
Sodium	<	<	3.4	3.5	4.3	4.7	1.8	2.5
Bicarbonate	.	.	250	250	250	250	260	240
Carbonate	.	.	<	<	<	<	<	<
Chloride	.	.	7.7	7.8	9.7 J	10	3.1	5
Fluoride	.	.	<	<	<	<	<	<
Nitrate as N	.	.	1.6	1.6	1.5	1.5	0.23	0.15
Sulfate	.	.	2.7	2.7	3.1	3.1	1.2	1.6
Charge balance error (%)	.	.	-1.5	.	2	.	-1.8	0.9
Trace Metals (mg/L)								
Aluminum	<	<	<	<	<	<	<	<
Arsenic	<	<	<	<	<	<	<	<
Barium	0.083	0.085	0.0094	0.0095	0.012	0.012	0.0099	0.014
Boron	<	<	<	<	<	<	<	<
Chromium	<	<	<	<	<	<	<	<
Iron	<	<	<	<	<	<	<	<
Lithium	<	<	<	<	<	<	<	<
Manganese	<	<	<	<	<	<	<	<
Nickel	<	<	<	<	<	<	<	<
Strontium	0.047	0.048	0.02	0.02	0.024	0.025	0.015	0.018
Uranium	<	<	<	<	<	<	<	<
Zinc	<	<	<	<	<	<	<	<
Chloroethenes (µg/L)								
Tetrachloroethene	<	<	<	<	<	<	<	<
Trichloroethene	<	<	<	<	<	<	<	<
cis-1,2-Dichloroethene	<	<	<	<	<	<	<	<
1,1-Dichloroethene	<	<	<	<	<	<	<	<
Chloroethanes (µg/L)								
1,1,1-Trichloroethane	<	<	<	<	<	<	<	<
1,1-Dichloroethane	<	<	<	<	<	<	<	<
Freon (µg/L)								
Trichlorofluoromethane	.	.	.	.	.	.	.	.

APPENDIX F.1: CY 2011 MONITORING DATA FOR THE CHESTNUT RIDGE HYDROGEOLOGIC REGIME
Field Measurements, Miscellaneous Analytes, Major Ions, Trace Metals, and Volatile Organic Compounds

Sampling Point	GW-298				GW-301			
Functional Area	ECRWP				CRBAWP			
Date Sampled	01/12/11	03/03/11		07/12/11	01/12/11		07/12/11	
Program	B/U	B/U	B/U	B/U	B/U	B/U	B/U	B/U
Sample Type		Verify	Dup			Dup		Dup
Field Measurements								
Time Sampled	14:30	9:30	.	15:40	14:20	.	9:35	.
Measuring Point Elev. (ft)	1,049.01	1,049.01	.	1,049.01	1,086.55	.	1,086.55	.
Depth to Water (ft)	107.91	102.18	.	109.41	131.71	.	133.20	.
Groundwater Elevation (ft)	941.10	946.83	.	939.60	954.84	.	953.35	.
Conductivity (µmho/cm)	225	269	.	322	335	.	382	.
Dissolved Oxygen (ppm)	1.64	4.19	.	1.55	6.56	.	12.39	.
Oxidation/Reduction (mV)	9	87	.	-133	-38	.	174	.
Temperature (degrees C)	6.92	12	.	20.7	10.1	.	17.6	.
Turbidity (NTU)	19	3	.	4	3	.	7	.
pH	7.95	8.56	.	7.24	8.7	.	6.91	.
Miscellaneous Analytes								
Dissolved Solids (mg/L)	.	.	.	.	.	.	.	.
Suspended Solids (mg/L)	.	.	.	.	.	.	.	.
Major Ions (mg/L)								
Calcium	37	.	.	38	.	.	.	.
Magnesium	21	.	.	22	.	.	.	.
Potassium	0.51	.	.	<	.	.	.	.
Sodium	2.3	.	.	2.2	.	.	.	.
Bicarbonate	190	.	.	180	.	.	.	.
Carbonate	<	.	.	<	.	.	.	.
Chloride	0.77	.	.	0.82	.	.	.	.
Fluoride	<	.	.	<	.	.	.	.
Nitrate as N	0.056	.	.	0.064	.	.	.	.
Sulfate	5.8	.	.	5.8	.	.	.	.
Charge balance error (%)	-3.4	.	.	0.7	.	.	.	.
Trace Metals (mg/L)								
Aluminum	<	.	.	<	.	.	.	.
Arsenic	<	.	.	<	.	.	.	.
Barium	0.016	.	.	0.019	.	.	.	.
Boron	<	.	.	<	.	.	.	.
Chromium	<	.	.	<	.	.	.	.
Iron	<	.	.	<	.	.	.	.
Lithium	<	.	.	<	.	.	.	.
Manganese	<	.	.	<	.	.	.	.
Nickel	<	.	.	<	.	.	.	.
Strontium	0.02	.	.	0.023	.	.	.	.
Uranium	<	.	.	<	.	.	.	.
Zinc	<	.	.	<	.	.	.	.
Chloroethenes (µg/L)								
Tetrachloroethene	<	<	<	<	<	<	<	<
Trichloroethene	2	<	<	<	<	<	<	<
cis-1,2-Dichloroethene	<	<	<	<	<	<	<	<
1,1-Dichloroethene	<	<	<	<	<	<	<	<
Chloroethanes (µg/L)								
1,1,1-Trichloroethane	<	<	<	<	<	<	<	<
1,1-Dichloroethane	<	<	<	<	<	<	<	<
Freon (µg/L)								
Trichlorofluoromethane	.	.	.	.	.	.	.	.

APPENDIX F.1: CY 2011 MONITORING DATA FOR THE CHESTNUT RIDGE HYDROGEOLOGIC REGIME
Field Measurements, Miscellaneous Analytes, Major Ions, Trace Metals, and Volatile Organic Compounds

Sampling Point	GW-305				GW-322	GW-521		GW-522	
Functional Area	LIV				CRSP	LIV		LIV	
Date Sampled	01/18/11	04/18/11	07/14/11	10/27/11	08/10/11	01/18/11	07/19/11	01/19/11	
Program	B/U	B/U	B/U	B/U	GWPP	B/U	B/U	B/U	B/U
Sample Type									Dup
Field Measurements									
Time Sampled	10:00	10:50	10:30	14:00	13:50	9:45	10:20	9:45	.
Measuring Point Elev. (ft)	1,183.72	1,183.72	1,183.72	1,183.72	1,134.98	1,182.88	1,182.88	1,175.48	.
Depth to Water (ft)	119.69	112.75	123.26	123.30	156.00	83.54	83.27	94.97	.
Groundwater Elevation (ft)	1,064.03	1,070.97	1,060.46	1,060.42	978.98	1,099.34	1,099.61	1,080.51	.
Conductivity (µmho/cm)	252	368	355	391	539	242	258	380	.
Dissolved Oxygen (ppm)	5.04	6.1	5.11	4.81	3.12	4	2.51	7.64	.
Oxidation/Reduction (mV)	116.5	148	71	16.1	153	58	54	151	.
Temperature (degrees C)	9.9	17.9	23.3	88	24.7	13.6	17	13.6	.
Turbidity (NTU)	2	3	3	7	.	2	2	2	.
pH	7.83	9.41	7.05	7.12	7.1	8.05	7.73	7.17	.
Miscellaneous Analytes									
Dissolved Solids (mg/L)	170	.	181	.	.	142	144	215	222
Suspended Solids (mg/L)	<	.	<	.	.	4.43	<	<	<
Major Ions (mg/L)									
Calcium	37.9	.	38.7	.	.	20.7	28	46.9	47.6
Magnesium	22.8	.	23.6	.	.	22.4	22.4	28	28.7
Potassium	<	.	<	.	.	<	<	<	<
Sodium	2.21	.	2.66	.	.	2.92	2.67	<	<
Bicarbonate	189	.	182	.	.	152	162	229	224
Carbonate	<	.	<	.	.	<	<	<	<
Chloride	<	.	<	.	.	<	<	<	<
Fluoride	<	.	<	.	.	<	<	<	<
Nitrate as N	<	.	<	.	.	<	<	<	<
Sulfate	<	.	<	.	.	<	<	5.06	<
Charge balance error (%)	1.1	.	4.6	.	.	-0.6	1.8	-0.8	.
Trace Metals (mg/L)									
Aluminum	<	.	<	.	.	<	<	<	<
Arsenic	<	.	<	.	.	<	<	<	<
Barium	0.0128	.	0.0115	.	.	<	<	0.013	0.0129
Boron	<	.	<	.	.	<	<	<	<
Chromium	<	.	<	.	.	<	<	<	<
Iron	<	.	<	.	.	0.327	<	<	<
Lithium	.	.	.	.	.	.	.	.	.
Manganese	<	.	<	.	.	0.0127	<	<	<
Nickel	0.0389	.	0.0329	.	.	<	<	<	<
Strontium	0.0185	.	0.018	.	.	<	<	0.0197	0.0197
Uranium	<	.	<	.	.	<	<	<	<
Zinc	<	.	<	.	.	<	<	<	<
Chloroethenes (µg/L)									
Tetrachloroethene	<	<	<	<	3 J	<	<	<	<
Trichloroethene	<	<	<	<	<	<	<	<	<
cis-1,2-Dichloroethene	<	<	<	<	<	<	<	<	<
1,1-Dichloroethene	7.22	6.8	6.72	8.29	34	<	<	<	<
Chloroethanes (µg/L)									
1,1,1-Trichloroethane	11.6	12.5	11	11.4	11	<	<	<	<
1,1-Dichloroethane	35.8	37.1	37.8	47.8	57	<	<	<	<
Freon (µg/L)									
Trichlorofluoromethane	<	<	<	<	19	<	<	<	<

APPENDIX F.1: CY 2011 MONITORING DATA FOR THE CHESTNUT RIDGE HYDROGEOLOGIC REGIME
Field Measurements, Miscellaneous Analytes, Major Ions, Trace Metals, and Volatile Organic Compounds

Sampling Point	GW-522		GW-540		GW-557		GW-560		GW-562	
Functional Area	LIV		LII		LV		CDLVII		CDLVII	
Date Sampled	07/18/11		01/20/11	07/21/11	01/18/11	07/20/11	01/19/11	07/21/11	01/19/11	07/21/11
Program	B/U	B/U	B/U	B/U	B/U	B/U	B/U	B/U	B/U	B/U
Sample Type		Dup								
Field Measurements										
Time Sampled	14:45	.	14:20	11:00	14:00	14:00	11:20	10:00	13:30	15:20
Measuring Point Elev. (ft)	1,175.48	.	1,072.31	1,072.31	1,081.36	1,081.36	949.05	949.05	934.69	934.69
Depth to Water (ft)	102.76	.	83.20	81.41	123.80	121.90	50.01	47.85	11.61	8.17
Groundwater Elevation (ft)	1,072.72	.	989.11	990.90	957.56	959.46	899.04	901.20	923.08	926.52
Conductivity (µmho/cm)	357	.	440	458	297	331	303	282	319	360
Dissolved Oxygen (ppm)	8.2	.	1	5.91	7.8	6.68	6.45	6.08	5.26	5.7
Oxidation/Reduction (mV)	-6	.	60	146	127	43	147	40	124	180
Temperature (degrees C)	17.9	.	13.8	18.6	14.1	19.8	13.8	16.7	12.9	23
Turbidity (NTU)	2	.	8	2	4	5	0	2	25	7
pH	7.4	.	8.1	6.84	7.38	8.03	7.3	7.15	7.31	7.86
Miscellaneous Analytes										
Dissolved Solids (mg/L)	201	206	266	230	170	153	175	163	192	160
Suspended Solids (mg/L)	<	<	<	<	<	<	<	<	5.67	<
Major Ions (mg/L)										
Calcium	42.5	44.8	50.4	57.1	35.9	41.2	42.2	43.2	40.8	43.6
Magnesium	23.8	26.1	32.6	34.7	20.5	22.2	18.1	19	23.6	25.5
Potassium	<	<	<	<	<	<	<	<	<	<
Sodium	<	<	9.27	3.4	<	<	<	<	<	<
Bicarbonate	211	211	275	274	176	180	184	167	197	198
Carbonate	<	<	<	<	<	<	<	<	<	<
Chloride	<	<	<	<	<	<	<	<	<	<
Fluoride	<	<	<	<	<	<	<	<	<	<
Nitrate as N	0.542	0.547	<	<	<	<	<	<	<	<
Sulfate	<	<	<	<	<	<	<	<	<	<
Charge balance error (%)	-2.1	.	0.9	3.3	-0.6	3.8	-1.6	5.4	0.1	3.8
Trace Metals (mg/L)										
Aluminum	<	<	<	<	<	<	<	<	0.306	0.231
Arsenic	<	<	<	<	<	<	<	<	<	<
Barium	0.0116	0.0122	0.0139	0.0132	<	0.0115	0.262	0.258	0.0122	0.0123
Boron	<	<	<	<	<	<	<	<	<	<
Chromium	<	<	<	<	<	<	<	<	<	<
Iron	<	<	<	<	<	<	<	<	0.259	0.171
Lithium	.	.	.	.	.	.	.	.	.	.
Manganese	<	<	<	<	<	<	<	<	<	<
Nickel	<	<	<	<	<	<	<	<	<	<
Strontium	0.0177	0.0187	0.0345	0.0355	0.0166	0.0187	0.027	0.027	0.0216	0.0221
Uranium	<	<	<	<	<	<	<	<	<	<
Zinc	<	<	<	<	<	<	<	<	<	<
Chloroethenes (µg/L)										
Tetrachloroethene	<	<	<	<	<	<	<	<	<	<
Trichloroethene	<	<	<	<	<	<	<	<	<	<
cis-1,2-Dichloroethene	<	<	<	<	<	<	<	<	<	<
1,1-Dichloroethene	<	<	<	<	<	<	<	<	<	<
Chloroethanes (µg/L)										
1,1,1-Trichloroethane	<	<	<	<	<	<	<	<	<	<
1,1-Dichloroethane	<	<	<	<	<	<	<	<	<	<
Freon (µg/L)										
Trichlorofluoromethane	<	<	<	<	<	<	<	<	<	<

APPENDIX F.1: CY 2011 MONITORING DATA FOR THE CHESTNUT RIDGE HYDROGEOLOGIC REGIME
Field Measurements, Miscellaneous Analytes, Major Ions, Trace Metals, and Volatile Organic Compounds

Sampling Point	GW-564				GW-709		GW-731	GW-732	GW-757	
Functional Area	CDLVII				LII		CRSDB	CRSDB	LII	
Date Sampled	01/19/11		07/20/11		01/20/11	07/25/11	01/18/11	01/14/11	01/20/11	07/25/11
Program	B/U	B/U	B/U	B/U	B/U	B/U	B/U	B/U	B/U	B/U
Sample Type		Dup		Dup						
Field Measurements										
Time Sampled	14:00	.	14:45	.	10:30	14:40	9:10	10:35	10:30	10:30
Measuring Point Elev. (ft)	938.07	.	938.07	.	906.81	906.81	1,049.38	1,064.29	961.64	961.64
Depth to Water (ft)	12.00	.	11.10	.	28.48	29.41	124.61	157.61	84.01	84.64
Groundwater Elevation (ft)	926.07	.	926.97	.	878.33	877.40	924.77	906.68	877.63	877.00
Conductivity (µmho/cm)	230	.	252	.	317	449	234	253	195	289
Dissolved Oxygen (ppm)	4.39	.	5.53	.	4.1	1.96	6.21	5.05	1.6	6.73
Oxidation/Reduction (mV)	152.5	.	45	.	-57	-90	20	79	81.8	-41
Temperature (degrees C)	14.27	.	16.7	.	9.9	24.1	11.6	12.8	8.39	21.7
Turbidity (NTU)	2	.	5	.	4	6	2	11	2	7
pH	6.74	.	6.25	.	9.23	8.71	8.24	8	10.24	8.81
Miscellaneous Analytes										
Dissolved Solids (mg/L)	145	144	137	133	193	207	140	160	143	131
Suspended Solids (mg/L)	<	<	<	<	<	<	7.6	8.2	<	<
Major Ions (mg/L)										
Calcium	36.6	36	37.6	38.9	38.6	40.9	30	35	3.14	2.87
Magnesium	13.8	14.4	16.4	16.1	29.9	30.2	18	22	3.2	2.69
Potassium	<	<	<	<	<	<	1	3.7	17.4	17.1
Sodium	<	<	<	<	3.67	3.24	0.61	1.1	40.2	38.4
Bicarbonate	128	133	149	150	235	225	.	.	56	56.3
Carbonate	<	<	<	<	<	<	.	.	58.7	53.2
Chloride	<	<	<	<	<	<	.	.	<	<
Fluoride	<	<	<	<	<	<	.	.	1.28	1.3
Nitrate as N	1.3 J	1.31 J	<	<	<	<	.	.	<	<
Sulfate	11.3	11.2	<	<	9.76	10	.	.	12.3	12.5
Charge balance error (%)	1.3	.	4	.	-3.9	-0.5	.	.	-3.3	-1
Trace Metals (mg/L)										
Aluminum	<	<	<	<	<	<	<	0.27	<	<
Arsenic	<	<	<	<	<	<	<	<	<	<
Barium	0.0217	0.0215	0.0137	0.0139	0.77	0.818	0.0086	0.016	0.0855	0.08
Boron	<	<	<	<	<	<	<	<	<	<
Chromium	<	<	<	<	<	<	<	<	<	<
Iron	<	<	<	<	<	<	<	<	<	<
Lithium	.	.	.	.	.	.	<	<	.	.
Manganese	<	<	<	<	<	<	<	<	<	<
Nickel	<	<	<	<	<	<	<	<	<	<
Strontium	0.054	0.0531	0.0244	0.0256	0.0529	0.055	0.019	0.025	0.178	0.169
Uranium	<	<	<	<	<	<	<	<	<	<
Zinc	<	<	<	<	<	<	<	<	<	<
Chloroethenes (µg/L)										
Tetrachloroethene	<	<	<	<	<	<	.	.	<	<
Trichloroethene	<	<	<	<	<	<	.	.	<	<
cis-1,2-Dichloroethene	<	<	<	<	<	<	.	.	<	<
1,1-Dichloroethene	<	<	<	<	<	<	.	.	<	<
Chloroethanes (µg/L)										
1,1,1-Trichloroethane	<	<	<	<	<	<	.	.	<	<
1,1-Dichloroethane	<	<	<	<	<	<	.	.	<	<
Freon (µg/L)										
Trichlorofluoromethane	<	<	<	<	<	<	.	.	<	<

APPENDIX F.1: CY 2011 MONITORING DATA FOR THE CHESTNUT RIDGE HYDROGEOLOGIC REGIME
Field Measurements, Miscellaneous Analytes, Major Ions, Trace Metals, and Volatile Organic Compounds

Sampling Point	GW-796		GW-797		GW-798		GW-799		GW-801	
Functional Area	LV		LV		CDLVII		LV		LV	
Date Sampled	01/18/11	07/20/11	01/20/11	07/20/11	01/19/11	07/20/11	01/18/11	07/21/11	01/18/11	07/19/11
Program	B/U	B/U	B/U	B/U	B/U	B/U	B/U	B/U	B/U	B/U
Sample Type										
Field Measurements										
Time Sampled	14:20	10:00	14:30	11:00	15:20	14:15	15:10	15:15	12:00	14:30
Measuring Point Elev. (ft)	1,052.62	1,052.62	1,060.00	1,060.00	1,006.00	1,006.00	981.29	981.29	1,097.16	1,097.16
Depth to Water (ft)	78.16	72.97	72.97	73.18	80.02	76.21	22.30	22.11	112.31	110.65
Groundwater Elevation (ft)	974.46	979.65	987.03	986.82	925.98	929.79	958.99	959.18	984.85	986.51
Conductivity (µmho/cm)	190	218	420	548	224	376	238	272	253	232
Dissolved Oxygen (ppm)	7.97	9.02	3.93	4.17	4.74	6.65	4.8	2.2	8.68	7.41
Oxidation/Reduction (mV)	106.5	10	118	86	127	107	45	-86	101	15
Temperature (degrees C)	14.06	18.1	13.5	21.9	15.34	17.4	13.2	18.2	12.5	16.4
Turbidity (NTU)	7	2	3	5	1	2	112	9	3	4
pH	8.27	8.75	7.54	6.36	7.66	7.53	7.92	7.4	7.53	7.55
Miscellaneous Analytes										
Dissolved Solids (mg/L)	128	104	292	304	137	120	181	141	137	149
Suspended Solids (mg/L)	<	<	<	<	<	<	59.2	5.6	<	<
Major Ions (mg/L)										
Calcium	26.4	26.5	56.6	61	29.8	32.9	32.1	33.3	33.8	34
Magnesium	15.3	15.6	34.3	31.4	16.2	17.5	16.6	18.6	19.3	18.8
Potassium	<	<	<	<	<	<	<	<	<	<
Sodium	<	<	3.49	4.85	<	<	<	<	<	<
Bicarbonate	123	126	219	216	155	137	155	147	155	151
Carbonate	<	<	<	<	<	<	<	<	<	<
Chloride	<	<	5.59	5.95	<	<	<	<	<	<
Fluoride	<	<	<	<	<	<	<	<	<	<
Nitrate as N	<	<	2.27	2.4	0.657 J	0.658	1 J	1.02	<	<
Sulfate	<	<	46.3	52	<	<	<	<	<	<
Charge balance error (%)	2.3	1.6	1.2	0.9	-5.5	5	.	2.9	2.8	3.6
Trace Metals (mg/L)										
Aluminum	<	<	<	<	<	<	1.48	0.413	<	<
Arsenic	<	<	<	<	<	<	<	<	<	<
Barium	<	<	0.0119	0.0127	0.0107	0.0111	<	<	<	<
Boron	<	<	<	<	<	<	<	<	<	<
Chromium	<	<	<	<	<	<	0.022	0.0264	<	<
Iron	<	<	<	<	<	<	1.26	0.404	<	<
Lithium	.	.	.	.	.	.	.	.	.	.
Manganese	<	<	<	<	<	<	0.0278	0.0106	<	<
Nickel	<	<	<	<	<	<	<	<	<	<
Strontium	0.0134	0.0129	0.0321	0.0345	0.0169	0.0179	0.0195	0.0204	0.0173	0.0173
Uranium	<	<	<	<	<	<	<	<	<	<
Zinc	<	<	<	<	<	<	<	<	<	<
Chloroethenes (µg/L)										
Tetrachloroethene	<	<	<	<	5.64	9.12	<	<	<	<
Trichloroethene	<	<	<	<	<	<	<	<	<	<
cis-1,2-Dichloroethene	<	<	<	<	<	9.38	<	<	<	<
1,1-Dichloroethene	<	<	<	<	<	4.44	<	<	<	<
Chloroethanes (µg/L)										
1,1,1-Trichloroethane	<	<	<	<	<	<	<	<	<	<
1,1-Dichloroethane	<	<	<	<	<	<	<	<	<	<
Freon (µg/L)										
Trichlorofluoromethane	<	<	<	<	8.25	11.5	<	<	<	<

APPENDIX F.1: CY 2011 MONITORING DATA FOR THE CHESTNUT RIDGE HYDROGEOLOGIC REGIME
Field Measurements, Miscellaneous Analytes, Major Ions, Trace Metals, and Volatile Organic Compounds

Sampling Point	GW-831		KHB-09	MCK 1.4		MCK 2.0			MCK 2.05	
Functional Area	FCAP		EXP-SW	EXP-SW		EXP-SW			EXP-SW	
Date Sampled	01/13/11	07/13/11	12/13/11	03/24/11	08/23/11	03/24/11	08/23/11		03/24/11	
Program	B/U	B/U	GWPP	B/U	B/U	B/U	B/U	B/U	B/U	B/U
Sample Type								F		Dup
Field Measurements										
Time Sampled	14:05	15:40	9:02	14:40	8:20	14:20	9:43	.	14:00	.
Measuring Point Elev. (ft)	1,091.29	1,091.29	.	.	.	.	.	.	.	.
Depth to Water (ft)	129.03	126.65	.	.	.	.	.	.	.	.
Groundwater Elevation (ft)	962.26	964.64	.	.	.	.	.	.	.	.
Conductivity (µmho/cm)	220	339	.	207	256	230	331	.	258	.
Dissolved Oxygen (ppm)	4.11	1.76	.	9.03	5.22	6.67	6.44	.	5.98	.
Oxidation/Reduction (mV)	138	-76	.	94.8	102	96	109.2	.	100.2	.
Temperature (degrees C)	6.5	18.5	.	10.85	22.28	12.56	16.91	.	13.25	.
Turbidity (NTU)	5	1	.	4	2	4	5	.	9	.
pH	8.1	8.1	.	7.21	8.4	7.17	7.82	.	7.06	.
Miscellaneous Analytes										
Dissolved Solids (mg/L)	.	.	161	.	.	180	200	.	190	200
Suspended Solids (mg/L)	.	.	<	.	.	<	<	.	24 R	4 R
Major Ions (mg/L)										
Calcium	.	.	41.3	38	33	38	49	48	41	40
Magnesium	.	.	14.1	10	9.6	13	17	17	14	14
Potassium	.	.	<	1.3	1.2	3.2	3.5	3.5	3.4	3.4
Sodium	.	.	0.769	1.4	0.98	1.2	1.4	1.4	1.2	1.3
Bicarbonate	.	.	147	.	.	140	170	.	150	140
Carbonate	.	.	<	.	.	<	<	.	<	<
Chloride	.	.	1.44	.	.	1.4	1.2	.	1.6	1.4
Fluoride	.	.	<	.	.	<	<	.	<	<
Nitrate as N	.	.	1.74	.	.	.	.	.	.	.
Sulfate	.	.	5.73	.	.	25	19	.	25	25
Charge balance error (%)	.	.	0.5	.	.	-4	2.1	.	-3.3	.
Trace Metals (mg/L)										
Aluminum	.	.	<	<	<	<	<	<	<	<
Arsenic	.	.	<	<	<	0.011	0.02	0.0066	0.023	0.048
Barium	.	.	0.0486	0.046	0.048	0.055	0.072	0.068	0.068	0.09
Boron	.	.	<	<	<	0.15	0.18	0.18	0.17	0.16
Chromium	.	.	<	<	<	<	<	<	<	<
Iron	.	.	0.0845	<	<	0.19	0.51	<	0.73	2
Lithium	.	.	<	<	<	0.041	0.048	0.047	0.045	0.044
Manganese	.	.	0.00829	0.0095	0.033	0.16	0.4	0.3	0.36	0.89
Nickel	.	.	<	<	<	<	<	<	<	<
Strontium	.	.	0.0471	0.19	0.18	0.54	0.75	0.74	0.58	0.57
Uranium	.	.	0.00051	<	<	<	<	<	<	<
Zinc	.	.	<	<	<	<	<	<	<	<
Chloroethenes (µg/L)										
Tetrachloroethene	<	<	.	.	.	.	.	.	.	.
Trichloroethene	<	<	.	.	.	.	.	.	.	.
cis-1,2-Dichloroethene	<	<	.	.	.	.	.	.	.	.
1,1-Dichloroethene	<	<	.	.	.	.	.	.	.	.
Chloroethanes (µg/L)										
1,1,1-Trichloroethane	<	<	.	.	.	.	.	.	.	.
1,1-Dichloroethane	<	<	.	.	.	.	.	.	.	.
Freon (µg/L)										
Trichlorofluoromethane	.	.	.	.	.	.	.	.	.	.

APPENDIX F.1: CY 2011 MONITORING DATA FOR THE CHESTNUT RIDGE HYDROGEOLOGIC REGIME
Field Measurements, Miscellaneous Analytes, Major Ions, Trace Metals, and Volatile Organic Compounds

Sampling Point	MCK 2.05				S17		SCR1.25SP		SCR1.5SW
Functional Area	EXP-SW				EXP-SW		EXP-SW		EXP-SW
Date Sampled	08/23/11		08/23/11		07/27/11	12/13/11	03/24/11	08/23/11	07/27/11
Program	B/U	B/U	B/U	B/U	GWPP	GWPP	B/U	B/U	GWPP
Sample Type		Dup	F	F/Dup					
Field Measurements									
Time Sampled	10:05	.	.	.	13:50	8:56	13:05	11:20	9:55
Measuring Point Elev. (ft)	.	.	.	.	.	.	.	.	.
Depth to Water (ft)	.	.	.	.	.	.	.	.	.
Groundwater Elevation (ft)	.	.	.	.	.	.	.	.	.
Conductivity (µmho/cm)	3	.	.	.	546	.	228	322	331
Dissolved Oxygen (ppm)	8.5	.	.	.	3.78	.	5.29	8.39	8.13
Oxidation/Reduction (mV)	167	.	.	.	175	.	100.6	187	202
Temperature (degrees C)	16.67	.	.	.	15.6	.	14.61	18.37	22
Turbidity (NTU)	3	.	.	.	.	.	10	5	.
pH	8.32	.	.	.	6.89	.	7.3	8.44	7.42
Miscellaneous Analytes									
Dissolved Solids (mg/L)	210	210	.	.	279	166	120	180	117
Suspended Solids (mg/L)	12	58	.	.	2	<	6.6	21	4
Major Ions (mg/L)									
Calcium	49	48	48	50	60.6	38.9	27	44	40.6
Magnesium	17	17	17	17	34.8	13.4	11	20	18.2
Potassium	3.5	3.4	3.4	3.5	<	<	0.51	0.72	<
Sodium	1.4	1.4	1.4	1.5	2.51	0.727	0.7	0.87	1.18
Bicarbonate	170	170	.	.	253	141	110	180	153
Carbonate	<	<	.	.	<	<	<	<	18.2
Chloride	1.2	1.3	.	.	4.81	1.44	2.1	1.8	1.89
Fluoride	<	<	.	.	<	<	<	<	<
Nitrate as N	.	.	.	.	10.1	1.74	0.08	0.11	<
Sulfate	20	20	.	.	6.19	5.71	6.4	4.5	5.62
Charge balance error (%)	1.8	.	.	.	-0.4	-0.4	-2.2	1.9	-0.2
Trace Metals (mg/L)									
Aluminum	<	<	<	<	<	<	<	<	0.36
Arsenic	0.018	0.016	0.011	0.012	<	<	<	<	<
Barium	0.078	0.072	0.058	0.069	0.167	0.0472	0.047	0.074	0.0371
Boron	0.18	0.17	0.18	0.18	<	<	<	<	<
Chromium	<	<	<	<	<	<	<	<	0.00299
Iron	0.47	0.32	<	<	0.0597	0.0911	0.47	0.28	0.261
Lithium	0.047	0.047	0.046	0.047	<	<	<	<	<
Manganese	0.52	0.33	<	0.061	0.0147	0.0083	0.1	0.073	0.0258
Nickel	<	<	<	<	<	<	<	<	<
Strontium	0.74	0.74	0.73	0.75	0.0467	0.0448	0.029	0.049	0.0567
Uranium	<	<	<	<	0.00116	<	<	<	0.00118
Zinc	<	<	<	<	<	<	<	<	0.22
Chloroethenes (µg/L)									
Tetrachloroethene	.	.	.	.	<	.	<	<	<
Trichloroethene	.	.	.	.	<	.	<	<	<
cis-1,2-Dichloroethene	.	.	.	.	<	.	<	<	<
1,1-Dichloroethene	.	.	.	.	<	.	<	<	<
Chloroethanes (µg/L)									
1,1,1-Trichloroethane	.	.	.	.	<	.	<	<	<
1,1-Dichloroethane	.	.	.	.	<	.	<	<	<
Freon (µg/L)									
Trichlorofluoromethane	.	.	.	.	<	.	.	.	<

APPENDIX F.1: CY 2011 MONITORING DATA FOR THE CHESTNUT RIDGE HYDROGEOLOGIC REGIME
Field Measurements, Miscellaneous Analytes, Major Ions, Trace Metals, and Volatile Organic Compounds

Sampling Point	SCR2.1SP	SCR2.2SP	SCR3.5SP		SCR3.5SW	SCR4.3SP		SCR5.1SP	SCR5.2SP
Functional Area	EXP-SW	EXP-SW	EXP-SW		EXP-SW	EXP-SW		EXP-SW	EXP-SW
Date Sampled	07/27/11	07/27/11	03/24/11	08/23/11	07/27/11	01/19/11	07/20/11	12/13/11	12/13/11
Program	GWPP	GWPP	B/U	B/U	GWPP	B/U	B/U	GWPP	GWPP
Sample Type									
Field Measurements									
Time Sampled	15:25	10:20	13:50	9:01	14:40	9:25	10:30	10:12	9:12
Measuring Point Elev. (ft)	.	.	.	.	.	.	.	.	.
Depth to Water (ft)	.	.	.	.	.	.	.	.	.
Groundwater Elevation (ft)	.	.	.	.	.	.	.	.	.
Conductivity (µmho/cm)	392	366	223	347	384	238	283	.	.
Dissolved Oxygen (ppm)	5.35	5.99	5.41	6.91	6.16	4.68	6.75	.	.
Oxidation/Reduction (mV)	191	203	99.1	69	203	139	7	.	.
Temperature (degrees C)	23	16.8	13.27	18.51	21.8	10.56	16.9	.	.
Turbidity (NTU)	.	.	7	2	.	28	23	.	.
pH	7.44	7.15	7.22	8.43	7.47	7.45	6.31	.	.
Miscellaneous Analytes									
Dissolved Solids (mg/L)	183	140	150	200	199	181	156	90	240
Suspended Solids (mg/L)	5	4	7.6	<	12	4.61	5.6	<	<
Major Ions (mg/L)									
Calcium	50	51.7	38	56	51.4	42.2	43.4	14.4	64.3
Magnesium	20.9	16.5	12	17	17	11.8	13.2	8.28	15.3
Potassium	<	<	1.4	1.8	2.48	2.08	2.1	<	<
Sodium	1.48	1.68	0.66	1	1.29	3.73	2.7	0.522	1.08
Bicarbonate	200	186	140	190	183	112	124	69.9	186
Carbonate	<	<	<	<	<	<	<	<	<
Chloride	1.97	2.59	1.4	1.3	1.48	5.71	4.4	1.33	1.82
Fluoride	<	<	<	<	0.135	<	<	<	0.12
Nitrate as N	0.186	0.437	0.3	0.1	0.112	1.59 J	0.742	1.07	4.28
Sulfate	4.72	6.49	12	8.4	9.87	38.4	30.1	3.62	10.7
Charge balance error (%)	1.4	0.7	-2.7	3.2	2	-0.3	2.1	-5.4	2.4
Trace Metals (mg/L)									
Aluminum	<	<	0.62	0.56	0.38	1.54	0.446	<	<
Arsenic	<	<	0.0074	0.014	<	<	<	<	<
Barium	0.0468	0.0448	0.09	0.1	0.0859	0.0855	0.112	0.0154	0.0407
Boron	<	<	<	<	<	<	<	<	<
Chromium	0.00414	<	<	<	0.00364	<	<	<	<
Iron	<	<	0.98	1.3	0.457	1.01	0.299	0.0921	0.0623
Lithium	<	<	<	0.014	0.0216	.	.	<	<
Manganese	0.0203	0.00537	0.14	0.65	0.142	<	<	0.00538	<
Nickel	<	<	<	<	<	<	<	<	<
Strontium	0.0654	0.0693	0.2	0.32	0.322	0.146	0.125	0.013	0.0614
Uranium	0.00366	0.00104	<	<	0.00051	<	<	<	<
Zinc	0.292	<	<	<	0.278	<	<	<	<
Chloroethenes (µg/L)									
Tetrachloroethene	<	<	<	<	<	<	<	.	.
Trichloroethene	<	<	<	<	<	<	<	.	.
cis-1,2-Dichloroethene	<	<	<	<	<	<	<	.	.
1,1-Dichloroethene	<	<	<	<	<	<	<	.	.
Chloroethanes (µg/L)									
1,1,1-Trichloroethane	<	<	<	<	<	<	<	.	.
1,1-Dichloroethane	<	<	<	<	<	<	<	.	.
Freon (µg/L)									
Trichlorofluoromethane	<	<	.	.	<	<	<	.	.

APPENDIX F.1: CY 2011 MONITORING DATA FOR THE CHESTNUT RIDGE HYDROGEOLOGIC REGIME
Field Measurements, Miscellaneous Analytes, Major Ions, Trace Metals, and Volatile Organic Compounds

Sampling Point	UNC SW-1	
Functional Area	EXP-SW	
Date Sampled	03/07/11	09/15/11
Program	B/U	B/U
Sample Type		
Field Measurements		
Time Sampled	13:00	8:50
Measuring Point Elev. (ft)	.	.
Depth to Water (ft)	.	.
Groundwater Elevation (ft)	.	.
Conductivity (µmho/cm)	85	154
Dissolved Oxygen (ppm)	5.81	5.65
Oxidation/Reduction (mV)	102.6	104.6
Temperature (degrees C)	12.7	19.01
Turbidity (NTU)	10	7
pH	6.57	6.19
Miscellaneous Analytes		
Dissolved Solids (mg/L)	.	.
Suspended Solids (mg/L)	.	.
Major Ions (mg/L)		
Calcium	13	19
Magnesium	3.1	4.9
Potassium	<	0.91
Sodium	1.8	3.3
Bicarbonate	38	54
Carbonate	<	<
Chloride	4	6
Fluoride	<	<
Nitrate as N	0.14	0.16
Sulfate	7.5	6.9
Charge balance error (%)	-2.8	3.9
Trace Metals (mg/L)		
Aluminum	<	<
Arsenic	<	<
Barium	0.021	0.035
Boron	<	<
Chromium	<	<
Iron	<	<
Lithium	<	<
Manganese	<	0.0051
Nickel	<	<
Strontium	0.028	0.043
Uranium	<	<
Zinc	<	<
Chloroethenes (µg/L)		
Tetrachloroethene	.	.
Trichloroethene	.	.
cis-1,2-Dichloroethene	.	.
1,1-Dichloroethene	.	.
Chloroethanes (µg/L)		
1,1,1-Trichloroethane	.	.
1,1-Dichloroethane	.	.
Freon (µg/L)		
Trichlorofluoromethane	.	.

APPENDIX F.2

RADIOLOGICAL ANALYTES

APPENDIX F.2: CY 2011 MONITORING DATA FOR THE CHESTNUT RIDGE HYDROGEOLOGIC REGIME
Radiological Analytes: Gross Alpha and Gross Beta Activity

Sampling Point	Functional Area	Date Sampled	Program	Smple Type	Gross Alpha (pCi/L)			Gross Beta (pCi/L)		
					Result	TPU	MDA	Result	TPU	MDA
1090	UNCS	03/03/11	B/U		<	.	1.95	<	.	4.24
		08/08/11	B/U		<	.	2.06	<	.	3.32
GW-141	LIV	01/27/11	B/U		<	.	1.77	<	.	2.77
		07/25/11	B/U		<	.	1.46	<	.	2.74
GW-143	KHQ	01/06/11	B/U		<	.	3.36	14.7	3.63	4.2
GW-144	KHQ	01/06/11	B/U		<	.	2.49	<	.	4.27
GW-145	KHQ	01/06/11	B/U		6.54	2.36	2.55	11.8	3.03	3.9
GW-161	ECRWP	01/12/11	B/U		<	.	2.87	.	.	.
		07/12/11	B/U		<	.	2.21	.	.	.
GW-177	CRSP	01/13/11	B/U		<	.	2.81	<	.	4
		07/13/11	B/U		2.91	1.2	1.53	4.17	1.56	2.65
GW-203	UNCS	03/02/11	B/U		<	.	2.1	<	.	3.74
		08/08/11	B/U		<	.	2.12	<	.	3.47
GW-205	UNCS	03/02/11	B/U		<	.	3.28	14.6	3.52	3.84
		08/08/11	B/U		<	.	2.81	14.9	3.37	3.46
GW-217	LIV	01/19/11	B/U		<	.	1.92	<	.	3.12
		07/19/11	B/U		<	.	1.52	<	.	2.76
GW-221	UNCS	03/02/11	B/U		<	.	2.03	<	.	3.73
		08/08/11	B/U		<	.	2.44	<	.	3.54
GW-231	KHQ	01/06/11	B/U		<	.	2.7	<	.	3.89
			B/U	Dup	2.87	1.83	2.83	<	.	4.03
GW-294	ECRWP	01/13/11	B/U		<	.	1.83	.	.	.
			B/U	Dup	<	.	2.4	.	.	.
		07/13/11	B/U		<	.	1.55	.	.	.
			B/U	Dup	1.85	0.971	1.48	.	.	.
GW-296	ECRWP	01/13/11	B/U		<	.	3.57	.	.	.
		07/11/11	B/U		<	.	1.87	.	.	.
GW-298	ECRWP	01/12/11	B/U		<	.	2.73	.	.	.
		07/12/11	B/U		<	.	1.82	.	.	.
GW-305	LIV	01/18/11	B/U		<	.	1.18	<	.	2.65
		07/14/11	B/U		<	.	1.39	<	.	2.78
GW-521	LIV	01/18/11	B/U		<	.	2.84	<	.	4.64
		07/19/11	B/U		<	.	1.71	<	.	2.62
GW-522	LIV		B/U		<	.	2.11	<	.	3.07
		01/19/11	B/U	Dup	<	.	1.68	<	.	3.25
		07/18/11	B/U		2.96	1.12	1.18	4.44	1.58	2.56
			B/U	Dup	1.86	1.01	1.54	<	.	2.98
GW-540	LII	01/20/11	B/U		<	.	1.87	<	.	3.54
		07/21/11	B/U		2.31	1.23	1.78	<	.	2.95
GW-557	LV	01/18/11	B/U		1.22	0.74	1.1	<	.	2.86
		07/20/11	B/U		<	.	1.11	3.3	1.56	2.8
GW-560	CDLVII	01/19/11	B/U		<	.	1.31	3.83	1.43	2.38
		07/21/11	B/U		1.81	0.81	0.83	<	.	3.42
GW-562	CDLVII	01/19/11	B/U		<	.	2.04	<	.	3.05
		07/21/11	B/U		1.32	0.84	1.26	2.83	1.48	2.71
GW-564	CDLVII	01/19/11	B/U		<	.	1.5	3.05	1.42	2.55
			B/U	Dup	<	.	1.1	<	.	2.86
		07/20/11	B/U		<	.	0.98	2.9	1.42	2.58
			B/U	Dup	1.04	0.6	0.77	<	.	2.83
GW-709	LII	01/20/11	B/U		1.35	0.86	1.3	3.5	1.63	2.94
		07/25/11	B/U		2.98	1.19	1.44	<	.	3.01

APPENDIX F.2: CY 2011 MONITORING DATA FOR THE CHESTNUT RIDGE HYDROGEOLOGIC REGIME
Radiological Analytes: Gross Alpha and Gross Beta Activity

Sampling Point	Functional Area	Date Sampled	Program	Smple Type	Gross Alpha (pCi/L)			Gross Beta (pCi/L)		
					Result	TPU	MDA	Result	TPU	MDA
GW-757	LII	01/20/11	B/U		<	.	2.18	14.3	2.87	3.1
		07/25/11	B/U		4.59	1.73	1.54	19.1	3.55	3.37
GW-796	LV	01/18/11	B/U		<	.	1.02	2.65	1.31	2.37
		07/20/11	B/U		<	.	2.41	<	.	7.71
GW-797	LV	01/20/11	B/U		<	.	1.51	3.06	1.58	2.89
		07/20/11	B/U		<	.	1.58	<	.	3.02
GW-798	CDLVII	01/19/11	B/U		<	.	1.07	3.23	1.37	2.37
		07/20/11	B/U		1.71	0.91	1.32	<	.	3.18
GW-799	LV	01/18/11	B/U		<	.	2.29	<	.	2.78
		07/21/11	B/U		1.92	0.89	1.11	4.23	1.61	2.72
GW-801	LV	01/18/11	B/U		<	.	1.45	2.78	1.4	2.55
		07/19/11	B/U		<	.	1.25	<	.	2.79
MCK 2.0	EXP-SW	03/24/11	B/U		1.94	1.2	1.86	4.51	1.72	2.9
		08/23/11	B/U		<	.	4.1	6.49	2.81	4.99
MCK 2.05	EXP-SW	03/24/11	B/U		<	.	1.85	<	.	3.21
			B/U	Dup	<	.	1.94	4.75	1.73	2.87
		08/23/11	B/U		<	.	2.95	<	.	4.96
			B/U	Dup	<	.	2.4	5.12	2.55	4.71
S17	EXP-SW	07/27/11	GWPP		<	.	4.4	<	.	6.2
SCR1.25SP	EXP-SW	03/24/11	B/U		<	.	1.81	<	.	2.85
		08/23/11	B/U		3.48	1.92	2.51	<	.	4.84
SCR1.5SW	EXP-SW	07/27/11	GWPP		<	.	3.9	<	.	8.1
SCR2.1SP	EXP-SW	07/27/11	GWPP		<	.	3.8	<	.	12
SCR2.2SP	EXP-SW	07/27/11	GWPP		<	.	4.6	<	.	8.6
SCR3.5SP	EXP-SW	03/24/11	B/U		<	.	1.96	<	.	3.11
		08/23/11	B/U		<	.	2.48	4.84	2.5	4.73
SCR3.5SW	EXP-SW	07/27/11	GWPP		<	.	5.8	<	.	9
SCR4.3SP	EXP-SW	01/19/11	B/U		<	.	1.34	4.86	1.64	2.65
		07/20/11	B/U		1.64	0.83	0.95	<	.	3.57
UNC SW-1	EXP-SW	03/07/11	B/U		<	.	2.45	<	.	4.36
		09/15/11	B/U		<	.	2.58	4.26	1.94	3.5

APPENDIX F.2: CY 2011 MONITORING DATA FOR THE CHESTNUT RIDGE HYDROGEOLOGIC REGIME
Radiological Analytes: Isotopic Analyses

Sampling Point	1090						GW-203					
Functional Area	UNCS						UNCS					
Date Sampled	03/03/11			08/08/11			03/02/11			08/08/11		
Program	B/U			B/U			B/U			B/U		
Sample Type												
Result (pCi/L)	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA
Gross Alpha	<	.	1.95	<	.	2.06	<	.	2.1	<	.	2.12
Gross Beta	<	.	4.24	<	.	3.32	<	.	3.74	<	.	3.47
Cesium-137	.	.	.	.	.	.	.	.	.	.	.	.
Cobalt-60	.	.	.	.	.	.	.	.	.	.	.	.
Potassium-40	.	.	.	.	.	.	.	.	.	.	.	.
Strontium-89/90	<	.	2.3	<	.	1.88	<	.	1.92	<	.	1.89
Technetium-99	.	.	.	.	.	.	.	.	.	.	.	.
Uranium-234	<	.	0.392	<	.	0.382	0.819	0.421	0.372	0.492	0.287	0.232
Uranium-235	<	.	0.284	<	.	0.263	<	.	0.28	<	.	0.193
Uranium-238	<	.	0.361	<	.	0.31	<	.	0.233	<	.	0.262

Sampling Point	GW-205						GW-221					
Functional Area	UNCS						UNCS					
Date Sampled	03/02/11			08/08/11			03/02/11			08/08/11		
Program	B/U			B/U			B/U			B/U		
Sample Type												
Result (pCi/L)	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA
Gross Alpha	<	.	3.28	<	.	2.81	<	.	2.03	<	.	2.44
Gross Beta	14.6	3.52	3.84	14.9	3.37	3.46	<	.	3.73	<	.	3.54
Cesium-137	<	.	9.4	<	.	8.86	.	.	.	.	.	.
Cobalt-60	<	.	9.12	<	.	9.44	.	.	.	.	.	.
Potassium-40	<	.	170	<	.	164	.	.	.	.	.	.
Strontium-89/90	<	.	1.88	3.06	1.18	1.76	<	.	1.99	2.34	1.03	1.68
Technetium-99	<	.	11.8	<	.	10.8	.	.	.	.	.	.
Uranium-234	0.523	0.325	0.308	0.74	0.37	0.319	0.433	0.301	0.375	<	.	0.329
Uranium-235	<	.	0.273	<	.	0.239	<	.	0.283	<	.	0.262
Uranium-238	<	.	0.308	<	.	0.319	<	.	0.443	<	.	0.193

Sampling Point	UNC SW-1					
Functional Area	UNCS					
Date Sampled	03/07/11			09/15/11		
Program	B/U			B/U		
Sample Type						
Result (pCi/L)	Activity	TPU	MDA	Activity	TPU	MDA
Gross Alpha	<	.	2.45	<	.	2.58
Gross Beta	<	.	4.36	4.26	1.94	3.5
Cesium-137	<	.	9.19	<	.	6.1
Cobalt-60	<	.	10	<	.	7.09
Potassium-40	<	.	144	<	.	126
Strontium-89/90	.	.	.	.	.	.
Technetium-99	.	.	.	.	.	.
Uranium-234	.	.	.	.	.	.
Uranium-235	.	.	.	.	.	.
Uranium-238	.	.	.	.	.	.

APPENDIX G

CY 2011 QUALITY ASSURANCE/QUALITY CONTROL DATA

EXPLANATION

Sampling Point:

- BCK - Bear Creek Kilometer
- GHK - Gum Hollow Branch Kilometer
- GW - Monitoring Well (also locations beginning with a number; e.g., 55-3A)
- NPR - North of Pine Ridge near the Scarboro Community (surface water sampling location)
- NT - Northern Tributary to Bear Creek
- S17 - Surface water station
- SCR - South Chestnut Ridge (tributary prefix for spring or surface water sampling location)
- SS - Spring (Bear Creek Regime)
- D - Field Duplicate Sample

Hydrogeologic Regime:

- BC - Bear Creek Hydrogeologic Regime
- CR - Chestnut Ridge Hydrogeologic Regime
- EF - Upper East Fork Poplar Creek Hydrogeologic Regime

Notes:

Appendix G shows the method (laboratory) blank and trip blank samples associated with each groundwater and surface water sample collected under management of the GWPP during CY 2011. Each method and trip blank was analyzed for volatile organic compounds (VOCs). None of the method blank samples contained VOCs. However, as shown in the following table, methylene chloride was detected in one trip blank sample.

Sampling Point	Date Collected	Trip Blank Sample No.	Compound	Result (µg/L)	
				Trip Blank	Assoc. Sample
GW-729-44	06/29/11	A111800014	Methylene chloride	4 J	ND
Note: J - estimated concentration; ND – not detected.					

The groundwater sample from GW-729-44 did not contain methylene chloride.

Two field blank samples were collected and analyzed for VOCs during CY 2011. These samples were collected at well GW-101 (02/01/11) in the Bear Creek Ridge Regime and well 55-3C (10/18/11) in the East Fork Regime. The field blank samples were analyzed for VOCs and none were detected in either sample.

Equipment rinsate samples were collected during CY 2011 at Westbay wells GW-134 and GW-729 (Bear Creek Regime) during the second quarter and Westbay well GW-722 (East Fork Regime) during the third quarter. The rinsate samples were analyzed for the VOCs and the analytes shown below were detected.

Well-Port	Sample Number	Date Sampled	Analyte	Result	Units
GW-134-35	A110940174	06/02/11	2-Butanone	17	µg/L
			2-Hexanone	3 J	µg/L
			Acetone	23	µg/L
GW-729-44	A110940161	06/29/11	Acetone	7 J	µg/L
			Methylene chloride	2 J	µg/L

None of these VOCs were detected in the groundwater samples associated with these rinsate samples. Therefore, the rinsate results appear to be artifacts and do not reflect a deficiency in the equipment cleaning procedure.

APPENDIX G: CY 2011 QUALITY ASSURANCE/QUALITY CONTROL DATA
Correlation with Associated Groundwater and Surface Water Samples

Sampling Point	Hydrogeologic Regime	Date Sampled	Sample Number	Trip Blank Sample Number	Method Blank Sample Number
55-2A	EF	04/27/11	A110940160	A110950136	Q111450028
55-2B	EF	04/26/11	A110940159	A110950135	Q111440411
55-2C	EF	04/26/11	A110940158	A110950135	Q111440411
55-3A	EF	04/27/11	A110940157	A110950136	Q111440415
55-3A	EF	10/17/11	A112700248	A112700251	Q113190135
55-3B	EF	04/28/11	A110940156	A110950137	Q111450062
55-3B	EF	10/17/11	A112700247	A112700251	Q113190137
55-3B D	EF	10/17/11	A112700236	A112700251	Q113190137
55-3C	EF	04/27/11	A110940155	A110950136	Q111450028
55-3C	EF	10/18/11	A112700246	A112700249	Q113190137
56-1A	EF	05/02/11	A110940154	A110950138	Q111510266
56-1C	EF	05/02/11	A110940153	A110950138	Q111450062
56-2A	EF	05/04/11	A110940152	A110950140	Q111510266
56-2B	EF	05/04/11	A110940151	A110950140	Q111510102
56-2C	EF	05/05/11	A110940150	A110950141	Q111510098
56-3A	EF	05/04/11	A110940149	A110950140	Q111510266
56-3B	EF	05/05/11	A110940148	A110950141	Q111510102
56-3B D	EF	05/05/11	A110940147	A110950141	Q111510098
56-3C	EF	05/04/11	A110940146	A110950140	Q111510102
56-4A	EF	04/28/11	A110940145	A110950137	Q111450028
GW-014	BC	01/25/11	A103550103	A103550213	Q110320165
GW-053	BC	02/09/11	A103550102	A103550219	Q110680004
GW-058	BC	01/26/11	A103550100	A103550214	Q110320165
GW-068	BC	02/09/11	A103550099	A103550219	Q110680004
GW-071	BC	01/19/11	A103550098	A103550211	Q110330041
GW-071	BC	08/22/11	A111730271	A111920133	Q112580136
GW-082	BC	08/23/11	A111730270	A111920134	Q112630099
GW-085	BC	02/07/11	A103550090	A103550217	Q110400134
GW-085 D	BC	02/07/11	A103550089	A103550217	Q110400134
GW-098	BC	02/07/11	A103550088	A103550217	Q110400134
GW-100	BC	02/01/11	A103550092	A103550215	Q110400158
GW-101	BC	02/01/11	A103550091	A103550215	Q110400158
GW-122	BC	08/08/11	A111730265	A111920125	Q112360000
GW-127	BC	08/08/11	A111730264	A111920125	Q112360000
GW-134-05	BC	06/02/11	A110940172	A110950150	Q111600000
GW-134-11	BC	06/07/11	A110940171	A110950149	Q111640019
GW-134-15	BC	06/07/11	A110940170	A110950149	Q111640019
GW-134-18	BC	06/08/11	A110940169	A111440392	Q111640019
GW-134-21	BC	06/02/11	A110940173	A110950150	Q111600000
GW-134-33	BC	05/26/11	A110940176	A110950148	Q111530043
GW-134-35	BC	06/02/11	A110940175	A110950150	Q111600000
GW-134-36	BC	05/25/11	A110940178	A110950147	Q111530043
GW-134-36 D	BC	05/25/11	A110940177	A110950147	Q111530043
GW-153	EF	08/25/11	A111730241	A111920136	Q112630137
GW-174	CR	08/09/11	A111730252	A111920126	Q112360004
GW-175	CR	08/10/11	A111730251	A111920127	Q112360048
GW-175 D	CR	08/10/11	A111730250	A111920127	Q112360048
GW-176	CR	08/09/11	A111730249	A111920126	Q112360004

APPENDIX G: CY 2011 QUALITY ASSURANCE/QUALITY CONTROL DATA
Correlation with Associated Groundwater and Surface Water Samples

Sampling Point	Hydrogeologic Regime	Date Sampled	Sample Number	Trip Blank Sample Number	Method Blank Sample Number
GW-180	CR	08/09/11	A111730248	A111920126	Q112360004
GW-204	EF	02/23/11	A103540713	A103550231	Q110830029
GW-220	EF	02/15/11	A103540711	A103550226	Q110680159
GW-220	EF	08/25/11	A111730240	A111920136	Q112630137
GW-220 D	EF	02/15/11	A103540710	A103550226	Q110680159
GW-225	BC	02/10/11	A103550087	A103550224	Q110680008
GW-229	BC	02/08/11	A103550086	A103550218	Q110680004
GW-229 D	BC	02/08/11	A103550085	A103550218	Q110680004
GW-236	BC	08/04/11	A111730263	A111920124	Q112360000
GW-240	EF	08/25/11	A111730239	A111920136	Q112630137
GW-242	BC	08/24/11	A111730267	A111920135	Q112630099
GW-246	BC	08/08/11	A111730262	A111920125	Q112360000
GW-246 D	BC	08/08/11	A111730261	A111920125	Q112360000
GW-251	EF	02/21/11	A103540708	A103550229	Q110680241
GW-265	EF	04/25/11	A110940133	A110950134	Q111440415
GW-268	EF	04/27/11	A110940132	A110950136	Q111440411
GW-269	EF	04/19/11	A110940183	A110950131	Q111380033
GW-270	EF	04/25/11	A110940182	A110950134	Q111440415
GW-272	EF	04/19/11	A110940181	A110950131	Q111380033
GW-274	EF	04/20/11	A110940180	A110950132	Q111380033
GW-275	EF	04/21/11	A110940179	A110950133	Q111320206
GW-289	BC	08/23/11	A111730269	A111920134	Q112630099
GW-307	BC	02/09/11	A103550082	A103550219	Q110680004
GW-315	BC	02/14/11	A103550022	A103550225	Q110620167
GW-322	CR	08/10/11	A111730247	A111920127	Q112360048
GW-332	EF	02/24/11	A103540707	A103550232	Q110830029
GW-337	EF	02/17/11	A103540706	A103550228	Q110680159
GW-365	BC	02/08/11	A103550084	A103550218	Q110680004
GW-381	EF	08/29/11	A111730238	A111920137	Q112650041
GW-383	EF	08/30/11	A111730237	A111920138	Q112650041
GW-383	EF	11/01/11	A112760196	A112700256	Q113350168
GW-383	EF	11/02/11	A112760195	A112700258	Q113360010
GW-508	EF	10/18/11	A112700243	A112700249	Q113190141
GW-508 D	EF	10/18/11	A112700235	A112700249	Q113190141
GW-601	BC	02/09/11	A103550083	A103550219	Q110680004
GW-615	BC	02/02/11	A103550093	A103550216	Q110400158
GW-616	BC	08/09/11	A111730260	A111920126	Q112360004
GW-623	BC	01/24/11	A103550097	A103550212	Q110330029
GW-627	BC	01/19/11	A103550096	A103550211	Q110330041
GW-627	BC	08/22/11	A111730268	A111920133	Q112580136
GW-633	EF	03/01/11	A103540705	A103550233	Q110830076
GW-653	BC	01/18/11	A103550095	A103550210	Q110330041
GW-656	EF	08/30/11	A111730236	A111920138	Q112650041
GW-686	EF	05/09/11	A110940144	A110950142	Q111510123
GW-690	EF	05/09/11	A110940143	A110950142	Q111510123
GW-691	EF	05/11/11	A110940142	A110950143	Q111510123
GW-691	EF	10/25/11	A112700242	A112700254	Q113260028
GW-692	EF	05/03/11	A110940141	A110950139	Q111510266

APPENDIX G: CY 2011 QUALITY ASSURANCE/QUALITY CONTROL DATA
Correlation with Associated Groundwater and Surface Water Samples

Sampling Point	Hydrogeologic Regime	Date Sampled	Sample Number	Trip Blank Sample Number	Method Blank Sample Number
GW-698	EF	05/12/11	A110940140	A110950144	Q111510127
GW-698	EF	10/19/11	A112700241	A112700250	Q113190141
GW-698 D	EF	05/12/11	A110940139	A110950144	Q111510127
GW-700	EF	08/29/11	A111730235	A111920137	Q112650041
GW-700 D	EF	08/29/11	A111730234	A111920137	Q112650041
GW-703	BC	02/14/11	A103550021	A103550225	Q110620167
GW-722-14	EF	07/19/11	A111730233	A111920118	Q112280005
GW-722-17	EF	07/20/11	A111730232	A111920119	Q112280005
GW-722-20	EF	07/20/11	A111730230	A111920119	Q112280005
GW-722-22	EF	07/19/11	A111730229	A111920118	Q112280005
GW-722-33	EF	07/19/11	A111730228	A111920118	Q112280005
GW-724	BC	02/16/11	A103550020	A103550227	Q110680104
GW-725	BC	02/17/11	A103550019	A103550228	Q110680241
GW-729-18	BC	06/13/11	A110940168	A111440393	Q111680075
GW-729-22	BC	06/23/11	A110940167	A111440395	Q112020214
GW-729-26	BC	06/23/11	A110940166	A111440395	Q112020214
GW-729-30	BC	06/27/11	A110940165	A111440396	Q112000136
GW-729-34	BC	06/28/11	A110940163	A111440397	Q112000136
GW-729-39	BC	06/27/11	A110940164	A111440396	Q112000136
GW-729-44	BC	06/29/11	A110940162	A111800014	Q112020232
GW-735	EF	08/01/11	A111730227	A111920123	Q112350051
GW-735 D	EF	08/01/11	A111730226	A111920123	Q112350051
GW-738	BC	02/16/11	A103550018	A103550227	Q110680104
GW-740	BC	02/16/11	A103550017	A103550227	Q110680104
GW-740 D	BC	02/16/11	A103550016	A103550227	Q110680104
GW-744	EF	08/16/11	A111730225	A111920130	Q112360052
GW-747	EF	08/15/11	A111730224	A111920129	Q112360052
GW-750	EF	08/01/11	A111730223	A111920123	Q112350051
GW-763	EF	08/11/11	A111730222	A111920128	Q112360048
GW-765	EF	10/25/11	A112700240	A112700254	Q113260028
GW-769	EF	05/16/11	A110940138	A110950145	Q111510257
GW-769	EF	10/20/11	A112700239	A112700252	Q113260062
GW-770	EF	10/24/11	A112700238	A112700253	Q113260028
GW-775	EF	02/10/11	A103540704	A103550224	Q110680008
GW-776	EF	02/23/11	A103550081	A103550231	Q110830029
GW-779	EF	05/17/11	A110940137	A110950146	Q111510261
GW-781	EF	08/17/11	A111730221	A111920131	Q112580136
GW-782	EF	08/17/11	A111730220	A111920131	Q112580136
GW-783	EF	08/18/11	A111730219	A111920132	Q112580136
GW-791	EF	08/16/11	A111730218	A111920130	Q112360052
GW-816	EF	08/11/11	A111730217	A111920128	Q112360052
GW-820	EF	05/16/11	A110940136	A110950145	Q111510261
GW-820 D	EF	05/16/11	A110940135	A110950145	Q111510261
GW-930	EF	02/22/11	A103540703	A103550230	Q110680241
GW-959	EF	10/31/11	A112700237	A112700255	Q113350168
GW-960	EF	05/17/11	A110940134	A110950146	Q111510261

APPENDIX G: CY 2011 QUALITY ASSURANCE/QUALITY CONTROL DATA
Correlation with Associated Groundwater and Surface Water Samples

Sampling Point	Hydrogeologic Regime	Date Sampled	Sample Number	Trip Blank Sample Number	Method Blank Sample Number
Surface water and Springs					
BCK-04.55	BC	07/26/11	A111730259	A111920121	Q112350036
BCK-04.55 D	BC	07/26/11	A111730258	A111920121	Q112350036
BCK-09.40	BC	07/26/11	A111730257	A111920121	Q112350036
BCK-11.97	BC	07/25/11	A111730256	A111920120	Q112350036
GHK2.51WSW	EF	01/24/11	A103540701	A103550212	Q110330029
NPR12.0SW	EF	01/24/11	A103540700	A103550212	Q110260316
NPR23.0SW	EF	01/24/11	A103550101	A103550212	Q110330029
NT-01	BC	07/26/11	A111730255	A111920121	Q112350036
S17	CR	07/27/11	A111730246	A111920122	Q112350047
SCR1.5SW	CR	07/27/11	A111730245	A111920122	Q112350047
SCR2.1SP	CR	07/27/11	A111730244	A111920122	Q112350047
SCR2.2SP	CR	07/27/11	A111730243	A111920122	Q112350047
SCR3.5SW	CR	07/27/11	A111730242	A111920122	Q112350047
SP-17	EF	01/24/11	A103540702	A103550212	Q110260316
SS-4	BC	07/26/11	A111730254	A111920121	Q112350036
SS-5	BC	07/25/11	A111730253	A111920120	Q112350036

DISTRIBUTION

U.S. DEPARTMENT OF ENERGY

J. D. Darby, DOE-EM
J. P. Donnelly, DOE-NNSA *

TENNESSEE DEPARTMENT OF ENVIRONMENT AND CONSERVATION DOE-ORR OVERSIGHT DIVISION

J. E. Sebastian *
J. A. Owsley

B&W Y-12, LLC PROGRAM MANAGEMENT

D. R. McDaniel

B&W Y-12, LLC ENVIRONMENTAL COMPLIANCE DEPT.

T. K. Cothron
S. M. Field
C. C. Hill
S. B. Jones *
E. R. Schultz
S. E. McNamara
L. O. Vaughan

B&W Y-12, LLC ANALYTICAL CHEMISTRY ORGANIZATION

L. K. Rawlins

B&W Y-12, LLC ENGINEERING ORGANIZATION

S. B. Ahmed
S. A. Shults

Y-12 Central Files *
9114DMC-01971865.6551-RC
Y-12 Records Services (Electronic copy- OSTI)
YDCC - RC *

URS | CH2M OAK RIDGE LLC

M. E. Cleveland (RSI)
H. K. Haase
R. H. Ketelle (RSI)
J. W. Kubarewicz
L. M. Sims (RSI) *
File - EMEF-DMC
File - Y-12 Project PDCC

SCIENCE APPLICATIONS INTERNATIONAL CORPORATION

W. K. Jago

UT-BATTELLE, LLC

D. B. Watson

ELVADO ENVIRONMENTAL LLC

T. R. Harrison *
J. R. Walker *

Note: * = receives hard copy version