**Y-12
NATIONAL
SECURITY
COMPLEX**

**CALENDAR YEAR 2008
GROUNDWATER MONITORING REPORT,
U.S. DEPARTMENT OF ENERGY
Y-12 NATIONAL SECURITY COMPLEX,
OAK RIDGE, TENNESSEE**

December 2009

Prepared by

**Elvado Environmental LLC
Under Subcontract No. 4300068789**

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**

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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
CASI	Commodore Advanced Sciences, Inc.
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
EMWMF	Environmental Management Waste Management Facility
ETB	ethylbenzene
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
HCDA	Hazardous Chemical Disposal Area
ILF	Industrial Landfill
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

List of Acronyms and Abbreviations (continued)

msl	mean sea level
NHP	New Hope Pond
NPDES	National Pollution Discharge Elimination System
NT	northern tributary (of Bear Creek)
OF	outfall
OLF	Oil Landfarm
ORNL	Oak Ridge National Laboratory
ORR	Oak Ridge Reservation
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
TCFM	trichlorofluoromethane
TDEC	Tennessee Department of Environment and Conservation
TDS	total dissolved solids
TPU	total propagated uncertainty
U-234	uranium-234
U-238	uranium-238
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) 2008 at the U.S. Department of Energy (DOE) Y-12 National Security Complex (hereafter referenced as Y-12) on the DOE Oak Ridge Reservation (ORR) in Oak Ridge, Tennessee. The CY 2008 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 extent of groundwater contamination.

The CY 2008 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 Bechtel Jacobs Company LLC (BJC). Cooperative implementation of the monitoring programs directed by the Y-12 GWPP and BJC (i.e., coordinating sample collection and sharing data) ensures that the CY 2008 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. 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 2008 by the Y-12 GWPP and BJC address DOE Order 450.1A (*Environmental Protection Program*) 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 2008 by either the Y-12 GWPP or BJC. 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). Included are 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 parallel 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 dominates 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 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 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 dominate 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 feet 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 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 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) weak 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 2002).

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 Buildings 9204-4, 9201-5, and 9201-4, and possibly 9204-2 have influenced local groundwater flow and contaminant transport patterns (DOE 1998). Note that the operation of two sumps located in the southern portion of Building 9201-5 ended in December 2005. In CY 2006, all remaining pumps in this building were shut down and water, consisting of steam condensate, rainwater, and groundwater began to accumulate in the basement.

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. Some residues may have been buried in the Boneyard. 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 and the filled area was graded to drain, mulched, 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 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 BCV 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 Section 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).

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 (ETB), and total xylene) 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.

Groundwater with radiological contamination occurs primarily in the aquitard east of the former S-3 Ponds, at the Salvage Yard, 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, and boron in the groundwater downgradient of the site. Elevated total boron concentrations occur in a well located downgradient to the east of the site (GW-217), while VOCs have been repeatedly detected in a well located south of the eastern portion of the site (GW-305). These 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.

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 Tennessee Department of Environment and Conservation (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 2008 MONITORING PROGRAMS

As noted in Section 1.0, the groundwater and surface water monitoring data included in this report were obtained during CY 2008 from implementation of monitoring programs directed by the Y-12 GWPP and BJC. The Y-12 GWPP implemented monitoring needed to specifically meet requirements of DOE Order 450.1A for surveillance monitoring and exit-pathway/perimeter monitoring (hereafter referenced collectively as DOE Order monitoring). 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 2008 (BWXT Y-12, L.L.C. [BWXT] 2007a), 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 at Y-12 during CY 2008: (1) RCRA post-closure detection monitoring and RCRA post-closure corrective action monitoring (collectively referenced as RCRA monitoring); (2) CERCLA monitoring in accordance with an applicable ROD 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 monitoring for several nonhazardous solid waste disposal facilities (SWDFs) located in the Chestnut Ridge Regime (referenced as SWDF detection 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 2008 (BJC 2007a); the environmental monitoring plan for the EMWMF (BJC 2007b); and a SWDF detection 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 (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.

Cooperative implementation of the monitoring programs directed by the Y-12 GWPP and BJC (i.e., preparing SAPs, coordinating sample collection, and sharing data) ensures that the CY 2008 monitoring results fulfill requirements of all the applicable monitoring drivers (DOE Order, 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 2008 from 236 sampling locations at Y-12, including 204 monitoring wells (complete construction details for each well are provided in Appendix C), 10 springs, and 22 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 72 monitoring wells, three springs, and 11 surface water stations in the Bear Creek Regime were sampled during CY 2008 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 2008 sampling locations in the Bear Creek Regime

Monitoring Driver	Monitoring Wells	Springs	Surface Water Stations
DOE Order	45	2	4
RCRA	6	1	0
CERCLA	21	0	7
Totals:	72	3	11

Samples were collected either annually or semiannually from most of the monitoring locations during CY 2008. Of the 72 monitoring wells sampled during CY 2008, 28 wells were sampled annually and 29 wells were sampled semiannually (Table B.2). Spring and surface water samples were collected annually (six locations), semiannually (three locations), or were scheduled for quarterly sampling (five location) during CY 2008 (Table B.2).

Thirty-nine of the wells that were sampled specifically for DOE Order monitoring during CY 2008 are located near waste management facilities 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 six wells are components of two Exit Pathway Pickets in the regime: Picket B (two wells) is located about 2,000 ft west of the Oil Landfarm and Picket C (four wells) 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 contaminant migration pathway in the Bear Creek Regime.

The springs that were sampled during CY 2008 specifically for DOE Order exit pathway/perimeter monitoring discharge into Bear Creek (Table B.2 and Figure A.11), and are located southwest (hydraulically downgradient) of the OLF (SS-4) and the BCBG WMA (SS-5). The surface water stations include three locations in Bear Creek (BCK-04.55, BCK-09.40, and BCK.11.97) and a northern tributary of Bear Creek (NT-01) about 1,500 ft west of the S-3 Site (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 2008 (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).

Twenty-one monitoring wells and seven surface water stations in the Bear Creek Regime were sampled to meet CERCLA monitoring requirements during CY 2008 (Table B.2 and Figure A.11). Thirteen monitoring wells and five surface water stations were sampled for CERCLA detection monitoring purposes at the EMWMF. Eight monitoring wells (GW-077, GW-078, GW-079, GW-080, GW-683, GW-684, GW-704, and GW-706) were sampled to support CERCLA ROD monitoring requirements. 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 88 monitoring wells, two springs, and five surface water stations in the East Fork Regime (and surrounding areas) were sampled during CY 2008 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 2008 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	66	0	3
RCRA	5	0	0
CERCLA	18	2	2
Totals:	88 *	2	5
Note: * = The total number is less than the sum because separate samples were collected from well GW-722 for DOE Order (July) and CERCLA (February) monitoring purposes (see Table B.3).			

Most of the CY 2008 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 four surface water stations are located in drainage features along the ORR boundary on the north side of Pine Ridge (Figure A.14). Of the 88 monitoring wells, 66 wells were sampled annually, 21 wells were sampled semiannually, and one well (GW-220) was sampled during each quarter of CY 2008 (Table B.3). The springs and three surface water stations were sampled annually and two surface water stations were sampled during the first and third quarters.

Sixty monitoring wells in East Fork Regime, most of which are located within the western and central areas of Y-12 (Figure A.13), were sampled during CY 2008 specifically to meet DOE Order surveillance monitoring requirements (Table B.3). Six monitoring wells and three surface water locations were sampled to meet DOE Order exit pathway/perimeter monitoring requirements (Table B.3). The exit pathway wells are located between UEFPC and Scarboro Road at the east end of Y-12, except for one well that is located next to UEFPC in the gap through Pine Ridge northeast of Y-12 (Figure A.13). One well is equipped with Westbay™ multi-port sampling equipment (Westbay well GW-722), with groundwater samples collected in July 2008 from five discrete depths intervals in the well (Figure A.15). The surface water stations are located north of Pine Ridge (Figure A.14), and samples were collected in October 2008 (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 2008. 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.13).

Eighteen monitoring wells, two springs, and two surface water stations were sampled during CY 2008 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 (Figure A.13). The surface water stations (200A6 and Station 8) are located in the central Y-12 area (Figure A.13). The other five monitoring wells and the springs are located in Union Valley east of the ORR boundary along Scarboro Road (Figure A.13). Sampling locations used for CERCLA baseline monitoring include five monitoring wells: two wells in the western (GW-253 and GW-618) and three wells in the eastern (GW-281, GW-658, and GW-802) Y-12 areas.

3.1.3 Chestnut Ridge Regime

As shown below in Table 3, a total of 44 monitoring wells, five springs, and six surface water stations in the Chestnut Ridge Regime were sampled during CY 2008 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.16.

Table 3. CY 2008 sampling locations in the Chestnut Ridge Regime

Monitoring Driver	Monitoring Wells	Springs	Surface Water Stations
DOE Order	8	2	3
SWDF	17	1	0
RCRA	15	0	0
CERCLA	4	2	3
Totals:	44	5	6

Groundwater samples were collected semiannually from most (36 wells) of the monitoring wells during CY 2008, with samples collected annually from eight wells (Table B.4). Samples from the springs and surface water stations were collected annually (five locations) and semiannually (six locations).

Eight monitoring wells located near the CRSP (GW-173, GW-175, GW-178, GW-322, GW-514, GW-608, GW-609, and GW-612) were sampled specifically for DOE Order surveillance monitoring purposes during CY 2008 (Figure A.16 and Table B.4). Springs and surface water sampling locations used for DOE Order exit-pathway/perimeter monitoring are located in the southwestern portion of the regime (springs SCR2.1SP and SCR2.2SP) and along Bethel Valley Road in main channels of drainage features (surface water sampling stations SCR1.5SW, SCR3.5SW, and S17) where surface water exits the Chestnut Ridge Regime (Figure A.16).

Seventeen monitoring wells and one spring were sampled during CY 2008 to meet SWDF detection 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.16). A spring (SCR4.3SP) was sampled for the purposes of SWDF detection monitoring at ILF V and is located about 2,400 ft southeast of the site (Figure A.16). Note that the post-closure care period for CDL VI was completed and monitoring of the site ended during CY 2007.

Groundwater samples were collected from 15 monitoring wells to meet RCRA monitoring requirements during CY 2008 in the Chestnut Ridge Regime: three wells for RCRA post-closure corrective action monitoring and 12 wells for RCRA post-closure detective 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.16). 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.16). The spring sampling location (SCR4.3SP) is located south of CDL VII (Figure A.16). During CY 2008, 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.16). 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.16). The RCRA monitoring network for CY 2008 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.16).

Samples were collected from four monitoring wells, two springs, and three surface water stations to meet CERCLA monitoring requirements in the Chestnut Ridge Regime during CY 2008. The wells (located at the United Nuclear Corporation Site) and the surface water stations (one near the United Nuclear Corporation Site and two in McCoy Branch) were sampled for CERCLA ROD monitoring purposes (Figure A.16 and Table B.4). A spring (SCR1.25SP) located along Dunaway Branch in the southwestern portion of the regime and a spring (SCR3.5SP) located along McCoy Branch in the central portion of the regime (Figure A.16) were sampled for CERCLA baseline monitoring purposes (Table B.4).

3.2 QUALITY ASSURANCE/QUALITY CONTROL SAMPLING

The following discussion pertains to the QA/QC sampling activities managed by the Y-12 GWPP during CY 2008. Comparable QA/QC sampling protocols also were performed by monitoring programs managed by BJC (BJC 2007c 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 2008 included 110 trip blanks, 70 method (laboratory) blanks, two field blanks, two equipment rinsate samples, and 16 duplicate groundwater and surface water samples.

Table 4. QA/QC samples analyzed in CY 2008 for the Y-12 GWPP

Sample Type	Total Number of Samples per Quarter of CY 2008				Annual Total
	First	Second	Third	Fourth	
Trip Blank Samples	23	31	31	25	110
Method Blank Samples	15	21	21	13	70
Field Blank Samples	0	1	0	1	2
Equipment Rinsate Samples	1	0	1	0	2
Duplicate Samples	4	5	4	3	16

The blanks and equipment rinsate samples were prepared and analyzed as specified in the *Field Quality Control Samples* operating procedure (BWXT 2007b). 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 deionized 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 deionized water that were transported to the field in a sealed glass container and transferred to sample bottles at monitoring wells 55-3A (second quarter) and GW-322 (fourth quarter) and then transported to the laboratory in a cooler containing the other samples from the well. Method blanks were samples of deionized 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 deionized water from the final rinse of the decontaminated portable sampling equipment after sampling was completed at well GW-124 during the first quarter and Westbay well GW-722 during the third quarter of CY 2008 (Appendix G).

Method blanks, trip blanks, field blanks, and equipment rinsate samples were analyzed for VOCs. The equipment rinsate collected at well GW-124 was analyzed for the same analytes as the associated groundwater sample. 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 2008.

A total of 16 field duplicate samples were collected during CY 2008 from five wells and one spring in the Bear Creek Regime (Table B.2), eight wells in the East Fork Regime (Table B.3), and one well and one spring 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 2008. 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 2008. 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 2002a and BWXT 2007c). 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. Similar protocols were followed under the monitoring programs managed by BJC during CY 2008 (Commodore Advanced Sciences, Inc [CASI] 2005).

Unfiltered samples were collected from the monitoring wells, springs, and surface water stations in each hydrogeologic regime during CY 2008. Groundwater samples were collected from most monitoring wells with dedicated bladder pumps (Well Wizard™). However, samples were obtained from one well equipped with a dedicated Westbay™ multi-port sampling apparatus (well GW-722).

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 well GW-722 in accordance with the most recent and approved version of the operating procedures for the multi-port sampling equipment (BWXT 2002b and BWXT 2006b). 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 bottle.

In conjunction with low-flow sampling, groundwater samples also were collected using passive sampling methods from eight monitoring wells during CY 2008. The Y-12 GWPP performed a small-scale study to statistically compare analytical results obtained from “paired” samples collected from these wells, whereby samples are collected from each well using a passive diffusion bag (PDB) and/or a Hydrasleeve® sampler within one day before collecting samples using the low-flow sampling method. A description of the sampling methods, analytical results, statistical evaluation, and conclusions of the study are presented in Appendix H of this report.

3.4 FIELD MEASUREMENTS AND LABORATORY ANALYTES

The following discussion pertains to the field measurements and laboratory analytes associated with the CY 2008 groundwater and surface water sampling activities directed by the Y-12 GWPP. Identical or functionally equivalent field measurements and laboratory analyses were performed under the monitoring programs managed by BJC during CY 2008 (BJC 2007a, BJC 2007b, and EnergySolutions 2007).

Field personnel measured the depth to the static water surface before sampling groundwater in each monitoring well (except well GW-722) and 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 well GW-722. Additionally, REDOX and dissolved oxygen were not recorded for well GW-722 (not applicable when a well is equipped with a multiport sampling apparatus). Field measurements were obtained in accordance with the most recent and approved technical procedures referenced in the CY 2008 SAP for the Y-12 GWPP (BWXT 2007a). The field measurements recorded for the sampling locations in each regime are presented in Appendices D.1, E.1, and F.1.

All of the CY 2008 groundwater samples and surface water samples were analyzed for: (1) miscellaneous laboratory analytes—turbidity, total suspended solids, and total dissolved solids; (2) major ions and trace metals; (3) VOCs; and (4) gross alpha and gross beta activity (Table B.5). Note that turbidity was only reported for samples collected during the first quarter of CY 2008; the constituent was removed from the requested list of analyses in April 2008 (see Table B.1, Addendum 08-06). 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).

The analytical method used for mercury concentrations in groundwater and surface water samples was modified to achieve a significantly lower reporting limit (0.00005 mg/L). This change applies to the samples collected after October 1, 2008 (see Table B.1, Addendum 2008-11 and Table B.5). The lower reporting limit

can address whether groundwater may have been an undetected contributor of mercury to UEFPC. The issue is that the previous reporting limit (0.0002 mg/L) may not have been low enough to detect concentrations of mercury possibly entrained by groundwater.

3.5 DATA MANAGEMENT AND DQO EVALUATION

The following discussion pertains to the data management protocols associated with the CY 2008 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 2008 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 data management process (BJC 2007d) is similar to the process described above for the Y-12 GWPP. Analytical results and field measurements associated with monitoring programs managed by BJC were extracted from the Project Environmental Measurements System or 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 2008 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” or “Q” 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 (BJC 2007d). 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 2008 from BJC that are presented in this report may not meet the GWPP DQOs.

3.6 GROUNDWATER ELEVATION MONITORING

As shown in Table 5, respective networks of selected monitoring wells in the Bear Creek, East Fork, and Chestnut Ridge hydrogeologic regimes were used to monitor representative groundwater elevations during seasonally low flow conditions in CY 2008.

Table 5. Summary of CY 2008 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	Isopleth Map
Bear Creek	60	October 1-7, 2008	Table B.6	Figure A.4
East Fork	54	October 1-8, 2008	Table B.7	Figure A.5
Chestnut Ridge	76	October 1-8, 2008	Table B.8	Figure A.6

Field personnel with subcontracted by BJC measured the depth to the static water surface in each well in accordance with the operating procedure (CASI 2005).

4.0 CY 2008 MONITORING DATA

The monitoring data obtained in CY 2008 for compliance with the groundwater monitoring and reporting requirements of DOE Order 450.1A 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, and 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 2008), hereafter referenced as the GWPP Compendium. For each applicable well, spring, and surface water station, the GWPP compendium provides (1) a complete 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 analyze and interpret the CY 2008 monitoring results for the applicable RCRA, CERCLA, and SWDF sampling locations in the Bear Creek Regime, East Fork Regime, and Chestnut Ridge Regime: the *2009 Remediation Effectiveness Report* (DOE 2009), the *Calendar Year 2008 Resource Conservation and Recovery Act Annual Monitoring Report* (BJC 2009a), the *Annual Report for 2007 - 2008 Detection Monitoring at the Environmental Management Waste Management Facility* (BJC 2009b) and each semiannual *Groundwater Monitoring Report for the Oak Ridge Reservation Landfills* (BJC 2008a and BJC2008b).

4.1 SURVEILLANCE MONITORING

Groundwater quality monitoring performed during CY 2008 in areas that are, or could be, affected by Y-12 operations was evaluated to determine if any changes have occurred. 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 2008, groundwater samples were collected from 69 surveillance monitoring wells in the Bear Creek Regime (Table B.2). Forty-two 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-seven wells are completed in the geologic formations that comprise the aquifer in BCV (Copper Ridge Dolomite and Maynardville Limestone).

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 2008 from 23 aquitard wells in the Bear Creek Regime (Table B.9). A detailed analysis of the sampling results for each monitoring well (including data tables and trends charts) is presented in the GWPP Compendium (B&W Y-12 2008). The presence of contaminants in the groundwater at these wells is attributable to the transport/migration of the mobile components of the 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 2008 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 2008 from seven 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 2008: 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 2008	Jul-Dec 2008	Jan-May 2008	Jan-June 2008
GW-615	South 50 ft	245	NS	11,100	NS	1.53
GW-246*	50 ft	76	2,970/ 2,990	3,020/ 3,027	0.718/ 0.504	0.441/ 0.444
GW-276	Southeast 200 ft	18.5	12.4	19.0	0.39	0.32
GW-616	Southwest 400 ft	269	NS	242	NS	.
GW-829	West 2,050 ft	114.6	NS	10.8	NS	<
GW-537	2,500 ft	23.3	NS	491	NS	<
GW-085	3,000 ft	58.8	84.9	103	.	.
MCL			10		0.03	
Note: “.” = Not detected; NS = Not sampled; “<” = Less than the MCL; * = samples were collected four times from well GW-246 (see Table B.2).						

These sampling results show that the highest concentrations of nitrate occur in the groundwater from wells located directly south of (geologically down-dip) of the S-3 Site (GW-246 and GW-615), reflecting the density-driven vertical (dip-parallel) migration of the highly mineralized acidic wastes disposed at the site. Slightly elevated nitrate levels in the groundwater samples from well GW-829 shows the 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 3000 ft from the S-3 Site.

As with nitrate, the CY 2008 groundwater sampling results show that the highest concentrations of total uranium occur geologically down-dip to the south of the S-3 Site. These results also illustrate that elevated uranium concentrations in the Nolichucky Shale occur only in the low-pH groundwater within approximately 500 ft of the S-3 Site.

The CY 2008 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 concentration trends for wells GW-276 (nitrate and uranium) and GW-829 (nitrate), as illustrated by the nitrate data for the wells (Figure A.17). 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.
- Indeterminate trends for nitrate concentrations at wells GW-085, GW-246, GW-537, GW-615, and GW-616, and for uranium concentrations at well GW-246. For example, data for well GW-246 (Figure A.17) show little if any change in the uranium concentrations evident in March 1987 (0.464 mg/L) and December 2008 (0.444 mg/L). Additionally, the long-term stable trend for nitrate concentrations at well GW-246 seems unusual in light of the substantially reduced flux after the S-3 Ponds were closed and capped. The trend is 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 well.
- Increasing uranium concentration trend for well GW-615 (Figure A.17). The increasing concentrations of uranium indicated by the data for well GW-615 potentially reflect a long-term increase in the relative vertical flux of uranium down-dip of the site. This increase is somewhat conspicuous in light of the indeterminate trend for nitrate at well GW-615, which is far more mobile in groundwater than uranium.

Volatile Organic Compounds

Groundwater samples collected during CY 2008 from 18 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 ten VOCs reported for groundwater samples collected from 15 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 (two wells), OLF (four wells), and various waste disposal areas within the BCBG WMA (13 wells).

**Table 7. Bear Creek Regime CY 2008: maximum VOC concentrations
in surveillance monitoring aquitard wells**

Location/ Well Number (Fig. A.8)	Concentration (µg/L)									
	PCE	TCE	c12DCE	11DCE	VC	111TCA	112TCA	12DCA	MC	Ben- zene
S-3 Site										
GW-246	170	<	<	<	.	.	.	.	12	.
GW-276	5	<	.	.	.	.	.	.	.	.
OLF										
GW-006	<	<	<	.	.	.	.	.	.	.
GW-008	42	15	<	7	.	.	.	.	.	<
GW-098	.	<	<	<	.	.	.	.	.	.
BCBG										
GW-014	42	240	1,500	78	240	.	.	.	.	<
GW-046	430	930	3,500	55	330	<	<	<	.	22
GW-068	7	79	1,500	190	290	.	.	<	.	83
GW-071	1,100	130	<	110	6	1,100	.	.	.	1,600
GW-082	<	<	690	14	200	.	.	.	.	13
GW-257	180	.	.	.	.	.	.	.	.	.
GW-259	400	11	<	.	.	.	.	.	.	.
GW-289	750	24	<	<	.	.	.	.	.	.
GW-623	8,300	3,600	260	150	92	.	.	.	21	6
GW-626	820	910	14,000	140	3,700	37	<	18	.	380
GW-627	1,400	330	<	49	56	.	.	.	.	.
GW-629	22,000	4,600	78	380	43	100	9	<	.	7
GW-653	15	14	140	<	.	<	.	.	.	.
MCL	5	5	70	7	2	200	5	5	5	5
Note: ". ." = Not detected; "<" = Less than MCL.										

As shown in the preceding data summary, extremely high concentrations (>1,000 µg/L) of VOCs, especially PCE and c12DCE, were detected in the groundwater samples collected from several wells located at the BCBG. These results primarily reflect migration/transport of dissolved VOCs at depth (>300 ft bgs) in the Nolichucky Shale directly south (down dip) and/or southwest (along strike) of BG-A South (Figure A.8).

The CY 2008 sampling results for the wells listed in Table 7 support long-term VOC concentration trends (Table B.9), with time-series plots of the VOC data (individual compounds and/or summed concentrations of multiple VOCs) for each well, generally showing:

- Decreasing concentration trends for VOCs in groundwater from wells GW-006, GW-014, and GW-276, as illustrated by the PCE results for wells GW-014 and GW-276 (Figure A.18). 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 concentration trends for VOCs in groundwater from eight wells located hydraulically downgradient of the BCBG WMA (GW-046, GW-071, GW-082, GW-257, GW-259, GW-289, GW-623, and GW-653), as illustrated by the PCE results for wells GW-046 and GW-289 (Figure A.18). For example, PCE concentrations at well GW-046 show wide (seasonal) fluctuations, but similar results were reported for the groundwater samples collected from the well in August 1995 (460 µg/L) and July 2008 (430 µg/L). Essentially unchanged levels of VOCs, as shown by more than 20 years of sampling data for these wells suggest minimal corresponding change in the relative advective flux of VOCs via the low-permeability flowpaths monitored by each well.
- Increasing concentration trends for VOCs in groundwater from well GW-246 at the S-3 Site, well GW-008 at the OLF WMA, and wells GW-626, GW-627, and GW-629 at the BCBG WMA. The increasing concentration trend indicated by the PCE data for well GW-246 (Figure A.18) may be of questionable significance considering the prolonged gap (January 1990 - March 2004) in the sampling history for the well and the relatively low concentrations of PCE (and other VOCs) relative to other contaminants in the groundwater from this well (e.g., nitrate). Increasing concentrations of VOCs indicated by the sampling results for wells GW-626, GW-627 (Figure A.18), and GW-629 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.
- A mixture of decreasing and indeterminate concentration trends for individual VOCs in groundwater from wells GW-068 at the BCBG WMA and GW-098 at the OLF WMA. For example, historic data for 12DCE (the primary VOC) at well GW-098 show increasing concentrations from March 1987 (3 µg/L) to January 1990 (35 µg/L) followed by sharply decreasing concentrations through March 2008 (2 µg/L). However, the TCE concentrations reported for these samples remained fairly constant (6 µg/L, 9 µg/L, and 4 µg/L, respectively). The divergent concentration trends for individual VOCs may reflect differences in the relative mobility of each compound in groundwater, or may indicate differing flowpaths and/or sources.

Gross Alpha and Gross Beta Activity

Groundwater samples collected during CY 2008 from 18 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 six of these wells.

Table 8. Bear Creek Regime CY 2008: 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-085	03/13/08	4.9	<MDA		8	<	
GW-085	08/05/08	2.4	<		5.3	52	± 5.2
GW-246	03/12/08	150	390	± 140	210	6,600	± 310
GW-246	06/10/08	62	<MDA		140	9,300	± 290
GW-246	08/07/08	5.1	190	± 44	56	5,600	± 150
GW-246	12/10/08	38	420	± 63	67	9,600	± 190
GW-276	01/03/08	2.32	159	± 27.1	6.13	146	± 24.2
GW-276	07/07/08	2.58	113	± 19.4	4.89	180	± 29.4
GW-537	08/05/08	6.4	<MDA		8.9	220	± 14
GW-615	08/11/08	41	1,100	± 320	570	680	± 330
GW-623	03/18/08	8.3	16	± 7.7	10	<	
GW-623	09/22/08	4.6	<MDA		5.7	<	
Screening Level		15			50		
Note: “<” = Less than or equal to screening level.							

Elevated levels of gross alpha activity and gross beta activity in the groundwater samples from all but well GW-623 reflect the 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 2008 sampling results reflects the limited mobility of uranium isotopes beyond the acidic groundwater in the Nolichucky Shale within approximately 500 ft of the site. The elevated gross alpha activity reported for the March 2008 sample from well GW-623 may be an analytical artifact because the result for the September 2008 sample was below the MDA. The results for all but one of the previous samples from the well have been below 6 pCi/L.

As shown by the CY 2008 sampling results summarized in Table 8, gross beta activity remains extremely high (>1,000 pCi/L) in groundwater from the aquitard (Nolichucky Shale) nearest to the S-3 Site, as indicated by the results for well GW-246. Gross beta activity exceeds 200 pCi/L in the shallow groundwater 2,500 ft west of the site, as indicated by the results for well GW-537. Moreover, as with nitrate, the CY 2008 sampling results for well GW-085 show slightly elevated gross beta activity extending approximately 3,000 ft west of the site (Figure A.10). 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 (TcO₄) 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 2008 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 trends for gross alpha and gross beta activity at well GW-276, located southeast of the S-3 Site (Figure A.19), which mirror the concurrently decreasing trends evident for nitrate and uranium (Figure A.17) and PCE (Figure A.18). 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, respectively, that occurred after the former S-3 Ponds were closed and capped.
- Indeterminate gross alpha and/or gross beta activity trends for wells GW-085, GW-246, GW-537, and GW-615, which together essentially characterize the lateral (GW-085) and vertical (GW-615) extent of radiological contamination in the aquitard (Nolichucky Shale) west of the S-3 Site. Of these wells, GW-085 and GW-537 have uninterrupted sampling histories extending back to January/February 1990. Respective data shows a consistent positive correlation between gross beta activity and nitrate concentrations in the groundwater from each well (Figure A.19). Results from these wells reflect the common source of nitrate and Tc-99 (the former S-3 Ponds) and their similar relative mobility in groundwater. Additionally, the data for well GW-085 show long-term fluctuations in gross beta activity (and nitrate concentrations), suggesting temporal “pulses” in the level of gross beta activity (and nitrate) in the shallow groundwater.

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 2008 from 24 aquifer wells in the Bear Creek Regime (Table B.9). Eight of these wells are components of two Exit Pathway Pickets in the Bear Creek Regime (Figure A.12): Picket B (GW-694, GW-703, GW-704, and GW-706) and Picket C (GW-724, GW-725, GW-738, and GW-740). The remaining wells are located near the eastern end of the regime near the S-3 Site (GW-122), Rust Spoil Area (GW-306, GW-310, and GW-312, and GW-648), and Spoil Area I (GW-314 and GW-315); near Bear Creek south of the OLF WMA (GW-065, GW-225, GW-226, GW-227, GW-229, GW-365, GW-367, and GW-369); and near Bear Creek south of the BCBG WMA (GW-058). A detailed analysis of the sampling results for each monitoring well (including data tables and trends charts) is presented in the GWPP Compendium (B&W Y-12 2008).

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 2008 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 at least one groundwater sample collected during CY 2008 from 13 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. Note that the elevated nitrate and uranium results reported for well GW-058 are inconsistent (much higher) with respect to available historical data and do not meet DQOs of the Y-12 GWPP (see Section 3.5). These results (flagged with a “Q” qualifier) are suspected outliers (possible sampling or analytical artifacts) that are excluded from further evaluation. Historical results for the well show nitrate levels consistently

below 10 mg/L, with uranium concentrations that are below or slightly above 0.03 mg/L. Future monitoring results will confirm or negate these elevated concentrations.

Table 9. Bear Creek Regime CY 2008: 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 2008	July-Dec 2008	Jan-June 2008	July-Dec 2008
S-3 Site	GW-122	375 ft Southwest	309	NS	<	NS
Exit Pathway Picket C	GW-724	3,000 ft West	15.6	NS	<	NS
	GW-725		11.8	NS	<	NS
	GW-738		16.2	NS	<	NS
OLF WMA	GW-227	4,300 ft West	<	NS	0.0549	NS
	GW-225	4,600 ft West	38.7	39.4	<	<
	GW-226		11.5	36	<	<
	GW-229	5,000 ft West	. /	.	0.174/ 0.167	0.157
			.			
Exit Pathway Picket B	GW-694	7,000 ft West	<	NS	0.0425	NS
	GW-703		17.6	NS	<	NS
	GW-704		11.3	NS	NA	NS
	GW-706		11.8	12.7	NA	0.064
BCBG	GW-058	9,000 ft West	18.2 Q	NS	0.0964 Q	NS
MCL			10		0.03	
Note: “.” = Not detected; “<” = Less than MCL; NS = Not sampled; NA = Not analyzed; Q = inconsistent with other measurements from the location						

These sampling results show that the highest nitrate concentrations in the aquifer occur at depths greater than 100 ft bgs within approximately 500 ft of the S-3 Site (e.g., GW-122). Also, the nitrate results for well GW-225 reflect the recharge of nitrate contaminated surface water that occurs hydraulically upgradient (east-northeast) of the well along a reach of Bear Creek that loses substantial flow to the Maynardville Limestone. Well GW-225 yields groundwater from about 200 ft bgs in the Maynardville Limestone south of the OLF WMA (Figure A.7),

As shown in Table 9, elevated concentrations of total uranium were reported only for groundwater samples from wells GW-227, GW-229, GW-694, and GW-706, which are all located hydraulically downgradient to the west of the BYBY (Figure A.9). Uranium-bearing wastes were disposed 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 were 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 2008 from the aquifer wells in the Bear Creek Regime support the respective long-term concentration trends indicated by historical data (Table B.9), with time-series plots of the nitrate and uranium data (excluding analytical results that do not meet DQOs) generally showing:

- Decreasing concentration trends for nitrate at six wells (GW-122, GW-225, GW-704, GW-706, GW-724, and GW-738), and for uranium at three wells (GW-227, GW-694, and GW-706), as illustrated by nitrate and uranium data for well GW-706 (Figure A.20). Decreasing concentrations of nitrate 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.
- Indeterminate concentration trends for nitrate in wells GW-226, GW-703, and GW-725, as illustrated by the nitrate results for wells GW-226 and GW-725 (Figure A.20). These trends suggest minimal overall change in the relative flux of nitrate within the hydrostratigraphic zones intercepted by the monitored interval in each well, which may indicate that these wells yield contaminated groundwater from flow/transport pathways that are not well connected to the most permeable karst network in the Maynardville Limestone.
- An increasing uranium concentration trend in well GW-229 (Figure A.20). Available sampling results for well GW-229 show an order-of-magnitude increase in the concentrations of uranium occurred between sampling events performed in September 1995 (0.014 mg/L) and March 2002 (0.238 mg/L), with subsequent sampling results defining a generally decreasing trend through April 2008 (0.157 mg/L). The decreasing uranium concentrations 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 2008 from 21 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. The elevated TCE results for wells GW-065 and GW-648 are suspected artifacts and future monitoring results will confirm or negate the presence of TCE in the groundwater at these wells. Groundwater samples were first collected from well GW-065 during CY 2008, and TCE was elevated in the August sample, but was not detected in the March sample. The elevated TCE result for well GW-648 is the first time TCE has been detected in samples from the well.

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, the OLF WMA, and the BCBG WMA (Figure A.8). The CY 2008 sampling results summarized in Table 10 are consistent with historical data, showing the continued persistence of TCE in the groundwater from about half of these wells without concurrent detection of TCE 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).

Table 10. Bear Creek Regime CY 2008: maximum VOC concentrations in surveillance monitoring aquifer wells

Well Number	Concentration (µg/L)					
	PCE	TCE	c12DCE	11DCE	VC	Benzene
GW-065	.	12	.	.	.	.
GW-225	<	230	<	<	.	.
GW-226	<	180	<	<	.	.
GW-227	.	23	<	.	.	.
GW-229	.	9	330	46	73	11
GW-306	<	30	<	.	.	.
GW-310	<	13	.	.	.	.
GW-312	.	31	.	.	.	.
GW-314	11	<	.	.	.	.
GW-315	6	<	.	.	.	.
GW-365	.	5	<	10	4	.
GW-367	.	15	.	.	.	.
GW-369	.	33	.	.	.	.
GW-648	.	10 Q	.	.	.	.
GW-703	.	10	<	.	.	.
GW-704	<	26	<	<	.	<
GW-706	<	17	<	<	.	<
GW-724	<	64	<	.	.	.
GW-725	<	7	.	.	.	.
GW-738	.	20	.	.	.	.
GW-740	.	47	<	.	.	.
MCL	5	5	70	7	2	5
Note: “.” = Not detected; “<” = Less than MCL; “Q” = inconsistent with other measurements for the location						

These VOC results support the long-term concentration trends (Table B.9), with time-series plots of the VOC data (individual compounds and/or summed concentrations of multiple VOCs) for each well, generally showing:

- Variable, but generally decreasing, concentration trends for VOCs (primarily TCE) in groundwater from wells GW-306, GW-310, GW-315, GW-367, GW-369, GW-703, GW-704, GW-738, and GW-740, as illustrated by TCE data for wells GW-704 and GW-738 (Figure A.21). 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 concentration trends for VOCs in groundwater from wells GW-065, GW-225, GW-226, GW-227, GW-312, GW-314, GW-706, GW-724, and GW-725, as illustrated by the TCE data for wells GW-225 and GW-706 (Figure A.21). The relatively unchanged levels of VOCs in the groundwater from these wells (excluding well GW-065) suggest there is minimal change in the advective flux of VOCs in the hydrostratigraphic zone monitored by each well.
- A mixture of indeterminate and either increasing or decreasing concentration trends for individual VOCs in groundwater from wells GW-229 and GW-365. The data for these wells are clearly distinguishable from the other wells listed in Table 10 by the dominant concentrations of TCE degradation products (12DCE, 11DCE, and VC). Concentrations of these compounds have increased over time, as illustrated

by the 11DCE and 12DCE results for well GW-229 (Figure A.21). 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.

Gross Alpha and Gross Beta Activity

Groundwater samples collected during CY 2008 from 25 aquifer surveillance monitoring wells contained gross alpha and/or gross beta activity above the associated MDA and the corresponding TPU (Table B.9). 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). The elevated gross beta activity for well GW-058 in January 2008 is inconsistent (much higher) with historical data for the well and does not meet DQOs of the Y-12 GWPP (see Section 3.5). This result (flagged with a “Q” qualifier) is possibly a sampling or analytical artifact. Additionally, the gross alpha activity reported for this sample is a suspected outlier (higher than historic data). As such, the results for both gross alpha and gross beta activity for well GW-058 were excluded from further evaluation. Future monitoring results will confirm or negate these elevated activities.

Table 11. Bear Creek Regime CY 2008: 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	01/23/08	4.4	33	± 6.1	7.3	58 Q	± 7.2
GW-227	02/05/08	3.6	33	± 6	6.7	<	
GW-229	02/06/08	7.3	53	± 8.8	7.5	<	
GW-229	06/17/08	3.8	48	± 7.7	6.2	53	± 6.1
GW-229	12/11/08	4.2	44	± 6.8	8	<	
GW-694	01/23/08	4.1	17	± 4.6	8	<	
GW-706	02/26/08	2.28	18.8	± 4.13	3.65	<	
GW-706	07/31/08	1.73	22.1	± 4.73	4.52	<	
Screening Level		15			50		
Note: “<” = Less than or equal to screening level; “Q” = Inconsistent with other results for the well							

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), the principal radiological components of the intermingled contaminant plume in the Maynardville Limestone.

The CY 2008 monitoring results show that the highest levels of gross alpha and gross beta activity occur in the groundwater from aquifer well GW-229, located downgradient (west-southwest) of the former BYBY (Figure A.9 and Figure A.10, respectively). 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. Uranium-bearing wastes removed from the BYBY are considered the principal source of the uranium isotopes in the groundwater from this well.

The elevated gross alpha and gross beta activity in samples collected from aquifer wells during CY 2008 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:

- An overall decreasing gross alpha activity trend for well GW-694 (Figure A.22). The long-term trend does not exhibit any clear response to the CERCLA BYBY remedial actions completed in May 2003.
- Indeterminate trends for gross alpha activity at wells GW-227 and GW-706 (Figure A.22). These long-term trends do not reflect any clear response to the CERCLA BYBY remedial actions, and suggest minimal change in the flux of uranium isotopes in the groundwater flow/transport pathways monitored by the wells.
- Overall increasing long-term trends for gross alpha and gross beta activity in groundwater from well GW-229 (Figure A.22), as compared to much lower historical radiological results (February 1990 and September 1995). These trends are similar to the long-term trend for total uranium (Figure A.20) which shows a significant concentration increase between September 1995 and March 2002, followed by a generally decreasing trend through April 2008. The most recent data for gross alpha and gross beta likewise show decreasing levels of gross alpha and gross beta activity between February 2003 (150 pCi/L and 120 pCi/L, respectively) and December 2008 (44 pCi/L and 46 pCi/L, respectively). Decreasing levels of gross alpha activity and gross beta activity indicated by the recent sampling results suggest a corresponding 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.

4.1.2 East Fork Regime

In CY 2008, groundwater samples were collected from 79 surveillance monitoring wells in the East Fork Regime (Table B.3). Forty-nine 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 30 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 2008 from 37 aquitard monitoring wells in the East Fork Regime (Table B.10). A detailed analysis of the sampling results for each monitoring well (including data tables and trends charts) is presented in the GWPP Compendium (B&W Y-12 2008). 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 (former S-3 Ponds), the S-2 Site, and the WCPA in the western Y-12 area and unidentified sources in the central and eastern Y-12 areas. 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 2008 from 11 wells in the East Fork Regime. As shown in Table 12, elevated

nitrate concentrations were reported for seven aquitard wells in the western Y-12 area and four 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, which 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-105, GW-106, GW-274, and GW-633); shallow bedrock (<70 ft bgs) interval (wells 55-2C, GW-108, and GW-275); and intermediate bedrock interval (GW-109) in the Nolichucky Shale east and southeast of the site.

Table 12. East Fork Regime CY 2008: 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-June 2008	Jul-Nov 2008	Jan-June 2008	Jul-Nov 2008
Western Y-12 Area	GW-105	500 E	635	NS	<	NS
	GW-106	500 E	680	NS	<	NS
	GW-633	720 E	863	NS	<	NS
	GW-108	800 SE	7,040	7,440	<	<
	GW-109	800 SE	9,190	9,630	<	<
	GW-274	1,300 SE	1,860	NS	<	NS
	GW-275	1,300 SE	8,570	NS	.	NS
Central Y-12 Area	55-2A	3,000 SE	203	NS	<	NS
	55-2B	3,000 SE	252	NS	.	NS
	55-2C	3,000 SE	237	NS	.	NS
	GW-204	5,100 SE	NS	<	NS	0.0431
MCL			10		0.03	
Note: “NA” = Not analyzed; “NS” = Not sampled; “<” = Concentration less than MCL; “.” = Not detected						

For the wells with elevated nitrate concentrations, the CY 2008 sampling results are consistent with historical nitrate concentration trends (Table B.10), with time-series plots (excluding analytical results that do not meet applicable DQOs) for each well generally showing:

- Decreasing nitrate concentration trends for wells GW-105, GW-108, GW-274, and GW-633, as illustrated by the nitrate data for wells GW-108 and GW-274 (Figure A.23). As noted previously, 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 and the cumulative effectiveness of natural attenuation processes.
- Indeterminate nitrate concentration trends for wells 55-2A, GW-106, GW-109, and GW-275, as illustrated by the nitrate data for wells GW-109 and GW-275 (Figure A.23). The relatively unchanged levels of nitrate in the groundwater from these wells seems unusual considering that the S-3 Ponds have been closed for more than 20 years. The persistently high levels of nitrate in these wells probably reflect 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 each well.

- Increasing nitrate concentration trends for well 55-2B and 55-2C (Figure A.23). The increasing concentrations of nitrate potentially reflect the continued eastward movement of the center of mass of the S-3 Ponds contaminant plume in the Nolichucky Shale east of the site (DOE 1998).

As shown in Table 12, elevated uranium concentrations were reported for only well GW-204, located in the central Y-12 area on the east side of Bldg. 9204-2 (Figure A.13). Well GW-204 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. However, the sampling method appears to bias the analytical results for uranium at well GW-204. The decreasing concentration trend may be an artifact of the change from conventional sampling to low-flow sampling (B&W Y-12 2008). Uranium results obtained with the conventional method show an indeterminate to slightly increasing trend, while uranium results obtained with the low-flow method show an indeterminate to slightly decreasing trend.

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 2008 from 33 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, ETB, and exceeding respective drinking water MCLs. The presence of dissolved VOCs reflects transport/migration from the contaminant plumes from several source areas, including: the former S-3 Ponds, the WCPA, former petroleum fuel dispensing facilities associated with the Rust Garage Area and the East End Fuel Facility, and other unspecified 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 2008 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.

Table 13. East Fork Regime CY 2008: maximum VOC concentrations in surveillance monitoring aquitard wells

Y-12 Area/ Well	Maximum Concentration (µg/L)											
	PCE	TCE	c12 DCE	11 DCE	VC	CTET	MC	112 TCA	12 DCA	Ben- zene	ETB	Tol- uene
Western												
GW-108	6	5	<	<	.	.	52	<	<	<	.	<
GW-109	110	<	.	.	.	.	14	.	.	.	.	.
GW-192	<	<	<	.	.	.	.	.	.	.	.	.
GW-265	27	<	.	.	.	.	.	.	.	.	.	.
GW-269	22	<	<	120	.	.	.	.	.	.	.	.
GW-274	1,700	10	<	.	.	.	26	.	.	160	.	.
GW-332	1,100	200	1,000	30	16	.	.	.	.	.	.	.
GW-336	250	210	990	60	23	<	.	.	.	.	.	.
GW-337	480	350	1,300	52	16	.	.	.	.	.	.	.
GW-508	<	.	.	.	.	.	.	.	.	410	<	1,200
GW-633	280	6	<	<	.	.	16	.	.	1,800	<	.
Central												
55-2A	230	110	300	7	3	.	.	.	.	.	.	.
55-2B	510	180	560	13	12	.	.	.	.	.	.	.
55-2C	370	150	550	14	10	.	.	.	.	.	.	.
55-3A	13,000	850	860	15	25	.	.	.	.	.	.	.
55-3B	50,000	3,800	740	120	170	.	.	.	.	.	.	<
55-3C	8,800	1,400	1,400	41	140	.	.	.	.	.	.	.
56-2A	5	.	.	.	.	.	.	.	.	.	.	.
56-2B	1,300	43	<	.	.	.	.	.	.	.	.	.
56-2C	350	340	900	17	59	.	.	.	.	.	.	.
56-3A	46	<	<	.	.	.	.	.	.	.	.	.
56-3B	24	5	<	.	.	.	.	.	.	.	.	.
56-3C	220	13	<	.	.	.	.	.	.	.	.	.
GW-656	33	2,000	170	200	6	.	.	.	.	.	.	.
GW-769	20	<	<	<	.	170	.	.	.	.	.	.
GW-770	<	.	.	.	.	39	.	.	.	.	.	.
GW-782	55	30	<	20	.	<	.	.	.	.	.	.
GW-783	6	.	<	<	.	.	.	.	.	.	.	.
GW-791	33	.	.	.	.	.	.	.	.	.	.	.
GW-792	<	<	.	.	.	.	.	.	.	.	.	.
Eastern												
GW-383	400	160	240	<	4	.	.	.	.	.	.	.
GW-658	.	.	.	.	.	.	.	72	470	7,700	1,000	3,100
GW-762	2,600	190	54	48	6	<	.	.	.	.	.	.
MCL	5	5	70	7	2	5	5	5	5	5	700	1,000
Note: “.” = Not detected; “<” = Less than MCL												

The CY 2008 sampling results for these wells support the long-term historical VOC concentration trends (Table B.10), with time-series plots of the VOC results excluding results that do not meet applicable DQOs (described in the introductory section of Appendix E and presented in Appendix E.2), generally showing:

- Decreasing concentration trends for VOCs at 13 wells, including six wells in the western Y-12 area (GW-109, GW-265, GW-332, GW-336, GW-337, and GW-508) and seven wells in the central Y-12 area (55-2A, 55-2B, 55-2C, 56-2A, GW-656, GW-791, and GW-792). Decreasing trends are illustrated by the summed concentrations of VOCs detected in the samples from wells GW-109 and GW-656 (Figure A.24). The decreasing concentration trends reflect several factors, including the RCRA closure of the S-3 Ponds (well GW-109). In the absence of similar actions, such as unknown source(s) of VOCs in the groundwater from wells 55-2A, 55-2C, and 56-2A, the decreasing concentrations of VOCs primarily reflect the cumulative effectiveness of natural attenuation processes, including biologically mediated degradation. Decreasing VOC concentrations in samples from well 55-2C also are concurrent with clearly increasing nitrate concentrations (Figure A.23), which suggest separate sources of VOCs and nitrate.
- Indeterminate concentration trends for VOCs in groundwater from eight wells, including two wells in the western Y-12 area (GW-108 and GW-192); five wells in the central Y-12 area (55-3A, 55-3B, 55-3C, 56-2B, and GW-782); and well GW-658 in the eastern Y-12 area. These trends are illustrated by the summed concentrations of VOCs detected in wells GW-108 and GW-782 (Figure A.24). Widely variable, but essentially unchanged, levels of VOCs over 15 years suggest minimal changes in the advective flux of VOCs in groundwater pathways intercepted by each well. The indeterminate concentration trends also suggest that the geochemical characteristics of the groundwater in most of these wells (i.e., excluding wells with elevated c12DCE concentrations) are not especially conducive to biologically-mediated degradation processes that would reduce VOC concentrations over the long term.
- Increasing concentration trends for VOCs from three wells, including well GW-274 in the western Y-12 area and wells GW-769 and GW-770 in the central Y-12 area, as illustrated by the summed concentrations of VOCs in wells GW-274 and GW-769 (Figure A.24). These wells yield VOC-contaminated groundwater from shallow depths (<60 ft bgs) in the Nolichucky Shale. The increasing concentration trends suggest corresponding increases in the relative flux of dissolved VOCs through the hydrostratigraphic zones monitored by each well.
- A mixture of decreasing, indeterminate, and increasing concentration trends (Table B.10) for individual VOCs in groundwater from nine wells, including two wells in the western Y-12 area (GW-269 and GW-633); five wells in the central Y-12 area (56-2C, 56-3A, 56-3B, 56-3C, and GW-783); and two wells in the eastern Y-12 area (GW-383 and GW-762). For instance, while 12DCE (total) concentrations reported for well GW-383 increased significantly between January 1991 (41 µg/L) and August 2008 (242 µg/L), there were minimal differences in initial and most recent concentrations of PCE (390 µg/L – 400 µg/L) and TCE (150 µg/L – 160 µg/L). These divergent concentrations trends are most likely attributable to the effects of biotic and/or chemical degradation processes, causing stable levels of parent compounds (PCE and TCE) and increased levels of a related degradation compound (c12DCE). Furthermore, the samples collected during CY 2008 from wells 56-3B and 56-3C, as compared to previous results, show a sharp decrease in PCE concentrations with a concurrent increase in chloroform concentrations. These divergent concentration trends probably reflect infiltration of chlorinated water, possibly from unidentified potable water line leaks upgradient of these wells. Chloroform (and other trihalomethanes) are formed by chemical interactions between natural organic matter in the subsurface and chlorine disinfectant used in potable water (U.S. Environmental Protection Agency 2001).

Gross Alpha and Gross Beta Activity

Groundwater samples collected during CY 2008 from 26 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 seven of these wells had elevated gross alpha activity (>15 pCi/L) and/or gross beta activity (>50 pCi/L). The elevated gross beta activity for well 55-3B in April 2008 is much higher than available historical data and does not meet DQOs of the Y-12 GWPP (see Section 3.5). This elevated result (flagged with a “Q” qualifier) is possibly a sampling or analytical artifact and is excluded from further evaluation.

Table 14. East Fork Regime CY 2008: 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	01/07/08	138	230	±	99.2	225	21,300	±	3,410
GW-108	07/08/08	32.7	129	±	33	36.7	13,900	±	2,220
GW-109	06/10/08	270	<MDA			670	4,000	±	530
GW-109	11/25/08	230	<MDA			350	1,400	±	260
GW-274	05/08/08	57	<MDA			69	4,400	±	150
GW-633	06/11/08	25	34 R	±	35	65	1,500	±	88
Central Y-12 Area									
55-3B	04/21/08	4.8	<MDA			7.6	92 Q	±	8.4
GW-204	10/27/08	3.5	27	±	4.4	6.4	<MDA		
GW-782	12/10/08	2.2	20	±	3.3	4.5	<		
Screening Level		15				50			
Note: “<” = Less than the screening level; “R” = Rejected result, >MDA but <TPU; “Q” = Inconsistent with other results for the well									

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/or gross beta activity in the groundwater from each of the above-listed 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 reported for wells GW-204 and GW-782 indicates groundwater transport of radiological contaminants (primarily uranium isotopes) from unspecified sources 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 2008 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 (excluding results that do not meet applicable DQOs) show:

- A decreasing trend for gross beta activity in groundwater samples collected (low flow method) from well GW-633 since June 2000 (Figure A.25). The decreasing gross beta activity reflects a decrease in Tc-99

flux along the shallow groundwater pathways monitored by the well. Also, the decreasing trend for gross beta activity corresponds with a decreasing concentration trend for nitrate (see above).

- Indeterminate trends for gross alpha and/or gross beta activity in groundwater from wells GW-108, GW-109, GW-204, GW-274, and GW-782 (Table B.10), as illustrated by the gross alpha activity results for well GW-108 and by gross beta activity results for well GW-274 (Figure A.25). Widely variable and not clearly increasing or decreasing levels of gross alpha activity in the groundwater from well GW-108 suggest minimal change in the flux of alpha-emitting radionuclides (primarily uranium isotopes) in the groundwater east of the S-3 Site. This indicates limited transport of uranium isotopes beyond the low-pH groundwater nearest the site.
- An increasing trend for gross beta activity in groundwater from well GW-108 (Figure A.25). The increasing beta activity 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 Ponds), the increasing levels of gross beta activity suggest that Tc-99 levels remain unaffected by natural attenuation processes that reduce nitrate concentrations.

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 2008 from 21 surveillance monitoring aquifer wells in the East Fork Regime (Table B.10), including four wells located in the western Y-12 area; seven wells located in the central Y-12 area; eight wells in the eastern Y-12 area; and two wells in Union Valley east of the ORR boundary. A detailed analysis of the sampling results for each monitoring well (including data tables and trends charts) is presented in the GWPP Compendium (B&W Y-12 2008).

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 2008 from seven 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 2008 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. The data for well GW-606 indicate nitrate concentrations above 10 mg/L occur at least 7,900 ft downgradient of the site (Figure A.7). The elevated uranium concentrations in groundwater reflect transport/migration from one or more unspecified sources in the central Y-12 area (GW-605) and 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 2008: elevated nitrate and uranium concentrations in surveillance monitoring aquifer wells

Well Location/Number		Nitrate (mg/L)		Uranium (mg/L)	
		Jan-June 2008	July-Nov 2008	Jan-June 2008	July-Nov 2008
Western Y-12 Area	GW-251	45.7	NS	<	NS
	GW-253	535	NS	<	NS
Central Y-12 Area	GW-698	158	161	<	<
Eastern Y-12 Area	GW-154	NA	NA	0.54	0.46
	GW-223	.	.	0.04	0.042
	GW-605	<	<	0.14	0.11
	GW-606	<	11.5	<	<
MCL		10		0.03	
Note: “.” = Not detected; “<” = Less than MCL; NS = Not sampled; NA = Not analyzed					

The CY 2008 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 concentration trend for well GW-251 dominated by wide seasonal fluctuations (Figure A.26), with the highest concentrations typically evident 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 and GW-605. These trends are illustrated by the historical data for wells GW-253 and GW-154 (Figure A.26). The relatively unchanged nitrate levels at well GW-253 suggest minimal long-term change in the flux of nitrate 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 closed more than 50 years ago and nitrate is highly mobile in groundwater. The uranium data obtained since 1991 for well GW-154 (Figure A.26) 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.26). 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 in the late 1980s and early 1990s. 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 Oil Skimmer Basin, closed along with New Hope Pond in 1988, is the suspected source of the uranium. 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 that the higher nitrate concentrations reflect an increase in the flux of nitrate from the S-2 Site along groundwater flowpaths monitored by the well.

Volatile Organic Compounds

Groundwater samples collected during CY 2008 from 20 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, chloroform, and/or MC 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 summed concentrations of chlorinated hydrocarbons (PCE, TCE, c12DCE, CTET, and chloroform) in the CY 2008 groundwater samples from aquifer wells GW-170 (7.3–11.4 µg/L) and GW-230 (10 µg/L) represent concentrations within the plume of dissolved VOCs that 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 2008 sampling results for the wells in Union Valley exceed the applicable drinking water MCLs.

Table 16. East Fork Regime CY 2008: maximum VOC concentrations in surveillance monitoring aquifer wells

Location and Well	Maximum Concentration (µg/L)						
	PCE	TCE	c12DCE	VC	CTET	Chloroform	MC
Western Y-12 Area							
GW-251	280	110	<	.	.	<	.
GW-253	940	830	310	110	36	<	.
GW-618	7	8	<	<	.	.	.
GW-619	35	9	<	.	.	.	.
Central Y-12 Area							
GW-686	.	.	<	2 J	.	.	.
GW-690	81	<	<	.	.	.	.
GW-691	1,300	8	<	.	.	.	.
GW-692	6	<	<	.	.	<	.
GW-698	200	770	120	.	7	<	.
GW-700	82	16	<	.	.	.	.
GW-820	4,100	750	960	70	.	.	.
Eastern Y-12 Area							
GW-148	.	.	81	3	.	.	.
GW-153	<	<	.	.	94	<	.
GW-223	100	39	82	7	<	<	.
GW-240	<	.	.	.	5	.	.
GW-382	17 J	<	7J	.	370	120	10 J
GW-605	91	96	160	<	80	<	.
GW-606	5	<	<	.	47	<	.
Union Valley							
GW-170	<	<	.	.	<	<	.
GW-230	.	.	<	2	.	.	.
MCL	5	5	70	2	5	80*	5
Note: “.” = Not detected; “<” = Less than the MCL; J = Estimated value; * = MCL for total trihalomethanes (byproducts of drinking water disinfection with chlorine)							

The CY 2008 VOC results for the aquifer wells support historical long-term concentration trends (Table B.10), and time-series plots of the VOC data, excluding results that do not meet applicable DQOs, generally show:

- Variable but generally decreasing trends for VOC concentrations for nine wells (GW-153, GW-170, GW-230, GW-240, GW-382, GW-618, GW-619, GW-690, and GW-700), as illustrated by the CTET concentrations detected in well GW-153 and summed VOC concentrations in well GW-382 (Figure A.27). The decreasing concentration trends reflect reduced flux of VOCs from the applicable source areas and the long-term effects of natural attenuation processes, including biologically mediated degradation. Additionally, the decreasing VOC concentrations at wells GW-153 and GW-240 may be attributable to the full-time operation of groundwater extraction well GW-845 located approximately 600 ft directly east of these wells (see Section 2.3.1.1 and Figure A.13).
- Indeterminate concentration trends for VOCs in groundwater from five wells (GW-251, GW-253, GW-686, GW-692, and GW-820). These trends are illustrated by the summed concentrations of VOCs detected in the groundwater samples from wells GW-251 and GW-820 (Figure A.27). The summed VOC concentrations at well GW-251 show clearly seasonal fluctuations, with high concentrations evident in samples collected during seasonally high flow conditions (April and May). As noted previously regarding nitrate levels in well GW-251, this relationship suggests seasonal inflow of contaminated recharge in groundwater flowpaths intercepted by the well.
- Increasing concentration trends for VOCs in groundwater from well GW-691 located in the central Y-12 area and wells GW-148 and GW-605 located in the eastern Y-12 area (Figure A.13), as illustrated by the summed VOC concentrations for wells GW-605 and GW-691 (Figure A.27). For example, the summed VOC concentrations in samples from well GW-605 show seasonal fluctuations, with high concentrations typically evident in samples collected during seasonally low flow conditions (July). This relationship suggests seasonal (and episodic) 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 wells.
- A combination of decreasing, indeterminate, and increasing trends for individual VOCs in groundwater from wells GW-223, GW-606, and GW-698 (Table B.10). Divergent concentration trends for VOCs may reflect different sources for individual compounds and/or biologically mediated degradation of the compounds. For instance, while the 12DCE (total) concentrations reported for well GW-223 (located near NHP, Figure A.13) increased between February 1991 (30 µg/L) and February 2008 (68 µg/L), significant concentration decreases were reported for this same time period for concentrations of PCE (190 µg/L - 28 µg/L) and TCE (42 µg/L - 15 µg/L).

Gross Alpha and Gross Beta

Groundwater samples collected during CY 2008 from 21 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 for three of these wells had elevated gross alpha activity (>15 pCi/L) or gross beta activity (>50 pCi/L). 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), one or more sources in the central Y-12 area (GW-605), and the Oil Skimmer Basin (GW-154).

Table 17. East Fork Regime CY 2008: 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	02/26/08	6.31	31.6	±	7.46	10.2	<		
Eastern Y-12 Area GW-154	02/27/08	2.14	431	±	69.8	7.26	64	±	11.5
GW-154	08/11/08	2.43	429	±	69.3	6.12	125	±	20.5
GW-605	01/07/08	2.48	66.8	±	12.4	4.65	<		
GW-605	07/08/08	2.43	44	±	8.6	4.67	<		
Screening Level		15				50			
Note: “<” = Less than the screening level									

The gross alpha and gross beta activity reported for the samples collected during CY 2008 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 but generally decreasing trends for gross alpha activity in well GW-253 and gross beta activity in well GW-154 (Figure A.28). These decreasing trends probably reflect a decrease in the levels of uranium isotopes (and beta-emitting decay products) in the groundwater.
- Widely variable, indeterminate long-term trends for gross alpha activity in groundwater from wells GW-154 and GW-605 (Figure A.28). These trends suggest minimal relative change in the flux of uranium isotopes in hydrostratigraphic intervals monitored by the wells. These indeterminate trends 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 2008 groundwater sampling results for 44 wells on Chestnut Ridge meet the requirements of surveillance monitoring in the Chestnut Ridge Regime. Sampling results show that most of these wells continue to yield uncontaminated groundwater, with data for a few wells being likely artifacts of well installation/construction, including elevated nickel from corrosion of the stainless steel well screen (GW-305) and the geochemical influence of cement grout, such as strongly basic pH and unusually high potassium concentrations (wells GW-205 and GW-757). Aside from these artifacts, VOCs were the contaminants most frequently detected in the groundwater samples collected during CY 2008, with at least one principal compound detected in samples from nine wells (Table B.11). A detailed analysis of the sampling results for each monitoring well (including data tables and trends charts) is presented in the GWPP Compendium (B&W Y-12 2008).

The CRSP are the source of the VOCs in the groundwater at eight of these wells (GW-173, GW-175, GW-177, GW-178, GW-322, GW-612, GW-796, and GW-798). 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). Historic 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.

As shown in Table 18, PCE, 11DCE, 111TCA, 11DCA, and trichlorofluoromethane (TCFM) are the VOCs detected most frequently in samples from CRSP monitoring wells. The maximum concentration of PCE and/or 11DCE reported for wells GW-177, GW-322, GW-612, and GW-798 exceed respective drinking water MCLs.

Table 18. Chestnut Ridge Regime CY 2008: maximum VOC concentrations in surveillance monitoring wells

Well	Maximum Concentration (µg/L)							
	PCE	TCE	c12DCE	11DCE	111TCA	11DCA	TCFM	F113
Near CRSP:								
GW-173	5 J	.	.	.	.	.	3 J	3 J
GW-175	5 J	.	.	.	.	.	4 J	.
GW-177	1 J	0.1 J	.	9	9	36	NA	NA
GW-178	.	.	.	5 J	4 J	9	.	.
GW-322	7	.	.	75	27	88	37	5 J
GW-612	2 J	.	.	26	8	41	.	.
GW-796	.	.	.	0.19 J	0.44 J	0.32 J	.	.
GW-798	8.8	0.88 J	8.9	4.7	2.1	3.4	11	.
IL IV:								
GW-305	.	.	.	6.4	13	25	.	.
MCL	5	5	70	7	200	NA	NA	NA
Note: “. ” = Not detected; J = Estimated value; NR = Not reported; NA = Not applicable								

The dissolved VOC concentrations reported for the CRSP wells generally define the strike- and dip-parallel extent VOCs originating from disposal trenches at the CRSP (Figure A.8). The concentrations of the primary components of the plume (PCE and 111TCA) have generally decreased, while the concentrations of 111TCA degradation products (11DCE and/or 11DCA) have increased or remained stable (e.g., GW-177, GW-178, and GW-322), which suggests active biotic and/or chemical degradation processes.

The CY 2008 sampling results generally continue the decreasing or indeterminate long-term concentration trends indicated by historical VOC data (Table B.11), as illustrated the VOC data for wells GW-612 and GW-798 (Figure A.29). The 111TCA and 11DCA concentrations at well GW-612 show decreasing trends, with a steeper decline for 111TCA. The 11DCA concentrations are higher than 111TCA concentrations in samples collected since March 2001. The VOC data for well GW-798 shows an overall indeterminate trend characterized by peak concentrations in January 2003, January 2007, and July 2008 (Figure A.29).

The groundwater samples collected from well GW-305 during CY 2008 contained 11DCE, 11DCA, and 111TCA (Table 18). The source of the VOCs in the groundwater from the well is unconfirmed. Along with the historical data, the CY 2008 monitoring results continue the concentration trends evident after the sequential detection of 111TCA, 11DCA, and 11DCE beginning in January 1992 (Figure A.29). The data

show the arrival of the parent compound (111TCA) followed four years later by the related degradation products (11DCA and 11DCE). Since January 2001, 111TCA concentrations have decreased, 11DCE concentrations have remained fairly stable, and 11DCA concentrations have steadily increased.

4.2 EXIT PATHWAY/PERIMETER MONITORING

This section describes results of groundwater and surface water quality monitoring performed during CY 2008 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 2008 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) 11 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 one sampling location in Bear Creek (BCK-11.97) and one 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), one sampling location in Bear Creek (BCK-09.40), and sampling locations in NT-3 (EMWNT-03A), 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 the surface water station BCK-04.55 (Figure A.11). A detailed analysis of the sampling results for each monitoring location is provided in Volume 5 of the GWPP Compendium (B&W Y-12 2008).

Table 19. Bear Creek Regime CY 2008: 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-11.97	NT-01
Middle	-		SS-4 SS-5	BCK-09.40	EMWNT-03A 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-04.55	-

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, which enters Bear Creek about 2,500 ft downstream of the site. The highly contaminated groundwater in the Nolichucky Shale extends west of NT-1 where it upwells into the shallow flow system and ultimately discharges into NT-2, which enters the main channel of 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, monitoring results obtained during CY 2008 show that nitrate, uranium, and PCE concentrations in Upper Bear Creek remain above respective screening levels, with the highest levels of nitrate and uranium in the main channel of Bear Creek.

Table 20. Upper Bear Creek CY 2008: maximum contaminant concentrations

Sampling Point	Nitrate (mg/L)	Uranium (mg/L)	PCE (µg/L)	Radioactivity (pCi/)	
				Alpha	Beta
NT-01 BCK-11.97	15.2 35	0.0047 0.17	6 NA	8.3 NA	30 NA
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. The CY 2008 contaminant concentrations reported for NT-01 are significantly lower than CY 2007 nitrate (>300 mg/L) and uranium (>0.04 mg/L) concentrations.

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 BYBY/HCDA (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 (DOE 1997a) which discharges from springs SS-4 and SS-5 located downgradient of this losing reach of Bear Creek.

As shown in Table 21, elevated concentrations (i.e., >screening level) of one or more of the principal contaminants in the Bear Creek Regime were reported for five of the exit pathway sampling locations in Middle Bear Creek. The highest nitrate concentrations were reported for spring SS-4, south of the BCBG WMA (Figure A.7). The highest uranium levels were reported for the sampling location in NT-8, west of the BCBG WMA (Figure A.11). As noted previously, the BYBY was a major source of uranium in Bear Creek via NT-3. Uranium levels in NT-3 decreased substantially in response to the CERCLA remedial actions at the site (see Section 2.4.1.2).

Table 21. Middle Bear Creek CY 2008: maximum contaminant concentrations

Sampling Point	Nitrate (mg/L)	Uranium (mg/L)	Chloroethenes (µg/L)					Radioactivity (pCi/L)	
			PCE	TCE	c12DCE	11DCE	VC	Alpha	Beta
EMWNT-03A	NA	.	.	.	.	.	.	NA	NA
NT-04	NA	.	.	.	7	NA	.	NA	NA
EMW-VWUNDER	NA	.	.	.	.	NA	.	NA	NA
EMWNT-05	NA	.	.	.	.	.	.	NA	NA
EMW-VWEIR	NA	.	.	.	.	.	.	NA	NA
SS-4	13	0.0954	.	3 J	.	.	.	69	45
NT-07	0.046	0.03	17	16	60	4 J	0.6 J	NA	NA
NT-08	0.082	0.51	15	14	90	4 J	2	NA	NA
SS-5	2.19	0.0186	.	.	2 J	.	.	17	12
BCK-09.40	9	0.0894	NA	NA	NA	NA	NA	NA	NA
Screening Level	10	0.03	5	5	70	7	2	15	50
Note: “.” = Not detected; J = Estimated concentration; NA = Not analyzed; BOLD = Exceeds screening level									

These monitoring results are generally consistent with historical data and show that contaminants associated with Y-12, particularly total uranium (and gross alpha activity) and VOCs, continue to impact the quality of surface water in Middle Bear Creek.

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 2008 monitoring results summarized in Table 22, the concentrations of all principal contaminants were below applicable screening levels, except for gross alpha activity at BCK-04.55.

Table 22. Lower Bear Creek CY 2008: maximum contaminant concentrations

Sampling Point	Nitrate (mg/L)	Uranium (mg/L)	Summed VOCs (µg/L)	Radioactivity (pCi/L)	
				Gross Alpha	Gross Beta
GW-712	.	.	.	.	3
GW-713	.	.	1 J	.	3.91
GW-714	0.22	.	.	3.08	4.13
SS-6	1.2	0.014	.	4.03	8.15
BCK-04.55	1.65	0.0262	.	22	.
Screening Level	10	0.03	MCL or >5 µg/L	15	50
Note: “.” = Not detected; J = estimated value; BOLD = Exceeds screening level					

The CY 2008 monitoring results are generally consistent with respective historical data and show that contaminants associated with Y-12 continue to impact the quality of surface water in Lower Bear Creek. Sampling results for the exit pathway monitoring wells indicate no significant impact on groundwater quality.

4.2.2 East Fork Regime

The CY 2008 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 and 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.13). The surface water sampling stations that are located within the East Fork Regime include an outfall (200A6) and a sampling location in UEFPC (Station 8) in the south-central part of Y-12 (Figure A.13). A detailed analysis of the sampling results for each monitoring location is provided in the GWPP Compendium (B&W Y-12 2008).

Table 23. East Fork Regime CY 2008: sampling locations for exit pathway/perimeter monitoring

Monitoring Wells				Springs	Surface Water Stations	
Well Number	Monitored Interval Depth (ft bgs)	Well Number	Monitored Interval Depth (ft bgs)	Union Valley	UEFPC	North of Pine Ridge
GW-151	85.0 - 110.0	GW-744	55.0 - 69.5	SCR7.1SP	200A6	GHK2.51WSW
GW-220	31.0 - 45.2	GW-747	60.8 - 73.0	SCR7.8SP	STATION 8	NPR12.0SW
GW-722	75.0 - 644.3	GW-748	14.2 - 27.2			NPR23.0SW
GW-733	240.1 - 256.5	GW-816	2.9 - 15.8			
		GW-832	4.0 - 11.8			

In addition to the surface water sampling locations within the East Fork Regime, two springs located along South Illinois Avenue east of Y-12 (Figure A.13) 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.14) also serve as exit pathway/perimeter monitoring locations. Sampling results for the Union Valley springs and surface water stations located north of Pine ridge showed principal contaminant concentrations below screening levels.

4.2.2.1 Groundwater

At least one of the groundwater samples collected during CY 2008 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.13). As shown in Table 24, the groundwater samples from each of these wells contained concentrations of CTET and /or PCE and TCE that exceed drinking water MCLs.

Table 24. East Fork Regime CY 2008: maximum VOC concentrations in exit pathway/perimeter monitoring wells

Well	Maximum Concentration (µg/L)					
	PCE	TCE	c12DCE	VC	CTET	Chloroform
GW-151	850	160	67	0.6 J	1,300	72
GW-220	620	130	70	.	1,400	87
GW-722-22	6	2 J	0.3 J	.	30	3
GW-722-20	11	2 J	0.7 J	.	64	14
GW-722-17	6	2 J	0.4 J	.	58	9
GW-722-14	3 J	1 J	0.2 J	.	29	4
GW-733	0.3 J	0.2 J	.	.	12	1
GW-832	7	1 J	0.8 J	.	17	2
MCL	5	5	70	2	5	NA
Note: “.” = Not detected; J = Estimated concentration ; 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 east end of Y-12. The CY 2008 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.30). 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.31).

4.2.2.2 Surface Water

Maximum concentrations reported for CY 2008 samples, summarized in Table 25 (sampling stations are listed from upstream to downstream along UEFPC), show that nitrate, uranium, or gross alpha activity was detected at three of the surface water sampling stations used for exit pathway/perimeter monitoring.

Table 25. East Fork Regime CY 2008: 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	0.034	NA	NA	NA
Station 8	NA	0.012	NA	NA	NA
North of Pine Ridge					
GHK2.51WSW	.	.	.	.	.
NPR12.0SW	0.0409	.	.	.	.
NPR23.0SW	.	.	.	3.1	.
Screening Level	10	0.03	5	15	50
Note: “.” = not detected (or below MDA); NA = not analyzed; BOLD = Exceeds screening level					

The CY 2008 uranium concentrations for surface water station 200A6 exceed the drinking water MCL (0.03 mg/L) and continue the indeterminate long-term concentration trend indicated by historical uranium results (Table B.10). Principal groundwater contaminant concentrations evident at these locations during CY 2008 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 the surface water in the East Fork Regime as a legacy of historical operations at Y-12. Extensive sampling (flow proportionate and grab samples) is performed by other monitoring programs (e.g., NPDES and CERCLA) and the annual monitoring results are not addressed in this document. However for information purposes, the mercury concentration reported for over 200 samples collected during CY 2008 from Station 17 ranged from 0.00005 mg/L (December 8, 2008) to 0.003741 mg/L (May 15), which slightly exceeds the drinking water MCL (0.002 mg/L). Station 17 is located in UEFPC on the south side of Bear Creek Road (Figure 13) downstream (north) of Lake Reality.

4.2.3 Chestnut Ridge Regime

The CY 2008 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. A detailed analysis of the sampling results for each monitoring location is provided in the GWPP Compendium (B&W Y-12 2008).

Table 26. Chestnut Ridge Regime CY 2008: sampling locations used for exit pathway/perimeter monitoring

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

4.2.3.1 Groundwater

The springs used for exit pathway/perimeter monitoring in the Chestnut Ridge Regime are located in four of the 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.16). The CY 2008 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) slightly 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 nitrate and uranium are either non-detect values or within the range of background levels in the Chestnut Ridge Regime. Excluding a trace level (2 µg/L) of 1,1,2-trichloro-1,2,2-trifluoroethane detected at SCR-2.1SP (first detection and suspected outlier), VOCs were not detected in the groundwater samples collected from the springs. Gross alpha or gross beta activity above the associated MDA was reported for only one spring sample, and this gross beta result (2.67 pCi/L at spring SCR4.3SP) indicates natural background radiation. These results suggest that operations at Y-12 have not 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 2008 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) and upstream of Rogers Quarry (SCR3.5SW); and in tributary SCR5 downstream of KHQ (S17) near the southeastern boundary of the regime (Figure A.16).

Analytical results for the surface water samples collected from McCoy Branch during CY 2008 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 2002). Historical data show that the surface water samples from both locations are distinguished by elevated concentrations of sulfate and

arsenic. Sulfate concentrations in the samples collected from both sampling locations during CY 2008 exceed background levels, with the highest concentration reported for samples collected from MCK 2.05 (23.3 mg/L) and MCK 2.0 (24.2 mg/L) in August 2008 (seasonally low flow conditions). The monitoring results obtained during CY 2008 show that the maximum arsenic concentration at MCK 2.05 (0.676 mg/L) and MCK 2.0 (0.043 mg/L) and are above the drinking water MCL (0.01 mg/L) and were reported for the samples collected from both locations in January 2008 (seasonally high flow conditions). Notably, lower concentrations of sulfate (17 mg/L) and arsenic (not detected at 0.005 mg/L) were reported for the sample collected in April 2008 from surface water station SCR3.5SW, located about 2,000 ft downstream from MCK 2.0. 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 2008 monitoring results for surface water stations located in the other drainage features in the Chestnut Ridge Regime show non-detect values or background levels of nitrate and uranium, except for nitrate concentration (2.17 mg/L) in the April 2008 sample from station S17. Similarly, VOCs were not detected in the samples collected from these surface water stations. Gross alpha activity and gross beta activity were below the associated MDAs in all but two surface water samples: gross alpha (3.7 pCi/L) in the April 2008 sample from station S17 and gross alpha (4.18 pCi/L) and gross beta (7.15 pCi/L) in the August 2008 sample from station UNC SW-1. These low activity levels are indicative of natural background radiation. Historical and current waste management operations do not appear to have significantly affected surface-water quality in these drainage features.

5.0 CONCLUSIONS AND RECOMMENDATIONS

The groundwater and surface water quality data obtained during CY 2008 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 236 sampling locations: 204 monitoring wells, 10 springs, and 22 surface water stations.

The CY 2008 monitoring results reported for 69 wells (42 aquitard wells and 27 aquifer wells) meet surveillance monitoring requirements in the Bear Creek Regime. Groundwater samples from 23 of the aquitard wells and 24 of the aquifer 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 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. The VOC concentrations reported during CY 2008 ($>20,000 \mu\text{g/L}$) for aquitard well GW-629 (located at the BCBG WMA) confirm the results reported in CY 2006 and CY 2007, and are significantly higher than in samples collected from the well in CY 1997 and CY 1998 ($<10 \mu\text{g/L}$).

The CY 2008 exit pathway/perimeter monitoring in the Bear Creek Regime is reported for 11 surface water stations along Bear Creek (including six northern tributaries), three 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-11.97, BCK-09.40, and BCK-04.55), three tributaries (NT-1, NT-7, and NT-8), and two springs (SS-4 and SS-5). 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 2008 concentrations of all principal contaminants except for gross alpha activity were below applicable screening levels.

The CY 2008 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 eight wells (seven aquitard and one aquifer) and one surface water station. These monitoring locations are near the S-3 Site (two wells and a surface water station), the OLF WMA (two wells), and the BCBG WMA (four wells). Decreasing or indeterminate (not increasing or decreasing) trends are evident for at least one contaminant detected in samples from 42 wells, six surface water stations, and two springs. 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 and/or transport flowpaths for the different contaminants.

The CY 2008 monitoring results reported for 49 aquitard wells and 30 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 37 of the aquitard wells and 21 of the aquifer 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 ($>70,000 \mu\text{g/L}$) 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, 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, within the co-mingled VOC plume from multiple sources in the central Y-12 area, and in the eastern Y-12 area near NHP/Lake Reality and Oil Skimmer Basin. 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 2008 monitoring results reported for 17 sampling locations (nine monitoring wells, two surface water stations in the central Y-12 area, two springs located east of Y-12, and four surface water stations located north of Pine Ridge along the border of the ORR) 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, primarily VOCs, were reported for at least one of the samples from five of the wells and one of the surface water sampling stations. 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. Analytical results for the surface water sampling stations suggest that the uranium concentrations reflect the continued impact of legacy Y-12 operations on the quality of surface water in UEFPC upstream of the ORR boundary. Note that mercury is a primary concern in the surface water of the East Fork Regime and results of flow-proportionate sampling performed under other monitoring programs are not addressed in this report. Because of low solubility, mercury is rarely detected in groundwater samples and is not considered to be a principal groundwater contaminant.

The CY 2008 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 21 wells, and decreasing or indeterminate (not increasing or decreasing) concentration trends are evident for at least one contaminant detected in samples from 57 wells and one surface water stations. 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 and/or transport flowpaths for the different contaminants.

The CY 2008 sampling results for 44 wells located on Chestnut Ridge meet the requirements of surveillance monitoring in the Chestnut Ridge Regime. Results indicative of legacy contamination associated with former operations at Y-12 were reported for well GW-305 at Industrial Landfill IV and eight wells near the CRSP. These wells each yield VOC-contaminated groundwater, with concentrations above applicable drinking water MCLs reported for PCE and/or 11DCE detected in the samples from well GW-305 and four wells at the CRSP. 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 2008 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 2008 monitoring results reported for five natural springs and five 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 in the samples from each spring and surface water station, or were detected at concentrations within the range of background levels in the regime. However, the CY 2008 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 in the Bear Creek Regime, East Fork Regime, and Chestnut Ridge Regime during CY 2008, the following actions are recommended:

- Results of mercury analyses for samples collected after October 1, 2008 using the revised analytical method with a lower reporting limit are consistent with previous results. Mercury was detected in samples from five locations, including one well in the Bear Creek Regime (GW-246), and four wells in the East Fork Regime (GW-109, GW-508, GW-692, and GW-698). All but one of these results is greater than the historic reporting limit (0.0002 mg/L), and there were no locations where mercury was detected for the first time. The lowest result was reported for well GW-508 (0.0000607 mg/L), and mercury had been detected above 0.0002 mg/L in five previous samples from the well. Therefore, results of the initial sampling event appear to support the fact that the standard reporting limit previously used has provided mercury results representative of groundwater conditions.
- Well GW-170 in Union Valley and well GW-205 in the Chestnut Ridge Regime should be redeveloped to attempt to reduce the apparent grout contamination in each well. Also, in order to ensure collection of the most representative (i.e., least grout-contaminated) groundwater samples from these wells, the conventional sampling method should be considered or, if the low-flow sampling method is used, each well should be purged until the pH is below 9 before the groundwater samples are obtained. Sampling of these wells is performed under monitoring programs other than the Y-12 GWPP.
- A significant decrease in contaminant concentrations 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, this drop in concentrations also may reflect bio-fouling of the well screen and/or filter pack. The pumping rates to purge and sample monitoring wells have been maintained electronically by the Y-12 GWPP since CY 2000. It is suggested that review of this data should be used to identify wells (if any) with a decreasing trend in the pumping rate used to collect groundwater samples, which would suggest decreased performance of the well (permeability of the filter pack and/or well screen). These wells would be candidates for rehabilitation (e.g., surging or swabbing) using a workover rig, with subsequent monitoring results used to evaluate the effectiveness of rehabilitation methods.

The following actions are recommended to improve monitoring efficiency, and could be incorporated into the GWPP SAP for CY 2010:

- A statistical evaluation that compared results obtained using passive sampling methods (Hydrasleeve® samplers and PDBs) to low flow sampling results was performed at selected wells during CY 2008 (see Appendix H). Although Hydrasleeve® samplers can be used for the full analytical suite (inorganics, organics, and radiochemistry), the inorganic and radiochemical results were biased by high levels of suspended solids collected with the sample. The evaluation suggests favorable agreement between PDB sampling results and low-flow sampling results. Therefore, using the PDB sampling method could be performed at wells that meet criteria for monitoring only for VOCs and have a monitored interval length of 10 ft or less. Further evaluation of the PDB results to historical results for the wells can be used to determine if using PDB sampling is appropriate for future monitoring events.

6.0 REFERENCES

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APPENDIX A

FIGURES

GWPP Fig1 09/23/08

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

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 OCTOBER 1-7, 2008

EXPLANATION

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

EXPLANATION

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

Fig. A.5. Groundwater elevations in the Upper East Fork Poplar Creek Hydrogeologic Regime, October 2008.

GROUNDWATER ELEVATIONS OCTOBER 1 - 8, 2008

EXPLANATION

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

Fig. A.6. Groundwater elevations in the Chestnut Ridge Hydrogeologic Regime, October 2008.

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

EXPLANATION

	— SURFACE DRAINAGE FEATURE		— BUILDINGS
	— BOUNDARY OF SITE		— NITRATE > 10 mg/L
(NITRATE AS "N")
	— BOUNDARY OF REGIME		
MAXIMUM CY2008 NITRATE			
	— 10-100 mg/L		
	— 100-1,000 mg/L		
	— >1,000 mg/L		

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

EXPLANATION

- SURFACE DRAINAGE FEATURE
- BOUNDARY OF SITE
- BOUNDARY OF REGIME
- BUILDINGS
- SUMMED VOCs > 5 ug/L

MAXIMUM CY2008 SUMMED VOCs

- 5-50 ug/L
- 50-500 ug/L
- 500-5,000 ug/L
- >5,000 ug/L

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 CY2008 GROSS ALPHA**
	— 15-150 pCi/L
	— 150-1,500 pCi/L

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

EXPLANATION

- SURFACE DRAINAGE FEATURE
- BOUNDARY OF SITE
- BOUNDARY OF REGIME
- BUILDINGS
- GROSS BETA > 50 pCi/L

MAXIMUM CY2008 GROSS BETA

- — 50-500 pCi/L
- — 500-5,000 pCi/L
- — >5,000 pCi/L

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

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

Fig. A.13. CY 2008 sampling locations in the Upper East Fork Poplar Creek Hydrogeologic Regime and in Union Valley.

EXPLANATION

▲ Surface Water Sampling Location

Fig. A.14. CY 2008 surface water sampling locations north of Pine Ridge.

GWMR08_15.xls

Fig. A.15. Westbay™ monitoring system sampling port depths in well GW-722.

Fig. A.16. CY 2008 sampling locations in the Chestnut Ridge Hydrogeologic Regime.
A-16

Fig. A.17. Bear Creek Regime CY 2008: nitrate and/or uranium concentration trends in surveillance monitoring aquitard wells GW-246, GW-276, GW-615, and GW-829.

Fig. A.18. Bear Creek Regime CY 2008: PCE concentration trends in surveillance monitoring aquitard wells GW-014, GW-046, GW-246, GW-276, GW-289, and GW-627.

Fig. A.19. Bear Creek Regime CY 2008: gross alpha and/or gross beta activity trends in surveillance monitoring aquitard wells GW-085, GW-276, and GW-537.

Fig. A.20. Bear Creek Regime CY 2008: nitrate and/or uranium concentration trends in surveillance monitoring aquifer wells GW-226, GW-229, GW-706, and GW-725.

Fig. A.21. Bear Creek Regime CY 2008: selected VOC concentration trends in surveillance monitoring aquifer wells GW-225, GW-229, GW-704, GW-706, and GW-738.

Fig. A.22. Bear Creek Regime CY 2008: gross alpha and/or gross beta activity trends in surveillance monitoring aquifer wells GW-227, GW-229, GW-694, and GW-706.

Fig. A.23. East Fork Regime CY 2008: nitrate concentration trends in surveillance monitoring aquitard wells 55-2B, 55-2C, GW-108, GW-109, GW-274, and GW-275.

Fig. A.24. East Fork Regime CY 2008: summed VOC concentration trends in surveillance monitoring aquitard wells GW-108, GW-109, GW-274, GW-656, GW-769, and GW-782.

Fig. A.25. East Fork Regime CY 2008: gross alpha and/or gross beta activity trends in surveillance monitoring aquitard wells GW-108, GW-274, and GW-633.

Fig. A.26. East Fork Regime CY 2008: nitrate and/or uranium concentration trends in surveillance monitoring aquifer wells GW-154, GW-223, GW-251, GW-253, and GW-606.

Fig. A.27. East Fork Regime CY 2008: selected VOC concentration trends in surveillance monitoring aquifer wells GW-153, GW-251, GW-382, GW-605, GW-691, and GW-820.

Fig. A.28. East Fork Regime CY 2008: gross alpha and/or gross beta activity trends in surveillance monitoring aquifer wells GW-154, GW-253, and GW-605.

Fig. A.29. Chestnut Ridge Regime CY 2008: VOC trends in surveillance monitoring wells GW-305, GW-612, and GW-798.

Fig. A.30. East Fork Regime CY 2008: PCE concentration trends in exit pathway monitoring wells GW-151, GW-220, GW-722-14, and GW-832.

Fig. A.31. East Fork Regime CY 2008: CTET concentration trend in exit pathway monitoring well GW-722-17.

APPENDIX B

TABLES

Table B.1. Summary of CY 2008 sampling and analysis plan addenda

Addendum No.	Effective Date	Modification to the CY 2008 Sampling and Analysis Plan ¹
2008-01	01/01/08	Add acetonitrile to the VOC(1) parameter group.
2008-02	01/01/08	Collect additional samples using passive diffusion bags at two wells in the Bear Creek Regime and at six wells in the East Fork Regime.
2008-03	01/01/08	Replace three bottle lists in Appendix E with corrected versions.
2008-04	01/14/08	Collect an equipment rinsate sample after removing and cleaning the equipment from well GW-124.
2008-05	04/04/08	Continue reporting concentrations of acrolein and acrylonitrile as analyzed in unpreserved samples, with the rest of the VOC(1) parameter group; results will be considered qualitative and flagged on hard copy reports from the lab.
2008-06	04/04/08	Remove turbidity from the Standard Suite of analytes (from the CHEM, miscellaneous parameter group).
2008-07	04/04/08	Remove well 56-8A from the SAP (East Fork Regime).
2008-08	04/28/08	Add surface water stations BCK-09.40 and BCK-11.97 to the SAP (Bear Creek Regime); samples to be analyzed for nitrate and uranium
2008-09	05/13/08	Supersedes Addendum 2008-02. In addition to low-flow samples, collect samples using a passive diffusion bag and/or a Hydrosleeve® sampler from four wells in the Bear Creek Regime and four wells in the East Fork Regime.
2008-10	07/09/08	Replace page G.2-1 (in Appendix G) with a page showing the corrected "RCRA Waste Code" for well GW-068.
2008-11	10/01/08	Change the analytical method used for Mercury (Table B.2) from "SW846-7470" to "SW846-7470A", which will lower the reporting limit to 0.00005 mg/L.
2008-12	10/01/08	Supplements Addendum 2008-09. Modify (increase) the monitoring frequency for the eight wells involved in the comparative sampling study, wherein low-flow sampling is performed in conjunction with passive sampling using passive diffusion bags and/or Hydrasleeve® samplers.

Note:

- 1 Modification to the *Y-12 Groundwater Protection Program Groundwater and Surface Water Sampling and Analysis Plan for Calendar Year 2008* (BWXT 2007a).

**Table B.2. CY 2008 groundwater and surface water sampling dates
in the Bear Creek Hydrogeologic Regime**

BJC 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 2008 Sampling Date ⁵							
		1st Quarter	2nd Quarter	3rd Quarter	4th Quarter				
GW-006	OLF	03/12/08	.	07/29/08	.	●			
GW-008	OLF	01/02/08 D	.	07/08/08 D	.	x		●	
GW-014	BG	.	.	09/17/08	.	●			
GW-046	BG	01/03/08	.	07/07/08	.	x		●	
GW-058	BG	01/23/08	.	.	.	●			
GW-065	OLF	03/03/08	.	08/06/08	.	●			
GW-068	BG	.	.	09/16/08	.	●			
GW-071	BG	03/25/08	.	09/16/08	.	●			
GW-077	BG	02/26/08	.	08/14/08	.	x			●
GW-078	BG	02/21/08	.	08/14/08	.	x			●
GW-079	BG	02/21/08	.	07/31/08	.	x			●
GW-080	BG	02/21/08 D	.	07/31/08 D	.	x			●
GW-082	BG	.	.	09/25/08	.	●			
GW-085	OLF	03/13/08	.	08/05/08	.	●			
GW-089	BG	.	.	09/24/08	.	●			
GW-098	OLF	03/11/08	.	.	.	●			
GW-122	S3	03/11/08	.	.	.	●			
GW-225	OLF	01/28/08	.	07/29/08	.	●			
GW-226	OLF	02/4/08	.	07/29/08	.	●			
GW-227	OLF	02/05/08	.	.	.	●			
GW-229	OLF	02/06/08 D	06/17/08	.	12/11/08	●			
GW-246	S3	03/12/08	06/10/08	08/07/08	12/10/08	●			
GW-257	BG	.	.	09/23/08	.	●			
GW-259	BG	03/10/08	.	09/23/08	.	●			
GW-276	S3	01/03/08	.	07/07/08	.	x		●	
GW-289	BG	.	.	09/24/08	.	●			
GW-306	RS	03/06/08	.	07/31/08	.	●			
GW-309	RS	03/05/08	.	07/30/08 D	.	●			
GW-310	RS	02/14/08	.	.	.	●			
GW-312	RS	02/19/08	.	.	.	●			
GW-314	SPI	03/24/08	.	08/04/08	.	●			
GW-315	SPI	02/19/08	.	.	.	●			
GW-363	EMWMF	02/21/08	04/24-29/08*	08/12/08	11/12/08	x			□
GW-365	OLF	01/28/08	.	.	.	●			

Table B.2 (continued)

BJC 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									
		CY 2008 Sampling Date ⁵									
Sampling Point ³	Functional Area ⁴	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter						
GW-367	OLF	02/25/08	.	07/30/08	.	●					
GW-369	OLF	03/05/08 D	.	.	.	●					
GW-531	OLF	.	.	08/05/08	.	●					
GW-537	OLF	.	.	08/05/08	.	●					
GW-615	S3	.	.	08/11/08	.	●					
GW-616	S3	.	.	08/11/08	.	●					
GW-623	BG	03/18/08	.	09/22/08	.	●					
GW-626	BG	02/26/08	06/03/08	09/17/08	12/02/08	●					
GW-627	BG	03/18/08	.	09/22/08	.	●					
GW-629	BG	03/18/08	.	09/02/08	.	●					
GW-639	EMWMF	02/21/08	04/29/08	08/12/08	11/11/08	x				□	
GW-648	RS	02/13/08	.	.	.	●					
GW-653	BG	.	.	09/25/08 D	.	●					
GW-683	EXP-A	02/25/08	.	07/24/08	.	x				●	
GW-684	EXP-A	02/25/08	.	07/24/08	.	x				●	
GW-694	EXP-B	01/23/08	.	.	.	●					
GW-703	EXP-B	01/23/08	.	.	.	●					
GW-704	EXP-B	02/25/08	.	07/31/08	.	x				●	
GW-706	EXP-B	02/26/08	.	07/31/08	.	x				●	
GW-712	EXP-W	01/02/08	.	07/01/08	.		x	●			
GW-713	EXP-W	01/02/08 D	.	07/07/08 D	.		x	●			
GW-714	EXP-W	01/02/08	.	07/01/08	.		x	●			
GW-724	EXP-C	03/06/08	.	.	.	●					
GW-725	EXP-C	02/07/08 D	.	.	.	●					
GW-738	EXP-C	02/12/08	.	.	.	●					
GW-740	EXP-C	02/12/08	06/26/08	.	12/17/08	●					
GW-829	OLF	.	.	08/04/08	.	●					
GW-916	EMWMF	02/13/08	04/21/08	08/07/08	11/05/08	x				□	
GW-917	EMWMF	02/11/08	04/15/08	08/05/08	11/04/08	x				□	
GW-918	EMWMF	02/14/08	04/16/08	08/05/08	11/05/08	x				□	
GW-920	EMWMF	02/12/08	04/17/08	08/04/08	11/10/08	x				□	
GW-921	EMWMF	02/12/08	04/17/08	08/05/08	11/03/08	x				□	
GW-922	EMWMF	02/12/08	04/16/08	08/04/08	11/05/08	x				□	
GW-923	EMWMF	02/19-20/08	04/21-23/08	08/06-11/08	11/03/08	x				□	
GW-924	EMWMF	02/19/08	04/22/08	08/06/08	11/06/08	x				□	

Table B.2 (continued)

BJC 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 2008 Sampling Date ⁵							
		1st Quarter	2nd Quarter	3rd Quarter	4th Quarter				
GW-925	EMWMF	02/14/08	04/17/08	08/05-06/08	11/05/08	x			□
GW-926	EMWMF	02/19/08	04/23/08	08/6/08	11/06/08	x			□
GW-927	EMWMF	02/11/08	04/15/08	08/07/08	11/04/08	x			□
BCK-04.55	EXP-SW	01/14/08	.	.	.		●		
BCK-09.40	EXP-SW	.	04/29/08	.	.		●		
BCK-11.97	EXP-SW	.	04/29/08	.	.		●		
EMWNT-03A	EXP-SW	02/11/08	04/14/08	08/11/08	Dry		x		□
EMWNT-05	EXP-SW	02/11/08	04/14/08	08/11/08	11/10/08		x		□
EMW-VWEIR	EXP-SW	02/11/08	04/14/08	08/11/08	11/10/08		x		□
EMW-VWUND	EXP-SW	02/14/08	04/23/08	08/06/08	11/10/08		x		□
NT-01	EXP-SW	01/14/08	.	.	.		●		
NT-04	EXP-SW	02/11/08	04/14/08	08/11/08	11/10/08		x		□
NT-07	EXP-SW	02/11/08	.	Dry	.		x		○
NT-08	EXP-SW	02/11/08	.	08/6/08	.		x		○
SS-4	EXP-SW	01/14/08 D	.	.	.		●		
SS-5	EXP-SW	01/14/08	.	.	.		●		
SS-6	EXP-SW	01/02/08	.	07/01/08	.		x	●	

Notes:

- 1 Groundwater and surface water sampling performed for monitoring programs managed by Bechtel Jacobs Company LLC (BJC).
 - 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. Although the CY 2008 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)

Table B.2 (continued)

Notes: (continued)

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
	Dry	-	Insufficient water volume for sample collection
	D	-	Duplicate sample collected on specified date
	*	-	Field measurements obtained on the initial date shown, with laboratory samples collected on subsequent days; dependant upon groundwater volume in well after purging.

**Table B.3. CY 2008 groundwater and surface water sampling dates in the
Upper East Fork Poplar Creek Hydrogeologic Regime**

BJC ¹		CERCLA ROD (●) and Baseline (○) 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 2008 Sampling Date ⁵							
		1st Quarter	2nd Quarter	3rd Quarter	4th Quarter				
55-1A	GRID B2	.	04/14/08	.	.	●			
55-2A	GRID B3	.	04/17/08	.	.	●			
55-2B	GRID B3	.	04/16/08 D	.	.	●			
55-2C	GRID B3	.	04/16/08	.	.	●			
55-3A	B9201-5	.	04/21/08	.	.	●			
55-3B	B9201-5	.	04/21/08	.	.	●			
55-3C	B9201-5	.	04/21/08	.	.	●			
55-6A	B9103	.	04/21/08	.	.	●			
56-1A	Y12	.	04/24/08	.	.	●			
56-1C	Y12	.	04/28/08	.	.	●			
56-2A	GRID C3	.	04/23/08	.	.	●			
56-2B	GRID C3	.	04/23/08	.	.	●			
56-2C	GRID C3	.	04/23/08	.	.	●			
56-3A	Y12	.	05/01/08	.	.	●			
56-3B	Y12	.	05/01/08 D	.	.	●			
56-3C	Y12	.	05/01/08	.	.	●			
56-4A	Y12	.	04/30/08	.	.	●			
56-6A	Y12	.	04/29/08	.	.	●			
60-1A	Y12	.	.	.	12/15/08	●			
GW-105	S3	.	05/14/08	.	.	●			
GW-106	S3	.	05/14/08 D	.	.	●			
GW-108	S3	01/07/08	.	07/08/08	.	x		●	
GW-109	S3	.	06/10/08	.	11/25/08	●			
GW-148	NHP	.	.	08/19/08	.	●			
GW-151	NHP	02/26/08	.	08/11/08	.		x		●
GW-153	NHP	.	.	08/20/08	.	●			
GW-154	NHP	02/27/08	.	08/11/08	.	x			●
GW-169	EXP-UV	02/26/08	.	.	.	x			●
GW-170	EXP-UV	02/26/08 D	.	08/13/08 D	.	x			●
GW-171	EXP-UV	02/27/08	.	.	.	x			●
GW-172	EXP-UV	02/27/08	.	.	.	x			●
GW-190	B4	.	05/07/08	.	.	●			
GW-192	B4	.	05/05/08	.	.	●			
GW-193	T2331	01/03/08	.	07/08/08	.	x		●	

Table B.3 (continued)

BJC ¹		CERCLA ROD (●) 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 2008 Sampling Date ⁵							
		1st Quarter	2nd Quarter	3rd Quarter	4th Quarter				
GW-204	T0134	.	.	.	10/27/08	●			
GW-220	NHP	03/24/08	06/10/08	08/19/08 D	12/02/08		●		
GW-223	NHP	02/27/08	.	08/13/08	.	x			●
GW-230	EXP-UV	02/27/08	.	.	.	x			●
GW-240	NHP	.	.	08/19/08	.	●			
GW-251	S2	.	05/15/08	.	.	●			
GW-253	S2	02/26/08	.	.	.	x			○
GW-265	SY	.	05/07/08	.	.	●			
GW-269	SY	.	05/12/08	.	.	●			
GW-274	SY	.	05/08/08	.	.	●			
GW-275	SY	.	05/08/08	.	.	●			
GW-281	FF	.	05/08/08*	.	.	x			○
GW-332	WCPA	.	05/12/08	.	.	●			
GW-336	WCPA	.	05/13/08	.	.	●			
GW-337	WCPA	.	05/13/08	.	.	●			
GW-380	NHP	02/28/08	.	08/12/08	.	x			●
GW-381	NHP	.	.	08/21/08	.	●			
GW-382	NHP	02/28/08	.	08/13/08	.	x			●
GW-383	NHP	.	.	08/18/08	.	●			
GW-508	RG	.	05/13/08	.	12/22/08	●			
GW-605	EXP-I	01/07/08 D	.	07/08/08 D	.	x		●	
GW-606	EXP-I	01/07/08	.	07/08/08	.	x		●	
GW-617	EXP-E	.	.	.	10/20/08	●			
GW-618	EXP-E	03/04/08	.	.	.	x			○
GW-619	FTF	.	.	.	12/01/08 D	●			
GW-620	FTF	.	.	.	12/10/08	●			
GW-633	RG	.	06/11/08	.	.	●			
GW-656	T0134	.	.	.	10/28/08	●			
GW-658	FF	.	05/06/08	.	.	x			○
GW-686	CPT	.	.	.	10/22/08	●			
GW-690	CPT	.	.	.	10/23/08	●			
GW-691	CPT	.	.	.	10/23/08	●			
GW-692	CPT	.	.	.	10/21/08	●			
GW-698	B8110	.	06/24/08 D	.	11/25/08	●			
GW-700	B8110	.	.	.	10/20/08	●			

Table B.3 (continued)

BJC ¹		CERCLA ROD (●) 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 2008 Sampling Date ⁵							
		1st Quarter	2nd Quarter	3rd Quarter	4th Quarter				
GW-722-14	EXP-J	.	.	07/28/08	.		x		●
GW-722-14	EXP-J	02/28/08	.	.	.		●		
GW-722-17	EXP-J	.	.	07/28/08	.		x		●
GW-722-17	EXP-J	02/28/08	.	.	.		●		
GW-722-20	EXP-J	.	.	07/16/08	.		x		●
GW-722-20	EXP-J	02/28/08	.	.	.		●		
GW-722-22	EXP-J	.	.	07/16/08	.		x		●
GW-722-22	EXP-J	02/28/08	.	.	.		●		
GW-722-33	EXP-J	.	.	07/15/08 D	.		x		●
GW-722-33	EXP-J	02/28/08	.	.	.		●		
GW-733	EXP-J	01/03/08	.	07/08/08	.		x	●	
GW-744	GRID K1	.	.	08/13/08	.		●		
GW-747	GRID K2	.	.	08/14/08	.		●		
GW-748	GRID K2	.	.	08/14/08	.		●		
GW-762	GRID J3	02/27/08 D	.	08/13/08 D	.	x			●
GW-763	GRID J3	.	.	08/18/08	.	●			
GW-769	GRID G3	.	06/04/08	.	12/03/08	●			
GW-770	GRID G3	.	06/04/08	.	12/09/08	●			
GW-781	GRID E3	.	.	.	12/18/08	●			
GW-782	GRID E3	.	.	.	12/10/08	●			
GW-783	GRID E3	.	.	.	12/15/08	●			
GW-791	GRID D2	.	.	.	10/27/08	●			
GW-792	GRID D2	.	.	.	10/28/08	●			
GW-802	FF	.	05/07/08	.	.	x			○
GW-816	EXP-SR	.	.	08/13/08	.		●		
GW-820	B9201-2	.	05/21/08	.	12/17/08 D	●			
GW-832	NHP	02/28/08	.	08/12/08	.		x		●
GW-960	GRID F2	.	05/15/08	.	12/18/08	●			
GHK2.51WSW	EXP-SW	.	.	.	10/13/08		●		
NPR12.0SW	EXP-SW	.	.	.	10/13/08		●		
NPR23.0SW	EXP-SW	.	.	.	10/13/08		●		
SCR7.1SP	EXP-SW	01/21/08	.	.	.		x		●
SCR7.8SP	EXP-SW	01/21/08	.	.	.		x		●
200A6	EXP-SW	01/28/08 S	.	08/18/08 S	.		x		●
STATION 8	EXP-SW	01/28/08 S	.	08/18/08 S	.		x		●

Table B.3 (continued)

Notes:

- 1 Groundwater and surface water sampling performed for monitoring programs managed by Bechtel Jacobs Company LLC (BJC).
- 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. Although the CY 2008 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 (suffix)
 - STATION 8 - Surface water sampling location in Upper East Fork Poplar Creek
 - SW - Surface water sampling location (suffix)
- 4
 - B4 - Beta-4 Security Pit
 - B8110 - Building 81-10
 - B9103 - Building 9103
 - 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)
 - FTF - Fire Training Facility
 - 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
 - WCPA - Waste Coolant Processing Area
 - Y12 - Y-12 Complex
- 5
 - .
 - *
 - D**
 - S
 - Not sampled.
 - Field measurements obtained the day before samples were collected (well GW-281 went dry)
 - Duplicate sample collected on specified date (shown in bold typeface).
 - Two sets of surface water samples collected; a stormflow sample on the date shown and a base flow sample collected later during the first (02/04/08) and third (08/26/08) quarters.

**Table B.4. CY 2008 groundwater and surface water sampling dates
in the Chestnut Ridge Hydrogeologic Regime**

BJC ¹		Solid Waste Disposal Facility Detection 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									
		CY 2008 Sampling Date ⁵									
Sampling Point ³	Functional Area ⁴										
		1st Quarter	2nd Quarter	3rd Quarter	4th Quarter						
1090	UNCS	03/03/08	.	08/13/08	.	x		●			
GW-141	LIV	01/24/08	.	07/16/08	.	x				●	
GW-143	KHQ	.	.	07/09/08	.	x			●		
GW-144	KHQ	.	.	07/09/08	.	x			●		
GW-145	KHQ	.	.	07/10/08	.	x			●		
GW-156	CRSDB	.	.	07/14/08 D	.	x			●		
GW-159	CRSDB	.	.	07/14/08	.	x			●		
GW-161	ECRWP	01/07/08	.	07/09/08	.	x			●		
GW-173	CRSP	.	04/14/08	.	11/13/08 D	●					
GW-175	CRSP	.	.	.	11/11/08	●					
GW-177	CRSP	01/09/08	.	08/12/08	.	x			○		
GW-178	CRSP	.	.	.	11/11/08	●					
GW-203	UNCS	02/28/08	.	08/18/08	.	x		●			
GW-205	UNCS	03/03/08	.	08/14/08	.	x		●			
GW-217	LIV	01/22/08	.	07/16/08	.	x				●	
GW-221	UNCS	02/28/08	.	08/14/08	.	x		●			
GW-231	KHQ	.	.	07/09/08 D	.	x			●		
GW-294	ECRWP	01/08/08 D	.	07/10/08 D	.	x			●		
GW-296	ECRWP	01/08/08	.	07/10/08	.	x			●		
GW-298	ECRWP	01/08/08	.	07/10/08	.	x			●		
GW-301	CRBAWP	01/09/08 D	.	07/10/08 D	.	x			○		
GW-305	LIV	01/28/08	.	07/15/08	.	x				●	
GW-322	CRSP	.	.	.	11/12/08	●					
GW-514	FCAP	.	.	.	11/18/08	●					
GW-521	LIV	01/28/08	.	07/15/08	.	x				●	
GW-522	LIV	01/23/08 D	.	07/15/08 D	.	x				●	
GW-540	LII/CDLVI	01/29/08	.	07/15/08	.	x				●	
GW-557	LV	01/23/08	.	07/17/08	.	x				●	
GW-560	CDLVII	01/29/08	.	07/21/08	.	x				●	
GW-562	CDLVII	01/24/08	.	07/21/08	.	x				●	
GW-564	CDLVII	01/31/08 D	.	07/21/08 D	.	x				●	
GW-608	CRSP	.	.	.	11/17/08	●					
GW-609	CRSP	.	.	.	11/17/08	●					
GW-612	CRSP	.	.	.	11/12/08	●					

Table B.4 (continued)

BJC ¹		Solid Waste Disposal Facility Detection 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 2008 Sampling Date ⁵									
		1st Quarter	2nd Quarter	3rd Quarter	4th Quarter						
GW-709	LII	01/29/08	.	07/16/08	.	x				●	
GW-731	CRSDB	.	.	07/15/08	.	x			●		
GW-732	CRSDB	.	.	07/14/08	.	x			●		
GW-757	LII	01/30/08	.	07/16/08	.	x				●	
GW-796	LV/CDLVII	01/23/08	.	07/17/08	.	x				●	
GW-797	LV	01/24/08	.	07/21/08	.	x				●	
GW-798	CDLVII	01/30/08	.	07/21/08	.	x				●	
GW-799	LV	01/24/08	.	07/17/08	.	x				●	
GW-801	LV	01/23/08	.	07/21/08	.	x				●	
GW-831	FCAP	01/09/08	.	07/10/08	.	x			○		
MCK 2.0	FCAP	01/16/08	.	08/19/08	.		x	●			
MCK 2.05	FCAP	01/16/08 D	.	08/19/08 D	.		x	●			
S17	EXP-SW	.	04/15/08	.	.		●				
SCR1.25SP	EXP-SW	01/16/08	.	08/19/08	.		x	○			
SCR1.5SW	EXP-SW	.	04/15/08	.	.		●				
SCR2.1SP	EXP-SW	.	04/15/08	.	.		●				
SCR2.2SP	EXP-SW	.	04/15/08 D	.	.		●				
SCR3.5SP	EXP-SW	01/16/08	.	08/19/08	.		x	○			
SCR3.5SW	EXP-SW	.	04/15/08	.	.		●				
SCR4.3SP	EXP-SW	01/23/08	.	07/16/08	.		x			●	
UNC SW-1	EXP-SW	03/03/08	.	08/27/08	.		x			●	

Notes:

- 1 Groundwater and surface water sampling performed under monitoring programs managed by Bechtel Jacobs Company LLC (BJC).

Table B.4 (continued)

Notes: (continued)

- 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. Although the CY 2008 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
 - GW - Groundwater monitoring well (also 1090)
 - MCK - McCoy Branch Kilometer
 - SCR - South Chestnut Ridge (tributary prefix)
 - SP - Spring sampling location (suffix)
 - SW - Surface water sampling location (suffix)

- 4
 - CDLVI - Construction/Demolition Landfill VI
 - 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 2008 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	Celsius
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
Turbidity	EPA-180.1	0.1	NTU
Anions			
Carbonate	SM 2320B 18	1.0	mg/L
Bicarbonate	SM 2320B 18	1.0	mg/L
Chloride	EPA-300.0	0.2	mg/L
Fluoride	SM 4500F 18	0.1	mg/L
Nitrate (as Nitrogen)	EPA-300.0	0.028	mg/L
Sulfate	EPA-300.0	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	0.0002/0.00005	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	Y/P65-7060	15	pCi/L
Uranium-234, 235, & 238	Y/P65-7061	0.4	pCi/L

Notes:

1 NA - not applicable

Analytical methods from:

- *Test Methods for Evaluating Solid Waste Physical/Chemical Methods* (U.S. Environmental Protection Agency 1996)
- *Methods for Chemical Analysis of Water and Wastes* (U.S. Environmental Protection Agency 1983)
- BWXT Y-12 Analytical Chemistry Organization Control Procedures: (Y/P65-7060 and Y/P65-7061)

The method used for mercury analysis was changed for the fourth quarter sampling event to lower the reporting limit from 0.0002 mg/L to 0.00005 mg/L. Results for samples collected after October 1, 2008 reflect the new reporting limit.

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, October 2008**

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	10/06/08	19.01	961.99
GW-008	OLF		●	965.39	10/06/08	17.21	948.18
GW-010	OLF		●	952.70	10/06/08	3.92	948.78
GW-012	OLF		●	955.57	10/06/08	8.58	946.99
GW-014	BG		●	934.50	10/02/08	9.02	925.48
GW-016	BG		●	928.81	10/02/08	15.20	913.61
GW-041	BG		●	1008.10	10/01/08	26.65	981.45
GW-046	BG		●	921.17	10/02/08	7.35	913.82
GW-047	BG		●	929.00	10/02/08	11.45	917.55
GW-052	BG	●		905.70	10/02/08	18.84	886.86
GW-053	BG	●		903.42	10/02/08	11.67	891.75
GW-065	OLF	●		982.50	10/07/08	29.90	952.60
GW-084	OLF		●	997.18	10/07/08	18.02	979.16
GW-086	OLF		●	982.80	10/07/08	16.80	966.00
GW-090	BG		●	961.88	10/01/08	8.29	953.59
GW-091	BG		●	952.62	10/01/08	10.18	942.44
GW-100	S3	●		987.40	10/06/08	6.87	980.53
GW-101	S3		●	1007.40	10/06/08	10.09	997.31
GW-115	S3		●	1055.01	10/06/08	15.33	1039.68
GW-127	S3		●	1005.90	10/06/08	17.91	987.99
GW-236	S3	●		983.21	10/06/08	13.00	970.21
GW-242	BG		●	978.69	10/02/08	7.97	970.72
GW-245	S3		●	1009.08	10/06/08	15.15	993.93
GW-257	BG		●	961.68	10/02/08	30.24	931.44
GW-276	S3		●	1001.57	10/06/08	9.45	992.12
GW-287	BG		●	927.04	10/02/08	10.05	916.99
GW-289	BG		●	948.73	10/02/08	20.29	928.44
GW-291	BG		●	948.66	10/02/08	14.42	934.24
GW-307	RS	●		993.14	10/07/08	35.59	957.55
GW-309	RS	●		988.17	10/07/08	23.77	964.40
GW-310	RS	●		995.52	10/06/08	24.32	971.20
GW-316	SPI	●		1047.17	10/06/08	64.22	982.95
GW-323	SPI	●		1130.11	10/07/08	86.30	1043.81
GW-325	S3		●	1003.00	10/07/08	19.41	983.59
GW-345	S3		●	999.63	10/06/08	21.75	977.88
GW-347	S3	●		1001.05	10/07/08	20.51	980.54

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-370	BG		●	960.81	10/01/08	17.70	943.11
GW-372	BG		●	983.16	10/01/08	26.74	956.42
GW-531	LD		●	1004.61	10/07/08	20.98	983.63
GW-537	OLF		●	976.65	10/07/08	9.38	967.27
GW-613	S3		●	1013.58	10/07/08	18.37	995.21
GW-621	EXP-B	●		925.45	10/01/08	21.01	904.44
GW-622	BG		●	924.16	10/02/08	16.22	907.94
GW-624	BG		●	922.15	10/01/08	14.02	908.13
GW-630	LD		●	986.65	10/07/08	10.76	975.89
GW-638	OLF		●	941.77	10/06/08	10.49	931.28
GW-641	BG		●	946.66	10/01/08	22.17	924.49
GW-642	BG		●	1014.95	10/01/08	23.44	991.51
GW-645	OLF	●		1006.40	10/02/08	80.83	925.57
GW-648	RS	●		1029.20	10/07/08	72.17	957.03
GW-652	BG	●		900.83	10/01/08	13.38	887.45
GW-653	BG		●	931.84	10/01/08	26.20	905.64
GW-654	BG		●	940.79	10/01/08	9.73	931.06
GW-795	AGLLSF		●	926.18	10/06/08	10.73	915.45
GW-835	S3		●	1000.91	10/06/08	15.60	985.31
GW-916	EMWMF		●	1002.85	10/06/08	9.28	993.57
GW-917	EMWMF		●	997.10	10/06/08	24.86	972.24
GW-918	EMWMF		●	1067.96	10/06/08	6.95	1061.01
GW-923	EMWMF		●	1016.73	10/06/08	35.88	980.85
GW-924	EMWMF		●	968.90	10/06/08	11.33	957.57

Notes:

- 1
 - AGLLSF - Above Grade Low-Level Storage Facility
 - BG - Bear Creek Burial Grounds Waste Management Area
 - EMWMF - Environmental Management Waste Management Facility
 - EXP-B - Exit Pathway (Maynardville Limestone) Picket B
 - LD - Lysimeter Demonstration Site
 - OLF - Oil Landfarm Waste Management Area
 - RS - Rust Spoil Area
 - SPI - Spoil Area I
 - S3 - S-3 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.7. Depth-to-water measurements and groundwater elevations for selected wells
in the Upper East Fork Poplar Creek Hydrogeologic Regime, October 2008**

Well Number	Location ¹	Hydrogeologic Unit		Measuring Point ²	Date Measured	Depth to Water ³	Groundwater Elevation ⁴
		Aquifer	Aquitard				
55-1A	Y12		●	986.91	10/07/08	11.25	975.66
55-3A	Y12		●	972.46	10/07/08	12.38	960.08
55-6A	Y12		●	989.29	10/07/08	11.00	978.29
56-1A	Y12		●	969.25	10/07/08	7.70	961.55
56-2A	Y12		●	963.53	10/07/08	8.92	954.61
56-8A	Y12	●		962.46	10/07/08	20.81	941.65
60-1A	Y12	●		929.66	10/06/08	13.10	916.56
GW-105	S3		●	1018.20	10/06/08	10.64	1007.56
GW-108	S3		●	999.00	10/06/08	7.77	991.23
GW-115	S3		●	1055.01	10/06/08	15.33	1039.68
GW-148	NHP	●		907.76	10/01/08	9.01	898.75
GW-152	NHP	●		921.18	10/01/08	20.15	901.03
GW-154	NHP	●		911.70	10/01/08	10.32	901.38
GW-167	EXP	●		931.95	10/01/08	32.96	898.99
GW-169	EXP-UV	●		932.12	10/01/08	34.25	897.87
GW-192	B4		●	1008.83	10/07/08	7.54	1001.29
GW-193	T2331	●		934.17	10/07/08	10.04	924.13
GW-195	B4		●	1002.90	10/07/08	7.83	995.07
GW-199	GRID11		●	961.08	10/06/08	18.57	942.51
GW-202	RDS		●	968.02	10/06/08	11.14	956.88
GW-204	T0134		●	958.74	10/07/08	11.17	947.57
GW-219	UOV	●		935.83	10/07/08	13.39	922.44
GW-253	S2	●		1004.24	10/07/08	28.79	975.45
GW-255	S2	●		1027.13	10/07/08	56.27	970.86
GW-261	SY		●	1049.99	10/06/08	19.97	1030.02
GW-263	SY		●	1057.73	10/06/08	33.00	1024.73
GW-334	WC		●	983.73	10/07/08	12.30	971.43
GW-335	WC		●	981.88	10/07/08	10.28	971.60
GW-349	S2	●		993.50	10/07/08	9.05	984.45
GW-380	NHP	●		913.55	10/01/08	11.85	901.70
GW-383	NHP		●	908.77	10/01/08	9.73	899.04
GW-605	EXP-I	●		919.06	10/01/08	11.53	907.53
GW-606	EXP-I	●		919.59	10/01/08	14.69	904.90
GW-617	EXP-E	●		985.28	10/07/08	15.58	969.70
GW-619	FTF	●		1015.42	10/07/08	31.58	983.84
GW-686	CPT	●		963.76	10/07/08	13.34	950.42
GW-691	CPT	●		968.59	10/07/08	12.38	956.21

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-733	EXP-J	●		959.84	10/01/08	60.39	899.45
GW-746	GRIDK1		●	906.88	10/01/08	8.20	898.68
GW-752	GRIDJ3		●	912.78	10/01/08	5.67	907.11
GW-754	GRIDJ2		●	928.78	10/01/08	13.55	915.23
GW-756	GRIDJ1		●	928.11	10/06/08	6.77	921.34
GW-759	GRIDG1		●	994.01	10/06/08	19.67	974.34
GW-761	GRIDG2		●	968.23	10/06/08	13.35	954.88
GW-763	GRIDJ3		●	915.03	10/01/08	9.67	905.36
GW-765	GRIDE1		●	1008.54	10/06/08	20.05	988.49
GW-767	GRIDI2		●	948.54	10/01/08	13.33	935.21
GW-770	GRIDG3		●	944.72	10/06/08	15.73	928.99
GW-774	GRIDH2		●	963.16	10/06/08	17.46	945.70
GW-776	GRIDH3		●	931.25	10/06/08	17.29	913.96
GW-783	GRIDE3		●	948.49	10/08/08	11.45	937.04
GW-792	GRIDD2		●	992.74	10/07/08	26.43	966.31
GW-816	EXP-SR		●	898.42	10/07/08	13.29	885.13
GW-960	GRID F2		●	963.26	10/08/08	13.64	949.62

Notes:

- 1
 - B4 - Beta-4 Security Pits
 - B8110 - Building 81-10
 - B9201-2 - Building 9201-2
 - CPT - Coal Pile Trench
 - EXP - Exit Pathway (Maynardville Limestone) monitoring well
 - E, -I, or -J: Maynardville Limestone Picket
 - UV: Offsite in Union Valley
 - SR: Along Scarboro Road in the gap through Pine Ridge
 - 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, October 2008**

Well Number	Location ¹	Measuring Point ²	Date Measured	Depth to Water ³	Groundwater Elevation ⁴
1082	ORSF	837.28	10/07/08	25.80	811.48
1084	ORSF	965.40	10/07/08	63.82	901.58
1090	UNCS	1104.48	10/06/08	61.86	1042.62
GW-141	LIV	1186.23	10/08/08	102.23	1084.00
GW-142	KHQ	971.15	10/06/08	146.60	824.55
GW-144	KHQ	913.54	10/06/08	83.29	830.25
GW-145	KHQ	840.24	10/06/08	9.58	830.66
GW-156	CRSDB	1049.28	10/01/08	143.95	905.33
GW-159	CRSDB	1051.38	10/01/08	119.82	931.56
GW-160	CRBAWP	1093.09	10/01/08	152.05	941.04
GW-173	CRSP	1115.00	10/06/08	159.85	955.15
GW-174	CRSP	1116.66	10/06/08	130.90	985.76
GW-175	CRSP	1084.19	10/06/08	128.37	955.82
GW-176	CRSP	1125.30	10/06/08	116.47	1008.83
GW-177	CRSP	1158.20	10/06/08	121.11	1037.09
GW-178	CRSP	1143.49	10/06/08	99.80	1043.69
GW-179	CRSP	1128.00	10/06/08	116.35	1011.65
GW-180	CRSP	1104.14	10/06/08	137.99	966.15
GW-184	RQ	927.63	10/06/08	111.31	816.32
GW-186	RQ	831.32	10/06/08	15.51	815.81
GW-188	RQ	837.09	10/06/08	20.81	816.28
GW-203	UNCS	1105.45	10/06/08	90.21	1015.24
GW-205	UNCS	1104.14	10/06/08	87.15	1016.99
GW-217	LIV	1177.03	10/06/08	120.36	1056.67
GW-221	UNCS	1106.16	10/06/08	91.59	1014.57
GW-231	KHQ	849.67	10/06/08	19.06	830.61
GW-241	CRSDB	982.84	10/02/08	58.20	924.64
GW-292	ECRWP	1073.00	10/06/08	117.60	955.40
GW-298	CRBAWP	1049.01	10/01/08	111.78	937.23
GW-299	CRBAWP	1053.86	10/01/08	106.81	947.05
GW-300	CRBAWP	1073.12	10/01/08	122.68	950.44
GW-301	CRBAWP	1086.55	10/01/08	138.20	948.35
GW-302	UNCS	1141.84	10/06/08	108.29	1033.55
GW-303	CRSDB	1007.16	10/01/08	90.14	917.02
GW-304	CRSDB	1045.49	10/01/08	119.59	925.90
GW-305	LIV	1183.72	10/07/08	130.71	1053.01
GW-322	CRSP	1134.98	10/06/08	167.88	967.10
GW-339	UNCS	1124.83	10/06/08	82.32	1042.51

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	10/07/08	117.58	975.63
GW-512	FCAP	1001.54	10/07/08	35.12	966.42
GW-521	LIV	1182.88	10/07/08	92.45	1090.43
GW-522	LIV	1175.48	10/07/08	114.40	1061.08
GW-539	LII	1093.20	10/07/08	114.59	978.61
GW-541	CDLVI	1058.40	10/07/08	65.05	993.35
GW-542	CDLVI	1051.81	10/07/08	73.10	978.71
GW-543	CDLVI	1024.01	10/07/08	66.41	957.60
GW-544	CDLVI	1045.19	10/07/08	59.43	985.76
GW-557	LV	1081.36	10/02/08	126.94	954.42
GW-558	SSCR	981.42	10/07/08	54.81	926.61
GW-559	SSCR	1102.79	10/02/08	145.23	957.56
GW-560	CDLVII	949.05	10/02/08	56.55	892.50
GW-562	CDLVII	934.69	10/02/08	20.72	913.97
GW-564	CDLVII	938.07	10/02/08	15.12	922.95
GW-608	CRSP	1075.38	10/06/08	140.63	934.75
GW-609	CRSP	1112.31	10/06/08	171.52	940.79
GW-610	CRSP	1059.44	10/06/08	96.42	963.02
GW-611	CRSP	1048.38	10/07/08	110.20	938.18
GW-612	CRSP	1131.03	10/06/08	132.88	998.15
GW-674	FCAP	883.79	10/06/08	10.03	873.76
GW-676	FCAP	846.50	10/06/08	8.30	838.20
GW-677	FCAP	1030.40	10/07/08	35.07	995.33
GW-678	FCAP	1000.70	10/07/08	31.75	968.95
GW-679	FCAP	1026.90	10/07/08	61.76	965.14
GW-680	FCAP	1001.50	10/02/08	35.28	966.22
GW-709	LII	906.81	10/07/08	30.78	876.03
GW-731	CRSDB	1049.38	10/01/08	126.23	923.15
GW-732	CRSDB	1064.29	10/01/08	158.16	906.13
GW-743	CRSP	1100.36	10/07/08	141.82	958.54
GW-757	LII	961.64	10/07/08	85.72	875.92
GW-796	LV	1052.62	10/07/08	89.15	963.47
GW-797	LV	1060.00	10/07/08	80.75	979.25
GW-798	CDLVII	1006.00	10/02/08	90.47	915.53
GW-799	LV	981.29	10/02/08	28.25	953.04
GW-801	LV	1097.16	10/02/08	124.24	972.92
GW-827	CDLVI	1051.60	10/07/08	47.82	1003.78
GW-831	FCAP	1091.29	10/07/08	134.45	956.84

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 2008 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	
			NO3	U	Ethenes	Ethanes	Methanes	Petrol.	Alpha	Beta
GW-006	●		.	.	▼	▼	.	.	.	.
GW-008	●		NA	.	+	+	.	.	.	.
GW-014	●		.	.	▼	▼	.	.	.	.
GW-046	●		NA	.	○	○	○	○	.	.
GW-058		●	Q	Q	.	.	.	.	○	Q
GW-065		●	.	.	○	.	.	.	.	.
GW-068	●		.	.	+	○	.	+	.	.
GW-071	●		.	.	○	○	.	○	.	.
GW-077	●		NA	.	.	.	.	.	NA	NA
GW-078	●		NA	.	.	.	.	.	NA	NA
GW-079	●		NA	.	.	.	.	.	NA	NA
GW-080	●		NA	.	.	.	.	.	NA	NA
GW-082	●		.	.	○	○	.	○	.	.
GW-085	●		○	.	.	.	.	.	.	○
GW-089	●		.	.	.	.	.	.	.	.
GW-098	●		.	.	○, ▼	.	.	.	.	.
GW-122		●	▼	.	.	.	.	.	.	.
GW-225		●	▼	.	○	.	.	.	.	.
GW-226		●	○	.	○	.	○	.	.	.
GW-227		●	.	▼	○	.	.	.	○	.
GW-229		●	.	+	+	○	.	○	+	+
GW-246	●		○	○	+	.	+	.	○	○
GW-257	●		.	.	○	.	.	.	.	.
GW-259	●		.	.	○	.	.	.	.	.
GW-276	●		▼	▼	▼	.	.	.	▼	▼
GW-289	●		.	.	○	.	.	.	.	.
GW-306		●	.	.	▼	.	.	.	.	.
GW-309		●	.	.	.	.	.	.	.	.
GW-310		●	.	.	▼	.	.	.	.	.
GW-312		●	.	.	○	.	.	.	.	.
GW-314		●	.	.	○	.	.	.	.	.
GW-315		●	.	.	▼	.	.	.	.	.
GW-363	●		NA	.	.	NA	.	.	NA	NA
GW-365		●	.	.	▼, ○	▼, ○	.	.	.	.
GW-367		●	.	.	▼	.	.	.	.	.
GW-369		●	.	.	▼	.	.	.	.	.
GW-531	●		.	.	.	.	.	.	.	.
GW-537	●		○	.	.	.	.	.	.	○
GW-615	●		○	+	.	.	.	.	.	○

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	
			NO3	U	Ethenes	Ethanes	Methanes	Petrol.	Alpha	Beta
GW-616	●		○	.	.	.	.	.	.	.
GW-623	●				○	○	○	○		
GW-626	●		.	.	+	+	+	+	.	.
GW-627	●		.	.	+	+	.	.	.	.
GW-629	●		.	.	+	+	.	+	.	.
GW-639	●		NA	.	.	NA	.	.	NA	NA
GW-648		●	.	.	Q	.	.	.	.	.
GW-653	●		.	.	○	.	.	.	.	.
GW-683		●	.	NA	.	.	.	.	.	.
GW-684		●	.	NA	.	.	.	.	.	.
GW-694		●	.	▼	.	.	.	.	▼	.
GW-703		●	○	.	▼	.	.	.	.	.
GW-704		●	▼	.	▼	.	.	.	.	.
GW-706		●	▼	▼	○	.	.	.	○	.
GW-712		●	.	.	.	.	.	.	.	.
GW-713		●	.	.	.	.	.	.	.	.
GW-714		●	.	.	.	.	.	.	.	.
GW-724		●	▼	.	○	.	.	.	.	.
GW-725		●	○	.	○	.	.	.	.	.
GW-738		●	▼	.	▼	.	.	.	.	.
GW-740		●	.	.	▼	.	.	.	.	.
GW-829	●		▼	.	.	.	.	.	.	.
GW-916	●		NA	.	.	NA	.	.	NA	NA
GW-917	●		NA	.	.	NA	.	.	NA	NA
GW-918	●		NA	.	.	NA	.	.	NA	NA
GW-920	●		NA	.	.	NA	.	.	NA	NA
GW-921	●		NA	.	.	NA	.	.	NA	NA
GW-922	●		NA	.	.	NA	.	.	NA	NA
GW-923	●		NA	.	.	NA	.	.	NA	NA
GW-924	●		NA	.	.	NA	.	.	NA	NA
GW-925	●		NA	.	.	NA	.	.	NA	NA
GW-926	●		NA	.	.	NA	.	.	NA	NA
GW-927	●		NA	.	.	NA	.	.	NA	NA
BCK-04.55	.	.	.	.	.	.	.	.	.	.
BCK-09.40	.	.	.	○	NA	NA	NA	NA	NA	NA
BCK-11.97	.	.	○	○	NA	NA	NA	NA	NA	NA
EMWNT-03A	.	.	NA	.	.	.	.	.	.	.
EMWNT-05	.	.	NA	.	.	.	.	.	.	.
EMW-VWEIR	.	.	NA	.	.	.	.	.	NA	NA
EMW-VWUND	.	.	NA	.	.	NA	.	.	NA	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	
			NO3	U	Ethenes	Ethanes	Methanes	Petrol.	Alpha	Beta
NT-01	.	.	○	○	○	.	.	.	.	○
NT-04	.	.	NA	.	○	NA	.	.	NA	NA
NT-07	.	.	.	.	▼	▼	.	.	NA	NA
NT-08	.	.	.	▼	▼	▼	.	.	NA	NA
SS-4	.	.	○	○	○	.	.	.	○	○
SS-5	.	.	.	.	.	.	.	.	○	○
SS-6	.	.	.	.	.	.	.	.	.	.

Notes:

- The exit pathway/perimeter monitoring locations are in bold typeface.
- Hydrostratigraphic Unit
 - AQF - Monitored interval in the formations comprising the aquifer
 - AQT - Monitoring interval in the formations comprising the aquitard
- Trend types were interpreted from data tables or plots of concentration changes over time.
 - .
 - NA - Not analyzed
 - Q - Results inconsistent with 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.
- CY 2008 nitrate (NO3) concentration greater than or equal to 10 mg/L.
Total uranium (U) concentration greater than or equal to 0.03 mg/L.
- Summed CY 2008 concentration of a VOC group (see below) greater than or equal to 5 µg/L.
 - Ethenes = Summed chloroethenes (PCE, TCE, 12DCE, 11DCE, 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)
- Maximum CY 2008 gross alpha activity greater than or equal to 15 pCi/L.
Maximum CY 2008 gross beta activity greater than or equal to 50 pCi/L.

Table B.10 Concentration trends for the principal contaminants detected at CY 2008 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	
			NO3	U	Ethenes	Ethanes	Methanes	Petrol.	Alpha	Beta
55-1A	●		.	.	.	.	.	.	.	.
55-2A	●		○	.	▼	▼	.	.	.	.
55-2B	●		+	.	▼	▼	.	.	.	.
55-2C	●		+	.	▼	▼	.	.	.	.
55-3A	●		.	.	○	.	.	.	.	.
55-3B	●		.	.	○	○	.	.	.	Q
55-3C	●		.	.	○	○	.	.	.	.
55-6A	●		.	.	.	.	.	.	.	.
56-1A	●		.	.	.	.	.	.	.	.
56-1C	●		.	.	.	.	.	.	.	.
56-2A	●		.	.	▼	.	.	.	.	.
56-2B	●		.	.	○	.	.	.	.	.
56-2C	●		.	.	▼,○	.	.	.	.	.
56-3A	●		.	.	○	.	+	.	.	.
56-3B	●		.	.	○	.	+	.	.	.
56-3C	●		.	.	○	.	+	.	.	.
56-4A	●		.	.	.	.	.	.	.	.
56-6A	●		.	.	.	.	.	.	.	.
60-1A		●	.	.	.	.	.	.	.	.
GW-105	●		▼	.	.	.	.	.	.	.
GW-106	●		○	.	.	.	.	.	.	.
GW-108	●		▼	.	○	.	○	.	○	+
GW-109	●		○	.	▼	.	▼	.	.	○
GW-148		●	.	.	+	.	.	.	.	.
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-190	●		.	.	.	.	.	.	.	.
GW-192	●		.	.	○	.	.	.	.	.
GW-193		●	NA	NA	NA	NA	NA	NA	NA	NA
GW-204	●		.	○	.	.	.	.	○	.
GW-220		●	.	.	+	.	+	.	.	.
GW-223		●	.	+	+,▼	.	.	.	.	.
GW-230		●	NA	NA	▼	.	.	.	NA	NA
GW-240		●	.	.	.	.	▼	.	.	.

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	
			NO3	U	Ethenes	Ethanes	Methanes	Petrol.	Alpha	Beta
GW-251		●	▼	.	○	.	○	.	.	.
GW-253		●	○	.	○	.	○	.	▼	.
GW-265	●		.	.	▼	.	.	.	.	.
GW-269	●		.	.	+	○	.	.	.	.
GW-274	●		▼	.	+	.	+	+	.	○
GW-275	●		○	.	.	.	.	.	.	.
GW-281	●		NA	NA	.	.	.	.	NA	NA
GW-332	●		.	.	▼	▼	.	.	.	.
GW-336	●		.	.	▼	▼	.	.	.	.
GW-337	●		.	.	▼	▼	.	.	.	.
GW-380		●	.	.	.	.	.	.	.	.
GW-381		●	.	.	.	.	.	.	.	.
GW-382		●	.	.	▼	.	▼	.	.	.
GW-383	●		.	.	○, +	.	.	.	.	.
GW-508	●		.	.	.	.	.	▼	.	.
GW-605		●	.	○	+	.	+	.	○	.
GW-606		●	+	.	○	.	▼	.	.	.
GW-617		●	.	.	.	.	.	.	.	.
GW-618		●	.	.	▼	.	.	.	.	.
GW-619		●	.	.	▼	.	.	.	.	.
GW-620		●	.	.	.	.	.	.	.	.
GW-633	●		▼	.	○, +	.	○	○, +	.	▼
GW-656	●		.	.	▼	▼	.	.	.	.
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-744	●		.	.	.	.	.	.	.	.
GW-747	●		.	.	.	.	.	.	.	.
GW-748	●		.	.	.	.	.	.	.	.

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	
			NO3	U	Ethenes	Ethanes	Methanes	Petrol.	Alpha	Beta
GW-762	●		.	.	+,○	○	.	.	.	.
GW-763	●		.	.	.	.	.	.	.	.
GW-769	●		.	.	+	.	+	.	.	.
GW-770	●		.	.	.	.	+	.	.	.
GW-781	●		.	.	.	.	.	.	.	.
GW-782	●		.	.	○	○	.	.	○	.
GW-783	●		.	.	▼	○	.	.	.	.
GW-791	●		.	.	▼	.	.	.	.	.
GW-792	●		.	.	▼	.	.	.	.	.
GW-802	●		NA	NA	.	.	.	.	NA	NA
GW-816	●		.	.	.	.	.	.	.	.
GW-820		●	.	.	○	.	.	.	.	.
GW-832		●	.	.	○	.	▼	.	.	.
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
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.

+

4 CY 2008 nitrate (NO3) concentration greater than or equal to 10 mg/L.
Total uranium (U) concentration greater than or equal to 0.03 mg/L.

Table B.10 (continued)

Notes (continued):

- 5 Summed CY 2008 concentration of a solvent group (see below) greater than or equal to 5 µg/L.

Ethenes = Summed chloroethenes (PCE, TCE, 12DCE, 11DCE, 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)

Note that individual compounds have different long-term concentration trends at wells 56-2C, GW-223, GW-383, GW-633, and GW-762.

- 6 Maximum CY 2008 gross alpha activity greater than or equal to 15 pCi/L.
Maximum CY 2008 gross beta activity greater than or equal to 50 pCi/L.

Table B.11 Concentration trends for contaminants detected at CY 2008 sampling locations in the Chestnut Ridge Hydrogeologic Regime

Sampling Location ¹	Contaminant Type and Long-Term Trend ² (○ = indeterminate, + = increasing, ▼ = decreasing)					
	VOCs ³				Radioactivity ⁴	
	Ethenes	Ethanes	Methanes	Freons	Alpha	Beta
1090	NA	NA	NA	NA	.	.
GW-141	.	.	.	.	.	.
GW-143	.	.	.	NA	.	.
GW-144	.	.	.	NA	.	.
GW-145	.	.	.	NA	.	.
GW-156	NA	NA	NA	NA	NA	NA
GW-159	NA	NA	NA	NA	NA	NA
GW-161	.	.	.	NA	.	.
GW-173	▼	.	.	○	.	.
GW-175	▼	.	.	○	.	.
GW-177	○	▼, +	.	NA	.	.
GW-178	○	▼, ○	.	.	.	.
GW-203	NA	NA	NA	NA	.	.
GW-205	NA	NA	NA	NA	.	○
GW-217	.	.	.	.	.	.
GW-221	NA	NA	NA	NA	.	.
GW-231	.	.	.	NA	.	.
GW-294	.	.	.	NA	.	.
GW-296	.	.	.	NA	.	.
GW-298	.	.	.	NA	.	.
GW-301	.	.	.	NA	NA	NA
GW-305	○	+ , ○	.	.	.	.
GW-322	▼, ○	▼, ○	.	○	.	.
GW-514	.	.	.	.	.	.
GW-521	.	.	.	.	.	.
GW-522	.	.	.	.	.	.
GW-540	.	.	.	.	.	.
GW-557	.	.	.	.	.	.
GW-560	.	.	.	.	.	.
GW-562	.	.	.	.	.	.
GW-564	.	.	.	.	.	.
GW-608	.	.	.	.	.	.
GW-609	.	.	.	.	.	.
GW-612	▼	▼	.	.	.	.
GW-709	.	.	.	.	.	.
GW-731	NA	NA	NA	NA	NA	NA
GW-732	NA	NA	NA	NA	NA	NA
GW-757	.	.	.	.	.	.

Table B.11 (continued)

Sampling Location ¹	Contaminant Type and Long-Term Trend ² (○ = indeterminate, + = increasing, ▼ = decreasing)					
	VOCs ³				Radioactivity ⁴	
	Ethenes	Ethanes	Methanes	Freons	Alpha	Beta
GW-796	○	▼	.	.	.	.
GW-797	.	.	.	.	.	.
GW-798	○	○	.	○	.	.
GW-799	.	.	.	.	.	.
GW-801	.	.	.	.	.	.
GW-831	.	.	.	NA	NA	NA
MCK 2.0	NA	NA	NA	NA	.	.
MCK 2.05	NA	NA	NA	NA	.	.
S17	.	.	.	.	.	.
SCR1.25SP	.	.	.	NA	.	.
SCR1.5SW	.	.	.	.	.	.
SCR2.1SP	.	.	.	.	.	.
SCR2.2SP	.	.	.	.	.	.
SCR3.5SP	.	.	.	NA	.	.
SCR3.5SW	.	.	.	.	.	.
SCR4.3SP	.	.	.	.	.	.
UNC SW-1	NA	NA	NA	NA	.	.

Notes:

- The exit pathway/perimeter monitoring locations are in bold typeface.
- Trend types were interpreted from data tables or plots of concentration changes over time.
 - .
 - NA - Not analyzed
 - - Indeterminate trend: fairly stable trend or insufficient data.
 - ▼ - Generally decreasing trend.
 - +
 - Generally increasing trend.
- Summed CY 2008 concentration of a solvent group (see below) greater than 0 µg/L (excluding trace levels of common laboratory reagents or suspected artifacts).

Ethenes = Summed chloroethenes (PCE, TCE, 12DCE, 11DCE, 11DCE, vinyl chloride)
 Ethanes = Summed chloroethanes (111TCA, 11DCA, chloroethane)
 Methanes = Summed chloromethanes (carbon tetrachloride, chloroform, methylene chloride)
 Freons = Summed chlorofluorocarbons (1,1,2-trichloro-1,2,2-trifluoroethane and trichlorofluoromethane)

Note that individual compounds have different long-term concentration trends at wells GW-177, GW-178, GW-305, and GW-322.
- Maximum CY 2008 gross alpha activity greater than or equal to 15 pCi/L.
Maximum CY 2008 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:

- B4 - Beta-4 Security Pits
- B8110 - Building 81-10
- B9103 - Building 9103
- 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)
- FTF - Fire Training Facility
- 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
- 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), top of Well Wizard™ (TOWW), or the ground surface (GS)
- Elevation - Feet above mean sea level (rounded to nearest 0.01 ft)
- Tag Depth - Depth to the bottom of the well (feet below the TOC), taken from the CY 2003 comprehensive well inspection program
- . - 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
- Crg - Rogersville Shale
- Cr - Rome 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, schedule 304
- STL - Carbon steel
- STL/gal - 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).

APPENDIX C: MONITORING WELL CONSTRUCTION DETAILS, CY 2008

Well Number Hydrogeologic Regime Functional Area	1090 CR UNCS	55-1A EF GRIDB2	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	55-6A EF B9103	56-1A EF Y12
General Information										
Date Installed	1982	09/09/83	08/08/83	1983	08/22/83	1983	1983	1983	1983	1983
Total Depth Drilled	96.7	19.3	14.1	27.6	75.9	14.3	38.1	77.5	12.9	19.0
East Coordinate	53,853	55,014	55,195	55,199	55,203	55,695	55,699	55,703	55,907	56,079
North Coordinate	28,718	30,470	30,085	30,085	30,085	29,959	29,959	29,959	30,667	30,351
Measuring Point	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW
Measuring Point Elevation	1,104.48	986.91	976.74	977.42	977.02	972.46	973.32	974.34	989.29	969.25
Ground Surface Elevation	1,101.58	986.20	976.17	976.17	976.07	971.59	971.57	971.76	986.82	968.72
Tag Depth-(TOC)	98.02	19.22	13.98	27.69	76.00	14.25	37.98	77.43	12.77	18.95
Geologic Information										
Hydrostratigraphic Unit	AQF	AQT	AQT	AQT	AQT	AQT	AQT	AQT	AQT	AQT
Geologic Formation	OCK	Cn	Cn	Cn	Cn	Cn	Cn	Cn	Cm	Cn
Aquifer Zone	WT	WT	WT	WT	BDR	WT	WT	BDR	WT	WT
Weathered Rock-Depth	.	5.0	11.5	10.0	14.5	7.0	5.0	7.0	.	2.0
Fresh Rock-Depth	.	.	.	.	47.2	.	.	.	.	.
Conductor Casing										
Casing Depth	.	.	.	.	15.5	.	.	.	.	.
Outside Diameter	.	.	.	.	4.5	.	.	.	.	.
Inside Diameter	.	.	.	.	.	.	.	.	.	.
Casing Material	.	.	.	.	STL	.	.	.	.	.
Well Casing										
Borehole Depth	96.7	19.3	14.1	27.6	75.9	14.3	38.1	77.5	12.9	19.0
Borehole Diameter	8	6	6	6	6	6	6	6	6	6
Casing Depth	.	14.3	9.1	22.6	70.9	9.3	33.1	72.5	7.9	14.0
Outside Diameter	6.5	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	PVC40	PVC40	PVC40	PVC40	PVC40
Monitored Interval										
Top-Depth	.	11.3	6.1	19.6	67.9	6.3	30.1	69.5	4.9	11.0
Midpoint-Depth	.	15.3	10.1	23.6	71.9	10.3	34.1	73.5	8.9	15.0
Pump Intake-Depth	84.80	16.30	11.43	25.00	73.30	12.13	33.75	72.42	977.29	15.97
Bottom of Screen-Depth	.	19.3	14.1	27.6	75.9	14.3	38.1	77.5	12.9	19.0
Bottom-Depth	96.7	19.3	14.1	27.6	75.9	14.3	38.1	77.5	12.9	19.0
Top-Elevation	.	974.90	970.07	956.57	908.17	965.29	941.47	902.26	981.92	957.72
Midpoint-Elevation	.	970.90	966.07	952.57	904.17	961.29	937.47	898.26	977.92	953.72
Pump Intake-Elevation	1016.78	969.91	964.74	951.22	902.82	959.46	937.82	899.34	9.53	952.75
Bottom-Elevation	1,004.88	966.90	962.07	948.57	900.17	957.29	933.47	894.26	973.92	949.72
Screen Length	.	5	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	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 2008

Well Number Hydrogeologic Regime Functional Area	56-1C EF Y12	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	56-6A EF Y12	60-1A EF Y12
General Information										
Date Installed	08/25/83	1983	1983	08/18/83	1983	1983	08/02/83	1983	1983	08/12/83
Total Depth Drilled	75.3	15.1	38.8	77.3	17.8	33.4	55.5	12.1	21.0	23.2
East Coordinate	56,077	56,229	56,226	56,231	56,453	56,478	56,449	56,802	56,915	60,200
North Coordinate	30,355	29,881	29,884	29,885	29,867	29,866	29,859	29,820	29,783	29,226
Measuring Point	TOC	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW
Measuring Point Elevation	969.49	963.53	962.45	965.11	963.03	964.33	962.86	962.07	960.28	929.66
Ground Surface Elevation	968.89	962.52	962.21	962.44	962.35	962.74	962.36	960.10	958.12	929.29
Tag Depth-(TOC)	73.45	15.03	38.63	77.03	17.92	30.85	55.35	12.60	20.97	23.10
Geologic Information										
Hydrostratigraphic Unit	AQT	AQT	AQT	AQT	AQT	AQT	AQT	AQT	AQT	AQF
Geologic Formation	Cn	Cn	Cn	Cn	Cn	Cn	Cn	Cn	Cn	Cmn
Aquifer Zone	BDR	WT	WT	BDR	WT	WT	BDR	WT	WT	WT
Weathered Rock-Depth	6.0	.	.	11.5	3.5	.	8.0	8.5	.	.
Fresh Rock-Depth	10.0	.	.	17.0	.	.	.	.	.	.
Conductor Casing										
Casing Depth	7.0	.	.	11.5	.	.	.	.	.	.
Outside Diameter	4.5	.	.	4.5	.	.	.	.	.	.
Inside Diameter	.	.	.	.	.	.	.	.	.	.
Casing Material	STL	.	.	STL	.	.	.	.	.	.
Well Casing										
Borehole Depth	75.3	15.1	38.8	77.3	17.8	33.4	55.5	12.1	21.0	23.2
Borehole Diameter	6	6	6	6	6	6	6	6	6	6
Casing Depth	70.3	10.1	33.8	72.3	12.8	28.4	50.5	7.1	16.0	18.2
Outside Diameter	4.5	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	4
Casing Material	PVC40	PVC40	PVC40	PVC40	PVC40	PVC40	PVC40	PVC40	PVC40	PVC40
Monitored Interval										
Top-Depth	67.3	7.1	30.8	69.3	9.8	25.4	47.5	4.1	13.0	15.2
Midpoint-Depth	71.3	11.1	34.8	73.3	13.8	29.4	51.5	8.1	17.0	19.2
Pump Intake-Depth	.	12.00	35.80	72.30	14.82	26.91	52.00	9.53	16.34	20.13
Bottom of Screen-Depth	75.3	15.1	38.8	77.3	17.8	33.4	55.5	12.1	21.0	23.2
Bottom-Depth	75.3	15.1	38.8	77.3	17.8	33.4	55.5	12.1	21.0	23.2
Top-Elevation	901.59	955.42	931.41	893.14	952.55	937.34	914.86	956.00	945.12	914.09
Midpoint-Elevation	897.59	951.42	927.41	889.14	948.55	933.34	910.86	952.00	941.12	910.09
Pump Intake-Elevation	.	950.53	926.45	890.11	947.53	935.83	910.36	950.57	941.78	909.16
Bottom-Elevation	893.59	947.42	923.41	885.14	944.55	929.34	906.86	948.00	937.12	906.09
Screen Length	5	5	5	5	5	5	5	5	5	5
Screen Material	SS/sw	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	0.01
Open-Hole Length	.	.	.	.	.	.	.	.	.	.
Open-Hole Diameter	.	.	.	.	.	.	.	.	.	.

APPENDIX C: MONITORING WELL CONSTRUCTION DETAILS, CY 2008

Well Number Hydrogeologic Regime Functional Area	GW-006 BC OLF	GW-008 BC OLF	GW-014 BC BG	GW-046 BC BG	GW-058 BC BG	GW-065 BC OLF	GW-068 BC BG	GW-071 BC BG	GW-077 BC BG	GW-078 BC BG
General Information										
Date Installed	09/17/83	09/21/83	09/29/83	10/27/83	03/06/84	03/14/84	03/22/84	03/25/84	03/29/84	03/30/84
Total Depth Drilled	46.8	25.5	13.2	20.5	45.2	35.0	85.0	220.6	100.5	21.1
East Coordinate	47,988	47,596	44,308	43,284	43,211	49,167	43,377	44,191	41,234	41,209
North Coordinate	29,818	29,783	29,848	29,562	28,714	29,185	29,500	29,495	29,729	29,730
Measuring Point	TOWW	TOWW	TOWW	TOWW	TOC	TOC	TOWW	TOWW	TOWW	TOWW
Measuring Point Elevation	963.33	965.39	934.50	921.17	913.30	982.50	924.61	928.90	919.30	918.10
Ground Surface Elevation	959.90	962.11	931.50	918.13	910.00	979.70	921.20	925.40	914.70	914.50
Tag Depth-(TOC)	51.08	26.69	14.50	23.85	48.90	36.89	86.10	218.40	104.10	23.40
Geologic Information										
Hydrostratigraphic Unit	AQT	AQT	AQT	AQT	AQF	AQF	AQT	AQT	AQT	AQT
Geologic Formation	Cn	Cn	Cn	Cn	Cmn	Cmn	Cn	Cn	Cn	Cn
Aquifer Zone	WT	WT	WT	WT	BDR	WT	BDR	BDR	BDR	BDR
Weathered Rock-Depth	6.5	0.6	4.0	7.7	.	.	.	5.5	7.0	6.5
Fresh Rock-Depth	16.5	.	.	.	20.8	30.1	25.0	16.0	13.0	8.5
Conductor Casing										
Casing Depth	.	.	.	.	.	.	.	16.0	35.0	.
Outside Diameter	.	.	.	.	.	.	.	10.63	4.5	.
Inside Diameter	.	.	.	.	.	.	.	10	4	.
Casing Material	.	.	.	.	.	.	.	PVC40	STL	.
Well Casing										
Borehole Depth	46.8	25.5	13.2	20.5	45.2	35.0	85.0	220.6	100.5	21.1
Borehole Diameter	4.5	4.5	6	6	4	4	8.75	8.75	3.88	6.5
Casing Depth	37.3	15.7	10.0	8.1	42.2	29.0	71.9	198.4	90.3	16.1
Outside Diameter	2.37	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	2
Casing Material	SS304	SS304	SS304	SS304	SS304	SS304	SS304	SS304	SS304	SS304
Monitored Interval										
Top-Depth	15.3	13.0	5.0	5.0	38.8	24.5	70.0	195.1	87.4	11.7
Midpoint-Depth	31.1	19.3	9.1	12.7	41.5	29.3	76.8	207.1	93.9	16.4
Pump Intake-Depth	.	17.70	9.00	12.00	43.70	.	77.59	208.50	.	.
Bottom of Screen-Depth	42.3	20.7	12.0	18.1	44.2	34.0	82.1	219.0	100.3	21.1
Bottom-Depth	46.8	25.5	13.2	20.3	44.2	34.0	83.6	219.0	100.3	21.1
Top-Elevation	944.60	949.11	926.50	913.13	871.20	955.20	851.20	730.30	827.30	902.80
Midpoint-Elevation	928.85	942.86	922.40	905.48	868.50	950.45	844.40	718.35	820.85	898.10
Pump Intake-Elevation	.	944.39	922.50	906.17	866.30	.	843.61	716.90	.	.
Bottom-Elevation	913.10	936.61	918.30	897.83	865.80	945.70	837.60	706.40	814.40	893.40
Screen Length	5	5	2	10	2	5	10.2	20.6	10	5
Screen Material	SS/sw	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	0.01
Open-Hole Length	.	.	.	.	.	.	.	.	.	.
Open-Hole Diameter	.	.	.	.	.	.	.	.	.	.

APPENDIX C: MONITORING WELL CONSTRUCTION DETAILS, CY 2008

Well Number Hydrogeologic Regime Functional Area	GW-079 BC BG	GW-080 BC BG	GW-082 BC BG	GW-085 BC OLF	GW-089 BC BG	GW-098 BC OLF	GW-105 EF S3	GW-106 EF S3	GW-108 EF S3	GW-109 EF S3
General Information										
Date Installed	03/23/84	03/24/84	03/17/84	03/22/84	1984	09/21/84	09/18/84	09/26/84	09/26/84	09/27/84
Total Depth Drilled	65.0	30.0	35.0	62.0	25.0	104.0	17.0	75.0	58.6	147.6
East Coordinate	41,616	41,621	42,090	49,058	43,406	46,959	52,833	52,843	53,207	53,207
North Coordinate	30,630	30,622	30,434	30,003	30,924	29,452	30,417	30,418	30,070	30,056
Measuring Point	TOWW	TOWW	TOWW	TOWW	TOC	TOWW	TOWW	TOWW	TOWW	TOWW
Measuring Point Elevation	981.20	981.00	964.00	983.57	964.36	945.95	1,018.20	1,016.92	999.00	997.82
Ground Surface Elevation	977.20	977.10	960.52	979.80	962.48	942.40	1,014.30	1,014.50	995.80	995.30
Tag Depth-(TOC)	64.70	33.00	38.45	62.34	27.97	105.65	19.40	74.10	58.30	125.45
Geologic Information										
Hydrostratigraphic Unit	AQT	AQT	AQT	AQT	AQT	AQT	AQT	AQT	AQT	AQT
Geologic Formation	Crg	Crg	Cm	Cn	Crt	Cn	Cn	Cn	Cn	Cn
Aquifer Zone	BDR	WT	BDR	BDR	WT	BDR	WT	BDR	BDR	BDR
Weathered Rock-Depth	4.0	3.5	7.0	2.0	.	1.0	10.0	12.5	4.0	5.0
Fresh Rock-Depth	26.5	23.5	23.0	40.0	.	7.5	.	.	.	16.0
Conductor Casing										
Casing Depth	.	.	25.0	.	.	20.0	2.5	20.0	20.7	20.0
Outside Diameter	.	.	6.5	.	.	10.63	7	10.63	10.63	10.63
Inside Diameter	.	.	.	.	.	10	.	10	10	10
Casing Material	.	.	STL	.	.	PVC40	S/gal	PVC40	PVC40	PVC40
Well Casing										
Borehole Depth	65.0	30.0	35.0	62.0	25.0	104.0	17.0	75.0	58.6	147.6
Borehole Diameter	6.5	6.5	4	4	6.5	9	6.5	9	9	9
Casing Depth	59.9	24.7	29.4	53.8	23.0	82.4	12.1	61.9	46.7	102.9
Outside Diameter	2.37	2.37	2.37	2.37	2.37	4.5	2.37	4.5	4.5	4.5
Inside Diameter	2	2	2	2	.	4	2	4	4	4
Casing Material	SS304	SS304	SS304	SS304	SS304	SS304	PVC	PVC	PVC40	PVC40
Monitored Interval										
Top-Depth	49.9	20.8	24.1	48.4	20.0	76.6	9.5	53.3	41.0	96.6
Midpoint-Depth	57.4	25.3	29.3	53.6	22.5	90.3	13.3	64.2	49.8	112.6
Pump Intake-Depth	61.80	.	31.50	51.20	.	96.40	14.60	67.58	49.80	113.50
Bottom of Screen-Depth	64.9	29.7	34.4	58.8	25.0	103.4	16.1	70.9	55.7	121.9
Bottom-Depth	64.9	29.7	34.4	58.8	25.0	104.0	17.0	75.0	58.6	128.5
Top-Elevation	927.30	956.30	936.42	931.40	942.48	865.80	1,004.80	961.20	954.80	898.70
Midpoint-Elevation	919.80	951.85	931.27	926.20	939.98	852.10	1,001.05	950.35	946.00	882.75
Pump Intake-Elevation	915.40	.	929.00	928.57	.	845.95	999.70	946.92	946.00	881.82
Bottom-Elevation	912.30	947.40	926.12	921.00	937.48	838.40	997.30	939.50	937.20	866.80
Screen Length	5	5	5	5	2	21	4	9	9	19
Screen Material	SS/sw	SS/sw	SS/sw	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	0.01	0.01	0.01
Open-Hole Length	.	.	.	.	.	.	.	.	.	.
Open-Hole Diameter	.	.	.	.	.	.	.	.	.	.

APPENDIX C: MONITORING WELL CONSTRUCTION DETAILS, CY 2008

Well Number Hydrogeologic Regime Functional Area	GW-122 BC S3	GW-141 CR LIV	GW-143 CR KHQ	GW-144 CR KHQ	GW-145 CR KHQ	GW-148 EF NHP	GW-151 EF NHP	GW-153 EF NHP	GW-154 EF NHP	GW-156 CR CRSDB
General Information										
Date Installed	07/25/85	09/04/87	10/24/85	10/24/85	10/14/85	07/30/85	08/14/85	10/31/85	07/30/85	10/18/85
Total Depth Drilled	142.0	156.0	253.0	195.0	110.0	11.1	96.5	60.0	11.2	157.6
East Coordinate	51,807	52,463	63,522	63,502	63,266	63,817	64,232	63,728	63,346	64,020
North Coordinate	29,741	28,755	24,257	24,255	24,441	29,202	28,958	28,613	28,987	27,626
Measuring Point	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW
Measuring Point Elevation	1,007.20	1,186.23	913.98	913.54	840.24	907.76	916.17	921.68	911.70	1,049.28
Ground Surface Elevation	1,004.15	1,183.45	911.04	910.48	837.29	904.53	913.06	918.53	908.60	1,046.94
Tag Depth-(TOC)	145.28	158.81	252.70	194.34	113.49	13.93	99.63	60.84	13.35	157.65
Geologic Information										
Hydrostratigraphic Unit	AQF	AQF	AQF	AQF	AQF	AQF	AQF	AQF	AQF	AQF
Geologic Formation	Cmn	OCK	OCK	OCK	OCK	Cmn	Cmn	Cmn	Cmn	OCK
Aquifer Zone	BDR	BDR	BDR	BDR	BDR	WT	BDR	BDR	WT	BDR
Weathered Rock-Depth	.	.	.	.	.	11.1	.	.	11.2	84.0
Fresh Rock-Depth	37.0	57.0	18.0	40.0	12.0	.	12.0	14.0	.	93.0
Conductor Casing										
Casing Depth	39.0	65.0	20.0	40.0	12.0	.	12.0	29.0	.	94.0
Outside Diameter	10.75	10.75	10.63	12.5	12.5	.	12.5	10.63	.	10.75
Inside Diameter	10	10	9.87	11.75	11.75	.	11.75	9.88	.	10
Casing Material	SF25	SF25	PVC40	PVC40	PVC40	.	PVC40	PVC40	.	SF25
Well Casing										
Borehole Depth	92.0	156.0	205.0	195.0	110.0	11.1	96.5	60.0	11.2	157.0
Borehole Diameter	9.79	10	10	11	11	8	11	11	8	8.5
Casing Depth	92.0	144.5	205.0	150.0	88.5	5.6	86.0	49.5	5.7	147.0
Outside Diameter	4.5	4.5	6.62	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Inside Diameter	4	4	6.12	4	4	4	4	4	4	4
Casing Material	SF25	SS304	SF25	PVC40	PVC40	PVC40	PVC40	PVC40	PVC40	PVC40
Monitored Interval										
Top-Depth	92.0	141.0	205.0	148.0	86.0	4.6	85.0	45.0	4.7	145.0
Midpoint-Depth	117.0	148.5	229.0	171.5	98.0	7.9	90.8	52.5	8.0	151.3
Pump Intake-Depth	131.90	147.70	226.10	170.90	100.00	7.80	90.80	52.90	8.40	150.70
Bottom of Screen-Depth	.	155.2	.	190.0	108.5	10.6	96.0	59.5	10.7	157.0
Bottom-Depth	142.0	156.0	253.0	195.0	110.0	11.1	96.5	60.0	11.2	157.6
Top-Elevation	912.15	1,042.45	706.04	762.48	751.29	899.93	828.06	873.53	903.90	901.94
Midpoint-Elevation	887.15	1,034.95	682.04	738.98	739.29	896.68	822.31	866.03	900.65	895.64
Pump Intake-Elevation	872.20	1035.73	684.98	739.54	737.24	896.76	822.27	865.68	900.20	896.28
Bottom-Elevation	862.15	1,027.45	658.04	715.48	727.29	893.43	816.56	858.53	897.40	889.34
Screen Length	.	10.7	.	40	20	5	10	10	5	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	50	.	48	.	.	.	.	.	.	.
Open-Hole Diameter	4	.	6	.	.	.	.	.	.	.

APPENDIX C: MONITORING WELL CONSTRUCTION DETAILS, CY 2008

Well Number Hydrogeologic Regime Functional Area	GW-159 CR CRSDB	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-173 CR CRSP	GW-175 CR CRSP	GW-177 CR CRSP	GW-178 CR CRSP
General Information										
Date Installed	10/18/85	07/07/87	09/16/86	04/01/86	02/26/86	05/05/86	08/15/85	06/22/88	10/24/85	08/20/87
Total Depth Drilled	157.0	400.0	34.8	156.9	31.2	133.9	165.0	166.7	145.0	133.0
East Coordinate	63,496	62,146	66,854	66,843	69,654	69,579	59,472	58,686	57,497	57,808
North Coordinate	27,764	27,805	28,545	28,545	28,403	28,358	28,271	28,677	28,483	28,552
Measuring Point	TOWW	TOC	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW
Measuring Point Elevation	1,051.38	1,093.54	932.12	932.64	920.72	926.69	1,115.00	1,084.19	1,158.20	1,143.49
Ground Surface Elevation	1,048.79	1,090.91	929.95	930.70	918.55	922.85	1,112.97	1,081.89	1,155.52	1,141.06
Tag Depth-(TOC)	155.87	402.88	36.23	156.16	32.64	137.50	167.34	169.49	150.69	134.68
Geologic Information										
Hydrostratigraphic Unit	AQF	AQF	AQF	AQF	AQF	AQF	AQF	AQF	AQF	AQF
Geologic Formation	OCK	OCK	Cmn	Cmn	Cmn	Cmn	OCK	OCK	OCK	OCK
Aquifer Zone	BDR	BDR	WT	BDR	WT	BDR	BDR	BDR	BDR	BDR
Weathered Rock-Depth	.	65.0	.	.	.	15.0	73.0	46.0	62.0	37.0
Fresh Rock-Depth	100.0	95.5	.	30.0	.	19.0	105.0	98.5	98.0	95.0
Conductor Casing										
Casing Depth	123.0	108.0	.	30.0	.	35.0	73.1	61.3	82.0	89.0
Outside Diameter	10.75	12.5	.	8.63	.	8.63	10.75	10.75	10.75	10.75
Inside Diameter	10	.	.	.	.	.	10	10	10	10
Casing Material	SF25	SF25	.	PVC40	.	SF25	SF25	.	SF25	SF25
Well Casing										
Borehole Depth	157.0	350.0	42.0	104.0	31.2	105.0	165.0	166.7	145.0	133.0
Borehole Diameter	8.5	11	8	6.62	8	6.62	10	9.5	8	10
Casing Depth	147.0	350.0	29.7	104.0	26.8	105.0	155.0	150.6	133.0	122.0
Outside Diameter	4.5	6.62	2.37	4.38	2.37	4.38	4.5	4.5	4.5	4.5
Inside Diameter	4	.	2	4	2	4	4	4	4	4
Casing Material	PVC40	SF25	PVC40	STL	PVC40	STL	SS304	SS304	PVC40	SS304
Monitored Interval										
Top-Depth	145.0	350.0	28.7	104.0	25.8	105.0	154.0	148.3	130.0	117.5
Midpoint-Depth	151.0	375.0	31.8	130.5	28.5	119.4	159.5	157.5	137.5	125.3
Pump Intake-Depth	148.40	.	.	124.10	.	123.20	950.00	162.70	.	127.60
Bottom of Screen-Depth	157.0	.	34.7	.	31.2	.	165.0	166.4	143.0	132.0
Bottom-Depth	157.0	400.0	34.8	156.9	31.2	133.8	165.0	166.7	145.0	133.0
Top-Elevation	903.79	740.91	901.25	826.70	892.75	817.85	958.97	933.59	1,025.52	1,023.56
Midpoint-Elevation	897.79	715.91	898.20	800.25	890.05	803.45	953.47	924.39	1,018.02	1,015.81
Pump Intake-Elevation	900.38	.	.	806.64	.	799.69	162.97	919.19	.	1013.49
Bottom-Elevation	891.79	690.91	895.15	773.80	887.35	789.05	947.97	915.19	1,010.52	1,008.06
Screen Length	10	.	5	.	4.4	.	10	15.8	10	10
Screen Material	PVC/sl	.	PVC/sl	.	PVC/sl	.	SS/sw	SS/sw	PVC/sl	SS/sw
Slot Size	0.01	.	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 2008

Well Number Hydrogeologic Regime Functional Area	GW-190 EF B4	GW-192 EF B4	GW-193 EF T2331	GW-203 CR UNCS	GW-204 EF T0134	GW-205 CR UNCS	GW-217 CR LIV	GW-220 EF NHP	GW-221 CR UNCS	GW-223 EF NHP
General Information										
Date Installed	08/01/89	09/30/85	08/04/89	10/24/85	08/30/89	10/25/85	08/13/87	08/22/85	10/24/85	08/21/85
Total Depth Drilled	26.2	17.5	18.5	156.0	17.5	164.0	180.0	45.2	158.0	90.5
East Coordinate	53,254	54,277	59,536	54,190	57,411	54,008	53,020	64,225	54,389	63,311
North Coordinate	30,776	30,772	29,344	28,356	29,956	28,363	28,758	28,949	28,359	28,938
Measuring Point	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW
Measuring Point Elevation	1,033.69	1,008.83	934.17	1,105.45	958.74	1,104.14	1,177.03	915.64	1,106.16	911.62
Ground Surface Elevation	1,030.19	1,006.04	931.11	1,102.34	955.47	1,101.46	1,174.29	912.74	1,103.36	908.97
Tag Depth-(TOC)	29.84	21.58	21.17	157.61	20.23	165.13	179.13	49.00	159.34	93.57
Geologic Information										
Hydrostratigraphic Unit	AQT	AQT	AQF	AQF	AQT	AQF	AQF	AQF	AQF	AQF
Geologic Formation	CON	Cm	Cmn	OCK	Cc	OCK	OCK	Cmn	OCK	Cmn
Aquifer Zone	WT	WT	WT	BDR	WT	BDR	BDR	BDR	BDR	BDR
Weathered Rock-Depth	8.0	17.5	2.5	86.0	10.0	100.0	55.0	.	36.0	.
Fresh Rock-Depth	.	.	.	93.0	.	146.0	75.0	11.0	90.0	10.0
Conductor Casing										
Casing Depth	.	.	5.0	94.0	.	154.0	81.7	13.0	92.0	11.0
Outside Diameter	.	.	9.63	10.75	.	10.75	10.75	12.5	6.63	12.5
Inside Diameter	.	.	.	10	.	10	10	11.75	.	11.75
Casing Material	.	.	STL	SF25	.	SF25	SF25	PVC40	SF25	PVC40
Well Casing										
Borehole Depth	26.2	17.5	18.5	156.0	17.5	164.0	180.0	45.2	158.0	90.5
Borehole Diameter	8.5	6	8	8.5	6	10	10	11	6	11
Casing Depth	9.8	7.5	8.2	146.0	7.3	154.0	166.8	34.7	148.0	80.0
Outside Diameter	4.5	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	4
Casing Material	SS304	PVC40	SS304	PVC40	SS304	PVC40	SS304	PVC40	PVC40	PVC40
Monitored Interval										
Top-Depth	8.0	6.5	5.5	144.0	6.5	152.0	165.2	31.0	146.0	79.0
Midpoint-Depth	17.1	12.0	12.0	150.0	11.9	158.0	172.6	38.1	152.0	84.8
Pump Intake-Depth	1,009.69	12.70	13.90	146.90	11.70	147.30	172.10	41.10	149.20	84.40
Bottom of Screen-Depth	25.9	17.5	18.5	156.0	17.3	164.0	177.4	44.7	158.0	90.0
Bottom-Depth	26.2	17.5	18.5	156.0	17.3	164.0	180.0	45.2	158.0	90.5
Top-Elevation	1,022.19	999.54	925.61	958.34	948.97	949.46	1,009.09	881.74	957.36	829.97
Midpoint-Elevation	1,013.09	994.04	919.14	952.34	943.57	943.46	1,001.69	874.64	951.36	824.22
Pump Intake-Elevation	20.50	993.33	917.17	955.45	943.74	954.14	1002.23	871.64	954.16	824.62
Bottom-Elevation	1,003.99	988.54	912.66	946.34	938.17	937.46	994.29	867.54	945.36	818.47
Screen Length	16.1	10	10.3	10	10	10	10.6	10	10	10
Screen Material	SS/sw	PVC/sl	SS/sw	PVC/sl	SS/sw	PVC/sl	SS/sw	PVC/sl	PVC/sl	PVC/sl
Slot Size	0.01	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 2008

Well Number Hydrogeologic Regime Functional Area	GW-225 BC OLF	GW-226 BC OLF	GW-227 BC OLF	GW-229 BC OLF	GW-230 EF EXP-UV	GW-231 CR KHQ	GW-240 EF NHP	GW-246 BC S3	GW-251 EF S2	GW-253 EF S2
General Information										
Date Installed	10/08/85	10/14/85	11/09/85	10/30/85	05/12/86	10/02/85	10/31/85	03/11/86	04/08/86	04/11/86
Total Depth Drilled	200.0	55.0	40.0	55.0	406.4	35.0	29.5	76.0	51.0	50.0
East Coordinate	47,461	47,473	47,802	47,017	69,617	63,410	63,726	52,098	53,843	54,057
North Coordinate	29,155	29,156	29,172	29,256	28,388	24,725	28,604	29,992	29,467	29,404
Measuring Point	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW
Measuring Point Elevation	943.11	943.57	946.46	949.00	923.11	849.67	922.90	1,009.19	1,003.80	1,004.24
Ground Surface Elevation	940.21	940.56	943.91	945.71	919.57	846.90	919.50	1,006.07	1,001.60	1,001.60
Tag Depth-(TOC)	203.30	58.47	42.64	51.45	409.48	37.70	32.55	76.50	50.04	50.51
Geologic Information										
Hydrostratigraphic Unit	AQF	AQF	AQF	AQF	AQF	AQF	AQF	AQT	AQF	AQF
Geologic Formation	Cmn	Cmn	Cmn	Cmn	Cmn	OCK	Cmn	Cn	Cmn	Cmn
Aquifer Zone	BDR	BDR	BDR	BDR	BDR	BDR	BDR	WT	BDR	WT
Weathered Rock-Depth	.	.	.	.	19.0	.	.	26.0	32.5	.
Fresh Rock-Depth	25.0	26.0	19.0	30.0	38.0	10.5	14.0	.	.	.
Conductor Casing										
Casing Depth	32.0	30.0	20.0	37.0	31.0	11.0	14.0	27.0	.	.
Outside Diameter	10.75	10.75	10.75	10.75	8.63	10.63	12.5	12.5	.	.
Inside Diameter	10	10	10	10	.	10	12	12	.	.
Casing Material	STL	STL	STL	STL	STL	PVC40	PVC40	PVC40	.	.
Well Casing										
Borehole Depth	150.0	45.0	30.0	40.0	341.0	35.0	29.5	76.0	51.0	50.0
Borehole Diameter	10	10	10	10	5.5	11	11	11	8.25	8.25
Casing Depth	150.0	45.0	30.0	40.0	341.0	24.5	24.0	46.5	37.5	37.0
Outside Diameter	4.5	4.5	4.5	4.5	4.38	4.5	4.5	6.5	4.5	4.5
Inside Diameter	4	4	4	4	4	4	4	6	4	4
Casing Material	STL	STL	STL	STL	STL	PVC40	PVC40	PVC40	PVC40	PVC40
Monitored Interval										
Top-Depth	150.0	45.0	30.0	40.0	341.0	22.8	21.0	34.2	35.0	36.2
Midpoint-Depth	175.0	50.0	35.0	47.5	373.7	28.9	25.3	55.1	43.0	43.1
Pump Intake-Depth	190.10	49.80	908.96	44.70	383.50	28.70	26.60	59.40	42.80	41.60
Bottom of Screen-Depth	.	.	.	.	.	34.5	29.0	74.6	47.1	46.7
Bottom-Depth	200.0	55.0	40.0	55.0	406.4	35.0	29.5	76.0	51.0	50.0
Top-Elevation	790.21	895.56	913.91	905.71	578.57	824.10	898.50	971.87	966.60	965.40
Midpoint-Elevation	765.21	890.56	908.91	898.21	545.87	818.00	894.25	950.97	958.60	958.50
Pump Intake-Elevation	750.11	890.77	34.95	901.00	536.11	818.17	892.90	946.69	958.80	960.04
Bottom-Elevation	740.21	885.56	903.91	890.71	513.17	811.90	890.00	930.07	950.60	951.60
Screen Length	.	.	.	.	.	10	5	28.1	9.6	9.7
Screen Material	.	.	.	.	.	PVC/sl	PVC/sl	PVC/sl	PVC/sl	PVC/sl
Slot Size	.	.	.	.	.	0.01	0.01	0.03	0.01	0.01
Open-Hole Length	50	10	10	15	65.4	.	.	.	.	.
Open-Hole Diameter	4	4	4	4	3.63	.	.	.	.	.

APPENDIX C: MONITORING WELL CONSTRUCTION DETAILS, CY 2008

Well Number Hydrogeologic Regime Functional Area	GW-257 BC BG	GW-259 BC BG	GW-265 EF SY	GW-269 EF SY	GW-274 EF SY	GW-275 EF SY	GW-276 BC S3	GW-281 EF FF	GW-289 BC BG	GW-293 CR ECRWP
General Information										
Date Installed	03/03/87	03/05/87	06/16/86	06/16/86	06/09/86	05/30/86	07/15/86	08/20/86	11/20/86	06/11/87
Total Depth Drilled	33.7	33.5	23.1	30.0	35.0	65.5	18.5	17.5	40.8	214.0
East Coordinate	43,230	43,129	53,308	53,779	53,673	53,688	52,557	61,907	42,875	62,321
North Coordinate	30,148	30,015	30,763	30,649	30,152	30,151	29,926	29,771	29,982	28,112
Measuring Point	TOWW	TOC	TOC	TOWW	TOWW	TOWW	TOWW	TOC	TOWW	TOC
Measuring Point Elevation	961.68	943.80	1,032.68	1,027.81	995.60	995.53	1,001.57	946.10	948.73	1,063.90
Ground Surface Elevation	959.21	941.48	1,030.85	1,025.38	992.94	993.08	998.70	946.53	946.32	1,061.70
Tag Depth-(TOC)	36.63	35.74	25.68	33.50	36.12	68.47	21.34	14.85	43.14	216.40
Geologic Information										
Hydrostratigraphic Unit	AQT	AQT	AQT	AQT	AQT	AQT	AQT	AQT	AQT	AQF
Geologic Formation	Cm	Cm	Cm	Cm	Cn	Cn	Cn	Cn	Cm	OCK
Aquifer Zone	WT	WT	WT	WT	WT	BDR	WT	WT	WT	BDR
Weathered Rock-Depth	.	.	10.0	10.0	3.0	5.0	18.5	17.5	24.0	57.0
Fresh Rock-Depth	33.7	33.5	22.0	.	35.0	35.0	.	.	38.0	110.0
Conductor Casing										
Casing Depth	.	.	.	.	.	38.0	.	.	.	57.8
Outside Diameter	.	.	.	.	.	10.63	.	.	.	10.75
Inside Diameter	.	.	.	.	.	10	.	.	.	10
Casing Material	.	.	.	.	.	PVC40	.	.	.	SF25
Well Casing										
Borehole Depth	33.7	33.5	23.1	30.0	35.0	65.5	18.5	17.5	40.8	197.0
Borehole Diameter	9	9	10	10	8	10	8	6	9	10
Casing Depth	23.0	22.3	17.5	23.7	28.5	54.8	13.0	5.0	30.6	197.0
Outside Diameter	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	6.62
Inside Diameter	4	4	4	4	4	4	4	4	4	.
Casing Material	SS304	SS304	PVC40	PVC40	SS304	SS304	SS304	SS304	SS304	SF25
Monitored Interval										
Top-Depth	19.0	21.1	15.5	21.9	25.8	53.3	11.3	4.0	28.9	197.0
Midpoint-Depth	26.4	27.3	19.3	26.0	30.4	59.4	14.9	9.5	34.9	205.5
Pump Intake-Depth	33.00	.	20.67	28.10	30.80	62.60	14.10	.	35.60	.
Bottom of Screen-Depth	33.7	33.0	23.1	29.4	33.9	65.2	18.3	15.0	40.6	.
Bottom-Depth	33.7	33.5	23.1	30.0	35.0	65.5	18.5	15.0	40.8	214.0
Top-Elevation	940.21	920.38	1,015.35	1,003.48	967.14	939.78	987.40	942.53	917.42	864.70
Midpoint-Elevation	932.86	914.18	1,011.55	999.43	962.54	933.68	983.80	937.03	911.47	856.20
Pump Intake-Elevation	926.18	.	1010.18	997.31	962.10	930.53	984.57	.	910.73	.
Bottom-Elevation	925.51	907.98	1,007.75	995.38	957.94	927.58	980.20	931.53	905.52	847.70
Screen Length	10.7	10.7	5.6	5.7	5.4	10.4	5.3	10	10	.
Screen Material	SS/sw	SS/sw	PVC/sl	PVC/sl	SS/sw	SS/sw	SS/sw	SS/sl	SS/sw	.
Slot Size	0.01	0.01	0.02	0.02	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 2008

Well Number Hydrogeologic Regime Functional Area	GW-294 CR ECRWP	GW-296 CR ECRWP	GW-298 CR ECRWP	GW-301 CR CRBAWP	GW-305 CR LIV	GW-306 BC RS	GW-309 BC RS	GW-310 BC RS	GW-312 BC RS	GW-314 BC SPI
General Information										
Date Installed	05/01/87	05/11/87	07/27/87	07/02/87	08/25/87	09/25/87	09/24/87	07/23/87	09/22/87	09/09/87
Total Depth Drilled	128.0	147.0	190.0	182.0	179.6	58.5	38.0	27.1	41.0	115.0
East Coordinate	62,483	62,023	62,445	61,964	52,962	49,521	50,176	50,497	49,778	52,125
North Coordinate	27,958	27,994	27,495	27,662	28,548	29,250	29,530	29,437	29,216	29,419
Measuring Point	TOC	TOC	TOC	TOWW	TOWW	TOC	TOC	TOWW	TOWW	TOC
Measuring Point Elevation	1,083.60	1,090.99	1,049.01	1,086.55	1,183.72	991.78	988.17	995.52	996.70	1,049.81
Ground Surface Elevation	1,083.67	1,088.29	1,046.40	1,083.94	1,181.07	989.44	985.77	992.40	994.13	1,047.20
Tag Depth-(TOC)	130.76	148.16	189.36	165.23	181.06	60.66	40.06	30.47	42.10	118.15
Geologic Information										
Hydrostratigraphic Unit	AQF	AQF	AQF	AQF	AQF	AQF	AQF	AQF	AQF	AQF
Geologic Formation	OCK	OCK	OCK	OCK	OCK	Cmn	Cmn	Cmn	Cmn	Cmn
Aquifer Zone	BDR	BDR	BDR	BDR	BDR	BDR	WT	WT	WT	BDR
Weathered Rock-Depth	62.0	67.0	65.0	94.0	53.0	.	20.0	27.1	.	47.0
Fresh Rock-Depth	87.0	81.5	80.0	136.0	84.0	44.0	.	.	.	49.0
Conductor Casing										
Casing Depth	74.5	86.5	83.3	105.0	64.0	.	.	.	.	66.0
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	128.0	147.0	190.0	163.5	179.6	58.5	38.0	27.1	41.0	115.0
Borehole Diameter	10	10	10	10	10	8	8	10	12	10
Casing Depth	117.6	136.3	176.0	151.0	168.9	48.1	27.0	21.8	30.5	103.0
Outside Diameter	4.5	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	4
Casing Material	SS304	SS304	SS304	SS304	SS304	SS304	SS304	SS304	SS304	SS304
Monitored Interval										
Top-Depth	113.0	134.4	171.1	148.5	165.3	46.2	25.0	19.5	29.6	101.0
Midpoint-Depth	120.5	140.7	180.6	156.0	172.5	52.4	31.5	23.3	35.3	108.0
Pump Intake-Depth	.	.	.	157.40	173.40	.	.	25.00	961.70	.
Bottom of Screen-Depth	128.0	146.8	186.0	161.0	179.6	58.1	37.0	27.1	40.5	113.0
Bottom-Depth	128.0	147.0	190.0	163.5	179.6	58.5	38.0	27.1	41.0	115.0
Top-Elevation	970.67	953.89	875.30	935.44	1,015.77	943.24	960.77	972.90	964.53	946.20
Midpoint-Elevation	963.17	947.59	865.85	927.94	1,008.62	937.09	954.27	969.10	958.83	939.20
Pump Intake-Elevation	.	.	.	926.55	1007.62	.	.	967.35	32.43	.
Bottom-Elevation	955.67	941.29	856.40	920.44	1,001.47	930.94	947.77	965.30	953.13	932.20
Screen Length	10.4	10.5	10	10	10.7	10	10	5.3	10	10
Screen Material	SS/sw	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	0.01
Open-Hole Length	.	.	.	.	.	.	.	.	.	.
Open-Hole Diameter	.	.	.	.	.	.	.	.	.	.

APPENDIX C: MONITORING WELL CONSTRUCTION DETAILS, CY 2008

Well Number Hydrogeologic Regime Functional Area	GW-315 BC SPI	GW-322 CR CRSP	GW-332 EF WCPA	GW-336 EF WCPA	GW-337 EF WCPA	GW-363 BC EMWMF	GW-365 BC OLF	GW-367 BC OLF	GW-369 BC OLF	GW-380 EF NHP
General Information										
Date Installed	09/25/87	09/02/87	08/11/87	08/06/87	08/12/87	03/16/88	05/02/88	05/12/88	05/31/88	08/19/88
Total Depth Drilled	104.0	193.0	24.1	21.4	22.1	75.0	150.0	151.4	150.2	15.5
East Coordinate	52,268	58,912	54,882	54,694	54,519	46,872	46,490	46,695	47,629	62,938
North Coordinate	29,455	28,241	30,058	30,057	30,057	29,961	29,150	28,884	28,921	28,714
Measuring Point	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW	TOC	TOC	TOWW
Measuring Point Elevation	1,047.45	1,134.98	981.24	985.92	987.48	957.91	935.58	988.16	999.72	913.55
Ground Surface Elevation	1,044.84	1,131.81	979.55	981.56	984.12	955.41	933.03	986.21	997.86	913.66
Tag Depth-(TOC)	105.98	191.99	27.07	23.93	25.33	77.27	152.49	153.48	150.30	15.80
Geologic Information										
Hydrostratigraphic Unit	AQF	AQF	AQT	AQT	AQT	AQT	AQF	AQF	AQF	AQF
Geologic Formation	Cmn	OCK	Cn	Cn	Cn	Cn	Cmn	Cmn	Cmn	Cmn
Aquifer Zone	BDR	BDR	WT	WT	WT	BDR	BDR	BDR	BDR	WT
Weathered Rock-Depth	54.0	49.0	6.0	4.0	.	9.0	11.0	39.0	10.8	15.5
Fresh Rock-Depth	71.0	120.0	.	.	.	21.0	15.0	72.0	68.0	.
Conductor Casing										
Casing Depth	84.4	61.0	.	.	.	36.0	18.5	58.4	31.0	.
Outside Diameter	10.75	10.75	.	.	.	10.75	11.75	11.75	11.75	.
Inside Diameter	10	10	.	.	.	10	11	11	11	.
Casing Material	SF25	SF25	.	.	.	STL	STL	STL	STL	.
Well Casing										
Borehole Depth	104.0	135.0	24.1	21.4	22.1	50.0	126.7	125.0	115.8	15.5
Borehole Diameter	10	10	10	10	10	9.5	10.75	10.75	10.6	10
Casing Depth	93.3	128.0	18.7	15.8	16.7	48.3	124.2	124.0	115.8	4.8
Outside Diameter	4.5	7	4.5	4.5	4.5	6.62	6.62	6.62	6.62	4.5
Inside Diameter	4	.	4	4	4	.	.	.	.	.
Casing Material	SS304	STL	SS304	SS304	SS304	SF25	SF25	SF25	SF25	SS304
Monitored Interval										
Top-Depth	90.0	128.0	16.8	13.2	15.0	50.0	126.7	125.0	115.8	2.8
Midpoint-Depth	97.0	160.5	20.5	17.3	18.6	62.5	138.4	138.2	133.0	9.2
Pump Intake-Depth	97.40	182.30	21.30	17.10	16.60	62.50	787.58	.	.	12.60
Bottom of Screen-Depth	103.3	.	24.1	21.4	22.1	.	.	.	.	15.2
Bottom-Depth	104.0	193.0	24.1	21.4	22.1	75.0	150.0	151.4	150.2	15.5
Top-Elevation	954.84	1,003.81	962.75	968.36	969.12	905.41	806.33	861.21	882.06	910.86
Midpoint-Elevation	947.84	971.31	959.10	964.26	965.57	892.91	794.68	848.01	864.86	904.51
Pump Intake-Elevation	947.45	949.48	958.24	964.42	967.48	892.91	145.45	.	.	901.05
Bottom-Elevation	940.84	938.81	955.45	960.16	962.02	880.41	783.03	834.81	847.66	898.16
Screen Length	10	.	5.4	5.6	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	26.4	34.4	.
Open-Hole Diameter	.	6	.	.	.	6	6	6	6.1	.

APPENDIX C: MONITORING WELL CONSTRUCTION DETAILS, CY 2008

Well Number Hydrogeologic Regime Functional Area	GW-381 EF NHP	GW-382 EF NHP	GW-383 EF NHP	GW-508 EF RG	GW-514 CR FCAP	GW-521 CR LIV	GW-522 CR LIV	GW-531 BC OLF	GW-537 BC OLF	GW-540 CR LII
General Information										
Date Installed	04/25/88	04/11/88	04/04/88	04/18/88	03/24/88	09/14/88	09/20/88	09/14/88	09/14/88	06/02/89
Total Depth Drilled	60.4	173.0	24.1	15.0	195.0	136.0	195.5	39.5	24.5	171.5
East Coordinate	62,948	62,956	63,522	53,148	57,341	52,040	52,612	49,331	49,539	52,371
North Coordinate	28,715	28,716	29,201	30,281	27,575	28,541	28,377	30,453	30,057	27,489
Measuring Point	TOWW	TOC	TOWW	TOC	TOWW	TOWW	TOWW	TOC	TOWW	TOWW
Measuring Point Elevation	913.36	913.17	908.77	1,010.74	1,001.22	1,182.88	1,175.48	1,004.61	976.65	1,072.31
Ground Surface Elevation	913.44	913.16	906.00	1,009.41	998.66	1,179.46	1,172.04	1,002.19	974.49	1,069.38
Tag Depth-(TOC)	61.01	173.20	26.54	15.11	197.13	136.70	197.10	41.28	27.35	173.83
Geologic Information										
Hydrostratigraphic Unit	AQF	AQF	AQT	AQT	AQF	AQF	AQF	AQT	AQT	AQF
Geologic Formation	Cmn	Cmn	Cn	Cn	OCK	OCK	OCK	Cm	Cn	OCK
Aquifer Zone	BDR	BDR	WT	WT	BDR	BDR	BDR	WT	WT	BDR
Weathered Rock-Depth	13.5	12.7	11.5	.	44.0	.	85.0	25.0	14.9	110.0
Fresh Rock-Depth	26.0	17.0	.	.	92.0	54.0	130.0	.	.	150.0
Conductor Casing										
Casing Depth	13.5	12.7	5.0	.	105.0	60.5	90.0	.	.	154.0
Outside Diameter	13	10.75	10.75	.	10.75	10.75	10.75	.	.	10.75
Inside Diameter	.	10	10	.	10	10	10	.	.	10
Casing Material	STL	STL	STL	.	STL	STL	STL	.	.	STL
Well Casing										
Borehole Depth	49.3	125.0	24.1	15.0	174.0	136.0	195.5	39.5	24.5	171.5
Borehole Diameter	9.5	9.5	8.75	7	9.5	9.5	9.5	8.75	8.75	9.25
Casing Depth	47.8	123.2	18.1	2.2	172.3	124.9	184.6	22.5	8.0	161.2
Outside Diameter	6.62	6.62	4.5	2.37	6.62	4.5	4.5	4.5	4.5	4.5
Inside Diameter	.	.	4	2	.	4	4	4	4	4
Casing Material	SF25	SF25	SS304	SS304	SF25	SS304	SS304	SS304	SS304	SS304
Monitored Interval										
Top-Depth	49.3	125.0	16.6	1.3	174.0	123.2	183.0	22.0	4.8	158.5
Midpoint-Depth	54.9	149.0	20.1	8.2	184.5	129.6	189.2	30.3	14.1	165.0
Pump Intake-Depth	55.50	.	20.50	.	189.40	129.00	187.60	.	22.80	166.10
Bottom of Screen-Depth	.	.	23.1	12.5	.	135.2	195.0	38.2	23.0	171.5
Bottom-Depth	60.4	173.0	23.6	15.0	195.0	136.0	195.3	38.5	23.3	171.5
Top-Elevation	864.14	788.16	889.40	1,008.11	824.66	1,056.26	989.04	980.19	969.69	910.88
Midpoint-Elevation	858.59	764.16	885.90	1,001.26	814.16	1,049.86	982.89	971.94	960.44	904.38
Pump Intake-Elevation	857.96	.	885.47	.	809.22	1050.48	984.48	.	951.65	903.31
Bottom-Elevation	853.04	740.16	882.40	994.41	803.66	1,043.46	976.74	963.69	951.19	897.88
Screen Length	.	.	5	10.3	.	10.3	10.4	15.7	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	11.1	48	.	.	21	.	.	.	.	.
Open-Hole Diameter	6.1	6.13	.	.	6	.	.	.	.	.

APPENDIX C: MONITORING WELL CONSTRUCTION DETAILS, CY 2008

Well Number Hydrogeologic Regime Functional Area	GW-557 CR LV	GW-560 CR CDLVII	GW-562 CR CDLVII	GW-564 CR CDLVII	GW-605 EF EXP-I	GW-606 EF EXP-I	GW-608 CR CRSP	GW-609 CR CRSP	GW-612 CR CRSP	GW-615 BC S3
General Information										
Date Installed	12/02/88	12/30/88	01/13/89	01/27/89	03/19/91	03/20/91	10/05/89	10/18/90	11/01/89	02/13/90
Total Depth Drilled	139.0	117.0	133.0	88.0	40.5	175.0	220.0	269.0	254.0	245.0
East Coordinate	59,520	60,743	61,640	59,865	62,002	61,951	59,724	60,040	58,504	52,224
North Coordinate	26,450	25,692	26,276	25,873	28,707	28,708	27,889	28,109	28,371	30,009
Measuring Point	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW
Measuring Point Elevation	1,081.36	949.05	934.69	938.07	919.06	919.59	1,075.38	1,112.31	1,131.03	1,017.55
Ground Surface Elevation	1,078.63	945.76	931.86	935.12	916.97	916.98	1,071.00	1,109.70	1,128.65	1,014.17
Tag Depth-(TOC)	136.07	82.90	61.24	78.74	42.00	174.36	219.80	268.80	256.28	246.84
Geologic Information										
Hydrostratigraphic Unit	AQF	AQF	AQF	AQF	AQF	AQF	AQF	AQF	AQF	AQT
Geologic Formation	OCK	OCK	OCK	OCK	Cmn	Cmn	OCK	OCK	OCK	Cn
Aquifer Zone	WT	WT	WT	WT	BDR	BDR	BDR	BDR	BDR	BDR
Weathered Rock-Depth	113.8	92.0	.	.	.	.	.	.	78.0	15.0
Fresh Rock-Depth	134.0	.	52.0	72.0	9.5	10.8	140.0	107.0	125.0	40.0
Conductor Casing										
Casing Depth	85.0	.	.	.	9.5	64.7	148.0	107.0	136.9	84.5
Outside Diameter	10.75	.	.	.	11.75	7	10.75	10.75	11.75	11.75
Inside Diameter	10	.	.	.	11	6.4	10	10	11	11
Casing Material	STL	.	.	.	SJ55	SJ55	STL	SJ55	SJ55	SJ55
Well Casing										
Borehole Depth	138.0	117.0	60.0	81.0	40.5	175.0	150.0	269.0	235.0	222.5
Borehole Diameter	9.5	9.5	9.5	9.5	10.6	9.63	15.5	9.5	10.63	10.63
Casing Depth	115.8	49.0	38.0	55.3	29.7	161.0	.	258.7	230.6	221.2
Outside Diameter	4.5	4.5	4.5	4.5	4.25	4.25	.	4.5	7	7
Inside Diameter	4	4	4	4	4	4	.	4.25	6.54	6.54
Casing Material	SS304	SS304	SS304	SS304	SS304	SS304	.	SS304	SF25	SF25
Monitored Interval										
Top-Depth	112.9	45.2	36.0	52.0	28.2	155.0	148.0	256.4	230.6	222.5
Midpoint-Depth	125.5	57.1	48.0	66.5	34.1	163.0	184.0	262.7	242.3	233.8
Pump Intake-Depth	123.60	59.40	48.20	65.50	33.90	166.40	860.38	261.40	247.60	68.60
Bottom of Screen-Depth	135.8	69.0	58.0	75.3	39.7	171.0	.	269.0	.	.
Bottom-Depth	138.0	69.0	60.0	81.0	39.9	171.0	220.0	269.0	254.0	245.0
Top-Elevation	965.73	900.56	895.86	883.12	888.77	761.98	923.00	853.30	898.05	791.67
Midpoint-Elevation	953.18	888.66	883.86	868.62	882.92	753.98	887.00	847.00	886.35	780.42
Pump Intake-Elevation	955.06	886.35	883.69	869.57	883.06	750.59	210.62	848.31	881.03	945.55
Bottom-Elevation	940.63	876.76	871.86	854.12	877.07	745.98	851.00	840.70	874.65	769.17
Screen Length	20	20	20	20	10	10	.	10.3	.	.
Screen Material	SS/sw	SS/sw	SS/sw	SS/sw	SS/sw	SS/ppk	.	SS/sw	.	.
Slot Size	0.01	0.01	0.01	0.01	0.01	0.01	.	0.01	.	.
Open-Hole Length	.	.	.	.	.	.	72	.	23.4	22.5
Open-Hole Diameter	.	.	.	.	.	.	9.5	.	6.25	6.25

APPENDIX C: MONITORING WELL CONSTRUCTION DETAILS, CY 2008

Well Number Hydrogeologic Regime Functional Area	GW-616 BC S3	GW-617 EF EXP-E	GW-618 EF EXP-E	GW-619 EF FTF	GW-620 EF FTF	GW-623 BC BG	GW-626 BC BG	GW-627 BC BG	GW-629 BC BG	GW-633 EF RG
General Information										
Date Installed	03/10/90	03/19/90	03/15/90	03/27/90	03/27/90	08/02/90	12/15/89	12/11/89	02/02/90	05/03/90
Total Depth Drilled	269.0	18.0	37.0	40.8	75.0	349.0	78.0	270.0	312.0	15.0
East Coordinate	51,907	54,756	54,738	52,906	52,895	44,138	42,772	42,774	43,047	53,100
North Coordinate	29,724	29,806	29,798	29,563	29,565	29,388	29,535	29,505	29,522	30,145
Measuring Point	TOWW	TOWW	TOWW	TOWW	TOWW	TOC	TOWW	TOWW	TOWW	TOWW
Measuring Point Elevation	1,011.81	985.28	985.14	1,015.42	1,015.57	925.21	942.87	943.51	928.03	996.43
Ground Surface Elevation	1,009.81	982.61	982.64	1,012.74	1,012.84	922.01	939.95	940.39	924.42	996.66
Tag Depth-(TOC)	270.59	20.69	38.30	43.63	77.91	277.93	80.92	270.96	314.59	15.15
Geologic Information										
Hydrostratigraphic Unit	AQT	AQF	AQF	AQF	AQF	AQT	AQT	AQT	AQT	AQT
Geologic Formation	Cn	Cmn	Cmn	Cmn	Cmn	Cn	Cn	Cn	Cn	Cn
Aquifer Zone	BDR	WT	WT	WT	WT	BDR	BDR	BDR	BDR	WT
Weathered Rock-Depth	35.0	.	25.0	40.0	41.0	16.0	2.0	3.0	12.0	8.5
Fresh Rock-Depth	42.0	.	27.0	.	70.0	38.0	64.0	43.0	42.0	.
Conductor Casing										
Casing Depth	45.6	.	27.5	.	42.5	218.0	62.5	47.5	45.1	.
Outside Diameter	11.75	.	10.75	.	10.75	7	11.75	11.75	11.75	.
Inside Diameter	11	.	10	.	10	6.54	11	11	11	.
Casing Material	SJ55	.	SJ55	.	SJ55	SJ55	SJ55	SJ55	SJ55	.
Well Casing										
Borehole Depth	219.7	18.0	37.0	40.8	75.0	274.5	78.0	254.0	262.3	15.0
Borehole Diameter	10.63	9.5	9.5	9.5	9.5	6	9.5	10.63	10.63	10.5
Casing Depth	217.8	7.3	26.7	30.0	64.2	244.0	67.7	252.7	266.3	5.0
Outside Diameter	7	4.5	4.5	4.5	4.5	2.37	4.5	7	7	4.5
Inside Diameter	6.54	4.25	4.25	4.25	4.25	2	4.25	6.54	6.54	4
Casing Material	SF25	SS304	SS304	SS304	SS304	SS304	SS304	SF25	SF25	PVC
Monitored Interval										
Top-Depth	219.1	6.8	26.0	26.8	61.7	238.1	63.0	254.0	262.3	3.5
Midpoint-Depth	244.1	12.4	31.5	33.8	68.4	256.2	70.5	262.0	287.2	9.3
Pump Intake-Depth	263.00	15.30	32.50	35.20	70.30	.	73.30	255.90	286.40	12.20
Bottom of Screen-Depth	.	17.6	37.0	40.8	75.0	274.2	77.7	.	.	15.0
Bottom-Depth	269.0	18.0	37.0	40.8	75.0	274.2	78.0	270.0	312.0	15.0
Top-Elevation	790.71	975.81	956.64	985.94	951.14	683.91	876.95	686.39	662.12	993.16
Midpoint-Elevation	765.76	970.21	951.14	978.94	944.49	665.86	869.45	678.39	637.27	987.41
Pump Intake-Elevation	746.81	967.28	950.14	977.52	942.57	.	866.67	684.51	638.03	984.43
Bottom-Elevation	740.81	964.61	945.64	971.94	937.84	647.81	861.95	670.39	612.42	981.66
Screen Length	.	10.3	10.3	10.8	10.8	30.2	10	.	.	10
Screen Material	.	SS/sw	SS/sw	SS/sw	SS/sw	SS/sw	SS/sw	.	.	PVC/sl
Slot Size	.	0.01	0.01	0.01	0.01	0.01	0.01	.	.	0.01
Open-Hole Length	49.9	.	.	.	.	.	.	16	49.7	.
Open-Hole Diameter	6.25	.	.	.	.	.	.	6.25	6.5	.

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Well Number Hydrogeologic Regime Functional Area	GW-639 BC EMWMF	GW-648 BC RS	GW-653 BC BG	GW-656 EF T0134	GW-658 EF FF	GW-683 BC EXP-A	GW-684 BC EXP-A	GW-686 EF CPT	GW-690 EF CPT	GW-691 EF CPT
General Information										
Date Installed	06/15/90	09/17/90	08/10/90	07/19/90	08/31/90	12/03/90	10/09/90	10/18/90	10/24/90	10/24/90
Total Depth Drilled	125.5	80.1	39.0	21.5	19.1	197.5	129.6	17.0	53.0	20.0
East Coordinate	45,260	49,888	42,317	57,439	62,146	41,552	41,354	55,956	55,990	55,983
North Coordinate	29,626	29,088	29,660	29,895	29,638	28,282	28,525	29,540	29,787	29,794
Measuring Point	TOWW	TOC	TOWW	TOWW	TOWW	TOWW	TOWW	TOC	TOWW	TOWW
Measuring Point Elevation	940.95	1,029.20	931.84	954.79	944.81	972.23	898.83	963.76	967.36	968.59
Ground Surface Elevation	937.98	1,026.50	928.85	954.90	942.04	969.45	895.53	964.43	967.71	968.09
Tag Depth-(TOC)	129.64	82.47	41.53	20.60	20.64	199.83	132.21	16.23	53.25	20.39
Geologic Information										
Hydrostratigraphic Unit	AQT	AQF	AQT	AQT	AQT	AQF	AQF	AQF	AQF	AQF
Geologic Formation	Cn	Cmn	Cn	Cn	Cn	OCK	Cmn	Cmn	Cmn	Cmn
Aquifer Zone	BDR	WT	WT	WT	WT	BDR	BDR	WT	BDR	WT
Weathered Rock-Depth	3.0	49.5	3.5	12.0	1.5	22.0	.	17.0	24.0	20.0
Fresh Rock-Depth	20.0	.	35.0	.	.	26.0	9.5	.	.	.
Conductor Casing										
Casing Depth	31.0	64.5	.	.	3.5	82.0	87.0	.	26.0	.
Outside Diameter	11.75	10.75	.	.	10.75	11.75	11.75	.	10.5	.
Inside Diameter	11	10	.	.	10	11	11	.	10	.
Casing Material	SJ55	SJ55	.	.	SJ55	SJ55	SJ55	.	PVC40	.
Well Casing										
Borehole Depth	95.5	80.1	39.0	21.5	19.1	197.5	129.6	16.0	53.0	20.0
Borehole Diameter	10	9.5	9.5	9.5	9.5	10.63	10.5	12	8.5	12
Casing Depth	94.5	70.1	29.0	10.7	8.8	146.0	113.8	6.0	42.8	10.0
Outside Diameter	7	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Inside Diameter	6.54	4.25	4.25	4.25	4.25	4.25	4.25	4.25	4.25	4.25
Casing Material	SF25	SS304	SS304	SS304	SS304	SS304	SS304	SS304	SS304	SS304
Monitored Interval										
Top-Depth	95.5	65.0	26.3	8.3	6.9	133.9	106.4	4.0	40.8	8.0
Midpoint-Depth	110.5	72.6	32.7	14.9	13.0	165.4	118.0	10.0	46.8	14.0
Pump Intake-Depth	.	.	33.50	18.10	13.80	171.20	119.70	15.67	48.40	14.50
Bottom of Screen-Depth	.	80.1	39.0	20.7	18.8	196.8	128.4	16.0	52.8	20.0
Bottom-Depth	125.5	80.1	39.0	21.5	19.1	196.8	129.6	16.0	52.8	20.0
Top-Elevation	842.48	961.50	902.55	946.60	935.14	835.55	789.13	960.43	926.91	960.09
Midpoint-Elevation	827.48	953.95	896.20	940.00	929.04	804.10	777.53	954.43	920.91	954.09
Pump Intake-Elevation	.	.	895.34	936.79	928.21	798.23	775.83	948.76	919.36	953.59
Bottom-Elevation	812.48	946.40	889.85	933.40	922.94	772.65	765.93	948.43	914.91	948.09
Screen Length	.	10	10	10	10	50.8	14.6	10	10	10
Screen Material	.	SS/sw	SS/sw	SS/sw	SS/sw	SS/ppk	SS/ppk	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	30	.	.	.	.	.	.	.	.	.
Open-Hole Diameter	6.25	.	.	.	.	.	.	.	.	.

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Well Number Hydrogeologic Regime Functional Area	GW-692 EF CPT	GW-694 BC EXP-B	GW-698 EF B8110	GW-700 EF B8110	GW-703 BC EXP-B	GW-704 BC EXP-B	GW-706 BC EXP-B	GW-709 CR LII	GW-712 BC EXP-W	GW-713 BC EXP-W
General Information										
Date Installed	10/25/90	02/07/91	11/02/90	10/03/90	12/07/90	12/20/90	01/27/91	04/05/91	06/20/91	01/13/92
Total Depth Drilled	53.0	204.5	75.0	31.0	182.0	256.0	182.5	80.6	457.5	315.2
East Coordinate	56,001	44,893	56,804	56,828	44,931	44,935	44,944	52,372	36,507	36,434
North Coordinate	29,653	28,845	29,277	29,453	28,806	28,845	28,946	25,344	28,233	28,236
Measuring Point	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW
Measuring Point Elevation	964.38	941.98	970.09	960.18	955.29	945.33	929.47	906.81	877.89	881.43
Ground Surface Elevation	964.55	938.58	970.09	957.78	951.80	941.99	925.78	903.84	873.61	877.83
Tag Depth-(TOC)	53.05	207.27	74.88	33.19	185.29	258.65	185.79	83.52	460.53	318.39
Geologic Information										
Hydrostratigraphic Unit	AQF	AQF	AQF	AQF	AQF	AQF	AQF	AQF	AQF	AQF
Geologic Formation	Cmn	Cmn	Cmn	Cmn	Cmn	Cmn	Cmn	OCk	OCk	Cmn
Aquifer Zone	BDR	BDR	BDR	WT	BDR	BDR	BDR	BDR	BDR	BDR
Weathered Rock-Depth	23.0	11.0	42.0	31.0	7.0	16.0	17.0	39.0	12.0	26.8
Fresh Rock-Depth	.	21.0	.	.	10.0	23.0	27.0	43.0	66.0	63.8
Conductor Casing										
Casing Depth	25.0	25.8	42.0	.	.	21.0	40.3	50.0	44.8	80.2
Outside Diameter	10.5	11.75	10.5	.	.	11.75	11.75	11.75	11.75	.
Inside Diameter	10	11	10	.	.	11	11	11	11	.
Casing Material	PVC40	STL	PVC40	.	.	SJ55	SJ55	SJ55	SJ55	SJ55
Well Casing										
Borehole Depth	53.0	154.0	75.0	31.0	135.0	246.0	157.0	80.6	441.5	305.0
Borehole Diameter	8.5	10.6	8.5	12	10.63	10.63	10.6	10.6	10.6	10.6
Casing Depth	43.0	152.0	65.0	21.0	132.8	243.5	155.1	70.4	440.2	303.7
Outside Diameter	4.5	7	4.5	4.5	7	7	7	4.25	7	7
Inside Diameter	4.25	6.45	4.25	4.25	6.54	6.54	6.54	4	6.54	6.54
Casing Material	SS304	SF25	SS304	SS304	SF25	SF25	SF25	SS304	SF25	SF25
Monitored Interval										
Top-Depth	41.0	153.0	63.0	19.0	133.8	244.5	156.1	68.7	441.5	305.0
Midpoint-Depth	47.0	178.8	69.0	25.0	157.9	250.3	169.3	74.7	449.5	310.1
Pump Intake-Depth	48.20	178.70	71.00	26.10	158.50	250.20	174.80	75.50	446.20	307.40
Bottom of Screen-Depth	53.0	.	75.0	31.0	.	.	.	80.4	.	.
Bottom-Depth	53.0	204.5	75.0	31.0	182.0	256.0	182.5	80.6	457.5	315.2
Top-Elevation	923.55	785.58	907.09	938.78	818.00	697.49	769.68	835.14	432.11	572.83
Midpoint-Elevation	917.55	759.83	901.09	932.78	793.90	691.74	756.48	829.19	424.11	567.73
Pump Intake-Elevation	916.38	759.88	899.09	931.68	793.29	691.83	750.97	828.31	427.39	570.43
Bottom-Elevation	911.55	734.08	895.09	926.78	769.80	685.99	743.28	823.24	416.11	562.63
Screen Length	10	.	10	10	.	.	.	10	.	.
Screen Material	SS/sw	.	SS/sw	SS/sw	.	.	.	SS/sw	.	.
Slot Size	0.01	.	0.01	0.01	.	.	.	0.01	.	.
Open-Hole Length	.	51.5	.	.	48.2	11.5	26.4	.	16	10.2
Open-Hole Diameter	.	6.25	.	.	6.25	6.5	6.25	.	6.25	6.25

APPENDIX C: MONITORING WELL CONSTRUCTION DETAILS, CY 2008

Well Number Hydrogeologic Regime Functional Area	GW-714 BC EXP-W	GW-722 EF EXP-J	GW-724 BC EXP-C	GW-725 BC EXP-C	GW-731 CR CRSDB	GW-732 CR CRSDB	GW-733 EF EXP-J	GW-738 BC EXP-C	GW-740 BC EXP-C	GW-744 EF GRIDK1
General Information										
Date Installed	01/24/92	08/09/91	08/12/91	08/27/91	09/12/91	09/11/91	10/02/91	11/21/91	12/20/91	01/08/92
Total Depth Drilled	145.0	644.3	301.6	142.5	180.4	190.6	256.5	90.1	190.0	69.5
East Coordinate	36,435	64,926	48,995	48,989	63,863	64,268	65,067	49,026	49,055	64,324
North Coordinate	28,422	28,532	29,198	29,405	27,464	27,717	28,447	29,150	29,027	30,282
Measuring Point	TOWW	TOC	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW
Measuring Point Elevation	875.88	953.71	979.75	961.63	1,049.38	1,064.29	959.84	983.31	1,020.25	907.43
Ground Surface Elevation	872.30	951.04	976.62	958.26	1,045.75	1,060.65	955.69	980.36	1,016.95	905.05
Tag Depth-(TOC)	146.90	642.68	293.60	145.42	178.53	192.84	259.93	91.78	192.67	69.28
Geologic Information										
Hydrostratigraphic Unit	AQF	AQF	AQF	AQF	AQF	AQF	AQF	AQF	AQF	AQT
Geologic Formation	Cmn	Cmn	Cmn	Cmn	OCK	OCK	Cmn	Cmn	Cmn	Cpv
Aquifer Zone	BDR	BDR	BDR	BDR	BDR	BDR	BDR	BDR	BDR	BDR
Weathered Rock-Depth	27.0	54.0	33.5	14.0	95.4	85.0	42.5	12.0	38.1	9.6
Fresh Rock-Depth	35.0	73.0	40.0	17.5	129.4	96.0	47.1	15.1	45.1	14.6
Conductor Casing										
Casing Depth	40.5	56.2	40.0	21.0	122.0	100.7	51.8	16.5	46.9	27.6
Outside Diameter	11.75	10.75	11.75	11.75	11.75	11.75	11.75	11.75	11.75	10.75
Inside Diameter	11	10	11	11	11	11	11	11	11	10
Casing Material	SJ55	SJ55	SJ55	SJ55	SJ55	SJ55	SJ55	SJ55	SJ55	SJ55
Well Casing										
Borehole Depth	115.1	75.0	289.6	132.5	175.4	189.5	240.1	90.1	165.6	69.5
Borehole Diameter	10.6	6	10.6	10.6	10.6	10.6	10.6	10.6	10.6	9.87
Casing Depth	113.8	74.5	288.3	131.2	165.2	179.3	238.8	67.3	164.3	57.0
Outside Diameter	7	4.5	7	7	4.5	4.5	7	4.5	7	4.5
Inside Diameter	6.54	4	6.54	6.54	4.25	4.25	6.54	4.25	6.54	4.25
Casing Material	SF25	SJ55	SF25	SF25	SS304	SS304	SF25	SS304	SF25	SS304
Monitored Interval										
Top-Depth	115.1	74.5	289.6	132.5	164.0	178.3	240.1	63.5	165.6	55.0
Midpoint-Depth	130.1	359.4	295.6	137.5	171.4	184.2	248.3	75.8	177.8	62.3
Pump Intake-Depth	138.40	.	294.40	137.10	169.90	184.40	248.90	78.60	183.70	65.10
Bottom of Screen-Depth	.	.	.	.	175.2	189.3	.	87.3	.	66.9
Bottom-Depth	145.0	644.3	301.6	142.5	178.7	190.0	256.5	88.0	190.0	69.5
Top-Elevation	757.20	876.54	687.02	825.76	881.75	882.35	715.59	916.86	851.35	850.05
Midpoint-Elevation	742.25	591.64	681.02	820.76	874.40	876.50	707.39	904.61	839.15	842.80
Pump Intake-Elevation	733.88	.	682.25	821.13	875.88	876.29	706.84	901.81	833.25	839.93
Bottom-Elevation	727.30	306.74	675.02	815.76	867.05	870.65	699.19	892.36	826.95	835.55
Screen Length	.	.	.	.	10	10	.	20	.	9.9
Screen Material	.	.	.	.	SS/sw	SS/sw	.	SS/sw	.	SS/sw
Slot Size	.	.	.	.	0.01	0.01	.	0.01	.	0.01
Open-Hole Length	29.9	569.8	12	10	.	.	16.4	.	24.4	.
Open-Hole Diameter	6.25	3.5	6.25	6.25	.	.	6.25	.	6.25	.

APPENDIX C: MONITORING WELL CONSTRUCTION DETAILS, CY 2008

Well Number Hydrogeologic Regime Functional Area	GW-747 EF GRIDK2	GW-748 EF GRIDK2	GW-757 CR LII	GW-762 EF GRIDJ3	GW-763 EF GRIDJ3	GW-769 EF GRIDG3	GW-770 EF GRIDG3	GW-781 EF GRIDE3	GW-782 EF GRIDE3	GW-783 EF GRIDE3
General Information										
Date Installed	01/28/92	01/30/92	04/24/92	05/15/92	05/13/92	06/04/92	06/04/92	08/10/92	08/12/92	08/13/92
Total Depth Drilled	73.3	27.2	166.5	60.2	17.0	61.4	20.0	69.6	36.0	16.3
East Coordinate	64,570	64,579	53,303	63,193	63,220	60,230	60,255	58,118	58,099	58,113
North Coordinate	29,730	29,741	25,410	29,115	29,117	29,510	29,505	29,711	29,719	29,734
Measuring Point	TOC	TOC	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW
Measuring Point Elevation	911.06	911.19	961.64	915.56	915.03	944.43	944.72	947.89	947.73	948.49
Ground Surface Elevation	911.68	911.71	958.65	911.85	911.38	941.53	941.67	944.66	944.48	945.81
Tag Depth-(TOC)	75.7	29.80	168.54	62.04	20.41	62.73	21.68	71.07	38.23	17.98
Geologic Information										
Hydrostratigraphic Unit	AQT	AQT	AQF	AQT	AQT	AQT	AQT	AQT	AQT	AQT
Geologic Formation	Cm	Cm	Ock	Cn	Cn	Cn	Cn	Cn	Cn	Cn
Aquifer Zone	BDR	BDR	BDR	BDR	WT	BDR	WT	BDR	BDR	WT
Weathered Rock-Depth	3.9	8.0	29.5	12.0	17.0	14.2	12.0	0.9	1.0	1.0
Fresh Rock-Depth	5.4	11.8	48.0	14.5	.	.	16.5	14.0	7.5	8.5
Conductor Casing										
Casing Depth	17.2	.	46.8	19.4	.	17.2	.	23.8	.	.
Outside Diameter	10.75	.	10.75	11.75	.	11.75	.	10.75	.	.
Inside Diameter	10	.	10.25	11	.	11	.	10	.	.
Casing Material	SJ55	.	SJ55	SJ55	.	SJ55	.	SJ55	.	.
Well Casing										
Borehole Depth	73.3	27.2	166.5	60.2	17.0	61.4	20.0	69.6	36.0	16.3
Borehole Diameter	9.87	9.87	9.62	9.87	8	10.62	10.62	9.87	9.87	9.87
Casing Depth	62.6	17.0	135.5	48.2	5.2	49.4	8.5	57.8	25.0	4.2
Outside Diameter	4.5	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	4.25
Casing Material	SS304	SS304	SS304	SS304	SS304	SS304	SS304	SS304	SS304	SS304
Monitored Interval										
Top-Depth	60.8	14.8	134.0	46.4	4.0	48.2	7.5	56.0	23.8	3.6
Midpoint-Depth	66.9	21.0	150.3	52.6	10.0	54.3	13.3	62.7	29.9	10.0
Pump Intake-Depth	62.0	17.52	155.00	.	11.80	54.90	13.60	62.80	29.80	10.30
Bottom of Screen-Depth	72.5	26.9	165.5	58.1	15.2	59.3	18.4	68.0	34.9	13.9
Bottom-Depth	73.0	27.2	166.5	58.7	16.0	60.3	19.0	69.3	35.9	16.3
Top-Elevation	844.28	896.91	824.65	865.45	907.38	893.33	934.17	888.66	920.68	942.21
Midpoint-Elevation	838.18	890.71	808.40	859.30	901.38	887.28	928.42	882.01	914.63	935.86
Pump Intake-Elevation	843.06	894.19	803.64	.	899.63	886.63	928.02	881.89	914.73	935.49
Bottom-Elevation	832.08	884.51	792.15	853.15	895.38	881.23	922.67	875.36	908.58	929.51
Screen Length	9.9	9.9	30	9.9	10	9.9	9.9	10.2	9.9	9.7
Screen Material	SS/sw	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	0.01
Open-Hole Length	.	.	.	.	.	.	.	.	.	.
Open-Hole Diameter	.	.	.	.	.	.	.	.	.	.

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Well Number Hydrogeologic Regime Functional Area	GW-791 EF GRIDD2	GW-792 EF GRIDD2	GW-796 CR LV	GW-797 CR LV	GW-798 CR CDLVII	GW-799 CR LV	GW-801 CR LV	GW-802 EF FF	GW-816 EF EXP-SR	GW-820 EF B9201-2
General Information										
Date Installed	09/21/92	09/24/92	03/04/93	03/16/93	03/18/93	03/25/93	07/01/93	06/25/93	06/02/94	.
Total Depth Drilled	70.6	29.2	139.7	134.1	135.5	92.0	188.9	26.5	16.1	17.3
East Coordinate	57,423	57,442	58,206	58,550	60,310	59,961	58,780	62,217	64,031	59,773
North Coordinate	30,483	30,481	27,924	27,447	27,265	26,746	26,808	29,655	31,582	29,175
Measuring Point	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW	TOC	TOWW	TOWW
Measuring Point Elevation	992.13	992.74	1,052.62	1,060.00	1,006.00	981.29	1,097.16	941.83	898.42	929.57
Ground Surface Elevation	988.51	989.60	1,048.80	1,056.10	1,002.42	978.10	1,093.82	942.30	894.56	929.67
Tag Depth-(TOC)	72.45	31.99	139.82	135.71	134.00	97.58	190.92	25.42	17.99	17.18
Geologic Information										
Hydrostratigraphic Unit	AQT	AQT	AQF	AQF	AQF	AQF	AQF	AQT	AQT	AQF
Geologic Formation	Cm	Cm	OCK	OCK	OCK	OCK	OCK	Cn	Cr	Cmn
Aquifer Zone	BDR	WT	BDR	BDR	BDR	BDR	BDR	WT	WT	WT
Weathered Rock-Depth	14.7	14.5	102.0	67.1	94.4	60.8	112.5	10.0	.	.
Fresh Rock-Depth	26.0	.	103.0	89.0	95.8	62.8	113.4	15.0	.	.
Conductor Casing										
Casing Depth	31.5	.	107.6	95.0	99.7	65.0	115.4	.	.	.
Outside Diameter	10.75	.	10.75	10.75	10.75	10.75	10.75	.	.	.
Inside Diameter	10	.	10	10	10	10	10	.	.	.
Casing Material	SJ55	.	SJ55	SJ55	SJ55	SJ55	SJ55	.	.	.
Well Casing										
Borehole Depth	70.6	29.2	139.7	134.1	135.5	92.0	188.9	26.5	15.8	.
Borehole Diameter	9.87	9.87	9.5	9.5	9.5	9.5	9.87	10.62	10	.
Casing Depth	59.0	18.5	126.5	123.5	124.5	81.0	178.1	15.5	4.2	.
Outside Diameter	4.5	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	4.25	4
Casing Material	SS304	SS304	SS304	SS304	SS304	SS304	SS304	PVC40	SS304	PVC
Monitored Interval										
Top-Depth	57.5	17.0	122.9	118.0	122.0	78.7	175.8	13.3	2.9	.
Midpoint-Depth	64.1	23.0	129.7	126.1	128.7	85.4	182.4	19.9	9.4	.
Pump Intake-Depth	63.80	24.90	131.20	128.10	125.90	84.80	177.70	.	11.10	15.60
Bottom of Screen-Depth	68.9	28.2	136.4	133.4	134.4	90.9	188.0	25.5	13.6	.
Bottom-Depth	70.6	29.0	136.5	134.1	135.4	92.0	188.9	26.5	15.8	17.3
Top-Elevation	931.01	972.60	925.90	938.10	880.42	899.40	918.02	929.00	891.66	.
Midpoint-Elevation	924.46	966.60	919.10	930.05	873.72	892.75	911.47	922.40	885.21	.
Pump Intake-Elevation	924.73	964.74	917.62	928.00	876.50	893.29	916.16	.	883.42	914.07
Bottom-Elevation	917.91	960.60	912.30	922.00	867.02	886.10	904.92	915.80	878.76	912.37
Screen Length	9.9	9.7	9.9	9.9	9.9	9.9	9.9	10	9.4	.
Screen Material	SS/sw	SS/sw	SS/sw	SS/sw	SS/sw	SS/sw	SS/sw	PVC/sl	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 2008

Well Number Hydrogeologic Regime Functional Area	GW-829 BC OLF	GW-831 CR FCAP	GW-832 EF NHP	GW-916 BC EMWMF	GW-917 BC EMWMF	GW-918 BC EMWMF	GW-920 BC EMWMF	GW-921 BC EMWMF	GW-922 BC EMWMF	GW-923 BC EMWMF
General Information										
Date Installed	03/17/95	07/30/96	05/09/96	01/29/01	01/22/01	02/02/01	01/16/01	01/31/01	01/17/01	02/01/01
Total Depth Drilled	115.0	200.0	11.9	36.0	51.0	75.0	55.0	50.0	46.0	102.0
East Coordinate	50,036	56,593	64,134	48,276	47,914	47,549	47,375	47,139	47,147	48,184
North Coordinate	29,953	26,654	29,142	31,186	30,463	31,672	30,193	30,350	30,024	30,822
Measuring Point	TOWW	TOWW	TOC	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW
Measuring Point Elevation	985.95	1,091.29	906.18	1,002.85	997.10	1,067.96	967.43	971.29	956.91	1,016.73
Ground Surface Elevation	981.92	1,088.04	906.83	.	.	.	.	.	.	.
Tag Depth-(TOC)	118.68	198.06	10.36	.	.	.	.	.	.	.
Geologic Information										
Hydrostratigraphic Unit	AQT	AQF	AQF	AQT	AQT	AQT	AQT	AQT	AQT	AQT
Geologic Formation	Cn	OCk	Cmn	Cc	Cc	Cc	Cc	Cc	Cc	Cc
Aquifer Zone	BDR	BDR	WT	WT	WT	WT	BDR	BDR	BDR	WT
Weathered Rock-Depth	1.3	134.8	.	10.0	21.0	.	.	.	10.0	.
Fresh Rock-Depth	29.0	140.8	.	15.0	27.0	30.0	12.0	13.0	13.0	62.0
Conductor Casing										
Casing Depth	.	138.3	.	.	.	.	.	.	.	.
Outside Diameter	.	10.75	.	.	.	.	.	.	.	.
Inside Diameter	.	10	.	.	.	.	.	.	.	.
Casing Material	.	STL	.	.	.	.	.	.	.	.
Well Casing										
Borehole Depth	115.0	200.0	11.9	.	.	.	.	.	.	.
Borehole Diameter	9.87	9.87	12	.	.	.	.	.	.	.
Casing Depth	104.7	183.2	5.9	.	20.0	20.0	24.0	18.0	25.0	40.0
Outside Diameter	4.5	4.5	6.63	.	2.37	.	2.37	2.37	2.37	2.37
Inside Diameter	4.25	4.25	6	.	2.07	.	2.07	2.07	2.07	2.07
Casing Material	SS304	SLS	PVC	.	SS304	SS304	SS304	SS304	SS304	SS304
Monitored Interval										
Top-Depth	102.9	182.0	4.0	13.0	18.0	18.0	22.0	16.0	23.0	36.0
Midpoint-Depth	108.8	190.8	7.9	24.5	34.5	25.5	38.5	33.0	34.5	55.5
Pump Intake-Depth	109.50	188.80	.	.	.	.	.	.	.	.
Bottom of Screen-Depth	114.5	193.6	10.9	35.0	50.0	30.0	54.0	48.0	45.0	70.0
Bottom-Depth	114.6	199.6	11.8	36.0	51.0	33.0	55.0	50.0	46.0	75.0
Top-Elevation	879.02	906.04	902.83	.	.	.	.	.	.	.
Midpoint-Elevation	873.17	897.24	898.93	.	.	.	.	.	.	.
Pump Intake-Elevation	872.45	899.29	.	975.35	959.60	1039.46	925.93	935.29	919.41	958.23
Bottom-Elevation	867.32	888.44	895.03	.	.	.	.	.	.	.
Screen Length	9.8	10.4	5	20	30	10	30	30	20	30
Screen Material	SS/sw	SS/sw	PVC/sl	SS/sw	SS/sw	SS/sw	SS/sw	SS/sw	SS/sw	SS/sw
Slot Size	0.01	0.01	0.02	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 2008

Well Number Hydrogeologic Regime Functional Area	GW-924 BC EMWMF	GW-925 BC EMWMF	GW-926 BC EMWMF	GW-927 BC EMWMF	GW-960 EF GridF2
General Information					
Date Installed	01/29/01	02/05/01	02/01/01	02/01/01	07/28/06
Total Depth Drilled	54.0	170.0	145.0	172.0	25.4
East Coordinate	46,300	47,128	46,290	47,906	59,228
North Coordinate	30,185	30,349	30,185	30,463	30,212
Measuring Point	TOWW	TOWW	TOWW	TOWW	TOC
Measuring Point Elevation	968.90	971.14	968.94	997.19	963.26
Ground Surface Elevation	.	.	.	.	959.88
Tag Depth-(TOC)	.	.	.	.	.
Geologic Information					
Hydrostratigraphic Unit	AQT	AQT	AQT	AQT	AQT
Geologic Formation	Cc	Cc	Cc	Cc	Cn
Aquifer Zone	WT	BDR	BDR	BDR	WT
Weathered Rock-Depth	21.8	.	15.0	25.0	17.0
Fresh Rock-Depth	22.0	15.0	18.0	30.0	17.2
Conductor Casing					
Casing Depth	.	.	.	.	.
Outside Diameter	.	.	.	.	.
Inside Diameter	.	.	.	.	.
Casing Material	.	.	.	.	.
Well Casing					
Borehole Depth	.	.	.	.	25.4
Borehole Diameter	.	.	.	.	.
Casing Depth	23.0	97.0	113.0	60.0	14.6
Outside Diameter	2.37	2.37	2.37	2.37	4.5
Inside Diameter	2.07	2.07	2.07	2.07	4
Casing Material	SS304	SS304	SS304	SS304	PVC
Monitored Interval					
Top-Depth	21.0	92.0	103.0	57.0	12.2
Midpoint-Depth	37.5	120.0	124.0	74.5	18.8
Pump Intake-Depth	.	.	.	.	.
Bottom of Screen-Depth	53.0	147.0	143.0	90.0	24.6
Bottom-Depth	54.0	148.0	145.0	92.0	25.4
Top-Elevation	.	.	.	.	947.68
Midpoint-Elevation	.	.	.	.	941.08
Pump Intake-Elevation	928.40	848.14	841.94	919.69	.
Bottom-Elevation	.	.	.	.	934.48
Screen Length	30	50	30	30	10
Screen Material	SS/sw	SS/sw	SS/sw	SS/sw	PVC/sl
Slot Size	0.01	0.01	0.01	0.01	0.01
Open-Hole Length	.	.	.	.	.
Open-Hole Diameter	.	.	.	.	.

APPENDIX D

CY 2008 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:

- BJC - managed by Bechtel Jacobs Company LLC
- GWPP - managed by Y-12 Groundwater Protection Program

Sample Type:

- Dup - Field duplicate sample

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 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 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 (mg/L)		Analyte	Reporting Limit (mg/L)	
	GWPP	BJC		GWPP	BJC
Cations			Anions		
Calcium	0.2	0.25	Bicarbonate	1.0	NS
Magnesium	0.2	0.05	Carbonate	1.0	NS
Potassium	2.0	0.25	Chloride	0.2	0.1
Sodium	0.2	0.25	Fluoride	0.1	0.05
			Nitrate (as Nitrogen)	0.028	0.1
			Sulfate	0.25	0.1
Note: “NS” - not specified.					

The major ion results for the following samples are qualitative because the ion charge balance error (percent difference between summed cation charge and summed anion charge) exceeds 20%.

The Y-12 GWPP sampling and analysis plan (SAP) for CY 2008 (BWXT 2007a) specifies trace metal reporting limits and analytical methods that are appropriate for DOE Order monitoring. The laboratories subcontracted by monitoring programs managed by BJC 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 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 reporting limits (BJC 2007) 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 2008 and are presented in Appendix D.1.

EXPLANATION (continued)

Analyte	Reporting Limit (mg/L)		Analyte	Reporting Limit (mg/L)	
	GWPP	BJC		GWPP	BJC
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	0.0002**	0.0002
Barium	0.004	0.005	Molybdenum	0.05	0.01*
Beryllium	0.001	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 BJC reporting limit; ** - reporting limit for mercury was lowered to 0.00005 mg/L beginning in October 2008; "NS" - not specified.					

Groundwater samples collected from the following wells for metals analysis during CY 2008 were diluted before analysis to obtain an optimum matrix. The detected results are valid, but some metals may be present at concentrations below the elevated reporting limits.

Sampling Location	Date Sampled	Dilution Factor	Sampling Location	Date Sampled	Dilution Factor
GW-246	03/12/08	10	GW-246	12/10/08	10
GW-246	06/10/08	10	GW-615	08/11/08	20
GW-246	08/07/08	20			

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
- R - Unusable; duplicate results differ significantly
- * - Field measurements obtained on a previous date, as shown below:

Sampling Location	Date Sampled	Field Measurements	Sampling Location	Date Sampled	Field Measurements
GW-363	02/21/08	02/20/08	GW-639	04/29/08	04/28/08
GW-363	08/12/08	08/11/08	GW-639	08/12/08	08/11/08
GW-639	02/21/08	02/20/08	GW-921	08/05/08	08/04/08

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 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, 28 compounds were detected in the CY 2008 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	76	4,600	Methylene chloride	8	21
cis-1,2-Dichloroethene	57	14,000	1,1,2-Trichloroethane	7	9
Tetrachloroethene	56	22,000	Carbon tetrachloride	6	4 J
1,1-Dichloroethene	41	380	1,2-Dichloroethane	5	18
1,1-Dichloroethane	34	3,000	Chlorobenzene	5	14
Vinyl chloride	24	3,700	Ethylbenzene	4	6
Benzene	24	1,600	1,4-Dichlorobenzene	4	4 J
trans-1,2-Dichloroethene	23	73	Acetone	3	56
1,1,1-Trichloroethane	21	1,100	Dichlorodifluoromethane	2	44
Chloroform	20	120	cis-1,3-Dichloropropene	1	3 J
Toluene	19	37	2-Butanone	1	2 J
1,1,2-Trichloro-1,2,2-trifluoroethane	17	590	1,2-Dichloropropane	1	1 J
Total Xylene	13	25	Carbon disulfide	1	1 J
Chloroethane	10	24	1,1,2,2-Tetrachloroethane	1	0.2 J

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

- . - Not analyzed
- < - Analyzed but not detected (also false-positive results)
- B - Also detected in the associated method blank sample
- J - Positively identified, estimated concentration below the contract-required quantitation limit
- Q - Result is inconsistent with historical measurements for the location

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. Quarterly monitoring at the EMWMF during CY 2008 includes analyses for an extensive list of isotopes with low detection limits. The following summary shows the primary radiological analytes relevant to DOE Order monitoring collected during CY 2008 in the Bear Creek Regime.

Analyte	No. of Results	No. Detected	Analyte	No. of Results	No. Detected
Gross Alpha	103	50	Technetium-99	109	22
Gross Beta	103	65	Uranium-234*	106	56
Americium-241	76	9	Uranium-235*	106	15
Neptunium-237	75	6	Uranium-236	5	3
Total Radium Alpha	2	2	Uranium-238	106	45
Strontium-89/90*	76	11			
Note: * = Reported by BJC laboratories in Appendix D.3 as equivalent GWPP analytes: Sr-90 = Sr-89/90; U-233/234 = U-234; U-235/236 = U-235.					

All of the results for gross alpha and gross beta are presented in the first three pages of Appendix D.3, followed by results for the primary isotopes shown above (pages D.3-4 through D.3-13).

The additional isotopic data obtained for sampling locations at the EMWMF are summarized below.

Analyte	No. of Results	No. Detected	Analyte	No. of Results	No. Detected
Actinium-227	74	7	Plutonium-236	74	1
Americium-243	74	22	Plutonium-238	74	0
Carbon-14	74	1	Plutonium-239/240	74	1
Cesium-137	74	0	Plutonium-241	74	0
Chlorine-36	74	2	Plutonium-242	74	6
Cobalt-60	74	1	Plutonium-244	74	1
Curium-242	74	26	Potassium-40	74	4
Curium-243/244	74	0	Radium-226	74	22
Curium-245	74	0	Radium-228	74	5
Curium-246	74	26	Thorium-227	74	7
Curium-247	74	1	Thorium-228	74	4
Curium-248	74	1	Thorium-229	74	9
Europium-152	74	0	Thorium-230	74	20
Europium-154	74	0	Thorium-231+234	74	22
Europium-155	74	0	Thorium-232	74	3
Iodine-129	74	6	Tritium	74	3
Nickel-63	74	5	Uranium-232	74	0
			Yttrium-90	74	11

Results for the isotopes that exceed the MDA (shown above as detected) are presented after the primary isotopic data (beginning on page D.3-14).

EXPLANATION (continued)

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)
- Q - Result is inconsistent with historical measurements for the location
- R - Result does not meet data quality objectives: exceeds the MDA but is less than the TPU.

EXPLANATION (continued)

Additional Analytes Not Presented in Appendix D tables:

As shown below, a few semivolatile organic compounds and pesticides were detected in at least one sample from most of the locations at the Environmental Management Waste Management Facility.

Sampling Location	Date Sampled	Compound	Result (µg/L)
GW-639	04/29/08	Benzo(a)pyrene	0.7 Q
GW-639	04/29/08	Indeno(1,2,3-cd)pyrene	0.5
GW-639	04/29/08	4,4'-DDE	0.018 Q
GW-639	04/29/08	Endosulfan sulfate	0.013 Q
GW-639	04/29/08	Endrin aldehyde	0.028 J
GW-916	02/13/08	Benzo(a)anthracene	0.5 Q
GW-917	02/11/08	Benzo(a)anthracene	0.5 Q
GW-917	02/11/08	Carbazole	0.5 Q
GW-917	02/11/08	Di-n-butylphthalate	0.6 J
GW-917	04/15/08	Di-n-butylphthalate	0.8 J
GW-918	02/14/08	Bis(2-ethylhexyl)phthalate	1 J
GW-918	04/16/08	Di-n-butylphthalate	1 J
GW-920	02/12/08	Benzo(a)anthracene	0.5 Q
GW-921	02/12/08	Benzo(a)anthracene	0.5 Q
GW-922	02/12/08	Benzo(a)anthracene	0.5 Q
GW-922	11/05/08	Bis(2-ethylhexyl)phthalate	0.7 J
GW-924	11/06/08	Di-n-butylphthalate	0.5 J
GW-925	02/14/08	Benzoic acid	0.9 Q
GW-925	11/05/08	Bis(2-ethylhexyl)phthalate	0.7 J
GW-926	02/19/08	Bis(2-ethylhexyl)phthalate	2 J
GW-926	11/06/08	Benzidine	1 J
GW-927	02/11/08	Benzo(a)anthracene	0.5 Q
GW-927	02/11/08	Benzoic acid	1 Q
GW-927	02/11/08	Di-n-butylphthalate	4 J
EMW-VWEIR	02/11/08	Benzoic acid	2 J
EMW-VWEIR	02/11/08	Di-n-butylphthalate	3 J
EMW-VWEIR	04/14/08	Di-n-butylphthalate	2 J
EMW-VWUNDER	08/06/08	Benzidine	1 J
EMW-VWUNDER	11/10/08	Di-n-butylphthalate	0.5 J
EMWNT-03A	02/11/08	Di-n-butylphthalate	2 J
EMWNT-03A	04/14/08	Di-n-butylphthalate	1 J
EMWNT-05	04/14/08	Di-n-butylphthalate	0.7 J

Because the concentrations are very low (most are estimated values), many are inconsistent with historical results (Q qualified), and the compounds are typically 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 2008 MONITORING DATA FOR THE BEAR CREEK HYDROGEOLOGIC REGIME
Field Measurements, Miscellaneous Analytes, Major Ions, and Trace Metals

Sampling Point	GW-006		GW-008		GW-014	GW-046		GW-058	GW-065		GW-068
Functional Area	OLF		OLF		BG	BG		BG	OLF		BG
Date Sampled	03/12/08	07/29/08	01/02/08	07/08/08	09/17/08	01/03/08	07/07/08	01/23/08	03/03/08	08/06/08	09/16/08
Program	GWPP	GWPP	BJC	BJC	GWPP	BJC	BJC	GWPP	GWPP	GWPP	GWPP
Sample Type											
Field Measurements											
Time Sampled	14:15	8:50	13:50	15:00	14:10	13:45	15:10	8:45	8:50	8:50	8:55
Measuring Point Elev. (ft)	963.33	963.33	965.39	965.39	934.50	921.17	921.17	913.30	982.50	982.50	924.61
Depth to Water (ft)	6.78	9.99	14.45	16.48	8.50	5.57	5.74	21.80	26.20	28.85	10.03
Groundwater Elevation (ft)	956.55	953.34	950.94	948.91	926.00	915.60	915.43	891.50	956.30	953.65	914.58
Conductivity (µmho/cm)	640	386	189	233	574	227	399	715	501	679	720
Dissolved Oxygen (ppm)	0.74	1.07	2.2	1.33	0.43	0.96	1.29	5.55	6.05	2.13	0.59
Oxidation/Reduction (mV)	161	178	87	63	30	108	129	180	245	145	-91
Temperature (degrees C)	15.3	19.5	13.3	18.1	18.5	15.1	21.4	13.4	9.1	18	17.1
Turbidity (NTU)	.	.	5	2	.	2	5	.	.	.	.
pH	7.22	7.2	5.99	5.14	6.79	5.63	5.42	7.24	7.04	6.87	7.53
Miscellaneous Analytes											
Dissolved Solids (mg/L)	327	362	.	.	392	.	.	420	1	294	364
Suspended Solids (mg/L)	<	<	.	.	<	.	.	28	10	<	7
Turbidity (NTU)	1.37	.	.	.	.	.	.	94.4	15.5	.	.
Major Ions (mg/L)											
Calcium	92	87.2	9.47	14.1	94.8	.	.	95.4	78.1	93.1	64
Magnesium	8.97	8.67	4.66	7.5	14	.	.	21.4	12.7	15.3	17.3
Potassium	2.03	2.17	1.02	1.31	<	.	.	2.52	2.08	4.58	10.4
Sodium	9.31	9.19	1.99	3.31	9.45	.	.	14.6	1.54	3.8	36.8
Bicarbonate	228	134	.	.	290	.	.	207	210	277	165
Carbonate	<	<	.	.	<	.	.	<	<	<	<
Chloride	8.57	8.04	.	.	11.4	.	.	25.7	0.74	7.64	111
Fluoride	<	<	.	.	<	.	.	0.272	0.107	0.109	0.114
Nitrate as N	3.4	3.1	.	.	<	.	.	18.2 Q	0.0526	1.07	<
Sulfate	29.6	28.7	.	.	6.08	.	.	40.2	20.3	20.5	4.74
Charge balance error (%)	1.1	19.4	.	.	0.4	.	.	1.5	4.2	-0.6	-0.4
Trace Metals (mg/L)											
Aluminum	<	<	<	<	<	.	.	2.92	1.02	<	<
Arsenic	<	<	<	<	<	.	.	<	<	<	<
Barium	0.299	0.286	0.0614	0.101	0.486	.	.	0.1	0.0258	0.0233	0.747
Beryllium	<	<	<	<	<	.	.	<	<	<	<
Boron	<	<	<	<	3.51	.	.	<	<	<	<
Cadmium	<	<	<	<	<	.	.	<	<	<	<
Chromium	<	<	<	<	<	.	.	0.0908 Q	<	0.0195	<
Cobalt	<	<	<	0.0319	<	.	.	<	<	<	<
Copper	<	<	<	<	<	.	.	<	<	<	<
Iron	<	<	1.73	5.14	0.0613	.	.	3.57	0.873	<	0.281
Lead	0.00093	<	<	<	<	.	.	0.0278	0.0242	0.00087	0.00293
Lithium	0.0256	0.0251	<	<	0.024	.	.	<	<	<	0.0642
Manganese	0.0106	0.0114	1.66	2.96	0.597	.	.	0.104	0.713	0.0267	0.0214
Mercury	<	<	<	<	<	.	.	<	<	<	<
Nickel	<	0.0112	0.0142	0.0286	0.043	.	.	0.0435	0.0233	0.00604	0.089
Strontium	0.352	0.342	0.0243	0.0394	0.32	.	.	0.197	0.134	0.149	1.83
Thallium	<	<	<	<	<	.	.	<	<	<	<
Uranium	<	<	<	<	0.00114	<	<	0.0964 Q	0.00689	0.00818	<
Vanadium	<	<	<	<	<	.	.	<	<	<	<
Zinc	<	<	<	<	<	.	.	<	<	<	<

APPENDIX D.1: CY 2008 MONITORING DATA FOR THE BEAR CREEK HYDROGEOLOGIC REGIME
Field Measurements, Miscellaneous Analytes, Major Ions, and Trace Metals

Sampling Point	GW-071		GW-077		GW-078		GW-079		GW-080	
Functional Area	BG		BG		BG		BG		BG	
Date Sampled	03/25/08	09/16/08	02/26/08	08/14/08	02/21/08	08/14/08	02/21/08	07/31/08	02/21/08	
Program	GWPP	GWPP	BJC	BJC	BJC	BJC	BJC	BJC	BJC	BJC
Sample Type										Dup
Field Measurements										
Time Sampled	10:10	10:45	11:25	14:45	14:20	14:10	13:25	14:25	13:30	.
Measuring Point Elev. (ft)	928.90	928.90	919.30	919.30	918.10	918.10	981.20	981.20	981.00	.
Depth to Water (ft)	8.03	10.33	7.04	11.70	4.97	10.61	19.79	23.77	21.26	.
Groundwater Elevation (ft)	920.87	918.57	912.26	907.60	913.13	907.49	961.41	957.43	959.74	.
Conductivity (µmho/cm)	1,742	1,742	320	707	489	676	293	228	241	.
Dissolved Oxygen (ppm)	0.38	0.31	0.21	1.12	2.72	2.78	1.05	2.23	5.59	.
Oxidation/Reduction (mV)	-309	-323	57	9	22	147	-56	-97	65	.
Temperature (degrees C)	8.1	19.1	14.5	21.3	14	16.1	13.2	15.8	13.6	.
Turbidity (NTU)	.	.	3	1	83	3	1	2	3	.
pH	10.26	10.55	7.05	7.8	6.96	7.17	7.13	7	6.9	.
Miscellaneous Analytes										
Dissolved Solids (mg/L)	860	880	243	238	267	237	143	138	119	104
Suspended Solids (mg/L)	<	2	<	<	60	5	<	<	21	23
Turbidity (NTU)	1.03	.	.	.	.	.	.	.	.	.
Major Ions (mg/L)										
Calcium	1.11	1.1	.	.	.	.	.	.	.	.
Magnesium	<	<	.	.	.	.	.	.	.	.
Potassium	3.15	3.04	.	.	.	.	.	.	.	.
Sodium	381	373	.	.	.	.	.	.	.	.
Bicarbonate	323	281	.	.	.	.	.	.	.	.
Carbonate	370	407	.	.	.	.	.	.	.	.
Chloride	45.4	43.8	.	.	.	.	.	.	.	.
Fluoride	5.54	6.2	.	.	.	.	.	.	.	.
Nitrate as N	<	<	.	.	.	.	.	.	.	.
Sulfate	20	18.5	.	.	.	.	.	.	.	.
Charge balance error (%)	2.1	0.9	.	.	.	.	.	.	.	.
Trace Metals (mg/L)										
Aluminum	0.276	0.289	.	.	.	.	.	.	.	.
Arsenic	0.0155	0.0119	.	.	.	.	.	.	.	.
Barium	0.0762	0.0736	.	.	.	.	.	.	.	.
Beryllium	<	<	.	.	.	.	.	.	.	.
Boron	0.76	0.779	.	.	.	.	.	.	.	.
Cadmium	<	<	.	.	.	.	.	.	.	.
Chromium	<	<	.	.	.	.	.	.	.	.
Cobalt	<	<	.	.	.	.	.	.	.	.
Copper	<	<	.	.	.	.	.	.	.	.
Iron	0.161	<	.	.	.	.	.	.	.	.
Lead	0.00218	0.00108	.	.	.	.	.	.	.	.
Lithium	0.153	0.144	.	.	.	.	.	.	.	.
Manganese	<	<	.	.	.	.	.	.	.	.
Mercury	<	<	.	.	.	.	.	.	.	.
Nickel	<	<	.	.	.	.	.	.	.	.
Strontium	0.187	0.186	.	.	.	.	.	.	.	.
Thallium	<	<	.	.	.	.	.	.	.	.
Uranium	<	<	<	<	<	<	<	<	<	<
Vanadium	<	<	.	.	.	.	.	.	.	.
Zinc	<	<	.	.	.	.	.	.	.	.

APPENDIX D.1: CY 2008 MONITORING DATA FOR THE BEAR CREEK HYDROGEOLOGIC REGIME
Field Measurements, Miscellaneous Analytes, Major Ions, and Trace Metals

Sampling Point	GW-080		GW-082	GW-085		GW-089	GW-098	GW-122	GW-225	
Functional Area	BG		BG	OLF		BG	OLF	S3	OLF	
Date Sampled	07/31/08		09/25/08	03/13/08	08/05/08	09/24/08	03/11/08	03/11/08	01/28/08	07/29/08
Program	BJC	BJC	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP
Sample Type		Dup								
Field Measurements										
Time Sampled	14:45	.	9:05	10:00	9:55	10:10	9:50	13:35	13:50	10:20
Measuring Point Elev. (ft)	981.00	.	964.00	983.57	983.57	964.36	945.95	1,007.20	943.11	943.11
Depth to Water (ft)	23.76	.	22.47	12.52	15.55	8.09	9.40	14.51	15.25	16.04
Groundwater Elevation (ft)	957.24	.	941.53	971.05	968.02	956.27	936.55	992.69	927.86	927.07
Conductivity (µmho/cm)	181	.	932	1,152	1,345	378	1,343	3,080	1,112	1,092
Dissolved Oxygen (ppm)	8.86	.	0.32	1.22	0.77	0.25	0.33	0.26	0.13	0.07
Oxidation/Reduction (mV)	-46	.	-28	171	162	47	43	134	59	159
Temperature (degrees C)	17.6	.	14.9	16.1	18.8	17.6	14.4	15.4	14.1	17.6
Turbidity (NTU)	24	.	.	.	.	.	.	.	.	.
pH	6.87	.	6.66	6.95	6.83	7.15	6.58	6.72	7.18	7.25
Miscellaneous Analytes										
Dissolved Solids (mg/L)	101	107	549	689	1,020	187	681	2,140	573	642
Suspended Solids (mg/L)	12	10	6	1	<	3	3	<	1	3
Turbidity (NTU)	.	.	.	3.07	.	.	0.43	2.17	3.37	.
Major Ions (mg/L)										
Calcium	.	.	160	176	200	51.7	221	379	114	118
Magnesium	.	.	18.3	11.5	13.3	9.69	33.5	115	47.7	46.8
Potassium	.	.	<	<	<	2.08	5.7	23.6	2.93	2.79
Sodium	.	.	9.66	9.32	10.3	7.14	33.3	92.1	26.6	26
Bicarbonate	.	.	361	196	215	174	557	392	221	243
Carbonate	.	.	<	<	<	<	<	<	<	<
Chloride	.	.	99.7	6.86	7.37	2.07	119	97.8	83.9	84.6
Fluoride	.	.	<	<	<	0.166	<	<	0.493	0.5
Nitrate as N	.	.	<	84.9	103	0.0321	<	309	38.7	39.4
Sulfate	.	.	5.8	7.75	7.9	14	17.9	11.9	59.5	50.7
Charge balance error (%)	.	.	-1.2	-1	-2.1	-1.3	1.7	0.1	0.1	-0.9
Trace Metals (mg/L)										
Aluminum	.	.	<	<	<	<	<	<	<	<
Arsenic	.	.	<	<	<	<	<	<	<	<
Barium	.	.	0.928	0.49	0.567	0.245	0.738	1.29	0.167	0.165
Beryllium	.	.	<	<	<	<	<	<	<	<
Boron	.	.	17.7	<	<	<	0.219	0.413	0.132	0.123
Cadmium	.	.	<	<	<	<	<	<	<	<
Chromium	.	.	<	<	<	<	<	<	<	<
Cobalt	.	.	<	<	<	<	<	<	<	<
Copper	.	.	<	<	<	<	<	<	<	<
Iron	.	.	0.578	0.107	0.116	<	0.192	0.378	0.272	0.626
Lead	.	.	0.00138	0.00244	0.00114	0.00114	0.00564	<	<	<
Lithium	.	.	0.307	0.0166	0.0179	0.0241	0.0413	0.163	0.02	0.0197
Manganese	.	.	0.951	0.00842	0.00812	3.05	0.88	0.0784	0.0135	0.05
Mercury	.	.	<	<	<	<	<	<	<	<
Nickel	.	.	0.0114	0.00516	0.0114	0.0102	0.0504	0.0118	<	0.0147
Strontium	.	.	0.306	0.406	0.474	0.266	1.39	12.5	1.92	1.75
Thallium	.	.	<	<	<	<	<	<	<	<
Uranium	<	<	<	<	<	<	0.00126	0.00196	0.00327	0.00263
Vanadium	.	.	<	<	<	<	<	<	<	<
Zinc	.	.	<	<	<	<	<	<	<	<

APPENDIX D.1: CY 2008 MONITORING DATA FOR THE BEAR CREEK HYDROGEOLOGIC REGIME
Field Measurements, Miscellaneous Analytes, Major Ions, and Trace Metals

Sampling Point	GW-226		GW-227	GW-229		GW-229		GW-246			
Functional Area	OLF		OLF	OLF		OLF		S3			
Date Sampled	02/04/08	07/29/08	02/05/08	02/06/08		06/17/08	12/11/08	03/12/08	06/10/08	08/07/08	12/10/08
Program	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP
Sample Type					Dup						
Field Measurements											
Time Sampled	10:25	13:45	13:40	13:30	13:30	8:20	10:50	8:45	9:30	8:25	9:30
Measuring Point Elev. (ft)	943.57	943.57	946.46	949.00	949.00	949.00	949.00	1,009.19	1,009.19	1,009.19	1,009.19
Depth to Water (ft)	8.76	17.11	7.30	14.44	14.44	26.77	17.15	11.63	13.61	13.72	13.48
Groundwater Elevation (ft)	934.81	926.46	939.16	934.56	934.56	922.23	931.85	997.56	995.58	995.47	995.71
Conductivity (µmho/cm)	1,068	1,136	995	1,696	1,696	1,668	1,660	19,940	19,670	19,440	18,070
Dissolved Oxygen (ppm)	0.52	0.36	0.13	0.07	0.07	0.27	0.32	0.19	0.65	0.37	0.82
Oxidation/Reduction (mV)	182	148	114	-59	-59	-34	-47	369	344	322	299
Temperature (degrees C)	10.7	21.8	14.6	16.2	16.2	16.3	14.9	13.8	18.8	19.1	16.9
Turbidity (NTU)	.	.	.	.	.	.	.	.	.	.	.
pH	6.78	7	6.73	6.41	6.41	6.32	6.46	4.41	4.71	4.71	5.02
Miscellaneous Analytes											
Dissolved Solids (mg/L)	664	700	737	882	726	26,300 Q	904	16,600	17,800	17,400	16,300
Suspended Solids (mg/L)	3.5	<	<	21	18	7	42	2	8	4	<
Turbidity (NTU)	19	.	15.9	76.6	72.4	.	.	0.132	.	.	.
Major Ions (mg/L)											
Calcium	152	140	161	186	196	191	196	2,880	2,800	2,980	2,900
Magnesium	41	44.4	33.9	35.3	35.7	35.3	36.8	630	570	604	593
Potassium	3.02	2.7	2.7	13.2	13.5	14.7	14	38.9	37.1	<	34.8
Sodium	23.9	29	15.7	74.7	75.4	83.1	80.5	578	457	462	440
Bicarbonate	424	312	425	601	599	643	619	29.7	56.4	65.3	72.9
Carbonate	<	<	<	<	<	<	<	<	<	<	<
Chloride	56	88.9	32.6	134	122	147	148	300	292	275	286
Fluoride	<	<	<	0.11	0.11	0.128	0.139	0.988	4.65	1.11	1.69
Nitrate as N	11.5	36	4.59	<	<	<	<	2970	2990	3020	3027
Sulfate	22	30.9	35.2	17.7	18	14.8	15.5	30.8	21.3	21.1	19.6
Charge balance error (%)	3.2	0	5	-1.2	1.7	-2.6	-0.6	0	-3.7	-1.5	-2.9
Trace Metals (mg/L)											
Aluminum	<	<	<	<	<	<	<	82.9	47.9	42	33
Arsenic	<	<	<	0.0102	0.00983	0.0116	0.00847	<	<	<	<
Barium	0.226	0.204	0.177	1.28	1.29	1.42	1.35	2.99	5.88	4.84	5.41
Beryllium	<	<	<	<	<	<	<	0.0402	0.0252	0.0217	0.0175
Boron	0.19	0.134	0.131	2.98	3	3.55	3.44	<	<	<	<
Cadmium	<	<	<	<	<	<	<	0.423	0.329	0.346	0.3
Chromium	<	<	<	<	<	<	<	<	<	<	<
Cobalt	<	<	<	<	<	<	<	0.624	0.452	0.457	0.404
Copper	<	<	<	<	<	<	<	<	<	<	<
Iron	2.17	0.711	1.89	18.4	18.7	28.4	20.7	<	<	<	<
Lead	<	<	<	<	<	0.000575	<	0.00144	<	<	<
Lithium	0.0161	0.0171	0.0191	0.114	0.118	0.126	0.118	0.758	0.58	0.608	0.584
Manganese	0.917	0.218	0.917	4.89	4.97	7.3	4.86	137	102	102	94.4
Mercury	<	<	<	<	<	<	<	0.00136	0.00084	0.00098	0.00045
Nickel	0.0134	0.0188	0.00607	0.0573	0.0558	0.053	0.0581	5.36	3.53	3.93	3.82
Strontium	0.604	0.793	0.325	0.596	0.6	0.577	0.635	10.3	10.1	10.8	10.9
Thallium	<	<	<	<	<	<	<	<	<	<	<
Uranium	0.0142	0.00656	0.0549	0.174	0.172	0.167	0.157	0.718	0.504	0.441	0.444
Vanadium	<	<	<	<	<	<	<	<	<	<	<
Zinc	<	<	<	<	<	<	<	<	<	<	<

APPENDIX D.1: CY 2008 MONITORING DATA FOR THE BEAR CREEK HYDROGEOLOGIC REGIME
Field Measurements, Miscellaneous Analytes, Major Ions, and Trace Metals

Sampling Point	GW-257	GW-259		GW-276		GW-289	GW-306		GW-309		
Functional Area	BG	BG		S3		BG	RS		RS		
Date Sampled	09/23/08	03/10/08	09/23/08	01/03/08	07/07/08	09/24/08	03/06/08	07/31/08	03/05/08	07/30/08	
Program	GWPP	GWPP	GWPP	BJC	BJC	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP
Sample Type											Dup
Field Measurements											
Time Sampled	11:00	13:45	9:30	12:30	11:00	8:45	10:25	10:15	14:10	10:15	10:15
Measuring Point Elev. (ft)	961.68	943.80	943.80	1,001.57	1,001.57	948.73	991.78	991.78	988.17	988.17	988.17
Depth to Water (ft)	30.12	4.27	14.06	6.26	8.22	20.00	31.22	36.09	19.30	21.27	21.27
Groundwater Elevation (ft)	931.56	939.53	929.74	995.31	993.35	928.73	960.56	955.69	968.87	966.90	966.90
Conductivity (µmho/cm)	336	379	390	435	1,372	374	858	859	869	886	886
Dissolved Oxygen (ppm)	1.08	1.15	0.78	4.75	0.75	0.36	0.6	0.41	0.3	1.39	1.39
Oxidation/Reduction (mV)	210	186	222	114	119	191	142	139	87	71	71
Temperature (degrees C)	17.7	14.7	19.8	8.5	21.1	16.9	12.6	19.5	14.8	18.4	18.4
Turbidity (NTU)	.	.	.	3	0	.	.	.	.	.	.
pH	6.16	6.23	6.01	5.2	5.25	6.55	6.81	6.74	6.7	6.61	6.61
Miscellaneous Analytes											
Dissolved Solids (mg/L)	195	219	244	.	.	150	115	474	482	544	486
Suspended Solids (mg/L)	1	<	<	.	.	3	<	<	<	<	<
Turbidity (NTU)	.	0.601	.	.	.	.	0.391	.	0.368	.	.
Major Ions (mg/L)											
Calcium	50.7	64.9	65.8	28.6	44.2	54.7	145	147	144	150	149
Magnesium	4.08	6.2	6.09	5.04	7.03	6.37	18.5	18.2	19.3	19.7	19.5
Potassium	<	<	<	5.05	4.73	<	2.57	2.39	3.89	3.66	3.71
Sodium	9.13	5.6	5.47	52.6	53.6	5.71	9.03	9.24	9.35	10.4	10.3
Bicarbonate	146	178	175	.	.	159	361	356	428	422	427
Carbonate	<	<	<	.	.	<	<	<	<	<	<
Chloride	1.57	2.93	3.03	.	.	2.56	23.8	24	17.3	24.3	23.7
Fluoride	0.106	<	<	.	.	<	<	<	<	<	<
Nitrate as N	0.309	0.541	0.489	12.4	19	0.231	3.32	3.18	<	<	<
Sulfate	9.96	17.9	16.4	.	.	8.66	44.9	43.5	19.1	23.9	24.9
Charge balance error (%)	1	-0.7	0.8	.	.	0.8	0.9	2	-0.9	0.2	-0.7
Trace Metals (mg/L)											
Aluminum	0.254	<	<	1.8	1.35	<	<	<	<	<	<
Arsenic	<	<	<	<	<	<	<	<	<	<	<
Barium	0.114	0.224	0.22	0.0694	0.077	0.126	0.0557	0.0555	0.0836	0.0771	0.0762
Beryllium	<	<	<	0.0024	0.002	<	<	<	<	<	<
Boron	<	<	<	<	<	<	<	<	<	<	<
Cadmium	<	<	<	0.0078	0.007	<	<	<	<	<	<
Chromium	<	<	<	<	<	<	<	<	<	<	<
Cobalt	<	<	<	0.0415	0.0299	<	<	<	<	<	<
Copper	<	<	<	<	<	<	<	<	<	<	<
Iron	0.215	<	<	<	<	<	<	<	<	0.0601	0.0547
Lead	0.0026	<	<	<	<	<	0.00118	<	<	<	0.00154
Lithium	<	0.0126	0.012	0.0147 J	0.0124	0.0108	<	<	<	<	<
Manganese	0.0172	<	<	1.83	1.69	<	<	<	6.31	6.76	6.74
Mercury	<	<	<	0.00044	<	<	<	<	<	<	<
Nickel	<	<	<	0.101	0.101	<	0.00579	0.0143	0.0058	0.0212	0.0165
Strontium	0.0755	0.119	0.12	0.0676	0.104	0.105	0.166	0.169	0.39	0.392	0.389
Thallium	<	<	<	<	<	<	<	<	<	<	<
Uranium	<	<	<	0.39	0.32	<	0.00096	0.00118	0.00099	0.00102	0.001
Vanadium	<	<	<	<	<	<	<	<	<	<	<
Zinc	<	<	<	<	<	<	<	<	<	<	<

APPENDIX D.1: CY 2008 MONITORING DATA FOR THE BEAR CREEK HYDROGEOLOGIC REGIME
Field Measurements, Miscellaneous Analytes, Major Ions, and Trace Metals

Sampling Point	GW-310	GW-312	GW-314		GW-315	GW-363				GW-365
Functional Area	RS	RS	SPI		SPI	EMWMF				OLF
Date Sampled	02/14/08	02/19/08	03/24/08	08/04/08	02/19/08	02/21/08*	04/24/08	08/12/08*	11/12/08	01/28/08
Program	GWPP	GWPP	GWPP	GWPP	GWPP	BJC	BJC	BJC	BJC	GWPP
Sample Type										
Field Measurements										
Time Sampled	10:20	10:25	8:50	9:15	14:00	9:00	14:35	10:30	9:30	10:40
Measuring Point Elev. (ft)	995.52	996.70	1,049.81	1,049.81	1,047.45	957.91	957.91	957.91	957.91	935.58
Depth to Water (ft)	20.42	33.01	55.43	62.93	53.45	4.45	4.73	5.41	6.32	11.24
Groundwater Elevation (ft)	975.10	963.69	994.38	986.88	994.00	953.46	953.18	952.50	951.59	924.34
Conductivity (µmho/cm)	971	320	699	762	826	372	433	797	338	1,143
Dissolved Oxygen (ppm)	0.62	1.6	0.82	0.65	0.36	3.54	3.02	0.63	4.08	0.17
Oxidation/Reduction (mV)	164	57	187	150	115	113	146	82	82	-119
Temperature (degrees C)	13	9.8	13.9	16.9	13.8	15.9	19.9	19.6	15.2	11.6
Turbidity (NTU)	.	.	.	.	.	4	3	4	4	.
pH	6.68	9.09	7.31	6.93	7.16	9.19	9.13	8.79	9.09	6.94
Miscellaneous Analytes										
Dissolved Solids (mg/L)	332	178	371	418	471	.	.	.	.	617
Suspended Solids (mg/L)	<	<	1	<	<	.	.	.	.	23
Turbidity (NTU)	0.193	0.286 J	0.117	.	0.321	.	.	.	.	280
Major Ions (mg/L)										
Calcium	144	32.3	110	121	135	1.31	1.87	1.23	1.26	149
Magnesium	14.8	3.18	18.8	30.5	15.6	0.572	0.852	0.536	0.556	41.5
Potassium	3.4	8.34	3.1	2.4	4.02	1.05	1.31	1.21	1.07	4.25
Sodium	22.8	19.7	16.1	5.87	8.84	112	99.2	104	99.8	20.1
Bicarbonate	317	54	302	388	275	.	.	.	.	431
Carbonate	<	<	<	<	<	.	.	.	.	<
Chloride	44.1	1.24	8.58	4.79	13.2	.	.	.	.	88.7
Fluoride	0.238	0.182	<	<	<	.	.	.	.	<
Nitrate as N	3.55	0.749	2.53	1.14	6.42	.	.	.	.	<
Sulfate	58.2	81.7	59.6	22.4	82.9	.	.	.	.	29.2
Charge balance error (%)	2.3	0.9	0.7	2.5	2.7	.	.	.	.	0.5
Trace Metals (mg/L)										
Aluminum	<	<	<	<	<	<	<	<	<	<
Arsenic	<	<	<	<	<	<	<	<	<	<
Barium	0.0697	0.00496	0.0747	0.0909	0.0697	0.0493	0.0624	0.0466	0.0482	0.374
Beryllium	<	<	<	<	<	<	<	<	<	<
Boron	<	<	<	<	<	0.329	0.299	0.318	0.317	0.224
Cadmium	<	<	<	<	<	<	<	<	<	<
Chromium	<	0.0427	<	<	<	<	<	<	<	<
Cobalt	<	<	<	<	<	<	<	<	<	<
Copper	<	<	<	<	<	<	<	<	<	<
Iron	<	<	<	<	<	0.0721	0.415	0.128	0.126	24.8
Lead	<	<	0.00064	<	<	<	<	<	<	0.0439 Q
Lithium	<	<	<	<	<	0.0555	0.0516	0.0526	0.0504	0.0444
Manganese	<	<	0.0548	0.113	0.0822	<	<	<	<	0.214
Mercury	<	<	<	<	<	<	<	<	<	<
Nickel	0.0189	<	<	0.00882	0.00554	<	<	<	<	0.0349
Strontium	0.361	0.206	0.176	0.141	0.234	0.0716	0.0847	0.0682	0.0702	1.44
Thallium	<	<	<	<	<	<	<	<	<	<
Uranium	0.00486	0.0015	0.00162	0.00103	0.003	<	<	<	0.0041	0.00072
Vanadium	<	<	<	<	<	<	<	<	<	<
Zinc	<	<	<	<	<	<	<	<	<	<

APPENDIX D.1: CY 2008 MONITORING DATA FOR THE BEAR CREEK HYDROGEOLOGIC REGIME
Field Measurements, Miscellaneous Analytes, Major Ions, and Trace Metals

Sampling Point	GW-367		GW-369		GW-531	GW-537	GW-615	GW-616	GW-623	
Functional Area	OLF		OLF		OLF	OLF	S3	S3	BG	
Date Sampled	02/25/08	07/30/08	03/05/08		08/05/08	08/05/08	08/11/08	08/11/08	03/18/08	09/22/08
Program	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP
Sample Type				Dup						
Field Measurements										
Time Sampled	9:25	8:30	9:10	9:10	8:45	13:35	8:40	13:25	11:45	8:45
Measuring Point Elev. (ft)	988.16	988.16	999.72	999.72	1,004.61	976.65	1,017.55	1,011.81	925.21	925.21
Depth to Water (ft)	64.43	71.51	70.35	70.35	19.02	8.07	13.65	10.44	5.29	7.80
Groundwater Elevation (ft)	923.73	916.65	929.37	929.37	985.59	968.58	1,003.90	1,001.37	919.92	917.41
Conductivity (µmho/cm)	385	388	868	868	74	4,280	47,700	2,490	1,452	1,518
Dissolved Oxygen (ppm)	3.29	3.35	1.26	1.26	3.81	0.13	0.69	0.27	0.65	0.25
Oxidation/Reduction (mV)	152	165	172	172	270	176	45	-29	-84	-49
Temperature (degrees C)	12.5	15.1	7.5	7.5	17.4	18.7	19.6	23.4	13.5	16.3
Turbidity (NTU)	.	.	.	.	.	.	.	.	.	.
pH	7.56	7.44	7.48	7.48	5.51	6.61	7.03	9.78	9.72	9.77
Miscellaneous Analytes										
Dissolved Solids (mg/L)	196	198	1 R	484 R	76	3,200	64,600	1,680	757	863
Suspended Solids (mg/L)	4	<	<	<	<	<	<	4	1	<
Turbidity (NTU)	36.3	.	2.69	3.2	.	.	.	.	1.32	.
Major Ions (mg/L)										
Calcium	47.9	46	97.8	100	5.87	731	10,100	1.91	1.14	1.09
Magnesium	22	20.6	42.8	43.6	1.43	55	2,430	0.691	0.214	<
Potassium	<	<	7.79	8.03	<	2.99	117	4.61	4.78	4.05
Sodium	3.39	2.92	15.1	15.3	5.17	37.1	2,360	481	358	340
Bicarbonate	180	186	203	204	35.3	307	279	52.5	324	267
Carbonate	<	<	<	<	<	<	<	69.4	196	244
Chloride	5.19	4.41	34.9	34.7	0.853	23.6	133	17.3	83.2	86
Fluoride	0.148	0.16	0.428	0.426	<	<	0.14	0.838	6.5	6.9
Nitrate as N	1.92	1.52	8.19	8.31	0.104	491	11,100	242	<	<
Sulfate	7.5	7.34	168	166	3.63	4.53	26.2	15.3	84	82
Charge balance error (%)	3.6	0.1	0.6	1.7	-12	0.9	0.4	1.4	2.9	0.6
Trace Metals (mg/L)										
Aluminum	<	<	<	<	<	<	<	<	0.247	0.36
Arsenic	<	<	<	<	<	<	<	<	0.00704	<
Barium	0.0823	0.0768	0.0972	0.0989	0.0256	1.67	371	0.139	0.0431	0.0393
Beryllium	<	<	<	<	<	<	<	<	<	<
Boron	<	<	<	<	<	<	<	0.934	0.826	0.817
Cadmium	<	<	<	<	<	<	0.0258	<	<	<
Chromium	<	<	<	<	<	<	<	0.0149	<	<
Cobalt	<	<	<	<	<	<	<	<	<	<
Copper	<	<	<	<	<	<	<	<	<	<
Iron	5.98	0.58	0.199	0.148	0.0773	<	1.09	0.386	0.0813	<
Lead	<	<	<	<	<	<	<	0.0109	0.000955	<
Lithium	<	<	0.0178	0.0203	<	0.0369	1.06	0.29	0.179	0.166
Manganese	0.013	<	<	<	0.00594	<	23.9	<	<	<
Mercury	<	<	<	<	<	<	<	<	<	<
Nickel	<	0.00531	0.0053	0.00552	<	0.042	0.359	<	<	<
Strontium	0.117	0.103	1.12	1.14	0.0184	1.92	292	0.278	0.117	0.111
Thallium	<	<	<	<	<	<	<	<	<	<
Uranium	0.002	0.00173	<	<	<	0.00104	1.53	<	0.00184	0.00169
Vanadium	<	<	<	<	<	<	<	<	<	<
Zinc	<	<	<	<	<	<	<	0.22	<	<

APPENDIX D.1: CY 2008 MONITORING DATA FOR THE BEAR CREEK HYDROGEOLOGIC REGIME
Field Measurements, Miscellaneous Analytes, Major Ions, and Trace Metals

Sampling Point	GW-626				GW-627		GW-629		GW-639	
Functional Area	BG				BG		BG		EMWMF	
Date Sampled	02/26/08	06/03/08	09/17/08	12/02/08	03/18/08	09/22/08	03/18/08	09/02/08	02/21/08*	04/29/08*
Program	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP	BJC	BJC
Sample Type										
Field Measurements										
Time Sampled	13:50	9:20	9:35	13:35	8:40	10:20	10:05	9:30	9:30	9:25
Measuring Point Elev. (ft)	942.87	942.87	942.87	942.87	943.51	943.51	928.03	928.03	940.95	940.95
Depth to Water (ft)	27.35	26.08	29.61	30.77	24.26	26.56	5.37	7.57	10.31	10.62
Groundwater Elevation (ft)	915.52	916.79	913.26	912.10	919.25	916.95	922.66	920.46	930.64	930.33
Conductivity (µmho/cm)	838	505	538	628	1,294	1,308	1,165	1,153	711	770
Dissolved Oxygen (ppm)	0.31	1.09	0.73	0.59	0.44	0.5	0.37	0.36	2.06	2.08
Oxidation/Reduction (mV)	-32	5	18	23	-137	-128	-108	-82	131	163
Temperature (degrees C)	13.2	17.8	19.2	14	12.8	17.2	13.3	21.7	14.9	16.1
Turbidity (NTU)	.	.	.	.	.	.	.	.	3	9
pH	7	7.12	6.86	7.05	9.31	9.11	9.28	8.87	9.25	9.23
Miscellaneous Analytes										
Dissolved Solids (mg/L)	497	332	325	372	698	745	663	552	.	.
Suspended Solids (mg/L)	<	2	<	<	1	<	<	1	.	.
Turbidity (NTU)	0.619	.	.	.	0.211	.	0.278	.	.	.
Major Ions (mg/L)										
Calcium	147	99.1	104	122	1.23	0.635	1.15	1.18	0.897	0.908
Magnesium	9.99	6.43	6.68	8.09	0.245	<	0.215	0.224	0.308	0.308
Potassium	<	<	<	<	<	<	<	<	1.5	1.48
Sodium	9.22	6.38	6.52	7.41	315	155 Q	286	292	208	216
Bicarbonate	292	239	259	278	465	452	470	464	.	.
Carbonate	<	<	<	<	102	109	105	110	.	.
Chloride	75.6	33.8	24.5	41.9	62.5	64.1	6.6	6.67	.	.
Fluoride	<	<	<	<	4.63	4.9	4.35	5	.	.
Nitrate as N	<	<	<	<	<	<	<	<	.	.
Sulfate	6.33	3.47	3.16	4.49	1.11	0.539	23	22.6	.	.
Charge balance error (%)	2.8	-0.4	0.8	1.8	1.5	-32.5 R	0.5	1.5	.	.
Trace Metals (mg/L)										
Aluminum	<	<	<	<	<	<	<	<	<	<
Arsenic	<	<	<	<	<	<	<	<	<	<
Barium	0.499	0.302	0.328	0.396	0.0501	0.0259	0.0557	0.057	0.0636	0.0656
Beryllium	<	<	<	<	<	<	<	<	<	<
Boron	<	<	<	<	0.484	0.253	0.513	0.558	0.605	0.612
Cadmium	<	<	<	<	<	<	<	<	<	<
Chromium	<	<	<	<	<	<	<	<	<	<
Cobalt	0.0266	<	<	<	<	<	<	<	<	<
Copper	<	<	<	<	<	<	<	<	<	<
Iron	0.106	0.0707	0.0664	<	0.0702	<	0.0558	<	0.111	0.178
Lead	<	<	<	<	<	<	<	0.0118	<	<
Lithium	0.0238	0.0168	0.018	0.019	0.114	0.0448	0.0824	0.0832	0.132	0.13
Manganese	<	<	<	<	0.0134	0.00892	0.00542	0.00532	<	<
Mercury	<	<	<	<	<	<	<	<	<	<
Nickel	0.176	0.0694	0.0512	0.0986	<	<	<	<	<	<
Strontium	0.326	0.2	0.213	0.26	0.0886	0.0458	0.075	0.0772	0.0924	0.0944
Thallium	<	<	<	<	<	<	<	<	<	<
Uranium	<	<	<	<	<	<	<	<	<	<
Vanadium	<	<	<	<	<	<	<	<	<	<
Zinc	<	<	<	<	<	<	<	<	<	<

APPENDIX D.1: CY 2008 MONITORING DATA FOR THE BEAR CREEK HYDROGEOLOGIC REGIME
Field Measurements, Miscellaneous Analytes, Major Ions, and Trace Metals

Sampling Point	GW-639		GW-648	GW-653		GW-683		GW-684		GW-694	GW-703
Functional Area	EMWMF		RS	BG		EXP-A		EXP-A		EXP-B	EXP-B
Date Sampled	08/12/08*	11/11/08	02/13/08	09/25/08	09/25/08	02/25/08	07/24/08	02/25/08	07/24/08	01/23/08	01/23/08
Program	BJC	BJC	GWPP	GWPP	GWPP	BJC	BJC	BJC	BJC	GWPP	GWPP
Sample Type					Dup						
Field Measurements											
Time Sampled	8:50	9:40	9:45	10:35	10:35	10:15	14:30	13:35	11:15	9:55	13:35
Measuring Point Elev. (ft)	940.95	940.95	1,029.20	931.84	931.84	972.23	972.23	898.83	898.83	941.98	955.29
Depth to Water (ft)	12.47	12.38	56.97	25.97	25.97	88.75	89.11	15.56	15.76	26.82	41.06
Groundwater Elevation (ft)	928.48	928.57	972.23	905.87	905.87	883.48	883.12	883.27	883.07	915.16	914.23
Conductivity (µmho/cm)	1,527	750	458	36	36	358	388	368	427	466	603
Dissolved Oxygen (ppm)	0.76	1.09	3.92	5.54	5.54	2.78	1.89	0.57	0.35	0.24	0.38
Oxidation/Reduction (mV)	104	72	178	298	298	193	49	197	101	103	99
Temperature (degrees C)	17.3	16.1	12	14.4	14.4	13	15	12.5	14.7	11.4	10.7
Turbidity (NTU)	5	9	.	.	.	8	1	1	1	.	.
pH	8.93	9.23	7.68	5.09	5.09	7.07	7.33	7.2	7.07	7.54	7.49
Miscellaneous Analytes											
Dissolved Solids (mg/L)	.	.	151	39	28	271	252	283	290	240	356
Suspended Solids (mg/L)	.	.	<	7	6	<	<	<	<	1	1
Turbidity (NTU)	.	.	0.208	.	.	.	.	.	.	0.735	4.08
Major Ions (mg/L)											
Calcium	0.907	0.924	52.4	1.97	2	50.9	57.9	55.4	71.1	66.5	77.6
Magnesium	0.313	0.312	31.8	1.05	1.07	17.6	22.7	13.7	18.1	14.6	30.7
Potassium	1.5	1.46	<	<	<	1.08	1.02	4.35	3.98	<	4.98
Sodium	217	208	1.89	2.06	2.11	4.38	4.08	5.23	8.07	7	13
Bicarbonate	.	.	251	19.8	19.5	189	200	205	228	168	222
Carbonate	.	.	<	<	<	<	<	<	<	<	<
Chloride	.	.	6.96	1.21	1.16	10.4	8.7	16.7	18.7	10.8	23
Fluoride	.	.	0.254	<	<	<	0.12	0.68	0.17	0.2	0.159
Nitrate as N	.	.	1.06	<	<	2.4	3.4	1.4	4.2	7.5	17.6
Sulfate	.	.	4.68	1.21	1.19	21.2	17.7	13.9	13.9	17.3	28.1
Charge balance error (%)	.	.	-0.8	-23.4 R	-21.7 R	-5.4	1	-8.3	-1.7	2.7	1.1
Trace Metals (mg/L)											
Aluminum	<	<	<	<	<	<	<	<	<	<	<
Arsenic	<	<	<	<	<	<	<	<	<	<	<
Barium	0.0631	0.0639	0.207	0.0325	0.0326	0.0992	0.125	0.0847	0.107	0.0747	0.104
Beryllium	<	<	<	<	<	<	<	<	<	<	<
Boron	0.623	0.598	<	<	<	<	<	<	<	<	<
Cadmium	<	<	<	<	<	<	<	<	<	<	<
Chromium	<	<	<	<	<	<	0.0275	<	<	<	<
Cobalt	<	<	<	<	<	<	<	<	<	<	<
Copper	<	<	0.0393	<	<	<	<	<	<	<	<
Iron	0.0731	0.0877	<	<	<	0.128	0.66	<	<	0.102	0.244
Lead	<	<	<	<	<	<	<	<	<	0.00056	<
Lithium	0.135	0.12	0.0257	<	<	<	<	0.0298	0.0284	<	0.0204
Manganese	<	<	<	<	<	<	0.0154	0.056	0.055	0.0743	<
Mercury	<	<	<	<	<	<	<	<	<	<	<
Nickel	<	<	<	<	<	<	0.0248	<	<	<	<
Strontium	0.0934	0.0927	0.075	0.0173	0.0176	0.111	0.151	0.153	0.179	0.137	0.261
Thallium	0.0018 Q	<	<	<	<	<	<	<	<	<	<
Uranium	<	0.004	<	<	<	.	.	.	.	0.0425	0.014
Vanadium	<	<	<	<	<	<	<	<	<	<	<
Zinc	<	<	<	<	<	<	<	<	<	<	<

APPENDIX D.1: CY 2008 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-B		EXP-W		EXP-W			
Date Sampled	02/25/08		02/26/08	07/31/08	01/02/08	07/01/08	01/02/08		07/07/08	
Program	BJC	BJC	BJC	BJC	BJC	BJC	BJC	BJC	BJC	BJC
Sample Type								Dup		Dup
Field Measurements										
Time Sampled	15:40	11:20	9:35	9:45	14:00	10:20	12:10	.	14:30	.
Measuring Point Elev. (ft)	945.33	945.33	929.47	929.47	877.89	877.89	881.43	.	881.43	.
Depth to Water (ft)	31.94	36.32	13.41	18.23	33.70	35.72	36.39	.	38.65	.
Groundwater Elevation (ft)	913.39	909.01	916.06	911.24	844.19	842.17	845.04	.	842.78	.
Conductivity (µmho/cm)	554	686	649	1,731	279	439	222	.	344	.
Dissolved Oxygen (ppm)	0.32	2.34	0.16	0.85	1.13	0.7	5.01	.	0.62	.
Oxidation/Reduction (mV)	173	111	200	85	42	-46	92	.	-70	.
Temperature (degrees C)	14.2	16.7	13.2	16.8	8.1	20.4	4.4	.	19.7	.
Turbidity (NTU)	10	2	7	1	6	6	1	.	6	.
pH	7.1	8.25	7.08	7.01	8	9.2	8.76	.	8.71	.
Miscellaneous Analytes										
Dissolved Solids (mg/L)	399	258	503	546	.	.	.	.	.	.
Suspended Solids (mg/L)	<	<	<	<	.	.	.	.	.	.
Turbidity (NTU)	.	.	.	.	.	.	.	.	.	.
Major Ions (mg/L)										
Calcium	72.7	21.8	104	115	46.8	5.41	55.7	55.9	6.57	6.74
Magnesium	28.5	30.1	23.3	24.2	32.4	27.3	32.1	32.4	24.2	24.2
Potassium	2.64	16.6	8.02	4.88	2.09	3.7 J	2.68	2.67	3	2.94
Sodium	12.8	12.4	17.8	18.2	7.46	14.8	12.1	12.1	11.1	11.1
Bicarbonate	230	117	266	295	.	.	.	.	.	.
Carbonate	<	<	<	<	.	.	.	.	.	.
Chloride	33.1	12.4	52.6	82.6	.	.	.	.	.	.
Fluoride	0.42	0.19	0.22	0.24	.	.	.	.	.	.
Nitrate as N	11.3	5.9	11.8	12.7	<	<	<	<	<	<
Sulfate	24.5	9.8	29.7	47.2	.	.	.	.	.	.
Charge balance error (%)	-2	15.3	-1.1	-7.9	.	.	.	.	.	.
Trace Metals (mg/L)										
Aluminum	<	<	<	<	.	<	<	<	<	<
Arsenic	<	<	<	<	<	<	<	<	<	<
Barium	0.112	0.0416	0.16	0.162	0.034	0.0052	0.0454	0.045	0.0056	0.0054
Beryllium	<	<	<	<	<	<	<	<	<	<
Boron	<	<	0.126	0.148	<	<	<	<	<	<
Cadmium	<	<	<	<	<	<	<	<	<	<
Chromium	<	<	<	<	<	<	<	<	<	<
Cobalt	<	<	<	<	<	<	<	<	<	<
Copper	<	<	<	<	<	<	<	<	<	<
Iron	1.03	0.637	0.533	0.629	0.643	0.53	1.48	1.42	0.153	0.171
Lead	<	<	<	<	<	<	<	<	<	<
Lithium	0.0153	0.0419	0.0243 J	0.0183	0.0105	0.0183	0.0146	0.0148	0.0157	0.0155
Manganese	0.0084	0.0194	0.0163	0.0161	0.131	0.0269	0.162	0.163	0.0259	0.026
Mercury	<	.	<	.	.	.	.	.	.	.
Nickel	<	<	<	<	<	<	<	<	<	<
Strontium	0.318	0.0913	0.405	0.318	0.6	0.055	1.2	1.2	0.0758	0.0796
Thallium	<	<	<	<	<	<	<	<	<	<
Uranium	.	0.0042	.	0.064	<	<	<	<	<	<
Vanadium	<	<	<	<	<	<	<	<	<	<
Zinc	<	<	<	<	<	<	<	<	<	<

APPENDIX D.1: CY 2008 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-738	GW-740			GW-829
Functional Area	EXP-W		EXP-C	EXP-C		EXP-C	EXP-C			OLF
Date Sampled	01/02/08	07/01/08	03/06/08	02/07/08		02/12/08	02/12/08	06/26/08	12/17/08	08/04/08
Program	BJC	BJC	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP
Sample Type					Dup					
Field Measurements										
Time Sampled	11:00	15:00	9:10	9:20	9:20	9:35	13:55	9:00	9:20	10:25
Measuring Point Elev. (ft)	875.88	875.88	979.75	961.63	961.63	983.31	1,020.25	1,020.25	1,020.25	985.95
Depth to Water (ft)	30.21	31.40	28.11	8.06	8.06	27.66	69.68	74.76	69.88	62.93
Groundwater Elevation (ft)	845.67	844.48	951.64	953.57	953.57	955.65	950.57	945.49	950.37	923.02
Conductivity (µmho/cm)	560	776	874	1,035	1,035	913	575	597	397	762
Dissolved Oxygen (ppm)	1.4	0.68	1.25	0.08	0.08	0.88	2.07	2.04	2.12	0.65
Oxidation/Reduction (mV)	88	57	131	118	118	144	44	105	128	150
Temperature (degrees C)	6	23.2	13	13	13	11.2	14.1	15.3	13.1	16.9
Turbidity (NTU)	10	15	.	.	.	.	.	.	.	.
pH	7.73	7.35	7.22	6.89	6.89	6.95	7.24	7.25	7.25	6.93
Miscellaneous Analytes										
Dissolved Solids (mg/L)	.	.	524	475	512	478	314	209	274	265
Suspended Solids (mg/L)	.	.	<	<	1.5	<	1	2	2	<
Turbidity (NTU)	.	.	1.78	3.31	3.34	0.288	8.74	.	.	.
Major Ions (mg/L)										
Calcium	53.8	58.1	89.7	144	148	137	72.1	71.2	76.5	8.39
Magnesium	23	24.1	38	22.7	23	24.1	34.2	32.3	35	2.99
Potassium	1.53	1.38 J	2.44	3.09	3	2.97	<	<	<	4.19
Sodium	5.85	6.1	30	27.2	27.3	10.2	2.39	2.23	2.68	99.9
Bicarbonate	.	.	253	337	336	332	278	271	274	196
Carbonate	.	.	<	<	<	<	<	<	<	7.74
Chloride	.	.	67.1	62.8	63.2	20.9	7.66	7.3	8.5	2.06
Fluoride	.	.	0.212	0.239	0.243	<	0.175	0.181	0.183	0.504
Nitrate as N	0.19	0.22	15.6	11.8	12.1	16.2	1.84	1.77	1.87	10.8
Sulfate	.	.	32	37.4	37	33.1	12	11.9	12.8	17.6
Charge balance error (%)	.	.	1.3	0.9	1.9	1.5	2.8	2.4	5.3	-1.7
Trace Metals (mg/L)										
Aluminum	<	<	<	<	<	<	<	<	<	<
Arsenic	<	<	<	<	<	<	<	<	<	<
Barium	0.0806	0.0902	0.163	0.204	0.205	0.0671	0.0951	0.0969	0.0985	0.301
Beryllium	<	<	<	<	<	<	<	<	<	<
Boron	<	<	<	<	<	<	<	<	<	0.245
Cadmium	<	<	<	<	<	<	<	<	<	<
Chromium	<	<	<	<	<	<	<	0.0116	<	0.0102
Cobalt	<	<	<	<	<	<	<	<	<	<
Copper	<	<	<	<	<	<	<	<	<	<
Iron	0.343	1.88	0.345	0.302	0.489	<	1.95	1.21	0.855	<
Lead	<	<	<	<	0.00109	<	<	<	0.0009	<
Lithium	<	<	0.0203	<	<	<	0.0156	0.0173	0.0171	0.0468
Manganese	0.0902	0.0607	<	0.857	0.856	0.0162	0.00903	0.0105	0.00664	<
Mercury	.	.	<	<	<	<	<	<	<	<
Nickel	<	<	<	<	<	<	<	<	0.0051	<
Strontium	0.336	0.368	1.16	0.332	0.335	0.156	0.0595	0.0562	0.061	0.516
Thallium	<	<	<	<	<	<	<	<	<	<
Uranium	<	<	0.00074	0.0126	0.0133	0.00298	<	<	<	0.0016
Vanadium	<	<	<	<	<	<	<	<	<	<
Zinc	<	<	<	<	<	<	<	0.231	<	<

APPENDIX D.1: CY 2008 MONITORING DATA FOR THE BEAR CREEK HYDROGEOLOGIC REGIME
Field Measurements, Miscellaneous Analytes, Major Ions, and Trace Metals

Sampling Point	GW-916				GW-917				GW-918	
Functional Area	EMWMF				EMWMF				EMWMF	
Date Sampled	02/13/08	04/21/08	08/07/08	11/05/08	02/11/08	04/15/08	08/05/08	11/04/08	02/14/08	04/16/08
Program	BJC	BJC	BJC	BJC	BJC	BJC	BJC	BJC	BJC	BJC
Sample Type										
Field Measurements										
Time Sampled	10:45	13:40	14:30	10:45	14:05	13:50	14:20	10:00	10:15	11:00
Measuring Point Elev. (ft)	1,002.85	1,002.85	1,002.85	1,002.85	997.10	997.10	997.10	997.10	1,067.96	1,067.96
Depth to Water (ft)	4.30	4.75	6.94	9.44	23.76	21.10	23.76	25.37	6.03	5.80
Groundwater Elevation (ft)	998.55	998.10	995.91	993.41	973.34	976.00	973.34	971.73	1,061.93	1,062.16
Conductivity (µmho/cm)	443	322	363	357	454	416	718	355	83	67
Dissolved Oxygen (ppm)	2.28	2.31	1.24	1.1	1.23	1.09	1.25	1.59	6.21	10.54
Oxidation/Reduction (mV)	99	7	63	117	61	29	51	78	213	108
Temperature (degrees C)	12.7	14.6	16.9	15.7	15.9	16.4	18.6	15.9	14.3	14.8
Turbidity (NTU)	12	5	6	2	7	3	2	7	5	12
pH	7.59	7.65	6.88	7.53	7.62	7.66	7.05	7.1	6.33	6.31
Miscellaneous Analytes										
Dissolved Solids (mg/L)	.	.	.	.	.	.	.	.	.	.
Suspended Solids (mg/L)	.	.	.	.	.	.	.	.	.	.
Turbidity (NTU)	.	.	.	.	.	.	.	.	.	.
Major Ions (mg/L)										
Calcium	40.8	38.1	38.9	37.9	63.4	65.7	66.4	66.7	9.78	10.9
Magnesium	6.89	6.12	6.07	5.91	8.95	9	8.69	8.92	3.97	4.33
Potassium	3.27	3.16	3.38	3.34	1.5	1.21	1.22	1.28	1.98	1.92
Sodium	27.8	25.8	26.9	27.8	9.03	9.09	9.66	8.78	4.42	4.46
Bicarbonate	.	.	.	.	.	.	.	.	.	.
Carbonate	.	.	.	.	.	.	.	.	.	.
Chloride	.	.	.	.	.	.	.	.	.	.
Fluoride	.	.	.	.	.	.	.	.	.	.
Nitrate as N	.	.	.	.	.	.	.	.	.	.
Sulfate	.	.	.	.	.	.	.	.	.	.
Charge balance error (%)	.	.	.	.	.	.	.	.	.	.
Trace Metals (mg/L)										
Aluminum	0.656	<	0.214	<	1.2	<	<	0.792	0.574	0.432
Arsenic	<	<	<	<	<	<	<	<	<	<
Barium	0.137	0.136	0.141	0.127	0.189	0.178	0.177	0.189	0.11	0.117
Beryllium	<	<	<	<	<	<	<	<	<	<
Boron	<	<	<	<	<	<	<	<	<	<
Cadmium	<	<	<	<	<	<	<	<	<	<
Chromium	<	<	<	<	<	<	<	<	<	<
Cobalt	<	<	<	<	<	<	<	<	<	<
Copper	<	<	<	<	<	<	<	<	<	<
Iron	0.647	0.588	0.892	0.229	1.16	0.198	0.107	1.48	0.183	0.345
Lead	<	<	<	<	<	<	<	<	<	<
Lithium	0.0688	0.065	0.0762	0.0695 J	0.0187	0.0182	0.018	0.0183	0.0122	0.0124
Manganese	0.139	0.404 Q	0.347	0.0846	0.0295	0.0158	0.026	0.0367	0.0051	0.0063
Mercury	<	<	<	<	<	<	<	<	<	<
Nickel	<	<	<	<	<	<	<	<	<	<
Strontium	1.08	1.07	1.15	1.1	0.133	0.133	0.133	0.132	0.0457	0.0479
Thallium	<	<	<	<	<	<	<	<	<	<
Uranium	<	<	<	<	<	<	<	<	<	<
Vanadium	<	<	<	<	<	<	<	<	<	<
Zinc	<	<	<	<	<	<	<	<	<	<

APPENDIX D.1: CY 2008 MONITORING DATA FOR THE BEAR CREEK HYDROGEOLOGIC REGIME
Field Measurements, Miscellaneous Analytes, Major Ions, and Trace Metals

Sampling Point	GW-918		GW-920				GW-921			
Functional Area	EMWMF		EMWMF				EMWMF			
Date Sampled	08/05/08	11/05/08	02/12/08	04/17/08	08/04/08	11/10/08	02/12/08	04/17/08	08/5/08*	11/03/08
Program	BJC	BJC	BJC	BJC	BJC	BJC	BJC	BJC	BJC	BJC
Sample Type										
Field Measurements										
Time Sampled	10:15	10:30	13:30	14:40	15:10	10:00	13:45	13:40	13:30	13:30
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)	6.42	6.89	6.48	7.32	6.10	10.11	5.81	6.09	7.38	8.68
Groundwater Elevation (ft)	1,061.54	1,061.07	960.95	960.11	961.33	957.32	965.48	965.20	963.91	962.61
Conductivity (µmho/cm)	185	93	272	203	583	255	423	410	387	367
Dissolved Oxygen (ppm)	5.3	5.04	2.02	1.2	1.02	1.07	1.82	1.19	1.02	1.4
Oxidation/Reduction (mV)	148	175	69	81	-38	-17	68	46	47	116
Temperature (degrees C)	16.2	15.8	15.7	18.1	18.3	15	16.2	16.6	18	17.1
Turbidity (NTU)	24	6	1	3	1	1	1	1	1	1
pH	5.9	6.34	7.08	7.44	7.27	7.27	7.92	7.12	6.61	7.46
Miscellaneous Analytes										
Dissolved Solids (mg/L)	.	.	.	.	.	.	.	.	.	.
Suspended Solids (mg/L)	.	.	.	.	.	.	.	.	.	.
Turbidity (NTU)	.	.	.	.	.	.	.	.	.	.
Major Ions (mg/L)										
Calcium	9.33	10.2	51.3	53.3	50.5	53.3	43.1	41.9	42.3	44
Magnesium	3.68	4.1	8.19	8.28	8.01	8.72	12.1	12.5	12.7	13.2
Potassium	1.8	1.98	1.49	1.5	1.63	1.62	2.54	2.52	2.82	2.6
Sodium	4.26	4.89	5.63	5.54	5.6	5.63	20.5	21.6	24.5	20.6
Bicarbonate	.	.	.	.	.	.	.	.	.	.
Carbonate	.	.	.	.	.	.	.	.	.	.
Chloride	.	.	.	.	.	.	.	.	.	.
Fluoride	.	.	.	.	.	.	.	.	.	.
Nitrate as N	.	.	.	.	.	.	.	.	.	.
Sulfate	.	.	.	.	.	.	.	.	.	.
Charge balance error (%)	.	.	.	.	.	.	.	.	.	.
Trace Metals (mg/L)										
Aluminum	0.32	0.317	<	<	<	<	<	<	<	<
Arsenic	<	<	<	<	<	<	<	<	<	<
Barium	0.105	0.119	0.24	0.243	0.256	0.275	0.261	0.263	0.308	0.3
Beryllium	<	<	<	<	<	<	<	<	<	<
Boron	<	<	<	<	<	<	<	<	<	<
Cadmium	<	<	<	<	<	<	<	<	<	<
Chromium	<	<	<	<	<	<	<	<	<	<
Cobalt	<	<	<	<	<	<	<	<	<	<
Copper	<	<	<	<	<	<	<	<	<	<
Iron	0.377	0.292	0.201	0.27	0.251	0.684	0.0689	0.0971	<	0.119
Lead	<	<	<	<	<	<	<	<	<	<
Lithium	0.0118	0.0147 J	<	0.0108	0.0115	0.0111	0.0244	0.026	0.0285	0.0252
Manganese	0.0069	0.0105	0.0393	0.0756	0.0454	0.0386	0.0088	0.0086	0.0088	0.0094
Mercury	<	<	<	<	<	<	<	<	<	<
Nickel	<	<	<	<	<	<	<	<	<	<
Strontium	0.043	0.05	0.413	0.414	0.439	0.475	1.22	1.21	1.3	1.29
Thallium	<	<	<	<	<	<	<	<	<	<
Uranium	<	<	<	<	<	<	<	<	<	<
Vanadium	<	<	<	<	<	<	<	<	<	<
Zinc	<	<	<	<	<	<	<	<	<	<

APPENDIX D.1: CY 2008 MONITORING DATA FOR THE BEAR CREEK HYDROGEOLOGIC REGIME
Field Measurements, Miscellaneous Analytes, Major Ions, and Trace Metals

Sampling Point	GW-922				GW-923			GW-924			
Functional Area	EMWMF				EMWMF			EMWMF			
Date Sampled	02/12/08	04/16/08	08/04/08	11/05/08	02/19/08	04/21/08	08/06/08	02/19/08		04/22/08	
Program	BJC	BJC	BJC	BJC	BJC	BJC	BJC	BJC	BJC	BJC	BJC
Sample Type									Dup		Dup
Field Measurements											
Time Sampled	10:30	14:45	10:50	14:30	14:50	15:25	14:30	14:00	.	10:00	.
Measuring Point Elev. (ft)	956.91	956.91	956.91	956.91	1,016.73	1,016.73	1,016.73	968.90	.	968.90	.
Depth to Water (ft)	5.13	5.12	5.40	5.60	29.00	30.09	33.63	7.22	.	9.95	.
Groundwater Elevation (ft)	951.78	951.79	951.51	951.31	987.73	986.64	983.10	961.68	.	958.95	.
Conductivity (µmho/cm)	262	195	530	290	349	317	417	415	.	198	.
Dissolved Oxygen (ppm)	1.45	3.25	1.7	2.83	.	6.02	3.6	3.05	.	5.64	.
Oxidation/Reduction (mV)	26	75	24	-20	134	134	100	124	.	100	.
Temperature (degrees C)	14.7	16	17.4	16.8	13	15.4	17.1	13.9	.	16.5	.
Turbidity (NTU)	1	3	1	5	264	336	1000	1	.	1	.
pH	7.57	7.54	7.28	7.79	6.61	6.95	6.1	7.14	.	7.34	.
Miscellaneous Analytes											
Dissolved Solids (mg/L)	.	.	.	.	.	.	.	.	.	.	.
Suspended Solids (mg/L)	.	.	.	.	.	.	.	.	.	.	.
Turbidity (NTU)	.	.	.	.	.	.	.	.	.	.	.
Major Ions (mg/L)											
Calcium	43.4	46.1	44.6	47.6	38.8	48.2	54.2	55.7	56.4	53.7	52.7
Magnesium	9.86	10.1	9.45	9.97	12.9	11.8	16.3	4.85	4.88	4.86	4.74
Potassium	2.87	2.86	2.75	2.7	2.16	1.77	5.87	0.868	0.849	0.828	0.698
Sodium	8.97	8.58	8.46	8.14	6.97	8.05	7.58	5.62	5.5	5.69	5.18
Bicarbonate	.	.	.	.	.	.	.	.	.	.	.
Carbonate	.	.	.	.	.	.	.	.	.	.	.
Chloride	.	.	.	.	.	.	.	.	.	.	.
Fluoride	.	.	.	.	.	.	.	.	.	.	.
Nitrate as N	.	.	.	.	.	.	.	.	.	.	.
Sulfate	.	.	.	.	.	.	.	.	.	.	.
Charge balance error (%)	.	.	.	.	.	.	.	.	.	.	.
Trace Metals (mg/L)											
Aluminum	<	0.459	<	0.379	6.77	3.03	32.1	<	<	<	<
Arsenic	<	<	<	<	<	<	0.0082	<	<	<	<
Barium	0.704	0.712	0.68	0.717	0.504	0.24	0.754	0.301	0.301	0.282	0.275
Beryllium	<	<	<	<	<	<	0.0018	<	<	<	<
Boron	<	<	<	<	<	<	<	<	<	<	<
Cadmium	<	<	<	<	<	<	<	<	<	<	<
Chromium	<	<	<	<	0.0169	0.0138	0.0738	<	<	<	<
Cobalt	<	<	<	<	<	<	<	<	<	<	<
Copper	<	<	<	<	0.0516	<	0.0869	<	<	<	<
Iron	0.172	0.584	0.136	0.723	7.2	3.35	27.6	0.0726	0.0671	0.0948	0.0975
Lead	<	<	<	<	0.0096	0.0048	0.0299	<	<	<	<
Lithium	0.0136	0.0145	0.0135	0.0138 J	0.0204	0.0129	0.057	0.0115	0.0113	0.0106	0.0104
Manganese	0.0152	0.027	0.0255	0.0424	0.19	0.0815	0.484	0.0339	0.0344	0.0349	0.036
Mercury	<	<	<	<	<	<	<	<	<	<	<
Nickel	<	<	<	<	0.0254	0.0117	0.0674	<	<	<	<
Strontium	0.799	0.78	0.734	0.74	0.0958	0.0962	0.136	0.107	0.106	0.103	0.1
Thallium	<	<	<	<	<	<	0.0015 J	<	<	<	<
Uranium	<	<	<	<	<	<	<	<	<	<	<
Vanadium	<	<	<	<	<	<	0.0316	<	<	<	<
Zinc	<	<	<	<	<	<	0.0854	<	<	<	<

APPENDIX D.1: CY 2008 MONITORING DATA FOR THE BEAR CREEK HYDROGEOLOGIC REGIME
Field Measurements, Miscellaneous Analytes, Major Ions, and Trace Metals

Sampling Point	GW-924				GW-925				GW-926	
Functional Area	EMWMF				EMWMF				EMWMF	
Date Sampled	08/06/08		11/06/08		02/14/08	04/17/08	08/05/08	11/05/08	02/19/08	04/23/08
Program	BJC	BJC	BJC	BJC	BJC	BJC	BJC	BJC	BJC	BJC
Sample Type		Dup		Dup						
Field Measurements										
Time Sampled	10:30	.	10:30	.	10:15	9:30	14:00	14:40	14:00	14:15
Measuring Point Elev. (ft)	968.90	.	968.90	.	971.14	971.14	971.14	971.14	968.94	968.94
Depth to Water (ft)	11.26	.	13.15	.	4.60	4.09	5.35	6.28	7.09	7.71
Groundwater Elevation (ft)	957.64	.	955.75	.	966.54	967.05	965.79	964.86	961.85	961.23
Conductivity (µmho/cm)	324	.	263	.	744	661	641	568	266	313
Dissolved Oxygen (ppm)	0.92	.	1.02	.	1.95	1.83	0.91	1.9	1.12	1.22
Oxidation/Reduction (mV)	73	.	5	.	70	2	5	177	77	-24
Temperature (degrees C)	16.9	.	15.9	.	11.8	18	18.6	17.2	14.4	18.4
Turbidity (NTU)	2	.	1	.	12	11	11	10	2	1
pH	6.9	.	7.17	.	9.84	10.18	9.62	9.65	7.55	7.5
Miscellaneous Analytes										
Dissolved Solids (mg/L)	.	.	.	.	.	.	.	.	.	.
Suspended Solids (mg/L)	.	.	.	.	.	.	.	.	.	.
Turbidity (NTU)	.	.	.	.	.	.	.	.	.	.
Major Ions (mg/L)										
Calcium	55.7	54.7	57	57.8	2.96	4.43	4.17	2.59	43.9	41
Magnesium	4.71	4.64	5	5	1.21	1.58	1.67	1.12	10.8	10.2
Potassium	0.799	0.888	0.843	0.738	1.39	1.61	1.96	1.57	1.96	1.96
Sodium	5.32	5.33	5.14	5.47	123	125	140	134	9.34	9.79
Bicarbonate	.	.	.	.	.	.	.	.	.	.
Carbonate	.	.	.	.	.	.	.	.	.	.
Chloride	.	.	.	.	.	.	.	.	.	.
Fluoride	.	.	.	.	.	.	.	.	.	.
Nitrate as N	.	.	.	.	.	.	.	.	.	.
Sulfate	.	.	.	.	.	.	.	.	.	.
Charge balance error (%)	.	.	.	.	.	.	.	.	.	.
Trace Metals (mg/L)										
Aluminum	<	<	<	<	0.605	1.24	2.11	0.532	<	<
Arsenic	<	<	<	<	<	<	0.0055	<	<	<
Barium	0.283	0.279	0.294	0.296	0.139	0.163	0.188	0.149	0.215	0.209
Beryllium	<	<	<	<	<	<	<	<	<	<
Boron	<	<	<	<	0.193	0.179	0.205	0.238	<	<
Cadmium	<	<	<	<	<	<	<	<	<	<
Chromium	<	<	<	<	<	<	<	<	<	<
Cobalt	<	<	<	<	<	<	<	<	<	<
Copper	<	<	<	<	<	<	<	<	<	<
Iron	0.078	0.0781	0.188	0.184	0.643	1.04	1.33	0.381	0.13	0.129
Lead	<	<	<	<	<	0.0021	0.0031	<	<	<
Lithium	0.011	0.0108	0.0112 J	0.0113 J	0.0647	0.0686	0.0653	0.0637 J	0.0127	0.0123
Manganese	0.0351	0.0337	0.0495	0.0502	0.018	0.0304	0.0321	0.0096	0.0155	0.0138
Mercury	<	<	<	<	<	<	<	<	<	<
Nickel	<	<	<	<	<	<	<	<	<	<
Strontium	0.0998	0.098	0.107	0.108	0.181	0.218	0.227	0.202	0.696	0.678
Thallium	<	<	<	<	<	<	<	<	<	<
Uranium	<	<	<	<	<	<	<	<	<	<
Vanadium	<	<	<	<	<	<	<	<	<	<
Zinc	<	<	<	<	<	<	<	<	<	<

APPENDIX D.1: CY 2008 MONITORING DATA FOR THE BEAR CREEK HYDROGEOLOGIC REGIME
Field Measurements, Miscellaneous Analytes, Major Ions, and Trace Metals

Sampling Point	GW-926		GW-927				BCK-04.55	BCK-09.40	BCK-11.97
Functional Area	EMWMF		EMWMF				EXP-SW	EXP-SW	EXP-SW
Date Sampled	08/06/08	11/06/08	02/11/08	04/15/08	08/07/08	11/04/08	01/14/08	04/29/08	04/29/08
Program	BJC	BJC	BJC	BJC	BJC	BJC	GWPP	GWPP	GWPP
Sample Type									
Field Measurements									
Time Sampled	13:45	13:30	12:45	10:00	10:20	14:45	9:05	8:10	8:25
Measuring Point Elev. (ft)	968.94	968.94	997.19	997.19	997.19	997.19	.	.	.
Depth to Water (ft)	9.72	11.65	20.26	17.28	20.67	22.64	.	.	.
Groundwater Elevation (ft)	959.22	957.29	976.93	979.91	976.52	974.55	.	.	.
Conductivity (µmho/cm)	594	347	444	408	685	340	317	505	1,124
Dissolved Oxygen (ppm)	1.04	0.63	1.39	1.24	1.84	1.82	6.96	5.79	6.08
Oxidation/Reduction (mV)	20	-63	43	-4	-40	-103	176	206	245
Temperature (degrees C)	17.6	15.9	13.7	15.2	17.4	16.2	7.3	10.6	9.8
Turbidity (NTU)	1	1	2	4	1	1	.	.	.
pH	7.4	7.57	7.65	7.72	7.35	7.51	6.87	7.28	7.57
Miscellaneous Analytes									
Dissolved Solids (mg/L)	.	.	.	.	.	.	159	.	.
Suspended Solids (mg/L)	.	.	.	.	.	.	1	.	.
Turbidity (NTU)	.	.	.	.	.	.	7.86	.	.
Major Ions (mg/L)									
Calcium	43.3	42.9	63.6	66.9	64.2	70.9	41.5	.	.
Magnesium	10.8	10.9	6.52	6.75	6.51	7.34	9.54	.	.
Potassium	2.12	1.96	0.804	0.865	0.926	0.872	<	.	.
Sodium	10.2	8.88	7.33	7.26	7.68	7.9	4.04	.	.
Bicarbonate	.	.	.	.	.	.	112	.	.
Carbonate	.	.	.	.	.	.	<	.	.
Chloride	.	.	.	.	.	.	5.83	20.3	86.2
Fluoride	.	.	.	.	.	.	<	.	.
Nitrate as N	.	.	.	.	.	.	1.65	9	35
Sulfate	.	.	.	.	.	.	16.8	22	38.6
Charge balance error (%)	.	.	.	.	.	.	2.7	.	.
Trace Metals (mg/L)									
Aluminum	<	<	<	<	<	<	0.658	.	.
Arsenic	<	<	<	<	<	<	<	<	<
Barium	0.226	0.211	0.206	0.213	0.196	0.213	0.0528	.	.
Beryllium	<	<	<	<	<	<	<	.	.
Boron	<	<	<	<	<	<	<	.	.
Cadmium	<	<	<	<	<	<	<	<	<
Chromium	<	<	<	<	<	<	<	<	<
Cobalt	<	<	<	<	<	<	<	.	.
Copper	<	<	<	<	<	<	<	.	.
Iron	0.283	0.127	0.305	0.155	0.115	0.179	0.394	.	.
Lead	<	<	<	<	<	<	0.0033	0.00174	<
Lithium	0.0132	0.0124	0.0167	0.0173	0.0169	0.018	<	.	.
Manganese	0.0215	0.0145	0.0336	0.0225	0.0223	0.0248	0.0212	.	.
Mercury	<	<	<	<	<	<	<	.	.
Nickel	<	<	<	<	<	<	<	<	0.0101
Strontium	0.746	0.726	0.111	0.112	0.111	0.122	0.0733	.	.
Thallium	<	<	<	<	<	<	<	<	<
Uranium	<	<	<	<	<	<	0.0262	0.0894	0.17
Vanadium	<	<	<	<	<	<	<	.	.
Zinc	<	<	<	<	<	<	<	.	.

APPENDIX D.1: CY 2008 MONITORING DATA FOR THE BEAR CREEK HYDROGEOLOGIC REGIME
Field Measurements, Miscellaneous Analytes, Major Ions, and Trace Metals

Sampling Point	EMWNT-03A		EMWNT-05				EMW-VWEIR				
Functional Area	EXP-SW		EXP-SW				EXP-SW				
Date Sampled	02/11/08	04/14/08	02/11/08	04/14/08	08/11/08	11/10/08	02/11/08	04/14/08	08/11/08	11/10/08	
Program	BJC	BJC	BJC	BJC	BJC	BJC	BJC	BJC	BJC	BJC	BJC
Sample Type								Dup			
Field Measurements											
Time Sampled	14:40	11:30	14:00	10:50	10:15	14:35	9:30		9:25	9:00	13:20
Measuring Point Elev. (ft)	.	.	.	.	.	.	.	.	.	.	.
Depth to Water (ft)	.	.	.	.	.	.	.	.	.	.	.
Groundwater Elevation (ft)	.	.	.	.	.	.	.	.	.	.	.
Conductivity (µmho/cm)	109	120	142	173	369	375	174		311	330	468
Dissolved Oxygen (ppm)	10.02	6.82	11.01	7.88	8.18	9.54	13.09		9.28	5.08	11.18
Oxidation/Reduction (mV)	79.1	78.9	16.8	70.3	117.6	-26.2	163		83	125.7	99.6
Temperature (degrees C)	10.12	10.32	9.76	10.18	20.31	12	5.16		11.35	23.5	15.52
Turbidity (NTU)	15	15.9	5	3.59	13.8	6.91	43		9.8	4.91	2.73
pH	7.57	7.28	7.44	7.41	7.79	7.64	8.17		8.84	7.86	8.3
Miscellaneous Analytes											
Dissolved Solids (mg/L)	.	.	.	.	.	.	.	.	.	.	.
Suspended Solids (mg/L)	.	.	.	.	.	.	.	.	.	.	.
Turbidity (NTU)	.	.	.	.	.	.	.	.	.	.	.
Major Ions (mg/L)											
Calcium	17.5	15.5	21	22.7	45.8	64.7	34	34.6	38.9	34	65
Magnesium	3.59	3.51	6.84	6.91	7.47	12.5	7.3	7.44	9.69	8.87	15
Potassium	1.25	1.21	1.67	1.4	1.2	1.6	2.45	2.35	2.3	5.93	4.39
Sodium	2.59	2.36	3.25	3.53	6.66	6.93	4.57	4.48	13.2	11.5	16
Bicarbonate	.	.	.	.	.	.	.	.	.	.	.
Carbonate	.	.	.	.	.	.	.	.	.	.	.
Chloride	.	.	.	.	.	.	.	.	.	.	.
Fluoride	.	.	.	.	.	.	.	.	.	.	.
Nitrate as N	.	.	.	.	.	.	.	.	.	.	.
Sulfate	.	.	.	.	.	.	.	.	.	.	.
Charge balance error (%)	.	.	.	.	.	.	.	.	.	.	.
Trace Metals (mg/L)											
Aluminum	0.792	0.409	<	<	<	<	1.41	1.26	0.206	<	<
Arsenic	<	<	<	<	<	<	<	<	<	<	<
Barium	0.0366	0.0391	0.0436	0.0461	0.0793	0.106	0.0459	0.0466	0.037	0.0864	0.116
Beryllium	<	<	<	<	<	<	<	<	<	<	<
Boron	<	<	<	<	<	<	<	<	0.288	0.21	0.292
Cadmium	<	<	<	<	<	<	<	<	<	<	<
Chromium	<	<	<	<	<	<	<	<	<	<	<
Cobalt	<	<	<	<	<	<	<	<	<	<	<
Copper	<	<	<	<	<	<	<	<	<	<	<
Iron	1.08	1.09	0.515	0.579	1.68	3.4	1.81	1.78	0.308	0.331	0.343
Lead	<	<	<	<	<	<	<	<	<	<	<
Lithium	<	<	<	<	<	<	<	<	0.0102	<	<
Manganese	0.0656	0.196	0.115	0.21	2.37	1.6	0.0267	0.0268	0.048	0.215	0.405
Mercury	<	<	<	<	<	<	<	<	<	<	<
Nickel	<	<	<	<	<	<	<	<	<	<	<
Strontium	0.0357	0.035	0.053	0.0564	0.101	0.134	0.0751	0.0769	0.117	0.104	0.194
Thallium	<	<	<	<	<	<	<	<	<	<	<
Uranium	<	0.0053 J	<	<	<	<	<	<	0.0177	<	<
Vanadium	<	<	<	<	<	<	<	<	<	<	<
Zinc	<	<	<	<	<	<	<	<	<	<	0.106

APPENDIX D.1: CY 2008 MONITORING DATA FOR THE BEAR CREEK HYDROGEOLOGIC REGIME
Field Measurements, Miscellaneous Analytes, Major Ions, and Trace Metals

Sampling Point	EMW-VWUNDER		EMW-VWUNDER		NT-01	NT-04				NT-07
Functional Area	EXP-SW		EXP-SW		EXP-SW	EXP-SW				EXP-SW
Date Sampled	02/14/08	04/23/08	08/06/08	11/10/08	01/14/08	02/11/08	04/14/08	08/11/08	11/10/08	02/11/08
Program	BJC	BJC	BJC	BJC	GWPP	BJC	BJC	BJC	BJC	BJC
Sample Type										
Field Measurements										
Time Sampled	13:45	14:00	15:10	14:15	10:55	10:30	10:00	9:30	14:00	13:25
Measuring Point Elev. (ft)	.	.	.	.	.	.	.	.	.	.
Depth to Water (ft)	.	.	.	.	.	.	.	.	.	.
Groundwater Elevation (ft)	.	.	.	.	.	.	.	.	.	.
Conductivity (µmho/cm)	500	242	718	281	372	420	567	600	443	320
Dissolved Oxygen (ppm)	5.7	8.62	2.15	2.9	8.64	9.52	7.18	5.65	8.58	9.58
Oxidation/Reduction (mV)	116	185	166	170	145	57	66.5	123.3	93	100.1
Temperature (degrees C)	15.6	20.8	20.8	17.1	5.4	5.72	10.2	20.18	11.1	7.97
Turbidity (NTU)	1	1	1	1	.	3	1.76	9.81	6.8	1.31
pH	6.26	6.09	6.02	5.91	6.95	6.81	7.12	7.39	7.64	7.67
Miscellaneous Analytes										
Dissolved Solids (mg/L)	.	.	.	.	187	.	.	.	.	258
Suspended Solids (mg/L)	.	.	.	.	3	.	.	.	.	6
Turbidity (NTU)	.	.	.	.	6.2	.	.	.	.	.
Major Ions (mg/L)										
Calcium	60.2	56.1	57.9	56.7	45.9	103	103	87.9	81.9	54.2
Magnesium	9.97	8.51	8.74	8.54	7.07	19.5	18.7	18.2	16.4	8.33
Potassium	1.95	1.92	1.99	1.78	2.29	1.59	1.44	1.42	2.45	2.07
Sodium	7.68	8.16	7.65	7.08	5.92	6.81	8.05	7.94	7.11	4.6
Bicarbonate	.	.	.	.	77.7	.	.	.	.	36
Carbonate	.	.	.	.	<	.	.	.	.	<
Chloride	.	.	.	.	5.07	.	.	.	.	13.1
Fluoride	.	.	.	.	0.283	.	.	.	.	<
Nitrate as N	.	.	.	.	15.2	.	.	.	.	0.046
Sulfate	.	.	.	.	19.2	.	.	.	.	24.5
Charge balance error (%)	.	.	.	.	-0.1	.	.	.	.	38.9 R
Trace Metals (mg/L)										
Aluminum	<	<	<	<	0.323	<	<	0.731	0.317	<
Arsenic	<	<	<	<	<	<	<	<	<	<
Barium	0.0882	0.0896	0.0941	0.0862	0.0616	0.728	0.489	0.471	0.329	0.0311
Beryllium	<	<	<	<	<	<	<	0.0015 Q	<	<
Boron	<	<	<	<	0.201	<	<	<	<	0.201
Cadmium	<	<	<	<	<	<	<	<	<	<
Chromium	<	<	<	<	<	<	<	<	<	<
Cobalt	<	<	<	<	<	<	<	<	<	<
Copper	<	<	<	<	<	<	<	<	<	<
Iron	0.051	<	<	0.0655	0.195	0.928	0.844	1.26	0.666	0.0991
Lead	<	<	<	<	0.0055	<	<	<	0.0043	<
Lithium	<	<	<	<	0.0209	<	<	<	<	0.039
Manganese	0.0166	0.0557	0.785	0.0712	0.397	0.641	0.895	0.299	0.146	0.0153
Mercury	<	<	<	<	<	<	<	<	<	.
Nickel	<	<	<	<	0.00932	<	<	<	<	<
Strontium	0.18	0.173	0.167	0.158	0.124	0.276	0.27	0.247	0.222	0.105
Thallium	<	<	<	<	<	<	<	<	<	<
Uranium	<	<	<	<	0.0047	<	0.0058 J	<	0.0061 J	0.03
Vanadium	<	<	<	<	<	<	<	<	<	<
Zinc	<	<	<	<	0.0617	<	<	<	<	<

APPENDIX D.1: CY 2008 MONITORING DATA FOR THE BEAR CREEK HYDROGEOLOGIC REGIME
Field Measurements, Miscellaneous Analytes, Major Ions, and Trace Metals

Sampling Point	NT-08		SS-4		SS-5	SS-6	
Functional Area	EXP-SW	EXP-SW	EXP-SW		EXP-SW	EXP-SW	
Date Sampled	02/11/08	08/06/08	01/14/08		01/14/08	01/02/08	07/01/08
Program	BJC	BJC	GWPP	GWPP	GWPP	BJC	BJC
Sample Type				Dup			
Field Measurements							
Time Sampled	13:45	9:30	9:50	9:50	9:30	10:00	13:25
Measuring Point Elev. (ft)	.	.	.	.	.	.	.
Depth to Water (ft)	.	.	.	.	.	.	.
Groundwater Elevation (ft)	.	.	.	.	.	.	.
Conductivity (µmho/cm)	217	442	622	622	374	576	640
Dissolved Oxygen (ppm)	8.6	4.81	6.61	6.61	5.14	7.68	5.76
Oxidation/Reduction (mV)	99.4	218.7	167	167	163	128.6	31.8
Temperature (degrees C)	7.39	22.63	9.8	9.8	12.1	11.66	20.18
Turbidity (NTU)	7.89	16.9	.	.	.	6.92	3.08
pH	7.42	7.46	7.08	7.08	7.02	7.17	7.32
Miscellaneous Analytes							
Dissolved Solids (mg/L)	164	297	324	326	184	.	.
Suspended Solids (mg/L)	7	41	11	13	<	.	.
Turbidity (NTU)	.	.	12.3	11.7	4.22	.	.
Major Ions (mg/L)							
Calcium	39.8	66.9 J	84.2	83	47	58.1	56.6
Magnesium	4.11	5.95 J	15.1	15.1	11.9	16.1	17.8
Potassium	1.48	2.9	2.33	2.36	<	1.15	0.947 J
Sodium	2.97	5.23	11.6	11.5	4.44	5.11	4.57
Bicarbonate	97	172	172	175	143	.	.
Carbonate	<	<	<	<	<	.	.
Chloride	7	17	19.1	19.8	6.92	.	.
Fluoride	<	0.13	0.301	0.305	0.112	.	.
Nitrate as N	0.028	0.082	13	13	2.19	1.2	1.2
Sulfate	14	8.9	39.7	39.1	18.6	.	.
Charge balance error (%)	1.2	0.2	2.2	1.1	-1.2	.	.
Trace Metals (mg/L)							
Aluminum	0.414	0.613 J	0.272	0.651	<	0.205	<
Arsenic	<	<	<	<	<	<	<
Barium	0.0666	0.113	0.0986	0.0987	0.0538	0.0708	0.0789
Beryllium	<	<	<	<	<	<	<
Boron	0.488	1.04	<	<	<	<	<
Cadmium	<	<	<	<	<	<	<
Chromium	<	<	<	<	<	<	<
Cobalt	<	<	<	<	<	<	<
Copper	<	<	<	<	<	<	<
Iron	0.405	0.848	0.375	0.651	0.0929	0.294	0.248
Lead	<	<	0.0228 R	0.00765 R	0.000905	<	<
Lithium	0.141	0.15 J	<	0.0107	<	<	<
Manganese	0.0336	0.153 J	0.171	0.19	0.00582	0.0242	0.0361
Mercury	.	.	<	<	<	.	.
Nickel	<	<	<	<	<	<	<
Strontium	0.0882	0.156	0.198	0.197	0.0786	0.0862	0.0996
Thallium	<	<	<	<	<	<	<
Uranium	0.51	0.46	0.0954	0.103	0.0186	0.0091	0.014
Vanadium	<	<	<	<	<	<	<
Zinc	<	<	<	<	<	<	<

APPENDIX D.2
VOLATILE ORGANIC COMPOUNDS

APPENDIX D.2: CY 2008 MONITORING DATA FOR THE BEAR CREEK HYDROGEOLOGIC REGIME
Volatile Organic Compounds

Sampling Point	GW-006		GW-008		GW-014	GW-046		GW-058	GW-065	
Functional Area	OLF		OLF		BG	BG		BG	OLF	
Date Sampled	03/12/08	07/29/08	01/02/08	07/08/08	09/17/08	01/03/08	07/07/08	01/23/08	03/03/08	08/06/08
Program	GWPP	GWPP	BJC	BJC	GWPP	BJC	BJC	GWPP	GWPP	GWPP
Sample Type										
Chloroethenes (µg/L)										
Tetrachloroethene	<	2 J	29	42	42	330	430	<	<	<
Trichloroethene	4 J	4 J	15	9	240	930 D	430	<	<	12
cis-1,2-Dichloroethene	5	5 J	28	21	1,500	3,500	1,400	<	<	<
trans-1,2-Dichloroethene	<	<	0.1 J	<	4 J	21	6	<	<	<
1,1-Dichloroethene	<	<	7	5 J	78	55	25	<	<	<
Vinyl chloride	<	<	<	<	240	330	120	<	<	<
Chloroethanes (µg/L)										
1,1,2,2-Trichloroethane	<	<	<	<	<	0.2 J	<	<	<	<
1,1,1-Trichloroethane	<	<	<	<	<	36	16	<	<	<
1,1,2-Trichloroethane	<	<	<	<	<	1 J	<	<	<	<
1,2-Dichloroethane	<	<	<	<	<	0.9 J	<	<	<	<
1,1-Dichloroethane	9	8	13	11	260	100	73	<	<	<
Chloroethane	<	<	0.5 J	<	10	4 J	<	<	<	<
Chloromethanes (µg/L)										
Carbon tetrachloride	<	<	<	<	<	<	<	<	<	<
Chloroform	<	<	<	<	<	0.5 J	2 J	<	<	<
Methylene chloride	<	<	<	<	<	<	<	<	<	<
Petrol. Hydrocarb. (µg/L)										
Benzene	<	<	1 J	<	3 J	8	22	<	<	<
Ethylbenzene	<	<	<	<	<	<	<	<	<	<
Toluene	<	<	<	<	<	<	<	<	<	<
Total Xylene	<	<	<	<	<	0.5 J	<	<	<	<
Chlorofluorocarbons (µg/L)										
1,1,2-Trichloro-1,2,2-trifluoroethane	<	<	.	.	<	.	.	<	<	<
Dichlorodifluoromethane	<	<	.	.	<	.	.	<	<	<
Miscellaneous (µg/L)										
1,2-Dichloropropane	<	<	1 J	<	<	<	<	<	<	<
1,4-Dichlorobenzene	<	<	.	.	<	.	.	<	<	<
2-Butanone	<	<	<	<	<	<	<	<	<	<
Acetone	<	<	<	<	<	<	<	<	<	<
Carbon disulfide	<	<	<	<	<	<	<	<	<	<
Chlorobenzene	<	<	<	<	<	<	<	<	<	<
cis-1,3-Dichloropropene	<	<	<	<	<	<	<	<	<	<

APPENDIX D.2: CY 2008 MONITORING DATA FOR THE BEAR CREEK HYDROGEOLOGIC REGIME
Volatile Organic Compounds

Sampling Point	GW-068	GW-071		GW-077		GW-078		GW-079	
Functional Area	BG	BG		BG		BG		BG	
Date Sampled	09/16/08	03/25/08	09/16/08	02/26/08	08/14/08	02/21/08	08/14/08	02/21/08	07/31/08
Program	GWPP	GWPP	GWPP	BJC	BJC	BJC	BJC	BJC	BJC
Sample Type									
Chloroethenes (µg/L)									
Tetrachloroethene	7	1,100	300	<	0.2 J	<	0.2 J	<	<
Trichloroethene	79	130	47	<	<	<	<	<	<
cis-1,2-Dichloroethene	1,500	46	35	<	<	<	<	<	<
trans-1,2-Dichloroethene	4 J	1 J	3 J	<	<	<	<	<	<
1,1-Dichloroethene	190	110	68	<	<	<	<	<	<
Vinyl chloride	290	6	3	<	<	<	<	<	<
Chloroethanes (µg/L)									
1,1,2,2-Trichloroethane	<	<	<	<	<	<	<	<	<
1,1,1-Trichloroethane	<	1,100	130	0.1 J	0.2 J	<	<	<	<
1,1,2-Trichloroethane	<	<	<	<	<	<	<	<	<
1,2-Dichloroethane	4 J	<	<	<	<	<	<	<	<
1,1-Dichloroethane	650	3,000	2,200	<	<	<	<	<	<
Chloroethane	<	<	24	<	<	<	<	<	<
Chloromethanes (µg/L)									
Carbon tetrachloride	<	<	<	<	<	<	<	<	<
Chloroform	<	<	<	<	<	<	<	<	<
Methylene chloride	<	<	<	<	<	<	<	<	<
Petrol. Hydrocarb. (µg/L)									
Benzene	83	1,600	1,000	<	<	<	<	<	<
Ethylbenzene	<	3 J	2 J	<	<	<	<	<	<
Toluene	7	37	25	<	<	<	0.3 J	<	<
Total Xylene	6	12	9	<	<	<	0.5 J	<	<
Chlorofluorocarbons (µg/L)									
1,1,2-Trichloro-1,2,2-trifluoroethane	<	430	120	.	.	.	.	.	.
Dichlorodifluoromethane	<	29	<	.	.	.	.	.	.
Miscellaneous (µg/L)									
1,2-Dichloropropane	<	<	<	<	<	<	<	<	<
1,4-Dichlorobenzene	<	<	<	.	.	.	.	.	.
2-Butanone	<	<	<	<	<	<	<	<	<
Acetone	<	17	<	<	<	<	<	<	<
Carbon disulfide	<	<	<	<	<	<	<	<	<
Chlorobenzene	<	<	<	<	<	<	<	<	<
cis-1,3-Dichloropropene	<	<	<	<	<	<	<	<	<

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Sampling Point	GW-080		GW-080		GW-082	GW-085		GW-089	GW-098	GW-122
Functional Area	BG		BG		BG	OLF		BG	OLF	S3
Date Sampled	02/21/08		07/31/08		09/25/08	03/13/08	08/05/08	09/24/08	03/11/08	03/11/08
Program	BJC	BJC	BJC	BJC	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP
Sample Type		Dup		Dup						
Chloroethenes (µg/L)										
Tetrachloroethene	<	<	<	<	2 J	<	<	2 J	<	1 J
Trichloroethene	<	<	<	<	1 J	<	<	<	4 J	<
cis-1,2-Dichloroethene	<	<	<	<	690	<	<	<	2 J	<
trans-1,2-Dichloroethene	<	<	<	<	1 J	<	<	<	<	<
1,1-Dichloroethene	<	<	<	<	14	<	<	<	1 J	<
Vinyl chloride	<	<	<	<	200	<	<	<	<	<
Chloroethanes (µg/L)										
1,1,2,2-Trichloroethane	<	<	<	<	<	<	<	<	<	<
1,1,1-Trichloroethane	<	<	<	<	<	<	<	<	<	<
1,1,2-Trichloroethane	<	<	<	<	<	<	<	<	<	<
1,2-Dichloroethane	<	<	<	<	<	<	<	<	<	<
1,1-Dichloroethane	<	<	<	<	270	<	<	<	<	<
Chloroethane	<	<	<	<	17	<	<	<	<	<
Chloromethanes (µg/L)										
Carbon tetrachloride	<	<	<	<	<	<	<	<	<	<
Chloroform	<	<	<	<	<	<	<	<	<	<
Methylene chloride	<	<	<	<	<	<	<	<	<	<
Petrol. Hydrocarb. (µg/L)										
Benzene	<	<	<	<	13	<	<	<	<	<
Ethylbenzene	<	<	<	<	<	<	<	<	<	<
Toluene	<	<	0.4 J	0.4 J	<	<	<	<	<	<
Total Xylene	<	<	0.4 J	0.4 J	<	<	<	<	<	<
Chlorofluorocarbons (µg/L)										
1,1,2-Trichloro-1,2,2-trifluoroethane	.	.	.	.	<	<	<	<	<	<
Dichlorodifluoromethane	.	.	.	.	<	<	<	<	<	<
Miscellaneous (µg/L)										
1,2-Dichloropropane	<	<	<	<	<	<	<	<	<	<
1,4-Dichlorobenzene	.	.	.	.	<	<	<	<	<	<
2-Butanone	<	<	<	<	<	<	<	<	<	<
Acetone	<	<	<	<	<	<	<	<	<	<
Carbon disulfide	<	<	<	<	<	<	<	<	<	<
Chlorobenzene	<	<	<	<	<	<	<	<	<	<
cis-1,3-Dichloropropene	<	<	<	<	<	<	<	<	<	<

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Volatile Organic Compounds

Sampling Point	GW-225		GW-226		GW-227	GW-229			
Functional Area	OLF		OLF		OLF	OLF			
Date Sampled	01/28/08	07/29/08	02/04/08	07/29/08	02/05/08	02/06/08		06/17/08	12/11/08
Program	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP
Sample Type							Dup		
Chloroethenes (µg/L)									
Tetrachloroethene	<	1 J	<	1 J	<	<	<	<	<
Trichloroethene	230	220	95	180	23	7	6	9	3 J
cis-1,2-Dichloroethene	2 J	3 J	6	4 J	3 J	330	330	320	260
trans-1,2-Dichloroethene	<	<	<	<	<	1 J	1 J	<	1 J
1,1-Dichloroethene	2 J	2 J	<	2 J	<	46	45	44	28
Vinyl chloride	<	<	<	<	<	39	43	20	73
Chloroethanes (µg/L)									
1,1,2,2-Trichloroethane	<	<	<	<	<	<	<	<	<
1,1,1-Trichloroethane	<	<	<	<	<	4 J	3 J	7	2 J
1,1,2-Trichloroethane	<	<	<	<	<	<	<	<	<
1,2-Dichloroethane	<	<	<	<	<	<	<	<	<
1,1-Dichloroethane	<	<	<	<	<	10	10	8	11
Chloroethane	<	<	<	<	<	<	<	<	<
Chloromethanes (µg/L)									
Carbon tetrachloride	1 J	2 J	<	4 J	<	<	<	<	<
Chloroform	1 J	2 J	<	2 J	<	<	<	<	<
Methylene chloride	<	<	<	<	<	<	<	<	<
Petrol. Hydrocarb. (µg/L)									
Benzene	<	<	<	<	<	8	8	11	9
Ethylbenzene	<	<	<	<	<	<	<	<	<
Toluene	<	<	<	<	<	<	<	<	<
Total Xylene	<	<	<	<	<	<	<	<	<
Chlorofluorocarbons (µg/L)									
1,1,2-Trichloro-1,2,2-trifluoroethane	<	<	<	<	<	28	28	40	18
Dichlorodifluoromethane	<	<	<	<	<	<	<	<	<
Miscellaneous (µg/L)									
1,2-Dichloropropane	<	<	<	<	<	<	<	<	<
1,4-Dichlorobenzene	<	<	<	<	<	3 J	3 J	4 J	3 J
2-Butanone	<	<	<	<	<	<	<	<	<
Acetone	<	<	<	<	<	<	<	<	<
Carbon disulfide	<	<	<	<	<	<	<	<	<
Chlorobenzene	<	<	<	<	<	11	11	14	12
cis-1,3-Dichloropropene	<	<	<	<	<	<	<	<	<

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Sampling Point	GW-246				GW-257	GW-259		GW-276		GW-289
Functional Area	S3				BG	BG		S3		BG
Date Sampled	03/12/08	06/10/08	08/07/08	12/10/08	09/23/08	03/10/08	09/23/08	01/03/08	07/07/08	09/24/08
Program	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP	BJC	BJC	GWPP
Sample Type										
Chloroethenes (µg/L)										
Tetrachloroethene	170	100	84	74	180	400	360	5	5	750
Trichloroethene	2 J	1 J	1 J	<	<	9	11	0.1 J	<	24
cis-1,2-Dichloroethene	1 J	<	<	<	<	4 J	6	<	<	4 J
trans-1,2-Dichloroethene	<	<	<	<	<	<	<	<	<	<
1,1-Dichloroethene	3 J	2 J	2 J	2 J	<	<	<	<	<	2 J
Vinyl chloride	<	<	<	<	<	<	<	<	<	<
Chloroethanes (µg/L)										
1,1,2,2-Trichloroethane	<	<	<	<	<	<	<	<	<	<
1,1,1-Trichloroethane	<	<	<	<	<	<	<	<	<	<
1,1,2-Trichloroethane	<	<	<	<	<	<	<	<	<	<
1,2-Dichloroethane	<	<	<	<	<	<	<	<	<	<
1,1-Dichloroethane	<	<	<	<	<	<	<	<	<	<
Chloroethane	<	<	<	<	<	<	<	<	<	<
Chloromethanes (µg/L)										
Carbon tetrachloride	<	<	<	<	<	<	<	<	<	<
Chloroform	36	30	29	22	<	<	<	0.2 J	<	<
Methylene chloride	12	11	12	11	<	<	<	<	<	<
Petrol. Hydrocarb. (µg/L)										
Benzene	<	<	<	<	<	<	<	<	<	<
Ethylbenzene	<	<	<	<	<	<	<	<	<	<
Toluene	<	<	<	<	<	<	<	<	<	<
Total Xylene	<	<	<	<	<	<	<	<	<	<
Chlorofluorocarbons (µg/L)										
1,1,2-Trichloro-1,2,2-trifluoroethane	78	41	39	30	<	<	<	.	.	<
Dichlorodifluoromethane	<	<	<	<	<	<	<	.	.	<
Miscellaneous (µg/L)										
1,2-Dichloropropane	<	<	<	<	<	<	<	<	<	<
1,4-Dichlorobenzene	<	<	<	<	<	<	<	.	.	<
2-Butanone	<	<	<	<	<	<	<	<	<	<
Acetone	<	<	<	<	<	<	<	<	<	<
Carbon disulfide	<	<	<	<	<	<	<	<	<	<
Chlorobenzene	<	<	<	<	<	<	<	<	<	<
cis-1,3-Dichloropropene	<	<	<	<	<	<	3 J	<	<	<

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Volatile Organic Compounds

Sampling Point	GW-306		GW-309			GW-310	GW-312	GW-314		GW-315
Functional Area	RS		RS			RS	RS	SPI		SPI
Date Sampled	03/06/08	07/31/08	03/05/08	07/30/08		02/14/08	02/19/08	03/24/08	08/04/08	02/19/08
Program	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP
Sample Type					Dup					
Chloroethenes (µg/L)										
Tetrachloroethene	1 J	<	<	<	<	2 J	<	11	4 J	6
Trichloroethene	28	30	<	<	<	13	31	3 J	1 J	2 J
cis-1,2-Dichloroethene	2 J	2 J	<	<	<	<	<	<	<	<
trans-1,2-Dichloroethene	<	<	<	<	<	<	<	<	<	<
1,1-Dichloroethene	<	<	<	<	<	<	<	<	<	<
Vinyl chloride	<	<	<	<	<	<	<	<	<	<
Chloroethanes (µg/L)										
1,1,2,2-Trichloroethane	<	<	<	<	<	<	<	<	<	<
1,1,1-Trichloroethane	<	<	<	<	<	<	<	<	<	<
1,1,2-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	<	<	<	<	<	<	<	<	<	<
Chlorofluorocarbons (µg/L)										
1,1,2-Trichloro-1,2,2-trifluoroethane	<	<	<	<	<	<	<	<	<	<
Dichlorodifluoromethane	<	<	<	<	<	<	<	<	<	<
Miscellaneous (µg/L)										
1,2-Dichloropropane	<	<	<	<	<	<	<	<	<	<
1,4-Dichlorobenzene	<	<	<	<	<	<	<	<	<	<
2-Butanone	<	<	<	<	<	<	<	<	<	<
Acetone	<	<	<	<	<	<	<	<	<	<
Carbon disulfide	<	<	<	<	<	<	<	<	<	<
Chlorobenzene	<	<	<	<	<	<	<	<	<	<
cis-1,3-Dichloropropene	<	<	<	<	<	<	<	<	<	<

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Volatile Organic Compounds

Sampling Point	GW-363				GW-365	GW-367		GW-369		GW-531
Functional Area	EMWMF				OLF	OLF		OLF		OLF
Date Sampled	02/21/08	04/24/08	08/12/08	11/12/08	01/28/08	02/25/08	07/30/08	03/05/08		08/05/08
Program	BJC	BJC	BJC	BJC	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP
Sample Type									Dup	
Chloroethenes (µg/L)										
Tetrachloroethene	<	<	<	<	<	<	<	<	<	<
Trichloroethene	<	<	<	<	5	15	10	33	35	<
cis-1,2-Dichloroethene	<	<	<	<	28	<	<	<	<	<
trans-1,2-Dichloroethene	.	.	.	.	<	<	<	<	<	<
1,1-Dichloroethene	.	.	<	<	10	<	<	<	<	<
Vinyl chloride	<	<	<	<	4	<	<	<	<	<
Chloroethanes (µg/L)										
1,1,2,2-Trichloroethane	.	.	.	.	<	<	<	<	<	<
1,1,1-Trichloroethane	<	<	<	<	<	<	<	<	<	<
1,1,2-Trichloroethane	.	.	.	<	<	<	<	<	<	<
1,2-Dichloroethane	.	.	.	.	<	<	<	<	<	<
1,1-Dichloroethane	<	<	<	<	4 J	<	<	<	<	<
Chloroethane	<	<	<	<	<	<	<	<	<	<
Chloromethanes (µg/L)										
Carbon tetrachloride	<	<	<	<	<	<	<	<	<	<
Chloroform	<	<	<	<	<	<	<	<	<	<
Methylene chloride	<	<	<	<	<	<	<	<	<	<
Petrol. Hydrocarb. (µg/L)										
Benzene	<	<	<	<	<	<	<	<	<	<
Ethylbenzene	.	.	.	.	<	<	<	<	<	<
Toluene	0.1 J	0.2 J	0.1 J	<	<	<	<	<	<	<
Total Xylene	<	<	<	<	<	<	<	<	<	<
Chlorofluorocarbons (µg/L)										
1,1,2-Trichloro-1,2,2-trifluoroethane	.	.	.	.	<	<	<	<	<	<
Dichlorodifluoromethane	.	.	.	.	<	<	<	<	<	<
Miscellaneous (µg/L)										
1,2-Dichloropropane	.	.	.	.	<	<	<	<	<	<
1,4-Dichlorobenzene	<	<	<	<	<	<	<	<	<	<
2-Butanone	<	<	<	<	<	<	<	<	<	<
Acetone	<	<	<	<	<	<	<	<	<	<
Carbon disulfide	<	<	<	<	<	<	<	<	<	<
Chlorobenzene	<	<	<	<	<	<	<	<	<	<
cis-1,3-Dichloropropene	.	.	.	.	<	<	<	<	<	<

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Volatile Organic Compounds

Sampling Point	GW-537	GW-615		GW-623		GW-626			
Functional Area	OLF	S3		BG		BG			
Date Sampled	08/05/08	08/11/08	08/11/08	03/18/08	09/22/08	02/26/08	06/03/08	09/17/08	12/02/08
Program	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP
Sample Type									
Chloroethenes (µg/L)									
Tetrachloroethene	<	<	<	3,100	8,300	200	640	450	820
Trichloroethene	<	<	<	3,600	640	910	330	240	560
cis-1,2-Dichloroethene	<	<	<	180	260	14,000	4,600	3,900	8,500
trans-1,2-Dichloroethene	<	<	<	6	16	34	12	8	16
1,1-Dichloroethene	<	<	<	98	150	140 J	90	61	130
Vinyl chloride	<	<	<	42	92	3,700	1,100	820	1,900
Chloroethanes (µg/L)									
1,1,2,2-Trichloroethane	<	<	<	<	<	<	<	<	<
1,1,1-Trichloroethane	<	<	<	<	<	37	17	11	<
1,1,2-Trichloroethane	<	<	<	<	<	3 J	1 J	<	2 J
1,2-Dichloroethane	<	<	<	<	<	<	18	<	<
1,1-Dichloroethane	<	<	<	970	1,600	520	180	160	300
Chloroethane	<	<	<	<	5 J	<	<	<	<
Chloromethanes (µg/L)									
Carbon tetrachloride	<	<	<	<	<	<	<	<	<
Chloroform	2 J	<	<	<	<	120	55	42	92
Methylene chloride	<	2 J	<	10	21	<	<	<	<
Petrol. Hydrocarb. (µg/L)									
Benzene	<	<	<	2 J	6	380	140	110	220
Ethylbenzene	<	<	<	3 J	6	<	<	<	<
Toluene	<	<	<	1 J	2 J	<	<	<	<
Total Xylene	<	<	<	10	25	<	<	<	<
Chlorofluorocarbons (µg/L)									
1,1,2-Trichloro-1,2,2-trifluoroethane	3 J	<	<	<	<	590	190	110	180
Dichlorodifluoromethane	<	<	<	<	<	44	<	<	<
Miscellaneous (µg/L)									
1,2-Dichloropropane	<	<	<	<	<	<	<	<	<
1,4-Dichlorobenzene	<	<	<	<	<	<	<	<	<
2-Butanone	<	<	<	<	2 J	<	<	<	<
Acetone	<	<	<	56	45	<	<	<	<
Carbon disulfide	<	<	<	<	<	<	<	<	<
Chlorobenzene	<	<	<	<	<	<	<	<	<
cis-1,3-Dichloropropene	<	<	<	<	<	<	<	<	<

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Volatile Organic Compounds

Sampling Point	GW-627		GW-629		GW-639				GW-648
Functional Area	BG		BG		EMWMF				RS
Date Sampled	03/18/08	09/22/08	03/18/08	09/02/08	02/21/08	04/29/08	08/12/08	11/11/08	02/13/08
Program	GWPP	GWPP	GWPP	GWPP	BJC	BJC	BJC	BJC	GWPP
Sample Type									
Chloroethenes (µg/L)									
Tetrachloroethene	1,400	670	22,000	12,000	<	<	<	<	<
Trichloroethene	330	220	4,600	4,000	<	<	<	<	10 Q
cis-1,2-Dichloroethene	35	41	65	78	<	<	<	<	<
trans-1,2-Dichloroethene	4 J	5 J	72	73	.	.	.	.	<
1,1-Dichloroethene	44	49	340	380	.	.	<	<	<
Vinyl chloride	55	56	38	43	<	<	<	<	<
Chloroethanes (µg/L)									
1,1,2,2-Trichloroethane	<	<	<	<	.	.	.	.	<
1,1,1-Trichloroethane	<	<	83	100	<	<	<	<	<
1,1,2-Trichloroethane	<	<	5	9	.	.	.	<	<
1,2-Dichloroethane	<	<	4 J	<	.	.	.	.	<
1,1-Dichloroethane	110	120	1,400	1,600	<	<	<	<	<
Chloroethane	2 J	3 J	4 J	5 J	<	<	<	<	<
Chloromethanes (µg/L)									
Carbon tetrachloride	<	<	<	<	<	<	<	<	<
Chloroform	<	<	<	<	<	<	<	<	<
Methylene chloride	<	<	<	<	<	<	<	<	<
Petrol. Hydrocarb. (µg/L)									
Benzene	<	<	6	7	<	<	<	<	<
Ethylbenzene	<	<	<	<	.	.	.	.	<
Toluene	<	<	6	8	<	<	0.2 J	<	<
Total Xylene	<	<	4 J	4 J	<	<	0.1 J	<	<
Chlorofluorocarbons (µg/L)									
1,1,2-Trichloro-1,2,2-trifluoroethane	<	<	<	<	.	.	.	.	<
Dichlorodifluoromethane	<	<	<	<	.	.	.	.	<
Miscellaneous (µg/L)									
1,2-Dichloropropane	<	<	<	<	.	.	.	.	<
1,4-Dichlorobenzene	<	<	<	<	<	<	<	<	<
2-Butanone	<	<	<	<	<	<	<	<	<
Acetone	<	<	<	<	<	<	<	<	<
Carbon disulfide	<	<	<	<	<	<	<	<	<
Chlorobenzene	<	<	<	<	<	<	<	<	<
cis-1,3-Dichloropropene	<	<	<	<	.	.	.	.	<

APPENDIX D.2: CY 2008 MONITORING DATA FOR THE BEAR CREEK HYDROGEOLOGIC REGIME
Volatile Organic Compounds

Sampling Point	GW-653		GW-683		GW-684		GW-694	GW-703	GW-704	
Functional Area	BG		EXP-A		EXP-A		EXP-B	EXP-B	EXP-B	
Date Sampled	09/25/08		02/25/08	07/24/08	02/25/08	07/24/08	01/23/08	01/23/08	02/25/08	07/31/08
Program	GWPP	GWPP	BJC	BJC	BJC	BJC	GWPP	GWPP	BJC	BJC
Sample Type		Dup								
Chloroethenes (µg/L)										
Tetrachloroethene	15	14	0.1 J	<	<	0.1 J	<	<	0.4 J	0.1 J
Trichloroethene	14	15	0.4 J	<	0.3 J	0.6 J	3 J	10	26	23
cis-1,2-Dichloroethene	140	130	0.7 J	<	0.3 J	1 J	<	7	7	2 J
trans-1,2-Dichloroethene	<	<	<	<	<	<	<	<	<	<
1,1-Dichloroethene	6	5	<	<	<	<	<	<	3	1 J
Vinyl chloride	<	<	<	<	<	<	<	<	<	<
Chloroethanes (µg/L)										
1,1,2,2-Trichloroethane	<	<	<	<	<	<	<	<	<	<
1,1,1-Trichloroethane	1 J	<	<	<	<	<	<	<	0.7 J	<
1,1,2-Trichloroethane	<	<	<	<	<	<	<	<	<	<
1,2-Dichloroethane	<	<	<	<	<	<	<	<	<	<
1,1-Dichloroethane	9	8	<	<	<	<	<	<	0.5 J	0.5 J
Chloroethane	<	<	<	<	<	<	<	<	<	<
Chloromethanes (µg/L)										
Carbon tetrachloride	<	<	<	<	<	<	<	<	0.7 J	<
Chloroform	<	<	<	<	<	<	<	<	0.3 J	<
Methylene chloride	<	<	<	<	<	<	<	<	<	<
Petrol. Hydrocarb. (µg/L)										
Benzene	<	<	<	<	<	<	<	<	<	0.2 J
Ethylbenzene	<	<	<	<	<	<	<	<	<	<
Toluene	<	<	<	<	<	<	<	<	<	0.3 J
Total Xylene	<	<	<	<	<	<	<	<	<	0.2 J
Chlorofluorocarbons (µg/L)										
1,1,2-Trichloro-1,2,2-trifluoroethane	1 J	2 J	.	.	.	.	<	<	.	.
Dichlorodifluoromethane	<	<	.	.	.	.	<	<	.	.
Miscellaneous (µg/L)										
1,2-Dichloropropane	<	<	<	<	<	<	<	<	<	<
1,4-Dichlorobenzene	<	<	.	.	.	.	<	<	.	.
2-Butanone	<	<	<	<	<	<	<	<	<	<
Acetone	<	<	<	<	<	<	<	<	<	<
Carbon disulfide	<	<	<	<	<	<	<	<	<	<
Chlorobenzene	<	<	<	<	<	<	<	<	<	<
cis-1,3-Dichloropropene	<	<	<	<	<	<	<	<	<	<

APPENDIX D.2: CY 2008 MONITORING DATA FOR THE BEAR CREEK HYDROGEOLOGIC REGIME
Volatile Organic Compounds

Sampling Point	GW-706		GW-712		GW-713				GW-714	
Functional Area	EXP-B		EXP-W		EXP-W				EXP-W	
Date Sampled	02/26/08	07/31/08	01/02/08	07/01/08	01/02/08		07/07/08		01/02/08	07/01/08
Program	BJC	BJC	BJC	BJC	BJC	BJC	BJC	BJC	BJC	BJC
Sample Type						Dup		Dup		
Chloroethenes (µg/L)										
Tetrachloroethene	0.5 J	0.7 J	<	<	<	<	<	<	<	<
Trichloroethene	14	17	<	<	0.2 J	0.2 J	<	<	<	<
cis-1,2-Dichloroethene	30	27	<	<	<	<	<	<	<	<
trans-1,2-Dichloroethene	0.1 J	<	<	<	<	<	<	<	<	<
1,1-Dichloroethene	4	4	<	<	<	<	<	<	<	<
Vinyl chloride	<	<	<	<	<	<	<	<	<	<
Chloroethanes (µg/L)										
1,1,2,2-Trichloroethane	<	<	<	<	<	<	<	<	<	<
1,1,1-Trichloroethane	1 J	1 J	<	<	<	<	<	<	<	<
1,1,2-Trichloroethane	<	<	<	<	<	<	<	<	<	<
1,2-Dichloroethane	<	<	<	<	<	<	<	<	<	<
1,1-Dichloroethane	0.7 J	0.6 J	<	<	<	<	<	<	<	<
Chloroethane	<	<	<	<	<	<	<	<	<	<
Chloromethanes (µg/L)										
Carbon tetrachloride	<	<	<	<	<	<	<	<	<	<
Chloroform	0.4 J	0.3 J	<	<	<	<	<	<	<	<
Methylene chloride	<	<	<	<	<	<	<	<	<	<
Petrol. Hydrocarb. (µg/L)										
Benzene	0.3 J	0.1 J	<	<	<	<	<	<	<	<
Ethylbenzene	<	<	<	<	<	<	<	<	<	<
Toluene	<	<	<	<	<	<	<	<	<	<
Total Xylene	<	<	<	<	<	<	<	<	<	<
Chlorofluorocarbons (µg/L)										
1,1,2-Trichloro-1,2,2-trifluoroethane	.	.	.	.	.	.	.	.	.	.
Dichlorodifluoromethane	.	.	.	.	.	.	.	.	.	.
Miscellaneous (µg/L)										
1,2-Dichloropropane	<	<	<	<	<	<	<	<	<	<
1,4-Dichlorobenzene	.	.	.	.	.	.	.	.	.	.
2-Butanone	<	<	<	<	<	<	<	<	<	<
Acetone	<	<	<	<	<	<	<	<	<	<
Carbon disulfide	<	<	<	<	<	<	1 J	<	<	<
Chlorobenzene	0.1 J	<	<	<	<	<	<	<	<	<
cis-1,3-Dichloropropene	<	<	<	<	<	<	<	<	<	<

APPENDIX D.2: CY 2008 MONITORING DATA FOR THE BEAR CREEK HYDROGEOLOGIC REGIME
Volatile Organic Compounds

Sampling Point	GW-724	GW-725		GW-738	GW-740			GW-829	GW-916	
Functional Area	EXP-C	EXP-C		EXP-C	EXP-C			OLF	EMWMF	
Date Sampled	03/06/08	02/07/08		02/12/08	02/12/08	06/26/08	12/17/08	08/04/08	02/13/08	04/21/08
Program	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP	BJC	BJC
Sample Type			Dup							
Chloroethenes (µg/L)										
Tetrachloroethene	4 J	2 J	2 J	<	<	<	<	<	<	<
Trichloroethene	64	7	6	20	42	47	43	<	<	<
cis-1,2-Dichloroethene	2 J	<	1 J	<	1 J	2 J	1 J	<	<	<
trans-1,2-Dichloroethene	<	<	<	<	<	<	<	<	.	.
1,1-Dichloroethene	<	<	<	<	<	<	<	<	.	.
Vinyl chloride	<	<	<	<	<	<	<	<	<	<
Chloroethanes (µg/L)										
1,1,2,2-Trichloroethane	<	<	<	<	<	<	<	<	.	.
1,1,1-Trichloroethane	<	<	<	<	<	<	<	<	<	<
1,1,2-Trichloroethane	<	<	<	<	<	<	<	<	.	.
1,2-Dichloroethane	<	<	<	<	<	<	<	<	.	.
1,1-Dichloroethane	<	<	<	<	<	<	<	<	<	<
Chloroethane	<	<	<	<	<	<	<	<	<	<
Chloromethanes (µg/L)										
Carbon tetrachloride	<	<	<	<	<	1 J	1 J	<	<	<
Chloroform	<	<	<	<	<	<	<	<	<	<
Methylene chloride	<	<	<	<	<	<	<	<	<	<
Petrol. Hydrocarb. (µg/L)										
Benzene	<	<	<	<	<	<	<	<	<	<
Ethylbenzene	<	<	<	<	<	<	<	<	.	.
Toluene	<	<	<	<	<	<	<	<	<	<
Total Xylene	<	<	<	<	<	<	<	<	<	<
Chlorofluorocarbons (µg/L)										
1,1,2-Trichloro-1,2,2-trifluoroethane	<	<	<	<	<	<	<	<	.	.
Dichlorodifluoromethane	<	<	<	<	<	<	<	<	.	.
Miscellaneous (µg/L)										
1,2-Dichloropropane	<	<	<	<	<	<	<	<	.	.
1,4-Dichlorobenzene	<	<	<	<	<	<	<	<	<	<
2-Butanone	<	<	<	<	<	<	<	<	<	<
Acetone	<	<	<	<	<	<	<	<	<	<
Carbon disulfide	<	<	<	<	<	<	<	<	<	<
Chlorobenzene	<	<	<	<	<	<	<	<	<	<
cis-1,3-Dichloropropene	<	<	<	<	<	<	<	<	.	.

APPENDIX D.2: CY 2008 MONITORING DATA FOR THE BEAR CREEK HYDROGEOLOGIC REGIME
Volatile Organic Compounds

Sampling Point	GW-916		GW-917				GW-918			
Functional Area	EMWMF		EMWMF				EMWMF			
Date Sampled	08/07/08	11/05/08	02/11/08	04/15/08	08/05/08	11/04/08	02/14/08	04/16/08	08/05/08	11/05/08
Program	BJC	BJC	BJC	BJC	BJC	BJC	BJC	BJC	BJC	BJC
Sample Type										
Chloroethenes (µg/L)										
Tetrachloroethene	<	<	<	<	<	<	<	<	<	<
Trichloroethene	<	<	<	<	<	<	<	<	<	<
cis-1,2-Dichloroethene	<	<	<	<	<	<	<	<	<	<
trans-1,2-Dichloroethene	.	.	.	.	.	.	.	.	.	.
1,1-Dichloroethene	<	<	.	.	.	<	.	.	.	<
Vinyl chloride	<	<	<	<	<	<	<	<	<	<
Chloroethanes (µg/L)										
1,1,2,2-Trichloroethane	.	.	.	.	.	.	.	.	.	.
1,1,1-Trichloroethane	<	<	<	<	<	<	<	<	<	<
1,1,2-Trichloroethane	.	<	.	.	.	<	.	.	.	<
1,2-Dichloroethane	.	.	.	.	.	.	.	.	.	.
1,1-Dichloroethane	<	<	<	<	<	<	<	<	<	<
Chloroethane	<	<	<	<	<	<	<	<	<	<
Chloromethanes (µg/L)										
Carbon tetrachloride	<	<	<	<	<	<	<	<	<	<
Chloroform	<	<	<	<	<	<	<	<	<	<
Methylene chloride	<	<	<	<	<	<	<	<	<	<
Petrol. Hydrocarb. (µg/L)										
Benzene	<	<	<	<	<	<	<	<	<	<
Ethylbenzene	.	.	.	.	.	.	.	.	.	.
Toluene	<	<	<	.	0.1 J	<	<	<	<	<
Total Xylene	<	<	<	<	<	<	<	<	<	<
Chlorofluorocarbons (µg/L)										
1,1,2-Trichloro-1,2,2-trifluoroethane	.	.	.	.	.	.	.	.	.	.
Dichlorodifluoromethane	.	.	.	.	.	.	.	.	.	.
Miscellaneous (µg/L)										
1,2-Dichloropropane	.	.	.	.	.	.	.	.	.	.
1,4-Dichlorobenzene	<	<	<	<	<	<	<	<	<	<
2-Butanone	<	<	<	<	<	<	<	<	<	<
Acetone	<	<	<	<	<	<	<	<	<	<
Carbon disulfide	<	<	<	<	<	<	<	<	<	<
Chlorobenzene	<	<	<	<	<	<	<	<	<	<
cis-1,3-Dichloropropene	.	.	.	.	.	.	.	.	.	.

APPENDIX D.2: CY 2008 MONITORING DATA FOR THE BEAR CREEK HYDROGEOLOGIC REGIME
Volatile Organic Compounds

Sampling Point	GW-920				GW-921				GW-922	
Functional Area	EMWMF				EMWMF				EMWMF	
Date Sampled	02/12/08	04/17/08	08/04/08	11/10/08	02/12/08	04/17/08	08/05/08	11/03/08	02/12/08	04/16/08
Program	BJC	BJC	BJC	BJC	BJC	BJC	BJC	BJC	BJC	BJC
Sample Type										
Chloroethenes (µg/L)										
Tetrachloroethene	<	<	<	<	<	<	<	<	<	<
Trichloroethene	<	<	<	<	<	<	<	<	<	<
cis-1,2-Dichloroethene	<	<	<	<	<	<	<	<	<	<
trans-1,2-Dichloroethene	.	.	.	.	.	.	.	.	.	.
1,1-Dichloroethene	.	.	<	.	.	.	.	<	.	.
Vinyl chloride	<	<	<	<	<	<	<	<	<	<
Chloroethanes (µg/L)										
1,1,2,2-Trichloroethane	.	.	.	.	.	.	.	.	.	.
1,1,1-Trichloroethane	<	<	<	<	<	<	<	<	<	<
1,1,2-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	<	<	<	<	<	<	<	<	<	<
Chlorofluorocarbons (µg/L)										
1,1,2-Trichloro-1,2,2-trifluoroethane	.	.	.	.	.	.	.	.	.	.
Dichlorodifluoromethane	.	.	.	.	.	.	.	.	.	.
Miscellaneous (µg/L)										
1,2-Dichloropropane	.	.	.	.	.	.	.	.	.	.
1,4-Dichlorobenzene	<	<	<	<	<	<	<	<	<	<
2-Butanone	<	<	<	<	<	<	<	<	<	<
Acetone	<	<	<	<	<	<	<	<	<	<
Carbon disulfide	<	<	<	<	<	<	<	<	<	<
Chlorobenzene	<	<	<	<	<	<	<	<	<	<
cis-1,3-Dichloropropene	.	.	.	.	.	.	.	.	.	.

APPENDIX D.2: CY 2008 MONITORING DATA FOR THE BEAR CREEK HYDROGEOLOGIC REGIME
Volatile Organic Compounds

Sampling Point	GW-922		GW-923			GW-924			
Functional Area	EMWMF		EMWMF			EMWMF			
Date Sampled	08/04/08	11/05/08	02/19/08	04/21/08	08/06/08	02/19/08		04/22/08	
Program	BJC	BJC	BJC	BJC	BJC	BJC	BJC	BJC	BJC
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)									
1,1,2,2-Trichloroethane	.	.	.	.	.	.	.	.	.
1,1,1-Trichloroethane	<	<	<	<	<	<	<	<	<
1,1,2-Trichloroethane	.	<	.	.	.	.	.	.	.
1,2-Dichloroethane	.	.	.	.	.	.	.	.	.
1,1-Dichloroethane	<	<	<	<	<	<	<	<	<
Chloroethane	<	<	<	<	<	<	<	<	<
Chloromethanes (µg/L)									
Carbon tetrachloride	<	<	<	<	<	<	<	<	<
Chloroform	<	<	<	<	<	<	<	<	<
Methylene chloride	<	<	<	<	<	<	<	<	<
Petrol. Hydrocarb. (µg/L)									
Benzene	<	<	<	<	<	<	<	<	<
Ethylbenzene	.	.	.	.	.	.	.	.	.
Toluene	<	<	0.2 J	<	<	<	<	<	<
Total Xylene	<	<	<	<	<	<	<	<	<
Chlorofluorocarbons (µg/L)									
1,1,2-Trichloro-1,2,2-trifluoroethane	.	.	.	.	.	.	.	.	.
Dichlorodifluoromethane	.	.	.	.	.	.	.	.	.
Miscellaneous (µg/L)									
1,2-Dichloropropane	.	.	.	.	.	.	.	.	.
1,4-Dichlorobenzene	<	<	<	<	<	<	<	<	<
2-Butanone	<	<	<	<	<	<	<	<	<
Acetone	<	<	<	<	<	<	<	<	<
Carbon disulfide	<	<	<	<	<	<	<	<	<
Chlorobenzene	<	<	<	<	<	<	<	<	<
cis-1,3-Dichloropropene	.	.	.	.	.	.	.	.	.

APPENDIX D.2: CY 2008 MONITORING DATA FOR THE BEAR CREEK HYDROGEOLOGIC REGIME
Volatile Organic Compounds

Sampling Point	GW-924				GW-925				GW-926	
Functional Area	EMWMF				EMWMF				EMWMF	
Date Sampled	08/06/08		11/06/08		02/14/08	04/17/08	08/05/08	11/05/08	02/19/08	04/23/08
Program	BJC	BJC	BJC	BJC	BJC	BJC	BJC	BJC	BJC	BJC
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)										
1,1,2,2-Trichloroethane	.	.	.	.	.	.	.	.	.	.
1,1,1-Trichloroethane	<	<	<	<	<	<	<	<	<	<
1,1,2-Trichloroethane	.	.	<	<	.	.	.	<	.	.
1,2-Dichloroethane	.	.	.	.	.	.	.	.	.	.
1,1-Dichloroethane	<	<	<	<	<	<	<	<	<	<
Chloroethane	<	<	<	<	<	<	<	<	<	<
Chloromethanes (µg/L)										
Carbon tetrachloride	<	<	<	<	<	<	<	<	<	<
Chloroform	<	<	<	<	<	<	<	<	<	<
Methylene chloride	<	<	<	<	<	<	<	<	<	<
Petrol. Hydrocarb. (µg/L)										
Benzene	<	<	<	<	<	<	<	<	<	<
Ethylbenzene	.	.	.	.	.	.	.	.	.	.
Toluene	<	<	<	<	0.2 J	<	<	<	<	<
Total Xylene	<	<	<	<	<	<	<	<	<	<
Chlorofluorocarbons (µg/L)										
1,1,2-Trichloro-1,2,2-trifluoroethane	.	.	.	.	.	.	.	.	.	.
Dichlorodifluoromethane	.	.	.	.	.	.	.	.	.	.
Miscellaneous (µg/L)										
1,2-Dichloropropane	.	.	.	.	.	.	.	.	.	.
1,4-Dichlorobenzene	<	<	<	<	<	<	<	<	<	<
2-Butanone	<	<	<	<	<	<	<	<	<	<
Acetone	<	<	<	<	<	<	<	<	<	<
Carbon disulfide	<	<	<	<	<	<	<	<	<	<
Chlorobenzene	<	<	<	<	<	<	<	<	<	<
cis-1,3-Dichloropropene	.	.	.	.	.	.	.	.	.	.

APPENDIX D.2: CY 2008 MONITORING DATA FOR THE BEAR CREEK HYDROGEOLOGIC REGIME
Volatile Organic Compounds

Sampling Point	GW-926		GW-927				BCK-04.55	EMWNT-03A	
Functional Area	EMWMF		EMWMF				EXP-SW	EXP-SW	
Date Sampled	08/06/08	11/06/08	02/11/08	04/15/08	08/07/08	11/04/08	01/14/08	02/11/08	04/14/08
Program	BJC	BJC	BJC	BJC	BJC	BJC	GWPP	BJC	BJC
Sample Type									
Chloroethenes (µg/L)									
Tetrachloroethene	<	<	<	<	<	<	<	<	<
Trichloroethene	<	<	<	<	<	<	<	<	<
cis-1,2-Dichloroethene	<	<	<	<	<	<	<	<	<
trans-1,2-Dichloroethene	.	.	.	.	.	.	.	.	.
1,1-Dichloroethene	<	<	.	.	<	<	<	.	.
Vinyl chloride	<	<	<	<	<	<	<	<	<
Chloroethanes (µg/L)									
1,1,2,2-Trichloroethane	.	.	.	.	.	.	.	<	.
1,1,1-Trichloroethane	<	<	<	<	<	<	<	<	<
1,1,2-Trichloroethane	.	<	.	.	.	<	<	.	.
1,2-Dichloroethane	.	.	.	.	.	.	<	.	.
1,1-Dichloroethane	<	<	<	<	<	<	<	<	<
Chloroethane	<	<	<	<	<	<	<	<	<
Chloromethanes (µg/L)									
Carbon tetrachloride	<	<	<	<	<	<	<	<	<
Chloroform	<	<	<	<	<	<	<	<	<
Methylene chloride	<	<	<	<	<	<	<	3 J	<
Petrol. Hydrocarb. (µg/L)									
Benzene	<	<	<	<	<	<	<	<	<
Ethylbenzene	.	.	.	.	.	.	<	.	.
Toluene	0.1 J	<	<	<	<	<	<	<	<
Total Xylene	<	<	<	<	<	<	<	<	<
Chlorofluorocarbons (µg/L)									
1,1,2-Trichloro-1,2,2-trifluoroethane	.	.	.	.	.	.	<	.	.
Dichlorodifluoromethane	.	.	.	.	.	.	<	.	.
Miscellaneous (µg/L)									
1,2-Dichloropropane	.	.	.	.	.	.	<	.	.
1,4-Dichlorobenzene	<	<	<	<	<	<	<	<	<
2-Butanone	<	<	<	<	<	<	<	<	<
Acetone	<	<	<	<	<	<	<	<	<
Carbon disulfide	<	<	<	<	<	<	<	<	<
Chlorobenzene	<	<	<	<	<	<	<	<	<
cis-1,3-Dichloropropene	.	.	.	.	.	.	<	.	.

APPENDIX D.2: CY 2008 MONITORING DATA FOR THE BEAR CREEK HYDROGEOLOGIC REGIME
Volatile Organic Compounds

Sampling Point	EMWNT-05				EMW-VWEIR			
Functional Area	EXP-SW				EXP-SW			
Date Sampled	02/11/08	04/14/08	08/11/08	11/10/08	02/11/08	04/14/08	08/11/08	11/10/08
Program	BJC	BJC	BJC	BJC	BJC	BJC	BJC	BJC
Sample Type					Dup			
Chloroethenes (µg/L)								
Tetrachloroethene	<	<	<	<	<	<	<	<
Trichloroethene	<	<	<	<	<	<	<	<
cis-1,2-Dichloroethene	<	<	<	<	<	<	<	<
trans-1,2-Dichloroethene	.	.	.	.	.	.	.	.
1,1-Dichloroethene	.	.	.	<	.	.	.	<
Vinyl chloride	<	<	<	<	<	<	<	<
Chloroethanes (µg/L)								
1,1,2,2-Trichloroethane	.	.	.	.	.	.	.	.
1,1,1-Trichloroethane	<	<	<	<	<	<	<	<
1,1,2-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	<	<	<	<	<	<	<	<
Chlorofluorocarbons (µg/L)								
1,1,2-Trichloro-1,2,2-trifluoroethane	.	.	.	.	.	.	.	.
Dichlorodifluoromethane	.	.	.	.	.	.	.	.
Miscellaneous (µg/L)								
1,2-Dichloropropane	.	.	.	.	.	.	.	.
1,4-Dichlorobenzene	<	<	<	<	<	<	<	<
2-Butanone	<	<	<	<	<	<	<	<
Acetone	<	<	<	<	<	<	<	<
Carbon disulfide	<	<	<	<	<	<	<	<
Chlorobenzene	<	<	<	<	<	<	<	<
cis-1,3-Dichloropropene	.	.	.	.	.	.	.	.

APPENDIX D.2: CY 2008 MONITORING DATA FOR THE BEAR CREEK HYDROGEOLOGIC REGIME
Volatile Organic Compounds

Sampling Point	EMW-VWUNDER				NT-01	NT-04			
Functional Area	EXP-SW				EXP-SW	EXP-SW			
Date Sampled	02/14/08	04/23/08	08/06/08	11/10/08	01/14/08	02/11/08	04/14/08	08/11/08	11/10/08
Program	BJC	BJC	BJC	BJC	GWPP	BJC	BJC	BJC	BJC
Sample Type									
Chloroethenes (µg/L)									
Tetrachloroethene	<	<	<	<	6	<	<	<	<
Trichloroethene	<	<	<	<	<	<	<	<	<
cis-1,2-Dichloroethene	<	<	<	<	<	<	7	<	<
trans-1,2-Dichloroethene	.	.	.	.	.	.	.	.	.
1,1-Dichloroethene	.	.	.	<	<	.	.	<	<
Vinyl chloride	<	<	<	<	<	<	<	<	<
Chloroethanes (µg/L)									
1,1,2,2-Trichloroethane	.	.	.	.	<	.	.	.	.
1,1,1-Trichloroethane	<	<	<	<	<	<	<	<	<
1,1,2-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	<	<	<	<	<	<	<	<	<
Chlorofluorocarbons (µg/L)									
1,1,2-Trichloro-1,2,2-trifluoroethane	.	.	.	.	<	.	.	.	.
Dichlorodifluoromethane	.	.	.	.	<	.	.	.	.
Miscellaneous (µg/L)									
1,2-Dichloropropane	.	.	.	.	<	.	.	.	.
1,4-Dichlorobenzene	<	<	<	<	<	<	<	<	<
2-Butanone	<	<	<	<	<	<	<	<	<
Acetone	<	<	<	<	<	<	<	<	<
Carbon disulfide	<	<	<	<	<	<	<	<	<
Chlorobenzene	<	<	<	<	<	<	<	<	<
cis-1,3-Dichloropropene	.	.	.	.	<	.	.	.	.

APPENDIX D.2: CY 2008 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	02/11/08	02/11/08	08/06/08	01/14/08		01/14/08	01/02/08	07/01/08
Program	BJC	BJC	BJC	GWPP	GWPP	GWPP	BJC	BJC
Sample Type					Dup			
Chloroethenes (µg/L)								
Tetrachloroethene	17	15	0.2 J	<	<	<	<	<
Trichloroethene	16	14	0.3 J	3 J	2 J	<	<	<
cis-1,2-Dichloroethene	60	90	1 J	<	<	<	<	<
trans-1,2-Dichloroethene	<	0.2 J	<	<	<	<	<	<
1,1-Dichloroethene	4	4	<	<	<	<	<	<
Vinyl chloride	0.6 J	2	<	<	<	<	<	<
Chloroethanes (µg/L)								
1,1,2,2-Trichloroethane	<	<	<	<	<	<	<	<
1,1,1-Trichloroethane	1 J	0.9 J	<	<	<	<	<	<
1,1,2-Trichloroethane	<	0.6 J	<	<	<	<	<	<
1,2-Dichloroethane	<	0.7 J	<	<	<	<	<	<
1,1-Dichloroethane	9	6	<	<	<	<	<	<
Chloroethane	<	<	<	<	<	<	<	<
Chloromethanes (µg/L)								
Carbon tetrachloride	<	<	<	<	<	<	<	<
Chloroform	1	1	<	<	<	<	<	<
Methylene chloride	<	<	<	<	<	<	<	<
Petrol. Hydrocarb. (µg/L)								
Benzene	<	0.3 J	<	<	<	<	<	<
Ethylbenzene	<	<	<	<	<	<	<	<
Toluene	<	<	<	<	<	<	<	<
Total Xylene	<	<	<	<	<	<	<	<
Chlorofluorocarbons (µg/L)								
1,1,2-Trichloro-1,2,2-trifluoroethane	.	.	.	<	<	<	.	.
Dichlorodifluoromethane	.	.	.	<	<	<	.	.
Miscellaneous (µg/L)								
1,2-Dichloropropane	<	<	<	<	<	<	<	<
1,4-Dichlorobenzene	.	.	.	<	<	<	.	.
2-Butanone	<	<	<	<	<	<	<	<
Acetone	<	<	<	<	<	<	<	<
Carbon disulfide	<	<	<	<	<	<	<	<
Chlorobenzene	<	<	<	<	<	<	<	<
cis-1,3-Dichloropropene	<	<	<	<	<	<	<	<

APPENDIX D.3
RADIOLOGICAL ANALYTES

APPENDIX D.3: CY 2008 MONITORING DATA FOR THE BEAR CREEK HYDROGEOLOGIC REGIME
Radiological Analytes: Gross Alpha and Gross Beta Activity

Sampling	Point	Functional Area	Date Sampled	Program	Gross Alpha (pCi/L)			Gross Beta (pCi/L)		
					Activity	TPU	MDA	Activity	TPU	MDA
GW-006		OLF	03/12/08	GWPP	<	.	5.8	<	.	10
GW-006		OLF	07/29/08	GWPP	8.7	3.1	0.55	<	.	5.4
GW-008		OLF	01/02/08	BJC	<	.	1.36	<	.	4.03
GW-008		OLF	07/08/08	BJC	<	.	1.93	<	.	4.06
GW-014		BG	09/17/08	GWPP	3.8	2.5	0.37	8.6	3.2	5.3
GW-046		BG	01/03/08	BJC	<	.	2.03	5.33	2.18	3.82
GW-046		BG	07/07/08	BJC	<	.	1.54	4.02	2.05	3.9
GW-058		BG	01/23/08	GWPP	33	6.1	4.4	58 Q	7.2	7.3
GW-065		OLF	03/03/08	GWPP	14	4.7	5	9.8	4.4	7.4
GW-065		OLF	08/06/08	GWPP	6.1	2.9	1.9	9.1	3.4	5.5
GW-068		BG	09/16/08	GWPP	4.1	2.8	2	12	3.5	5.5
GW-071		BG	03/25/08	GWPP	<	.	5.9	<	.	7.5
GW-071		BG	09/16/08	GWPP	9	4.2	0.59	<	.	6.7
GW-082		BG	09/25/08	GWPP	2 R	3	0.71	<	.	6.6
GW-085		OLF	03/13/08	GWPP	<	.	4.9	22	5.3	8
GW-085		OLF	08/05/08	GWPP	4.6	4	2.4	52	5.2	5.3
GW-089		BG	09/24/08	GWPP	<	.	4.1	<	.	6.7
GW-098		OLF	03/11/08	GWPP	4.8	4.6	4	<	.	7.9
GW-122		S3	03/11/08	GWPP	<	.	13	23	8.9	15
GW-225		OLF	01/28/08	GWPP	5.5	4.2	3.1	13	5	8.5
GW-225		OLF	07/29/08	GWPP	<	.	2.6	26	4.8	6.4
GW-226		OLF	02/04/08	GWPP	8.3	4.5	4.8	13	4.7	7.4
GW-226		OLF	07/29/08	GWPP	6.8	3.6	3.6	17	4.6	7.4
GW-227		OLF	02/05/08	GWPP	33	6	3.6	28	5.5	6.7
GW-229		OLF	02/06/08	GWPP	53	8.8	7.3	49	6.9	7.5
GW-229 Dup		OLF	02/06/08	GWPP	41	7.8	6.1	60	6.9	5.9
GW-229		OLF	06/17/08	GWPP	48	7.7	3.8	53	6.1	6.2
GW-229		OLF	12/11/08	GWPP	44	6.8	4.2	46	6.6	8
GW-246		S3	03/12/08	GWPP	390	140	150	6600	310	210
GW-246		S3	06/10/08	GWPP	<	.	62	9300	290	140
GW-246		S3	08/07/08	GWPP	190	44	5.1	5,600	150	56
GW-246		S3	12/10/08	GWPP	420	63	38	9,600	190	67
GW-257		BG	09/23/08	GWPP	5.8	2.8	0.54	13	4.1	6.5
GW-259		BG	03/10/08	GWPP	<	.	3.9	<	.	7.2
GW-259		BG	09/23/08	GWPP	<	.	3	<	.	7.2
GW-276		S3	01/03/08	BJC	159	27.1	2.32	146	24.2	6.13
GW-276		S3	07/07/08	BJC	113	19.4	2.58	180	29.4	4.89
GW-289		BG	09/24/08	GWPP	4.6	2.8	2.3	<	.	6.8
GW-306		RS	03/06/08	GWPP	<	.	6.2	<	.	10
GW-306		RS	07/31/08	GWPP	2.2 R	2.8	0.65	<	.	6.5
GW-309		RS	03/05/08	GWPP	<	.	4.6	<	.	7.4
GW-309		RS	07/30/08	GWPP	<	.	3.7	<	.	7.9
GW-309 Dup		RS	07/30/08	GWPP	2.3 R	2.7	0.6	9.9	3.6	5.5
GW-310		RS	02/14/08	GWPP	<	.	5.5	<	.	10
GW-312		RS	02/19/08	GWPP	<	.	5.7	<	.	10
GW-314		SPI	03/24/08	GWPP	<	.	5.4	12	5.5	10
GW-314		SPI	08/04/08	GWPP	<	.	4.1	7.6	3.7	6.3
GW-315		SPI	02/19/08	GWPP	<	.	4.7	19	5	7.4
GW-365		OLF	01/28/08	GWPP	<	.	7.3	<	.	10

APPENDIX D.3: CY 2008 MONITORING DATA FOR THE BEAR CREEK HYDROGEOLOGIC REGIME
Radiological Analytes: Gross Alpha and Gross Beta Activity

Sampling	Point	Functional Area	Date Sampled	Program	Gross Alpha (pCi/L)			Gross Beta (pCi/L)		
					Activity	TPU	MDA	Activity	TPU	MDA
GW-367		OLF	02/25/08	GWPP	8.6	4.1	4.5	<	.	10
GW-367		OLF	07/30/08	GWPP	<	.	3.7	6.7	3.5	6.2
GW-369		OLF	03/05/08	GWPP	<	.	6.8	18	4.7	6.8
GW-369 Dup		OLF	03/05/08	GWPP	<	.	5.4	18	5.1	8.1
GW-531		LD	08/05/08	GWPP	2.6	2.2	0.34	4.5	2.7	4.3
GW-537		OLF	08/05/08	GWPP	<	.	6.4	220	14	8.9
GW-615		S3	08/11/08	GWPP	1100	320	41	680	330	570
GW-616		S3	08/11/08	GWPP	<	.	7.4	<	.	13
GW-623		BG	03/18/08	GWPP	16	7.7	8.3	24	6.3	10
GW-623		BG	09/22/08	GWPP	<	.	4.6	10	3.7	5.7
GW-626		BG	02/26/08	GWPP	<	.	5.1	<	.	10
GW-626		BG	06/03/08	GWPP	3.1 R	3.6	3.1	<	.	5.9
GW-626		BG	09/17/08	GWPP	3.7	2.5	0.37	<	.	4.4
GW-626		BG	12/02/08	GWPP	<	.	2.7	<	.	7.3
GW-627		BG	03/18/08	GWPP	<	.	9.2	34	5.7	6.8
GW-627		BG	09/22/08	GWPP	<	.	5.5	<	.	6.6
GW-629		BG	03/18/08	GWPP	<	.	6.7	14	4.8	8.1
GW-629		BG	09/02/08	GWPP	<	.	4	<	.	6.8
GW-648		RS	02/13/08	GWPP	4.2	3.2	3	8	3.9	6.6
GW-653		BG	09/25/08	GWPP	<	.	3.4	<	.	6.1
GW-653 Dup		BG	09/25/08	GWPP	1.6 R	2.1	0.49	<	.	6.4
GW-683		EXP-A	02/25/08	BJC	10.6	3.44	2.74	16.3	3.72	3.89
GW-683		EXP-A	07/24/08	BJC	5.89	2.53	2.43	16.8	3.98	4.41
GW-684		EXP-A	02/25/08	BJC	7.87	2.67	2.16	19.3	4.25	4.14
GW-684		EXP-A	07/24/08	BJC	8.37	2.99	2.46	21.7	4.69	4.43
GW-694		EXP-B	01/23/08	GWPP	17	4.6	4.1	9.2	4.6	8
GW-703		EXP-B	01/23/08	GWPP	8.3	4.1	4.4	31	6.6	10
GW-704		EXP-B	02/25/08	BJC	4.91	1.9	1.85	27	5.01	2.98
GW-704		EXP-B	07/31/08	BJC	<	.	2.81	15.6	3.8	4.38
GW-706		EXP-B	02/26/08	BJC	18.8	4.13	2.28	49.2	8.5	3.65
GW-706		EXP-B	07/31/08	BJC	22.1	4.73	1.73	32.2	6.14	4.52
GW-712		EXP-W	01/02/08	BJC	<	.	2.84	<	.	4
GW-712		EXP-W	07/01/08	BJC	<	.	1.27	3	1.23	2.14
GW-713		EXP-W	01/02/08	BJC	<	.	2.93	<	.	4.58
GW-713 Dup		EXP-W	01/02/08	BJC	<	.	2.19	<	.	4.66
GW-713		EXP-W	07/07/08	BJC	<	.	1.59	3.91	2.02	3.86
GW-713 Dup		EXP-W	07/07/08	BJC	<	.	1.5	4.63	2.12	3.88
GW-714		EXP-W	01/02/08	BJC	3.08	1.62	2.07	4.13	2.14	4.09
GW-714		EXP-W	07/01/08	BJC	<	.	1.65	<	.	3.38
GW-724		EXP-C	03/06/08	GWPP	<	.	5.3	20	5.9	10
GW-725		EXP-C	02/07/08	GWPP	7.1	4.4	4.6	16	4.8	7.3
GW-725 Dup		EXP-C	02/07/08	GWPP	11	4.6	3.5	16	4.9	7.9
GW-738		EXP-C	02/12/08	GWPP	<	.	6.1	42	6.1	6.8
GW-740		EXP-C	02/12/08	GWPP	<	.	4.3	<	.	8
GW-740		EXP-C	06/26/08	GWPP	6.7	3.9	3.7	11	4.4	7.2
GW-740		EXP-C	12/17/08	GWPP	<	.	3.6	<	.	7
GW-829		OLF	08/04/08	GWPP	1.9 R	3	0.69	<	.	6.1

APPENDIX D.3: CY 2008 MONITORING DATA FOR THE BEAR CREEK HYDROGEOLOGIC REGIME
Radiological Analytes: Gross Alpha and Gross Beta Activity

Sampling	Point	Functional Area	Date Sampled	Program	Gross Alpha (pCi/L)			Gross Beta (pCi/L)		
					Activity	TPU	MDA	Activity	TPU	MDA
BCK-04.55		EXP-SW	01/14/08	GWPP	22	5.1	5.1	<	.	10
NT-01		EXP-SW	01/14/08	GWPP	8.3	3.8	3.7	30	5.6	7.2
SS-4		EXP-SW	01/14/08	GWPP	69	7.4	2.1	45	6.9	7.3
SS-4 Dup		EXP-SW	01/14/08	GWPP	58	7.1	2.8	36	6.7	8.5
SS-5		EXP-SW	01/14/08	GWPP	17	4.6	4.3	12	5.6	10
SS-6		EXP-SW	01/02/08	BJC	4.03	2.07	2.73	8.15	2.59	3.94
SS-6		EXP-SW	07/01/08	BJC	3.04	1.23	1.43	5.83	1.67	2.41

APPENDIX D.3: CY 2008 MONITORING DATA FOR THE BEAR CREEK HYDROGEOLOGIC REGIME
Radiological Analytes: Isotopic Analyses

Sampling Point	GW-046						GW-246					
Functional Area	BG						S3					
Date Sampled	01/03/08			07/07/08			03/12/08			06/10/08		
Program	BJC			BJC			GWPP			GWPP		
Sample Type												
Result (pCi/L)	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA
Gross Alpha	<	.	2.03	<	.	1.54	390	140	150	<	.	62
Gross Beta	5.33	2.18	3.82	4.02	2.05	3.9	6,600	310	210	9,300	290	140
Americium-241	.	.	.	.	.	.	.	.	.	.	.	.
Neptunium-237	.	.	.	.	.	.	.	.	.	.	.	.
Total Radium Alpha	.	.	.	.	.	.	.	.	.	.	.	.
Strontium-89/90	.	.	.	.	.	.	.	.	.	.	.	.
Technetium-99	<	.	11.4	<	.	10.4	140,000	450	61	28,000	100	16
Uranium-234	<	.	0.548	<	.	0.436	88	8.8	1.3	62	6.7	4.4
Uranium-235	<	.	0.389	<	.	0.401	4.5	0.83	0.4	3.3	0.72	0.48
Uranium-236	.	.	.	.	.	.	4.2	0.73	0.31	1.7	0.45	0.35
Uranium-238	<	.	0.389	<	.	0.307	210	20	0.64	150	15	0.45

Sampling Point	GW-246						GW-276					
Functional Area	S3						S3					
Date Sampled	08/07/08			12/10/08			01/03/08			07/07/08		
Program	GWPP			GWPP			BJC			BJC		
Sample Type												
Result (pCi/L)	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA
Gross Alpha	190	44	5.1	420	63	38	159	27.1	2.32	113	19.4	2.58
Gross Beta	5,600	150	56	9,600	190	67	146	24.2	6.13	180	29.4	4.89
Americium-241	.	.	.	.	.	.	<	.	0.124	<	.	0.0724
Neptunium-237	.	.	.	.	.	.	6.33	2.59	0.124	5.93	2.41	0.143
Total Radium Alpha	.	.	.	.	.	.	0.405	0.267	0.308	0.527	0.257	0.211
Strontium-89/90	.	.	.	.	.	.	<	.	2	<	.	1.86
Technetium-99	22,000	84	14	29,000	110	19	177	29.9	10.1	213	35.5	10.2
Uranium-234	61	7.1	1.5	2.9	1	1.9	65.8	11.6	0.276	54.4	9.44	0.162
Uranium-235	2.8	0.75	0.28	<	.	0.49	7.12	1.55	0.251	5	1.14	0.162
Uranium-236	1.5	0.48	0.29	<	.	0.3	.	.	.	.	.	.
Uranium-238	140	15	0.34	3.2	0.66	0.32	133	23	0.222	107	18.2	0.181

Sampling Point	GW-306						GW-309					
Functional Area	RS						RS					
Date Sampled	03/06/08			07/31/08			03/05/08			07/30/08		
Program	GWPP			GWPP			GWPP			GWPP		
Sample Type												
Result (pCi/L)	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA
Gross Alpha	<	.	6.2	<	.	0.65	<	.	4.6	<	.	3.7
Gross Beta	<	.	10	<	.	6.5	<	.	7.4	<	.	7.9
Americium-241	.	.	.	.	.	.	.	.	.	.	.	.
Neptunium-237	.	.	.	.	.	.	.	.	.	.	.	.
Total Radium Alpha	.	.	.	.	.	.	.	.	.	.	.	.
Strontium-89/90	.	.	.	.	.	.	.	.	.	.	.	.
Technetium-99	51	9.8	15	<	.	14	<	.	15	<	.	14
Uranium-234	.	.	.	.	.	.	.	.	.	.	.	.
Uranium-235	.	.	.	.	.	.	.	.	.	.	.	.
Uranium-236	.	.	.	.	.	.	.	.	.	.	.	.
Uranium-238	.	.	.	.	.	.	.	.	.	.	.	.

APPENDIX D.3: CY 2008 MONITORING DATA FOR THE BEAR CREEK HYDROGEOLOGIC REGIME
Radiological Analytes: Isotopic Analyses

Sampling Point	GW-309			GW-310			GW-363					
Functional Area	RS			RS			EMWMF					
Date Sampled	07/30/08			02/14/08			02/21/08			04/29/08		
Program	GWPP			GWPP			BJC			BJC		
Sample Type	Dup											
Result (pCi/L)	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA
Gross Alpha	<	.	0.6	<	.	5.5	.	.	.	.	.	.
Gross Beta	9.9	3.6	5.5	<	.	10	.	.	.	.	.	.
Americium-241	.	.	.	.	.	.	<	.	0.22	<	.	0.17
Neptunium-237	.	.	.	.	.	.	<	.	0.19	<	.	0.14
Total Radium Alpha	.	.	.	.	.	.	.	.	.	.	.	.
Strontium-89/90	.	.	.	.	.	.	<	.	1.62	<	.	1.72
Technetium-99	<	.	14	<	.	16	<	.	5.13	<	.	3.12
Uranium-234	.	.	.	.	.	.	<	.	0.2	0.43	0.24	0.13
Uranium-235	.	.	.	.	.	.	<	.	0.33	<	.	0.23
Uranium-236	.	.	.	.	.	.	.	.	.	.	.	.
Uranium-238	.	.	.	.	.	.	<	.	0.2	<	.	0.16

Sampling Point	GW-363						GW-537			GW-615		
Functional Area	EMWMF						OLF			S3		
Date Sampled	08/12/08			11/12/08			08/05/08			08/11/08		
Program	BJC			BJC			GWPP			GWPP		
Sample Type												
Result (pCi/L)	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA
Gross Alpha	.	.	.	.	.	.	<	.	6.4	1,100	320	41
Gross Beta	.	.	.	.	.	.	220	14	8.9	680	330	570
Americium-241	<	.	0.17	0.22	0.18	0.22	.	.	.	.	.	.
Neptunium-237	<	.	0.22	<	.	0.15	.	.	.	.	.	.
Total Radium Alpha	.	.	.	.	.	.	.	.	.	.	.	.
Strontium-89/90	1.56	0.64	1.55	<	.	1.53	.	.	.	.	.	.
Technetium-99	<	.	3.13	<	.	3.12	570	16	14	44	9.5	15
Uranium-234	<	.	0.15	0.18	0.15	0.18	.	.	.	170	20	27
Uranium-235	<	.	0.14	<	.	0.09	.	.	.	9.7	3.4	8.5
Uranium-236	.	.	.	.	.	.	.	.	.	.	.	.
Uranium-238	<	.	0.07	<	.	0.15	.	.	.	460	46	8.6

Sampling Point	GW-639											
Functional Area	EMWMF											
Date Sampled	02/21/08			04/29/08			08/12/08			11/11/08		
Program	BJC			BJC			BJC			BJC		
Sample Type												
Result (pCi/L)	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA
Gross Alpha	.	.	.	.	.	.	.	.	.	.	.	.
Gross Beta	.	.	.	.	.	.	.	.	.	.	.	.
Americium-241	<	.	0.2	<	.	0.18	<	.	0.2	<	.	0.15
Neptunium-237	<	.	0.16	0.18	0.15	0.16	<	.	0.19	<	.	0.17
Total Radium Alpha	.	.	.	.	.	.	.	.	.	.	.	.
Strontium-89/90	<	.	1.97	1.33	0.67	1.26	1.5	0.59	1.43	<	.	1.74
Technetium-99	<	.	5.13	<	.	3.12	<	.	3.13	<	.	3.12
Uranium-234	0.36	0.22	0.21	0.63	0.29	0.17	0.88	0.34	0.08	0.32	0.19	0.17
Uranium-235	<	.	0.25	<	.	0.3	<	.	0.09	<	.	0.17
Uranium-236	.	.	.	.	.	.	.	.	.	.	.	.
Uranium-238	<	.	0.19	<	.	0.16	0.2	0.15	0.08	<	.	0.16

APPENDIX D.3: CY 2008 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	02/25/08			07/24/08			02/25/08			07/24/08		
Program	BJC			BJC			BJC			BJC		
Sample Type												
Result (pCi/L)	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA
Gross Alpha	10.6	3.44	2.74	5.89	2.53	2.43	7.87	2.67	2.16	8.37	2.99	2.46
Gross Beta	16.3	3.72	3.89	16.8	3.98	4.41	19.3	4.25	4.14	21.7	4.69	4.43
Americium-241	.	.	.	.	.	.	.	.	.	.	.	.
Neptunium-237	.	.	.	.	.	.	.	.	.	.	.	.
Total Radium Alpha	.	.	.	.	.	.	.	.	.	.	.	.
Strontium-89/90	.	.	.	.	.	.	.	.	.	.	.	.
Technetium-99	12	6.2	9.39	19.3	7.36	10.3	11.5	6.22	9.48	19.8	7.81	11
Uranium-234	3.49	1.13	0.416	5.16	1.46	0.323	4.06	1.37	0.614	5.08	1.48	0.448
Uranium-235	0.586	0.419	0.373	0.502	0.401	0.459	<	.	0.529	<	.	0.402
Uranium-236	.	.	.	.	.	.	.	.	.	.	.	.
Uranium-238	7.28	1.84	0.452	7.06	1.8	0.459	5.36	1.63	0.615	9.09	2.2	0.487

Sampling Point	GW-704						GW-706					
Functional Area	EXP-B						EXP-B					
Date Sampled	02/25/08			07/31/08			02/26/08			07/31/08		
Program	BJC			BJC			BJC			BJC		
Sample Type												
Result (pCi/L)	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA
Gross Alpha	4.91	1.9	1.85	<	.	2.81	18.8	4.13	2.28	22.1	4.73	1.73
Gross Beta	27	5.01	2.98	15.6	3.8	4.38	49.2	8.5	3.65	32.2	6.14	4.52
Americium-241	.	.	.	.	.	.	.	.	.	.	.	.
Neptunium-237	.	.	.	.	.	.	.	.	.	.	.	.
Total Radium Alpha	.	.	.	.	.	.	.	.	.	.	.	.
Strontium-89/90	.	.	.	.	.	.	.	.	.	.	.	.
Technetium-99	36.9	8.59	8.98	<	.	9.94	48.2	10.1	9.17	57.1	12.1	10.8
Uranium-234	3.17	1.13	0.549	1.76	0.759	0.481	11.9	2.71	0.573	12.4	2.82	0.826
Uranium-235	<	.	0.513	<	.	0.414	1.72	0.782	0.418	2.14	0.894	0.543
Uranium-236	.	.	.	.	.	.	.	.	.	.	.	.
Uranium-238	5.31	1.55	0.361	1.17	0.605	0.45	23.7	4.7	0.206	21	4.25	0.575

Sampling Point	GW-712						GW-713					
Functional Area	EXP-W						EXP-W					
Date Sampled	01/02/08			07/01/08			01/02/08					
Program	BJC			BJC			BJC					
Sample Type										Dup		
Result (pCi/L)	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA
Gross Alpha	<	.	2.84	<	.	1.27	<	.	2.93	<	.	2.19
Gross Beta	<	.	4	3	1.23	2.14	<	.	4.58	<	.	4.66
Americium-241	.	.	.	.	.	.	.	.	.	.	.	.
Neptunium-237	.	.	.	.	.	.	.	.	.	.	.	.
Total Radium Alpha	.	.	.	.	.	.	.	.	.	.	.	.
Strontium-89/90	.	.	.	.	.	.	.	.	.	.	.	.
Technetium-99	<	.	10.7	<	.	9.24	<	.	10.5	<	.	11.1
Uranium-234	1.1	0.616	0.588	0.7	0.468	0.453	0.405	0.337	0.183	<	.	0.31
Uranium-235	<	.	0.535	<	.	0.453	<	.	0.449	<	.	0.364
Uranium-236	.	.	.	.	.	.	.	.	.	.	.	.
Uranium-238	<	.	0.563	<	.	0.319	<	.	0.45	<	.	0.406

APPENDIX D.3: CY 2008 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	07/07/08						01/02/08			07/01/08		
Program	BJC						BJC			BJC		
Sample Type	Dup											
Result (pCi/L)	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA
Gross Alpha	<	.	1.59	<	.	1.5	3.08	1.62	2.07	<	.	1.65
Gross Beta	3.91	2.02	3.86	4.63	2.12	3.88	4.13	2.14	4.09	<	.	3.38
Americium-241	.	.	.	.	.	.	.	.	.	.	.	.
Neptunium-237	.	.	.	.	.	.	.	.	.	.	.	.
Total Radium Alpha	.	.	.	.	.	.	.	.	.	.	.	.
Strontium-89/90	.	.	.	.	.	.	.	.	.	.	.	.
Technetium-99	<	.	9.34	<	.	10.4	<	.	10.8	<	.	9.54
Uranium-234	<	.	0.346	0.834	0.516	0.394	1.03	0.553	0.454	0.531	0.385	0.18
Uranium-235	<	.	0.346	<	.	0.336	<	.	0.351	<	.	0.365
Uranium-236	.	.	.	.	.	.	.	.	.	.	.	.
Uranium-238	<	.	0.386	<	.	0.439	0.702	0.438	0.173	0.731	0.456	0.18

Sampling Point	GW-829						GW-916					
Functional Area	OLF						EMWMF					
Date Sampled	08/04/08						02/13/08			04/21/08		
Program	GWPP						BJC			BJC		
Sample Type												
Result (pCi/L)	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA
Gross Alpha	<	.	0.69	.	.	.	.	.	.	.	.	.
Gross Beta	<	.	6.1	.	.	.	.	.	.	.	.	.
Americium-241	.	.	.	<	.	0.18	<	.	0.2	<	.	0.4
Neptunium-237	.	.	.	<	.	0.14	<	.	0.14	<	.	0.2
Total Radium Alpha	.	.	.	.	.	.	.	.	.	.	.	.
Strontium-89/90	.	.	.	<	.	1.82	<	.	1.56	<	.	1.33
Technetium-99	<	.	140	<	.	5.13	<	.	3.13	<	.	3.13
Uranium-234	<	.	1.2	<	.	0.16	<	.	0.15	<	.	0.17
Uranium-235	<	.	0.38	<	.	0.21	<	.	0.22	<	.	0.23
Uranium-236	<	.	0.22	.	.	.	.	.	.	.	.	.
Uranium-238	0.48	0.23	0.3	0.1	0.1	0.07	<	.	0.15	<	.	0.2

Sampling Point	GW-916						GW-917					
Functional Area	EMWMF						EMWMF					
Date Sampled	11/05/08						02/11/08			04/15/08		
Program	BJC						BJC			BJC		
Sample Type												
Result (pCi/L)	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA
Gross Alpha	.	.	.	.	.	.	.	.	.	.	.	.
Gross Beta	.	.	.	.	.	.	.	.	.	.	.	.
Americium-241	<	.	0.16	<	.	0.16	<	.	0.18	<	.	0.54
Neptunium-237	<	.	0.2	<	.	0.21	<	.	0.13	<	.	0.3
Total Radium Alpha	.	.	.	.	.	.	.	.	.	.	.	.
Strontium-89/90	<	.	1.69	<	.	1.92	<	.	2.05	<	.	1.2
Technetium-99	<	.	3.13	<	.	5.13	<	.	3.12	<	.	3.13
Uranium-234	<	.	0.28	<	.	0.14	0.54	0.25	0.14	<	.	0.23
Uranium-235	<	.	0.18	<	.	0.22	<	.	0.21	<	.	0.21
Uranium-236	.	.	.	.	.	.	.	.	.	.	.	.
Uranium-238	<	.	0.21	<	.	0.16	<	.	0.11	<	.	0.17

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Radiological Analytes: Isotopic Analyses

Sampling Point	GW-917			GW-918								
Functional Area	EMWMF			EMWMF								
Date Sampled	11/04/08			02/14/08			04/16/08			08/05/08		
Program	BJC			BJC			BJC			BJC		
Sample Type												
Result (pCi/L)	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA
Gross Alpha	.	.	.	.	.	.	.	.	.	.	.	.
Gross Beta	.	.	.	.	.	.	.	.	.	.	.	.
Americium-241	0.25	0.19	0.2	<	.	0.16	<	.	0.18	<	.	0.53
Neptunium-237	.	.	.	<	.	0.15	0.19	0.16	0.18	<	.	0.08
Total Radium Alpha	.	.	.	.	.	.	.	.	.	.	.	.
Strontium-89/90	<	.	1.89	<	.	1.96	<	.	1.57	<	.	1.57
Technetium-99	<	.	3.12	<	.	5.13	<	.	3.16	<	.	3.13
Uranium-234	<	.	0.16	<	.	0.24	<	.	0.16	<	.	0.2
Uranium-235	<	.	0.1	<	.	0.37	<	.	0.28	<	.	0.14
Uranium-236	.	.	.	.	.	.	.	.	.	.	.	.
Uranium-238	<	.	0.15	<	.	0.12	<	.	0.16	<	.	0.15

Sampling Point	GW-918			GW-920								
Functional Area	EMWMF			EMWMF								
Date Sampled	11/05/08			02/12/08			04/17/08			08/04/08		
Program	BJC			BJC			BJC			BJC		
Sample Type												
Result (pCi/L)	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA
Gross Alpha	.	.	.	.	.	.	.	.	.	.	.	.
Gross Beta	.	.	.	.	.	.	.	.	.	.	.	.
Americium-241	0.28	0.2	0.09	<	.	0.36	<	.	0.16	<	.	0.36
Neptunium-237	<	.	0.16	<	.	0.19	0.31	0.22	0.26	<	.	0.29
Total Radium Alpha	.	.	.	.	.	.	.	.	.	.	.	.
Strontium-89/90	<	.	1.46	<	.	1.5	<	.	1.59	<	.	1.72
Technetium-99	<	.	3.14	<	.	5.13	<	.	3.12	<	.	3.13
Uranium-234	<	.	0.15	0.16	0.14	0.15	0.42	0.22	0.17	<	.	0.2
Uranium-235	<	.	0.16	<	.	0.18	<	.	0.23	<	.	0.24
Uranium-236	.	.	.	.	.	.	.	.	.	.	.	.
Uranium-238	<	.	0.13	0.35	0.21	0.15	<	.	0.12	<	.	0.15

Sampling Point	GW-920			GW-921								
Functional Area	EMWMF			EMWMF								
Date Sampled	11/10/08			02/12/08			04/17/08			08/05/08		
Program	BJC			BJC			BJC			BJC		
Sample Type												
Result (pCi/L)	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA
Gross Alpha	.	.	.	.	.	.	.	.	.	.	.	.
Gross Beta	.	.	.	.	.	.	.	.	.	.	.	.
Americium-241	0.27	0.21	0.25	<	.	0.18	<	.	0.17	<	.	0.24
Neptunium-237	<	.	0.2	<	.	0.19	<	.	0.2	<	.	0.16
Total Radium Alpha	.	.	.	.	.	.	.	.	.	.	.	.
Strontium-89/90	<	.	1.45	<	.	1.58	<	.	2.01	<	.	1.54
Technetium-99	<	.	3.12	<	.	5.14	<	.	3.13	<	.	3.12
Uranium-234	0.45	0.23	0.22	1.07	0.39	0.23	0.22	0.17	0.17	<	.	0.2
Uranium-235	<	.	0.21	<	.	0.34	<	.	0.29	<	.	0.19
Uranium-236	.	.	.	.	.	.	.	.	.	.	.	.
Uranium-238	<	.	0.11	5.65	1.17	0.17	<	.	0.14	<	.	0.13

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Radiological Analytes: Isotopic Analyses

Sampling Point	GW-921			GW-922								
Functional Area	EMWMF			EMWMF								
Date Sampled	11/03/08			02/12/08			04/16/08			08/04/08		
Program	BJC			BJC			BJC			BJC		
Sample Type												
Result (pCi/L)	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA
Gross Alpha	.	.	.	.	.	.	.	.	.	.	.	.
Gross Beta	.	.	.	.	.	.	.	.	.	.	.	.
Americium-241	0.36	0.34	0.34	<	.	0.27	0.71	0.66	0.15	<	.	0.45
Neptunium-237	<	.	0.2	<	.	0.25	<	.	0.09	<	.	0.21
Total Radium Alpha	.	.	.	.	.	.	.	.	.	.	.	.
Strontium-89/90	<	.	1.57	<	.	1.54	<	.	1.51	<	.	1.11
Technetium-99	<	.	3.12	<	.	5.12	<	.	3.12	<	.	3.13
Uranium-234	<	.	0.16	<	.	0.19	0.36	0.22	0.17	<	.	4.47
Uranium-235	<	.	0.16	<	.	0.3	0.35	0.22	0.2	<	.	5.51
Uranium-236	.	.	.	.	.	.	.	.	.	.	.	.
Uranium-238	<	.	0.13	<	.	0.07	0.21	0.16	0.15	<	.	4.83

Sampling Point	GW-922			GW-923								
Functional Area	EMWMF			EMWMF								
Date Sampled	11/05/08			02/20/08			04/23/08			08/07/08		
Program	BJC			BJC			BJC			BJC		
Sample Type												
Result (pCi/L)	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA
Gross Alpha	.	.	.	.	.	.	.	.	.	.	.	.
Gross Beta	.	.	.	.	.	.	.	.	.	.	.	.
Americium-241	<	.	0.23	<	.	0.24	<	.	0.2	<	.	0.95
Neptunium-237	<	.	0.07	<	.	0.17	<	.	0.08	<	.	0.2
Total Radium Alpha	.	.	.	.	.	.	.	.	.	.	.	.
Strontium-89/90	<	.	1.5	<	.	1.56	<	.	1.97	<	.	1.58
Technetium-99	<	.	3.12	5.19	3.13	5.17	<	.	3.14	<	.	3.13
Uranium-234	<	.	0.22	0.64	0.33	0.25	0.69	0.29	0.16	1.46	0.51	0.29
Uranium-235	<	.	0.24	<	.	0.22	<	.	0.21	<	.	0.3
Uranium-236	.	.	.	.	.	.	.	.	.	.	.	.
Uranium-238	0.22	0.18	0.21	0.48	0.27	0.19	0.49	0.24	0.17	0.99	0.41	0.24

Sampling Point	GW-924											
Functional Area	EMWMF											
Date Sampled	02/19/08						04/22/08					
Program	BJC						BJC					
Sample Type												
Result (pCi/L)	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA
Gross Alpha	.	.	.	.	.	.	.	.	.	.	.	.
Gross Beta	.	.	.	.	.	.	.	.	.	.	.	.
Americium-241	<	.	0.25	<	.	0.24	<	.	0.14	<	.	0.2
Neptunium-237	<	.	0.07	<	.	0.31	<	.	0.19	<	.	0.18
Total Radium Alpha	.	.	.	.	.	.	.	.	.	.	.	.
Strontium-89/90	<	.	1.88	<	.	1.28	<	.	1.44	<	.	1.63
Technetium-99	<	.	5.13	<	.	5.14	<	.	3.12	<	.	3.12
Uranium-234	0.14	0.13	0.08	0.21	0.16	0.08	0.49	0.24	0.13	0.43	0.25	0.19
Uranium-235	<	.	0.31	<	.	0.26	<	.	0.17	<	.	0.24
Uranium-236	.	.	.	.	.	.	.	.	.	.	.	.
Uranium-238	<	.	0.15	<	.	0.14	0.18	0.15	0.14	<	.	0.19

APPENDIX D.3: CY 2008 MONITORING DATA FOR THE BEAR CREEK HYDROGEOLOGIC REGIME
Radiological Analytes: Isotopic Analyses

Sampling Point	GW-924											
Functional Area	EMWMF											
Date Sampled	08/06/08						11/06/08					
Program	BJC						BJC					
Sample Type	Dup						Dup					
Result (pCi/L)	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA
Gross Alpha	.	.	.	.	.	.	.	.	.	.	.	.
Gross Beta	.	.	.	.	.	.	.	.	.	.	.	.
Americium-241	<	.	0.34	<	.	0.34	<	.	0.28	<	.	0.25
Neptunium-237	<	.	0.16	<	.	0.21	<	.	0.13	<	.	0.25
Total Radium Alpha	.	.	.	.	.	.	.	.	.	.	.	.
Strontium-89/90	<	.	1.27	<	.	1.32	<	.	1.6	<	.	1.82
Technetium-99	<	.	3.13	<	.	3.13	<	.	3.12	<	.	3.12
Uranium-234	<	.	0.25	0.18	0.16	0.18	<	.	0.18	<	.	0.15
Uranium-235	<	.	0.18	<	.	0.24	<	.	0.26	<	.	0.13
Uranium-236	.	.	.	.	.	.	.	.	.	.	.	.
Uranium-238	<	.	0.15	<	.	0.18	<	.	0.15	<	.	0.12

Sampling Point	GW-925											
Functional Area	EMWMF											
Date Sampled	02/14/08			04/17/08			08/06/08			11/05/08		
Program	BJC			BJC			BJC			BJC		
Sample Type												
Result (pCi/L)	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA
Gross Alpha	.	.	.	.	.	.	.	.	.	.	.	.
Gross Beta	.	.	.	.	.	.	.	.	.	.	.	.
Americium-241	<	.	0.27	<	.	0.16	<	.	0.35	0.33	0.23	0.25
Neptunium-237	<	.	0.2	<	.	0.22	<	.	0.16	<	.	0.08
Total Radium Alpha	.	.	.	.	.	.	.	.	.	.	.	.
Strontium-89/90	<	.	1.62	1.64	0.75	1.41	<	.	1.81	<	.	1.87
Technetium-99	<	.	5.16	4.15	1.93	3.17	<	.	3.13	<	.	3.11
Uranium-234	0.2	0.16	0.17	0.79	0.31	0.15	0.24	0.18	0.23	0.24	0.16	0.12
Uranium-235	<	.	0.28	<	.	0.25	<	.	0.19	<	.	0.15
Uranium-236	.	.	.	.	.	.	.	.	.	.	.	.
Uranium-238	<	.	0.18	0.18	0.14	0.08	<	.	0.18	0.15	0.12	0.12

Sampling Point	GW-926											
Functional Area	EMWMF											
Date Sampled	02/19/08			04/23/08			08/06/08			11/06/08		
Program	BJC			BJC			BJC			BJC		
Sample Type												
Result (pCi/L)	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA
Gross Alpha	.	.	.	.	.	.	.	.	.	.	.	.
Gross Beta	.	.	.	.	.	.	.	.	.	.	.	.
Americium-241	<	.	0.33	<	.	0.21	<	.	0.42	<	.	0.34
Neptunium-237	<	.	0.16	<	.	0.14	<	.	0.14	<	.	0.16
Total Radium Alpha	.	.	.	.	.	.	.	.	.	.	.	.
Strontium-89/90	<	.	1.58	<	.	1.51	<	.	1.16	<	.	1.55
Technetium-99	<	.	5.14	<	.	3.12	<	.	3.13	<	.	3.12
Uranium-234	<	.	0.16	0.25	0.17	0.16	<	.	0.21	<	.	0.17
Uranium-235	<	.	0.23	<	.	0.21	<	.	0.19	<	.	0.15
Uranium-236	.	.	.	.	.	.	.	.	.	.	.	.
Uranium-238	<	.	0.14	<	.	0.13	<	.	0.18	<	.	0.16

APPENDIX D.3: CY 2008 MONITORING DATA FOR THE BEAR CREEK HYDROGEOLOGIC REGIME
Radiological Analytes: Isotopic Analyses

Sampling Point	GW-927											
Functional Area	EMWMF											
Date Sampled	02/11/08			04/15/08			08/07/08			11/04/08		
Program	BJC			BJC			BJC			BJC		
Sample Type												
Result (pCi/L)	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA
Gross Alpha	.	.	.	.	.	.	.	.	.	.	.	.
Gross Beta	.	.	.	.	.	.	.	.	.	.	.	.
Americium-241	<	.	0.35	<	.	0.14	<	.	0.64	0.19	0.16	0.19
Neptunium-237	<	.	0.18	<	.	0.2	<	.	0.14	<	.	0.19
Total Radium Alpha	.	.	.	.	.	.	.	.	.	.	.	.
Strontium-89/90	<	.	1.24	<	.	2.11	<	.	1.57	<	.	1.69
Technetium-99	<	.	5.13	<	.	3.12	<	.	3.12	<	.	3.12
Uranium-234	<	.	0.17	0.38	0.22	0.18	<	.	0.17	<	.	0.17
Uranium-235	<	.	0.18	<	.	0.25	<	.	0.21	< CE	0.12	0.09
Uranium-236	.	.	.	.	.	.	.	.	.	.	.	.
Uranium-238	<	.	0.15	<	.	0.15	<	.	0.19	<	.	0.15

Sampling Point	EMW-VWEIR											
Functional Area	EXP-SW											
Date Sampled	02/11/08						04/14/08			08/11/08		
Program	BJC						BJC			BJC		
Sample Type												
Result (pCi/L)	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA
Gross Alpha	.	.	.	.	.	.	.	.	.	.	.	.
Gross Beta	.	.	.	.	.	.	.	.	.	.	.	.
Americium-241	<	.	0.28	<	.	0.37	<	.	0.15	<	.	0.19
Neptunium-237	0.11	0.11	0.07	<	.	0.15	<	.	0.15	<	.	0.18
Total Radium Alpha	.	.	.	.	.	.	.	.	.	.	.	.
Strontium-89/90	20.1	1.52	1.75	20.1	1.57	1.78	46.6	2.27	1.67	32.5	1.76	1.35
Technetium-99	<	.	5.45	<	.	5.43	<	.	5.36	9.01	3.26	5.28
Uranium-234	3.72	1.05	0.54	4.88	1.28	0.37	8.44	1.86	0.31	1.44	0.46	0.16
Uranium-235	<	.	0.85	<	.	0.7	0.64	0.44	0.5	<	.	0.19
Uranium-236	.	.	.	.	.	.	.	.	.	.	.	.
Uranium-238	2.72	0.86	0.41	4.03	1.13	0.31	6.23	1.5	0.27	1.11	0.4	0.17

Sampling Point	EMW-VWEIR			EMW-VWUNDER								
Functional Area	EXP-SW			EXP-SW								
Date Sampled	11/10/08			02/14/08			04/23/08			06/19/08		
Program	BJC			BJC			BJC			BJC		
Sample Type												
Result (pCi/L)	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA
Gross Alpha	.	.	.	.	.	.	.	.	.	.	.	.
Gross Beta	.	.	.	.	.	.	.	.	.	.	.	.
Americium-241	<	.	0.17	<	.	0.16	<	.	0.22	.	.	.
Neptunium-237	<	.	0.18	<	.	0.19	<	.	0.21	.	.	.
Total Radium Alpha	.	.	.	.	.	.	.	.	.	.	.	.
Strontium-89/90	71	4.43	3.7	<	.	1.88	<	.	1.68	.	.	.
Technetium-99	<	.	5.3	<	.	5.14	<	.	3.12	.	.	.
Uranium-234	1.68	0.62	0.26	0.29	0.18	0.15	0.21	0.16	0.19	0.37	0.31	0.37
Uranium-235	<	.	0.27	<	.	0.16	<	.	0.19	<	.	0.27
Uranium-236	.	.	.	.	.	.	.	.	.	.	.	.
Uranium-238	1.17	0.5	0.22	0.16	0.13	0.15	0.14	0.12	0.13	<	.	0.24

APPENDIX D.3: CY 2008 MONITORING DATA FOR THE BEAR CREEK HYDROGEOLOGIC REGIME
Radiological Analytes: Isotopic Analyses

Sampling Point	EMW-VWUNDER						EMWNT-03A					
Functional Area	EXP-SW						EXP-SW					
Date Sampled	08/06/08			11/10/08			02/11/08			04/14/08		
Program	BJC			BJC			BJC			BJC		
Sample Type												
Result (pCi/L)	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA
Gross Alpha	.	.	.	.	.	.	.	.	.	.	.	.
Gross Beta	.	.	.	.	.	.	.	.	.	.	.	.
Americium-241	<	.	0.36	0.4	0.27	0.31	<	.	0.4	<	.	0.13
Neptunium-237	<	.	0.18	<	.	0.2	<	.	0.15	0.19	0.17	0.17
Total Radium Alpha	.	.	.	.	.	.	.	.	.	.	.	.
Strontium-89/90	1.56	0.49	1.15	<	.	1.88	<	.	1.75	<	.	1.6
Technetium-99	<	.	3.12	<	.	3.12	<	.	5.4	<	.	5.38
Uranium-234	0.29	0.21	0.28	<	.	0.18	0.41	0.32	0.33	0.81	0.45	0.28
Uranium-235	<	.	0.27	<	.	0.1	<	.	0.64	<	.	0.41
Uranium-236	.	.	.	.	.	.	.	.	.	.	.	.
Uranium-238	<	.	0.22	<	.	0.18	<	.	0.4	<	.	0.26

Sampling Point	EMWNT-05											
Functional Area	EXP-SW											
Date Sampled	02/11/08			04/14/08			08/11/08			11/10/08		
Program	BJC			BJC			BJC			BJC		
Sample Type												
Result (pCi/L)	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA
Gross Alpha	.	.	.	.	.	.	.	.	.	.	.	.
Gross Beta	.	.	.	.	.	.	.	.	.	.	.	.
Americium-241	<	.	0.15	<	.	0.2	<	.	0.34	<	.	0.42
Neptunium-237	<	.	0.15	<	.	0.2	<	.	0.12	<	.	0.19
Total Radium Alpha	.	.	.	.	.	.	.	.	.	.	.	.
Strontium-89/90	<	.	1.79	<	.	2	<	.	1.74	<	.	2.18
Technetium-99	<	.	5.34	<	.	5.35	6.87	3.08	5.03	<	.	5.29
Uranium-234	<	.	0.33	<	.	0.25	<	.	0.27	<	.	0.36
Uranium-235	<	.	0.73	<	.	0.47	<	.	0.28	<	.	0.29
Uranium-236	.	.	.	.	.	.	.	.	.	.	.	.
Uranium-238	<	.	0.33	<	.	0.25	<	.	0.22	<	.	0.28

Sampling Point	NT-04											
Functional Area	EXP-SW											
Date Sampled	02/11/08			04/14/08			06/19/08			08/11/08		
Program	BJC			BJC			BJC			BJC		
Sample Type												
Result (pCi/L)	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA
Gross Alpha	.	.	.	.	.	.	.	.	.	.	.	.
Gross Beta	.	.	.	.	.	.	.	.	.	.	.	.
Americium-241	<	.	0.28	<	.	0.18	.	.	.	<	.	0.41
Neptunium-237	<	.	0.15	<	.	0.18	.	.	.	<	.	0.13
Total Radium Alpha	.	.	.	.	.	.	.	.	.	.	.	.
Strontium-89/90	<	.	1.82	<	.	1.54	.	.	.	1.57	0.72	1.34
Technetium-99	<	.	5.33	<	.	5.34	.	.	.	5.16	3.05	5.04
Uranium-234	1.91	0.75	0.47	2.52	1.9	0.29	0.37	0.22	0.13	0.54	0.27	0.19
Uranium-235	<	.	0.52	<	.	0.47	<	.	0.13	<	.	0.17
Uranium-236	.	.	.	.	.	.	.	.	.	.	.	.
Uranium-238	2.7	0.91	0.42	3.69	2.33	0.29	0.69	0.3	0.09	0.61	0.29	0.16

APPENDIX D.3: CY 2008 MONITORING DATA FOR THE BEAR CREEK HYDROGEOLOGIC REGIME
Radiological Analytes: Isotopic Analyses

Sampling Point	NT-04			NT-07			NT-08			SS-6		
Functional Area	EXP-SW			EXP-SW			EXP-SW			EXP-SW		
Date Sampled	11/10/08			02/11/08			08/06/08			01/02/08		
Program	BJC			BJC			BJC			BJC		
Sample Type												
Result (pCi/L)	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA
Gross Alpha	.	.	.	.	.	.	.	.	.	4.03	2.07	2.73
Gross Beta	.	.	.	.	.	.	.	.	.	8.15	2.59	3.94
Americium-241	<	.	0.52	.	.	.	.	.	.	.	.	.
Neptunium-237	<	.	0.15	.	.	.	.	.	.	.	.	.
Total Radium Alpha	.	.	.	.	.	.	.	.	.	.	.	.
Strontium-89/90	<	.	1.54	.	.	.	.	.	.	.	.	.
Technetium-99	<	.	5.31	.	.	.	.	.	.	<	.	10.9
Uranium-234	0.72	0.39	0.33	7.23	1.84	0.495	45.8	8.2	0.323	2.23	0.949	0.516
Uranium-235	<	.	0.16	0.853	0.522	0.462	3.99	1.23	0.323	<	.	0.394
Uranium-236	.	.	.	.	.	.	.	.	.	.	.	.
Uranium-238	0.77	0.4	0.31	8.02	1.98	0.426	155	25.9	0.423	2.85	1.09	0.394

Sampling Point	SS-6		
Functional Area	EXP-SW		
Date Sampled	07/01/08		
Program	BJC		
Sample Type			
Result (pCi/L)	Activity	TPU	MDA
Gross Alpha	3.04	1.23	1.43
Gross Beta	5.83	1.67	2.41
Americium-241	.	.	.
Neptunium-237	.	.	.
Total Radium Alpha	.	.	.
Strontium-89/90	.	.	.
Technetium-99	9.85	6.19	9.59
Uranium-234	2.68	0.992	0.514
Uranium-235	0.361	0.328	0.196
Uranium-236	.	.	.
Uranium-238	4.61	1.38	0.338

APPENDIX D.3: CY 2008 MONITORING DATA FOR THE BEAR CREEK HYDROGEOLOGIC REGIME
Additional Isotopic Analyses at EMWMF: Detected Results

Sampling Point	Date Sampled	Isotope	Result (pCi/L)		
			Activity	TPU	MDA
GW-363	11/12/08	Americium-243	0.34	0.24	0.18
GW-363	11/12/08	Curium-245	0.4	0.27	0.25
GW-363	11/12/08	Curium-246	0.4	0.27	0.25
GW-363	08/12/08	Thorium-230	0.38 J	0.26	0.24
GW-363	08/12/08	Yttrium-90	1.56	0.64	1.55
GW-639	08/12/08	Actinium-227	0.23 J	0.16	0.16
GW-639	11/11/08	Actinium-227	0.21	0.19	0.2
GW-639	11/11/08	Americium-243	0.37	0.25	0.11
GW-639	11/11/08	Curium-245	0.48	0.3	0.22
GW-639	11/11/08	Curium-246	0.48	0.3	0.22
GW-639	04/29/08	Plutonium-242	0.29	0.23	0.14
GW-639	02/21/08	Potassium-40	68.8 Q	48.43	55.1
GW-639	08/12/08	Thorium-227	0.23 J	0.16	0.16
GW-639	11/11/08	Thorium-227	0.21	0.19	0.2
GW-639	08/12/08	Thorium-230	0.51 J	0.24	0.14
GW-639	04/29/08	Yttrium-90	1.33 Q	0.67	1.26
GW-639	08/12/08	Yttrium-90	1.5	0.59	1.43
GW-916	04/21/08	Actinium-227	0.28 J	0.2	0.15
GW-916	04/21/08	Americium-243	0.99 Q	0.57	0.16
GW-916	04/21/08	Curium-245	1.24	0.66	0.18
GW-916	11/05/08	Curium-245	0.24	0.18	0.22
GW-916	04/21/08	Curium-246	1.24	0.66	0.18
GW-916	11/05/08	Curium-246	0.24	0.18	0.22
GW-916	11/05/08	Iodine-129	1.94	0.72	1.82
GW-916	04/21/08	Nickel-63	38.3 Q	22.36	36.4
GW-916	08/07/08	Nickel-63	38.3	15.18	24.3
GW-916	02/13/08	Radium-226	0.24	0.12	0.11
GW-916	04/21/08	Radium-226	0.2	0.14	0.06
GW-916	08/07/08	Radium-226	0.36	0.19	0.18
GW-916	11/05/08	Radium-226	0.25	0.17	0.22
GW-916	04/21/08	Radium-228	0.91	0.33	0.71
GW-916	04/21/08	Thorium-227	0.28 J	0.2	0.15
GW-916	04/21/08	Thorium-230	0.39	0.24	0.17
GW-917	04/15/08	Americium-243	0.78 Q	0.37	0.12
GW-917	11/04/08	Americium-243	0.44	0.29	0.22
GW-917	04/15/08	Curium-245	0.85 Q	0.39	0.14
GW-917	11/04/08	Curium-245	0.53	0.32	0.23
GW-917	04/15/08	Curium-246	0.85 Q	0.39	0.14
GW-917	11/04/08	Curium-246	0.53	0.32	0.23
GW-917	11/04/08	Iodine-129	2.33	0.79	1.95
GW-917	02/11/08	Radium-226	0.2	0.11	0.16
GW-917	04/15/08	Radium-226	0.15	0.12	0.06
GW-917	02/11/08	Thorium-229	0.12	0.08	0.08
GW-917	08/05/08	Thorium-229	0.17	0.1	0.1
GW-918	04/16/08	Americium-243	0.4 J	0.34	0.15
GW-918	08/05/08	Americium-243	0.24	0.2	0.22
GW-918	11/05/08	Americium-243	0.27	0.19	0.19
GW-918	04/16/08	Curium-245	0.42 J	0.37	0.19
GW-918	08/05/08	Curium-245	0.32	0.25	0.31
GW-918	11/05/08	Curium-245	0.32	0.21	0.22
GW-918	04/16/08	Curium-246	0.42 J	0.37	0.19
GW-918	08/05/08	Curium-246	0.32	0.25	0.31
GW-918	11/05/08	Curium-246	0.32	0.21	0.22
GW-918	04/16/08	Plutonium-242	0.24 Q	0.19	0.14

APPENDIX D.3: CY 2008 MONITORING DATA FOR THE BEAR CREEK HYDROGEOLOGIC REGIME
Additional Isotopic Analyses at EMWMF: Detected Results

Sampling Point	Date Sampled	Isotope	Result (pCi/L)		
			Activity	TPU	MDA
GW-920	04/17/08	Actinium-227	0.18 J	0.16	0.14
GW-920	02/12/08	Plutonium-239/240	0.15	0.14	0.14
GW-920	04/17/08	Radium-226	0.16	0.12	0.06
GW-920	11/10/08	Radium-226	0.21	0.14	0.18
GW-920	02/12/08	Radium-228	0.98	0.33	0.58
GW-920	04/17/08	Thorium-227	0.18 J	0.16	0.14
GW-920	04/17/08	Thorium-229	0.13	0.12	0.09
GW-921	11/03/08	Americium-243	0.23	0.18	0.15
GW-921	11/03/08	Curium-245	0.32	0.22	0.2
GW-921	11/03/08	Curium-246	0.32	0.22	0.2
GW-921	02/12/08	Radium-226	0.47	0.22	0.3
GW-921	04/17/08	Radium-226	0.22	0.15	0.07
GW-921	04/17/08	Thorium-229	0.41 Q	0.34	0.1
GW-921	08/05/08	Thorium-229	0.54	0.23	0.12
GW-921	08/05/08	Thorium-230	0.56 J	0.31	0.29
GW-922	08/04/08	Actinium-227	0.35 J	0.24	0.22
GW-922	11/05/08	Americium-243	0.22	0.16	0.19
GW-922	04/16/08	Chlorine-36	9.94	2.8	3.14
GW-922	08/04/08	Curium-245	0.22	0.19	0.21
GW-922	11/05/08	Curium-245	0.24	0.18	0.2
GW-922	08/04/08	Curium-246	0.22	0.19	0.21
GW-922	11/05/08	Curium-246	0.24	0.18	0.2
GW-922	11/05/08	Nickel-63	32.6	12.59	19.7
GW-922	04/16/08	Plutonium-242	0.34	0.24	0.13
GW-922	08/04/08	Thorium-227	0.35 J	0.24	0.22
GW-922	04/16/08	Thorium-228	0.22	0.17	0.14
GW-922	04/16/08	Thorium-230	0.28 J	0.19	0.12
GW-922	08/04/08	Thorium-230	0.38 J	0.24	0.2
GW-923	02/20/08	Radium-226	2.23 Q	0.47	0.16
GW-923	04/23/08	Radium-226	0.37	0.2	0.07
GW-923	08/07/08	Radium-226	0.53	0.24	0.2
GW-923	02/20/08	Radium-228	1.12	0.57	1.1
GW-923	02/20/08	Thorium-228	0.69	0.36	0.33
GW-923	08/07/08	Thorium-228	0.79	0.32	0.19
GW-923	04/23/08	Thorium-229	0.18 Q	0.13	0.07
GW-923	08/07/08	Thorium-229	0.21	0.18	0.08
GW-923	02/20/08	Thorium-230	0.57	0.31	0.28
GW-923	08/07/08	Thorium-230	0.92	0.35	0.15
GW-923	02/20/08	Thorium-232	0.61	0.32	0.16
GW-923	08/07/08	Thorium-232	0.79	0.32	0.16
GW-924 D	04/22/08	Actinium-227	0.25 J	0.18	0.15
GW-924	11/06/08	Americium-243	0.44	0.29	0.12
GW-924 D	11/06/08	Americium-243	0.27	0.18	0.08
GW-924 D	02/19/08	Curium-245	0.35 J	0.32	0.34
GW-924	11/06/08	Curium-245	0.49	0.31	0.12
GW-924 D	11/06/08	Curium-245	0.3	0.2	0.14
GW-924 D	02/19/08	Curium-246	0.35 J	0.32	0.34
GW-924	11/06/08	Curium-246	0.49	0.31	0.12
GW-924 D	11/06/08	Curium-246	0.3	0.2	0.14
GW-924 D	04/22/08	Curium-247	0.24 J	0.24	0.17
GW-924 D	02/19/08	Plutonium-236	0.46	0.28	0.24
GW-924	04/22/08	Potassium-40	63.3 Q	45.04	37.4
GW-924 D	11/06/08	Potassium-40	56.7	46.92	37.8

APPENDIX D.3: CY 2008 MONITORING DATA FOR THE BEAR CREEK HYDROGEOLOGIC REGIME
Additional Isotopic Analyses at EMWMF: Detected Results

Sampling Point	Date Sampled	Isotope	Result (pCi/L)		
			Activity	TPU	MDA
GW-924	02/19/08	Radium-226	0.1	0.07	0.07
GW-924 D	04/22/08	Radium-226	0.17	0.12	0.06
GW-924 D	11/06/08	Radium-226	0.37	0.18	0.15
GW-924 D	11/06/08	Radium-228	0.69	0.25	0.44
GW-924 D	04/22/08	Thorium-227	0.25 J	0.18	0.15
GW-925	04/17/08	Actinium-227	0.18 J	0.15	0.14
GW-925	11/05/08	Americium-243	0.42	0.29	0.31
GW-925	08/06/08	Curium-245	0.29	0.24	0.27
GW-925	11/05/08	Curium-245	0.5	0.32	0.35
GW-925	08/06/08	Curium-246	0.29	0.24	0.27
GW-925	11/05/08	Curium-246	0.5	0.32	0.35
GW-925	02/14/08	Radium-226	0.23	0.11	0.12
GW-925	04/17/08	Radium-226	0.18	0.13	0.06
GW-925	04/17/08	Thorium-227	0.18 J	0.15	0.14
GW-925	04/17/08	Thorium-228	0.23	0.17	0.15
GW-925	08/06/08	Thorium-229	2.17 Q	1.98	0.13
GW-925	04/17/08	Thorium-230	0.18 J	0.14	0.08
GW-925	11/05/08	Thorium-230	0.22	0.17	0.18
GW-925	04/17/08	Thorium-232	0.15	0.13	0.12
GW-925	04/17/08	Yttrium-90	1.64	0.75	1.41
GW-926	11/06/08	Americium-243	0.39	0.24	0.1
GW-926	02/19/08	Curium-245	0.3 J	0.26	0.24
GW-926	11/06/08	Curium-245	0.46	0.27	0.1
GW-926	02/19/08	Curium-246	0.3 J	0.26	0.24
GW-926	11/06/08	Curium-246	0.46	0.27	0.1
GW-926	11/06/08	Iodine-129	2.33	0.99	2.24
GW-926	04/23/08	Plutonium-242	0.31	0.23	0.13
GW-926	02/19/08	Radium-226	0.17	0.1	0.15
GW-927	11/04/08	Americium-243	0.57	0.27	0.18
GW-927	11/04/08	Cobalt-60	9.06 Q	4.66	7.3
GW-927	11/04/08	Curium-245	0.68	0.31	0.21
GW-927	11/04/08	Curium-246	0.68	0.31	0.21
GW-927	04/15/08	Curium-248	0.43	0.4	0.16
GW-927	02/11/08	Iodine-129	2.35 J	0.76	1.88
GW-927	08/07/08	Nickel-63	141 Q	17.9	24.3
GW-927	02/11/08	Radium-226	0.18	0.1	0.12
GW-927	04/15/08	Radium-226	0.3	0.17	0.07
GW-927	11/04/08	Radium-228	0.46	0.23	0.44
GW-927	04/15/08	Thorium-230	0.18 J	0.16	0.14
NT-04	11/10/08	Americium-243	0.47	0.32	0.26
NT-04	04/14/08	Curium-245	0.35 J	0.28	0.12
NT-04	11/10/08	Curium-245	0.51	0.35	0.32
NT-04	04/14/08	Curium-246	0.35 J	0.28	0.12
NT-04	11/10/08	Curium-246	0.51	0.35	0.32
NT-04	02/11/08	Plutonium-242	0.25	0.19	0.18
NT-04	04/14/08	Plutonium-244	0.19 Q	0.18	0.15
NT-04	02/11/08	Thorium-230	0.29 J	0.21	0.21
NT-04	08/11/08	Thorium-230	0.38 J	0.23	0.2
NT-04	11/10/08	Tritium	758	175.97	242
NT-04	08/11/08	Yttrium-90	1.57	0.72	1.34

APPENDIX D.3: CY 2008 MONITORING DATA FOR THE BEAR CREEK HYDROGEOLOGIC REGIME
Additional Isotopic Analyses at EMWMF: Detected Results

Sampling Point	Date Sampled	Isotope	Result (pCi/L)		
			Activity	TPU	MDA
EMW-VWEIR	04/14/08	Americium-243	0.3 J	0.18	0.08
EMW-VWEIR	11/10/08	Americium-243	0.44	0.31	0.33
EMW-VWEIR D	02/11/08	Carbon-14	18.7	7.39	11.8
EMW-VWEIR	08/11/08	Chlorine-36	4.36	2.97	4.13
EMW-VWEIR	11/10/08	Curium-245	0.46	0.33	0.41
EMW-VWEIR	11/10/08	Curium-246	0.46	0.33	0.41
EMW-VWEIR D	02/11/08	Thorium-230	0.33	0.22	0.28
EMW-VWEIR	04/14/08	Thorium-230	0.21 J	0.17	0.16
EMW-VWEIR D	02/11/08	Tritium	767	147.98	229
EMW-VWEIR	04/14/08	Tritium	382	149.91	245
EMW-VWEIR	02/11/08	Yttrium-90	20.1	1.52	1.75
EMW-VWEIR D	02/11/08	Yttrium-90	20.1	1.57	1.78
EMW-VWEIR	04/14/08	Yttrium-90	46.6	2.27	1.67
EMW-VWEIR	08/11/08	Yttrium-90	32.5	1.76	1.35
EMW-VWEIR	11/10/08	Yttrium-90	71	4.43	3.7
EMW-VWUNDER	11/10/08	Americium-243	0.46	0.33	0.24
EMW-VWUNDER	11/10/08	Curium-245	0.52	0.35	0.24
EMW-VWUNDER	11/10/08	Curium-246	0.52	0.35	0.24
EMW-VWUNDER	04/23/08	Thorium-229	0.07	0.06	0.06
EMW-VWUNDER	02/14/08	Thorium-230	0.43	0.29	0.31
EMW-VWUNDER	04/23/08	Thorium-230	0.2 J	0.14	0.16
EMW-VWUNDER	08/06/08	Thorium-230	0.43 J	0.27	0.21
EMW-VWUNDER	08/06/08	Yttrium-90	1.56 Q	0.49	1.15
EMWNT-03A	04/14/08	Americium-243	0.18 J	0.16	0.09
EMWNT-03A	04/14/08	Curium-245	0.25 J	0.2	0.09
EMWNT-03A	04/14/08	Curium-246	0.25 J	0.2	0.09
EMWNT-03A	02/11/08	Nickel-63	99.4 Q	27.4	41.4
EMWNT-03A	04/14/08	Plutonium-242	0.25 Q	0.21	0.12
EMWNT-05	04/14/08	Americium-243	0.19 Q	0.16	0.15
EMWNT-05	11/10/08	Americium-243	0.23	0.2	0.22
EMWNT-05	04/14/08	Curium-245	0.25 Q	0.18	0.15
EMWNT-05	04/14/08	Curium-246	0.25 Q	0.18	0.15
EMWNT-05	02/11/08	Iodine-129	1.81	0.67	1.7
EMWNT-05	11/10/08	Iodine-129	2.12	0.72	1.57
EMWNT-05	02/11/08	Potassium-40	52.8 Q	43.43	43.5
EMWNT-05	04/14/08	Radium-226	0.56	0.41	0.18
EMWNT-05	02/11/08	Thorium-230	0.27 J	0.18	0.19
EMWNT-05	04/14/08	Thorium-230	0.28 J	0.19	0.17

APPENDIX E

CY 2008 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 locations that are 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:

B4	-	Beta-4 Security Pits
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)
FTF	-	Fire Training Facility
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:

BJC	-	managed by Bechtel Jacobs Company LLC
GWPP	-	managed by the Y-12 Groundwater Protection Program

Sample Type:

Dup	-	Field Duplicate Sample
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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	BJC		GWPP	BJC
Cations			Anions		
Calcium	0.2	0.25	Bicarbonate	1.0	NS
Magnesium	0.2	0.05	Carbonate	1.0	NS
Potassium	2.0	0.25	Chloride	0.2	0.1
Sodium	0.2	0.25	Fluoride	0.1	0.05
			Nitrate (as Nitrogen)	0.028	0.1
			Sulfate	0.25	0.1
Note: “NS” = not specified.					

The major ion results for at least one of the samples collected from wells 55-2B, GW-170, GW-265, and GW-508 are qualitative because the ion charge balance errors (percent) exceeds 20%. The geochemistry of samples from well GW-170 has reflected potential grout contamination since CY 2000, as shown by the elevated pH (typically > 12).

The Y-12 GWPP SAP (BWXT 2007a) 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 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 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 reporting limits (BJC 2007)

EXPLANATION (continued)

shown below. The trace metals shown in bold typeface below were detected in at least one sample collected during CY 2008 and are presented in Appendix E.1.

Analyte	Reporting Limit (mg/L)		Analyte	Reporting Limit (mg/L)	
	GWPP	BJC		GWPP	BJC
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	0.0002**	0.0002
Barium	0.004	0.005	Molybdenum	0.05	0.01*
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 BJC reporting limit; ** - reporting limit for mercury was lowered to 0.00005 mg/L beginning in October 2008; "NS" - not specified.					

Groundwater samples collected from the following wells for metals analysis during CY 2008 were diluted before analysis to obtain an optimum matrix. The detected results are valid, but some metals may be present at concentrations below the elevated reporting limits.

Sampling Location	Date Sampled	Dilution Factor	Sampling Location	Date Sampled	Dilution Factor
GW-108	01/07/08	12	GW-253	02/26/08	4
GW-108	07/08/08	6	GW-274	05/08/08	5
GW-109	06/10/08	20	GW-275	05/08/08	10
GW-109	11/25/08	20	GW-633	06/11/08	2

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 (BJC lithium results).
- R - Result does not meet data quality objectives (charge balance error that exceeds 20% or duplicate results that differ by at least an order of magnitude).

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 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, 33 compounds were detected in the CY 2008 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	100	50,000	Carbon disulfide	6	3 J
Trichloroethene	84	3,800	Bromoform	5	9
cis-1,2-Dichloroethene	74	1,400	Bromodichloromethane	4	1 J
Chloroform	65	120	Styrene	3	7
Carbon tetrachloride	49	1,400	1,4-Dichlorobenzene	3	3 J
1,1-Dichloroethene	39	200	Trichlorofluoromethane	3	2 J
trans-1,2-Dichloroethene	34	36	1,2-Dichloroethane	2	470
Vinyl chloride	31	170	1,1,2-Trichloroethane	2	72 J
1,1-Dichloroethane	24	43	Chloromethane	2	4 J
1,1,2-Trichloro-1,2,2-trifluoroethane	22	4,600	Chlorobenzene	2	1 J
Benzene	15	7,700	Acetonitrile	1	35
Toluene	13	3,100	4-Methyl-2-pentanone	1	10
1,1,1-Trichloroethane	12	47	1,1,1,2-Tetrachloroethane	1	2 J
Total Xylene	9	8,300	Bromomethane	1	2 J
Ethylbenzene	8	1,000	Chloroethane	1	0.3 J
Methylene chloride	8	52	1,1,2,2-Tetrachloroethane	1	0.1 J
Acetone	7	57			

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 during CY 2008.

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

- . - Not analyzed
- < - Analyzed but not detected (also false-positive results)
- FP - False-positive result (GWPP data): trichloroethene in the December 2008 sample from well GW-769 (see details in Appendix G).
- J - Positively identified, estimated concentration below the contract-required quantitation limit
- Q - Result inconsistent with historical measurements for the location (low results for the May 2008 samples from wells 56-3B and 56-3C)

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 2008 in the East Fork Regime.

Analyte	No. of Results	No. Detected	Analyte	No. of Results	No. Detected
Gross Alpha	128	47	Uranium-234*	16	14
Gross Beta	128	60	Uranium-235*	16	4
Technetium-99	21	6	Uranium-236	4	0
			Uranium-238	16	13
Note: * = Reported by BJC 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)
- R - Result does not meet data quality objectives: exceeds the MDA but is less than the TPU

APPENDIX E.1

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

APPENDIX E.1: CY 2008 MONITORING DATA FOR THE UPPER EAST FORK POPLAR CREEK HYDROGEOLOGIC REGIME
Field Measurements, Miscellaneous Analytes, Major Ions, and Trace Metals

Sampling Point	55-1A	55-2A	55-2B		55-2C	55-3A	55-3B	55-3C	55-6A	56-1A
Functional Area	GRIDB2	GRIDB3	GRIDB3		GRIDB3	B9201-5	B9201-5	B9201-5	B9103	Y12
Date Sampled	04/14/08	04/17/08	04/16/08		04/16/08	04/21/08	04/21/08	04/21/08	04/21/08	04/24/08
Program	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP
Sample Type				Dup						
Field Measurements										
Time Sampled	13:50	9:05	8:10	8:10	14:05	8:35	9:35	10:35	14:10	8:50
Measuring Point Elev. (ft)	986.91	976.74	977.42	977.42	977.02	972.46	973.32	974.34	989.29	969.25
Depth to Water (ft)	10.94	8.56	7.81	7.81	7.77	11.65	12.69	13.32	9.65	7.64
Groundwater Elevation (ft)	975.97	968.18	969.61	969.61	969.25	960.81	960.63	961.02	979.64	961.61
Conductivity (µmho/cm)	945	2,220	2,350	2,350	2,360	760	405	488	392	452
Dissolved Oxygen (ppm)	0.68	0.8	0.13	0.13	0.86	4.35	2.82	1.42	5.15	3.95
Iron (++)	.	.	.	.	.	.	.	.	.	.
Manganese (++)	.	.	.	.	.	.	.	.	.	.
Oxidation/Reduction (mV)	101	178	198	198	187	189	151	140	200	126
Temperature (degrees C)	15.2	13.2	17.5	17.5	18.5	15.3	17.1	16.7	16.6	17.2
Turbidity (NTU)	.	.	.	.	.	.	.	.	.	.
pH	7.7	6.85	6.4	6.4	6.89	7.17	7.7	7.56	6.63	7.87
Miscellaneous Analytes										
Dissolved Solids (mg/L)	644	1,880	2,210	1,930	1,940	464	319	285	254	234
Suspended Solids (mg/L)	<	<	<	<	<	<	<	1	<	1
Major Ions (mg/L)										
Calcium	124	354	369 R	38.6 R	279	111	55.7	55.5	61.9	59.4
Magnesium	15.3	22.3	29.9	14.9	47.5	16	11.1	13	9.97	9.79
Potassium	2.02	3.19	3.08	<	15.4	3.22	4.11	6.8	<	2.47
Sodium	24.6	10.5	10.7 R	0.834 R	104	9.48	3.4	12.9	4.32	12.3
Bicarbonate	134	203	145	149	216	152	138	171	155	123
Carbonate	<	<	<	<	<	<	<	<	<	<
Chloride	147	14	14.3	15.1	13.6	14.1	32.1	21.4	2.75	21.4
Fluoride	<	<	<	<	<	<	<	<	0.166	0.5
Nitrate as N	6.61	203	252	253	237	2	<	<	1.52	0.685
Sulfate	71.5	22	19.8	20.2	16.6	178	26.6	33.6	34.3	59.9
Charge balance error (%)	-1.3	1.6	-0.7	-74.6 R	1.7	0.4	-3.3	-1.6	1.1	-0.2
Trace Metals (mg/L)										
Aluminum	<	<	<	<	<	<	<	<	<	<
Antimony	<	<	<	<	<	<	<	<	<	<
Barium	0.0774	0.193	0.907 R	0.051 R	1.44	0.0377	0.238	0.145	0.0893	0.0514
Beryllium	<	<	<	<	<	<	<	<	<	<
Boron	<	<	<	<	<	0.136	<	<	<	<
Cadmium	<	<	<	<	<	<	<	<	<	<
Chromium	0.0687	<	<	<	<	<	<	<	<	0.0134
Cobalt	<	<	<	<	<	<	<	<	<	<
Copper	<	<	<	<	<	<	<	<	<	<
Iron	0.882	0.0725	<	<	<	<	<	<	<	<
Lead	<	0.00176	<	0.000645	0.00381	<	<	<	0.00219	<
Lithium	0.0281	<	0.0202	<	0.0607	<	0.0153	0.0191	<	0.0154
Manganese	0.00795	0.118	0.576 R	0.00978 R	0.515	0.00713	0.00734	0.0258	<	<
Mercury	<	<	<	<	<	<	<	<	<	<
Nickel	0.486	0.0101	0.0127	0.0121	0.0081	0.0257	<	<	<	0.015
Strontium	0.236	0.823	1.14 R	0.0466 R	5.98	0.269	0.656	1.37	0.103	0.364
Thallium	<	<	<	<	<	<	<	<	<	<
Uranium	<	0.00482	<	<	<	0.00067	<	<	0.00096	0.00214
Zinc	<	<	<	<	<	<	<	<	<	<

APPENDIX E.1: CY 2008 MONITORING DATA FOR THE UPPER EAST FORK POPLAR CREEK HYDROGEOLOGIC REGIME
Field Measurements, Miscellaneous Analytes, Major Ions, and Trace Metals

Sampling Point	56-1C	56-2A	56-2B	56-2C	56-3A	56-3B		56-3C	56-4A	56-6A	60-1A
Functional Area	Y12	GRIDC3	GRIDC3	GRIDC3	Y12	Y12		Y12	Y12	Y12	Y12
Date Sampled	04/28/08	04/23/08	04/23/08	04/23/08	05/01/08	05/01/08		05/01/08	04/30/08	04/29/08	12/15/08
Program	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP
Sample Type							Dup				
Field Measurements											
Time Sampled	10:15	9:20	10:25	14:10	7:50	8:55	8:55	10:00	13:25	9:10	9:35
Measuring Point Elev. (ft)	969.49	963.53	962.45	965.11	963.03	964.33	964.33	962.86	962.07	960.28	929.66
Depth to Water (ft)	7.01	8.78	8.10	9.85	10.38	10.74	10.74	10.44	10.46	10.62	11.58
Groundwater Elevation (ft)	962.48	954.75	954.35	955.26	952.65	953.59	953.59	952.42	951.61	949.66	918.08
Conductivity (µmho/cm)	404	643	610	591	546	501	501	546	245	694	538
Dissolved Oxygen (ppm)	1.88	0.36	3.37	0.95	2.42	2.44	2.44	1.87	3.94	2.58	0.68
Iron (++)	.	.	.	.	.	.	.	.	.	.	.
Manganese (++)	.	.	.	.	.	.	.	.	.	.	.
Oxidation/Reduction (mV)	119	57	126	93	176	162	162	147	181	206	-54
Temperature (degrees C)	17.2	16.7	18.6	22	15.4	17.4	17.4	18.1	20.4	15.4	16.4
Turbidity (NTU)	.	.	.	.	.	.	.	.	.	.	.
pH	7.72	7.25	7.59	8.48	7.3	7.16	7.16	7.22	7.1	7.43	7.36
Miscellaneous Analytes											
Dissolved Solids (mg/L)	208	352	368	387	328	246	277	318	176	348	385
Suspended Solids (mg/L)	<	2	2	1	1.5	2.5	<	1.5	2	1	1
Major Ions (mg/L)											
Calcium	27	108	90.1	5.21	88.9	78.8	84.4	89.4	31.5	73.3	95.2
Magnesium	7.98	7.78	12.2	1.57	7.49	4.36	4.5	5.45	4.07	32.7	11
Potassium	3.5	2.6	2.72	4.42	<	<	<	<	<	2.45	<
Sodium	48	8.48	11.3	125	3.86	6.4	6.49	7.3	8.42	15.4	8.91
Bicarbonate	193	202	188	238	199	188	189	182	88.8	336	220
Carbonate	<	<	<	<	<	<	<	<	<	<	<
Chloride	5.37	30.6	14.1	25	15.9	12.4	11.9	13.9	2.45	10.2	7.51
Fluoride	0.311	<	<	0.593	<	0.155	0.157	<	0.103	<	<
Nitrate as N	0.0793	0.414	1.19	<	0.48	0.51	0.505	0.693	1.72	0.0363	<
Sulfate	11.5	73.6	95.3	25.2	48.6	35.6	35.8	63.7	24.9	15.5	67.7
Charge balance error (%)	-1.1	0.0	-1.3	-0.7	-2.4	-3.4	-0.4	-1.7	-4.6	-1.7	0.2
Trace Metals (mg/L)											
Aluminum	<	<	<	<	<	<	<	<	<	<	<
Antimony	<	<	<	<	<	<	<	<	<	<	<
Barium	0.259	0.111	0.0551	0.121	0.0955	0.0863	0.0888	0.0699	0.0522	0.298	0.0986
Beryllium	<	<	<	<	<	<	<	<	<	<	<
Boron	0.137	0.104	0.128	1.15	<	0.175	0.18	0.125	<	<	<
Cadmium	<	<	<	<	<	<	<	<	<	<	<
Chromium	<	<	<	<	0.0109	<	<	<	0.0207	0.0164	<
Cobalt	<	<	<	<	<	<	<	<	<	<	<
Copper	<	<	<	<	<	<	<	<	<	<	<
Iron	<	0.0648	<	<	<	<	<	0.136	0.0951	<	0.509
Lead	<	<	<	0.00056	<	<	<	<	<	<	<
Lithium	0.0232	0.0143	0.0182	0.0812	<	<	<	<	<	0.0145	1.24
Manganese	<	<	<	<	<	<	<	<	0.00628	<	0.724
Mercury	<	<	<	<	<	<	<	<	<	<	<
Nickel	<	0.0114	<	<	0.0187	<	<	<	0.0297	0.00985	<
Strontium	0.845	0.248	0.296	0.306	0.14	0.117	0.119	0.155	0.0554	0.37	0.262
Thallium	<	<	<	<	<	<	<	<	<	<	<
Uranium	<	<	<	<	0.00063	0.00071	0.00071	0.0005	<	<	<
Zinc	<	<	<	<	<	<	<	<	<	<	<

APPENDIX E.1: CY 2008 MONITORING DATA FOR THE UPPER EAST FORK POPLAR CREEK HYDROGEOLOGIC REGIME
Field Measurements, Miscellaneous Analytes, Major Ions, and Trace Metals

Sampling Point	GW-105	GW-106		GW-108		GW-109		GW-148	GW-151		GW-153
Functional Area	S3	S3		S3		S3		NHP	NHP		NHP
Date Sampled	05/14/08	05/14/08		01/07/08	07/08/08	06/10/08	11/25/08	08/19/08	02/26/08	08/11/08	08/20/08
Program	GWPP	GWPP	GWPP	BJC	BJC	GWPP	GWPP	GWPP	BJC	BJC	GWPP
Sample Type			Dup								
Field Measurements											
Time Sampled	9:45	13:50	13:50	10:00	10:00	8:00	13:35	8:20	14:00	14:20	8:50
Measuring Point Elev. (ft)	1,018.20	1,016.92	1,016.92	999.00	999.00	997.82	997.82	907.76	916.17	916.17	921.68
Depth to Water (ft)	9.82	5.16	5.16	7.19	7.29	6.00	6.41	8.81	15.09	16.05	20.49
Groundwater Elevation (ft)	1,008.38	1,011.76	1,011.76	991.81	991.71	991.82	991.41	898.95	901.08	900.12	901.19
Conductivity (µmho/cm)	5,400	5,390	5,390	46,200	73,300	48,000	48,600	1,026	1,214	1,092	444
Dissolved Oxygen (ppm)	1.5	0.82	0.82	0.83	0.7	0.46	1.13	1.65	0.63	2.53	2.12
Iron (++)	.	.	.	.	.	.	.	.	.	.	.
Manganese (++)	.	.	.	.	.	.	.	.	.	.	.
Oxidation/Reduction (mV)	179	164	164	115	155	214	253	169	31	25	113
Temperature (degrees C)	16.4	17.5	17.5	17.6	23.1	20.7	17.8	21.9	14	18.7	16.5
Turbidity (NTU)	.	.	.	2	1	.	.	.	2	2	.
pH	6.71	6.95	6.95	5.46	5.52	5.55	5.86	6.49	7.3	7.05	7.34
Miscellaneous Analytes											
Dissolved Solids (mg/L)	4,140	4,640	4,420	.	.	53,500	49,900	511	331	312	204
Suspended Solids (mg/L)	1	1	<	.	.	13	14	<	<	<	<
Major Ions (mg/L)											
Calcium	749	689	707	9,750	9,100	10,500	10,400	174	59.3	58.4	51.9
Magnesium	97.4	164	170	971	1,000	1,270	1,430	11.3	27	26.8	20.7
Potassium	34.5	12.3	12.7	22.3	20.9	81.9	98.4	2.92	2.36	2.25	<
Sodium	22.4	30.7	31.8	452	425	387	447	37.7	7.14	7.1	8.97
Bicarbonate	141	129	129	739	806	476	455	365	234	224	187
Carbonate	<	<	<	<	<	<	<	<	<	<	<
Chloride	17.5	11.8	11.6	139	164	111	111	114	20.8	18.6	15.5
Fluoride	<	<	<	<	<	4.76	7.36	<	<	0.11	0.136
Nitrate as N	635	680	673	7,040	7,440	9,190	9,630	<	0.59	0.82	1.13
Sulfate	6.23	21.9	21.4	<	7.6	<	<	20.2	23.2	21.2	16
Charge balance error (%)	-1.6	-2.4	-0.4	5.9	0.3	-1.7	-3.1	1.8	-2.1	-0.2	0.9
Trace Metals (mg/L)											
Aluminum	0.632	<	<	<	<	<	5.06	<	<	<	<
Antimony	<	<	<	<	<	<	<	<	<	<	<
Barium	4.28	2.68	2.8	76.4	74	90.1	67.9	0.297	0.198	0.182	0.046
Beryllium	<	<	<	<	<	<	<	<	<	<	<
Boron	<	0.108	0.112	<	<	<	<	<	<	<	<
Cadmium	<	<	<	<	<	1.03	1.28	<	<	<	<
Chromium	<	0.0189	0.0238	<	<	<	<	<	<	<	<
Cobalt	<	<	<	0.147	0.134	<	<	<	<	<	<
Copper	<	<	<	<	<	<	<	<	<	<	<
Iron	0.554	<	<	<	<	<	<	<	<	<	<
Lead	0.00083	<	<	<	0.0124	<	<	0.00442	<	<	<
Lithium	0.0479	0.071	0.0758	0.54	0.486	0.626	0.85	<	<	<	<
Manganese	0.0771	0.0537	0.0562	146	139	70.1	76	0.298	<	<	<
Mercury	<	<	<	<	<	0.0157	0.0166	<	.	.	<
Nickel	0.0463	0.0155	0.0167	0.2	0.151	1.71	1.52	0.043	<	<	<
Strontium	1.78	19	19.7	29.2	28.8	64.5	61.4	0.593	0.585	0.539	0.159
Thallium	<	<	<	<	<	<	<	<	<	<	<
Uranium	0.00095	0.00254	0.0025	0.014	0.015	0.0264	0.0146	0.0008	<	<	0.00132
Zinc	<	<	<	<	<	<	<	<	<	<	<

APPENDIX E.1: CY 2008 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-190	GW-192
Functional Area	NHP		EXP-UV	EXP-UV				EXP-UV	EXP-UV	B4	B4
Date Sampled	02/27/08	08/11/08	02/26/08	02/26/08		08/13/08		02/27/08	02/27/08	05/07/08	05/05/08
Program	BJC	BJC	BJC	BJC	BJC	BJC	BJC	BJC	BJC	GWPP	GWPP
Sample Type					Dup		Dup				
Field Measurements											
Time Sampled	11:00	15:20	10:45	10:00	.	11:00	.	9:45	10:50	9:45	10:35
Measuring Point Elev. (ft)	911.70	911.70	932.12	932.64	.	932.64	.	920.72	926.69	1,033.69	1,008.83
Depth to Water (ft)	9.20	9.89	30.00	32.57	.	37.35	.	5.65	15.75	11.79	6.13
Groundwater Elevation (ft)	902.50	901.81	902.12	900.07	.	895.29	.	915.07	910.94	1,021.90	1,002.70
Conductivity (µmho/cm)	968	834	376	3,670	.	3,660	.	295	502	334	592
Dissolved Oxygen (ppm)	4.99	2.05	6.4	0.27	.	3.39	.	0.85	0.45	1.19	1.01
Iron (++)	.	.	.	.	.	.	.	1.71	1.84	.	.
Manganese (++)	.	.	.	.	.	.	.	5.5	0.8	.	.
Oxidation/Reduction (mV)	112	96	76	-33	.	-169	.	37	-84	121	210
Temperature (degrees C)	9.7	24.5	14.2	13.5	.	16.9	.	14.3	12	19.7	19.8
Turbidity (NTU)	69	8	3	6	.	5	.	13	2	.	.
pH	7.05	6.87	6.59	12.37	.	12.14	.	6.03	6.74	6.9	6.47
Miscellaneous Analytes											
Dissolved Solids (mg/L)	523	515	171	388	388	406	396	208	372	185	364
Suspended Solids (mg/L)	9	10	5	17	17	<	8	22	13	3	8
Major Ions (mg/L)											
Calcium	124	145	50.2	124	134	144	144	.	.	50.2	97.6
Magnesium	20.6	22.4	2.78	3.4	2.72	1.25	1.24	.	.	7.63	8.71
Potassium	5.72	6.67	2.24	14.7	15.2	14.4	14.5	.	.	<	<
Sodium	7.17	7.84	1.12	6.91	7.11	6.62	6.63	.	.	9.31	9.12
Bicarbonate	.	.	144	<	<	<	<	.	.	138	266
Carbonate	.	.	<	41	82	31.7	31.7	.	.	<	<
Chloride	.	.	2.4	7.9	5.1	6.5	6.2	.	.	10.7	26.3
Fluoride	.	.	<	<	<	0.1	0.12	.	.	0.163	0.129
Nitrate as N	.	.	0.52	0.22	0.23	0.25	0.25	.	.	0.133	<
Sulfate	.	.	4.8	7.3	6.7	6.6	5.7	.	.	24.5	5.04
Charge balance error (%)	.	.	-4.1	-55.1 R	.	-30.1 R	.	.	.	-0.7	-1.5
Trace Metals (mg/L)											
Aluminum	<	0.653	<	0.594	0.476	0.333	0.341	.	.	<	<
Antimony	<	<	<	<	<	<	<	.	.	<	<
Barium	0.0694	0.169	0.026	0.152	0.158	0.167	0.167	.	.	0.166	0.142
Beryllium	<	<	<	<	<	<	<	.	.	<	<
Boron	<	0.12	<	<	<	<	<	.	.	<	<
Cadmium	<	<	<	<	<	<	<	.	.	<	<
Chromium	<	<	<	<	0.0337	<	<	.	.	0.108	<
Cobalt	<	<	<	<	<	<	<	.	.	<	<
Copper	<	0.0989	<	<	<	<	<	.	.	<	0.0274
Iron	0.0571	0.865	0.188	1.29	1.22	0.407	0.434	.	.	0.728	2.69
Lead	<	0.0073	<	<	<	<	<	.	.	<	0.00418
Lithium	<	<	<	0.0451 J	0.0464 J	0.0437	0.0436	.	.	0.0129	0.0174
Manganese	0.113	2.35	0.0054	0.009	0.0081	<	<	.	.	1.93	2.03
Mercury	.	.	.	.	.	.	.	.	.	<	<
Nickel	<	<	<	<	<	<	<	.	.	0.172	0.00604
Strontium	0.442	0.488	0.0643	0.597	0.622	0.658	0.657	.	.	0.16	0.158
Thallium	<	<	<	<	<	<	<	.	.	<	<
Uranium	0.54	0.46	.	.	.	.	.	.	.	<	<
Zinc	<	0.0842	<	<	<	<	<	.	.	<	<

APPENDIX E.1: CY 2008 MONITORING DATA FOR THE UPPER EAST FORK POPLAR CREEK HYDROGEOLOGIC REGIME
Field Measurements, Miscellaneous Analytes, Major Ions, and Trace Metals

Sampling Point	GW-193		GW-204	GW-220					GW-223		GW-230
Functional Area	T2331		T0134	NHP					NHP		EXP-UV
Date Sampled	01/03/08	07/08/08	10/27/08	03/24/08	06/10/08	08/19/08		12/02/08	02/27/08	08/13/08	02/27/08
Program	BJC	BJC	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP	BJC	BJC	BJC
Sample Type							Dup				
Field Measurements											
Time Sampled	.	.	9:35	10:30	13:45	10:30	10:30	10:10	14:00	14:20	14:15
Measuring Point Elev. (ft)	934.17	934.17	958.74	915.64	915.64	915.64	915.64	915.64	911.62	911.62	923.11
Depth to Water (ft)	9.13	9.68	8.63	15.67	15.73	15.87	15.87	15.91	9.55	10.10	12.10
Groundwater Elevation (ft)	925.04	924.49	950.11	899.97	899.91	899.77	899.77	899.73	902.07	901.52	911.01
Conductivity (µmho/cm)	1,277	1,353	296	521	717	543	543	533	1,466	746	845
Dissolved Oxygen (ppm)	3.76	0.51	3.91	0.25	2.64	0.35	0.35	0.19	1.5	5.48	0.43
Iron (++)	.	.	.	.	.	.	.	.	.	.	1.61
Manganese (++)	.	.	.	.	.	.	.	.	.	.	0.8
Oxidation/Reduction (mV)	84	-150	160	148	175	86	86	92	22	29	-27
Temperature (degrees C)	5.3	28.6	19.3	14.6	17.9	18	18	15	11.9	20.8	12.6
Turbidity (NTU)	3	2	.	.	.	.	.	.	4	1	0
pH	7.54	7.44	7.4	7.48	7.54	7.31	7.31	7.47	7.02	7.14	6.34
Miscellaneous Analytes											
Dissolved Solids (mg/L)	.	.	203	226	325	283	274	266	383	374	618
Suspended Solids (mg/L)	.	.	16	2	6	1	2	<	5	<	8
Major Ions (mg/L)											
Calcium	.	.	47.5	64.7	61.6	65.8	65.1	64.4	95.5	93.1	.
Magnesium	.	.	7.27	26.6	26.2	26.8	26.8	27.3	13.7	13.8	.
Potassium	.	.	2.31	2.39	2.52	2.47	2.71	2.67	2.11	1.87	.
Sodium	.	.	2.62	5.36	5.57	5.65	5.67	5.73	12.9	14	.
Bicarbonate	.	.	99.8	246	228	238	237	233	242	216	.
Carbonate	.	.	<	<	<	<	<	<	<	<	.
Chloride	.	.	2.57	16.3	17.1	19	18.6	18.5	35.2	37	.
Fluoride	.	.	0.501	<	<	<	<	<	<	0.14	.
Nitrate as N	.	.	1.06	0.583	0.55	0.576	0.583	0.492	<	<	.
Sulfate	.	.	37.2	16.2	16.6	17.6	17.7	16.8	43.9	43.3	.
Charge balance error (%)	.	.	3.2	-0.4	1.0	0.8	0.9	1.9	-1.8	1.3	.
Trace Metals (mg/L)											
Aluminum	.	.	0.639	<	<	0.493	0.603	<	<	<	.
Antimony	.	.	<	<	<	<	<	<	<	<	.
Barium	.	.	0.0777	0.11	0.11	0.109	0.109	0.111	0.303	0.296	.
Beryllium	.	.	<	<	<	<	<	<	<	<	.
Boron	.	.	<	<	<	<	<	<	<	<	.
Cadmium	.	.	<	<	<	<	<	<	<	<	.
Chromium	.	.	<	<	<	<	<	<	<	<	.
Cobalt	.	.	<	<	<	<	<	<	<	<	.
Copper	.	.	<	<	<	<	<	<	<	<	.
Iron	.	.	0.562	0.0732	<	0.316	0.39	0.198	0.273	0.316	.
Lead	.	.	0.00139	<	<	<	0.00891	<	<	<	.
Lithium	.	.	0.0551	<	<	<	<	<	<	<	.
Manganese	.	.	0.0747	0.0156	0.0159	0.0102	0.011	0.00595	0.606	0.588	.
Mercury	.	.	<	<	<	<	<	<	<	<	.
Nickel	.	.	0.00615	<	<	<	0.00534	<	<	<	.
Strontium	.	.	0.0931	0.451	0.44	0.437	0.438	0.455	0.264	0.247	.
Thallium	.	.	<	<	<	<	<	<	<	<	.
Uranium	.	.	0.0431	<	<	<	<	<	0.04	0.042	.
Zinc	.	.	<	<	<	<	<	<	<	<	.

APPENDIX E.1: CY 2008 MONITORING DATA FOR THE UPPER EAST FORK POPLAR CREEK HYDROGEOLOGIC REGIME
Field Measurements, Miscellaneous Analytes, Major Ions, and Trace Metals

Sampling Point	GW-240	GW-251	GW-253	GW-265	GW-269	GW-274	GW-275	GW-281	GW-332	GW-336	GW-337
Functional Area	NHP	S2	S2	SY	SY	SY	SY	FF	WC	WC	WC
Date Sampled	08/19/08	05/15/08	02/26/08	05/07/08	05/12/08	05/08/08	05/08/08	05/08/08	05/12/08	05/13/08	05/13/08
Program	GWPP	GWPP	BJC	GWPP	GWPP	GWPP	GWPP	BJC	GWPP	GWPP	GWPP
Sample Type											
Field Measurements											
Time Sampled	13:30	8:35	14:45	11:10	10:25	9:10	10:45	9:30	14:05	8:25	9:45
Measuring Point Elev. (ft)	922.90	1,003.80	1,004.24	1,032.68	1,027.81	995.60	995.53	946.10	981.24	985.92	987.48
Depth to Water (ft)	12.47	19.19	6.48	10.95	16.95	4.06	3.90	5.20	10.92	11.16	11.41
Groundwater Elevation (ft)	910.43	984.61	997.76	1,021.73	1,010.86	991.54	991.63	940.90	970.32	974.76	976.07
Conductivity (µmho/cm)	1,879	937	5,213	319	183	12,050	45,700	957	254	391	567
Dissolved Oxygen (ppm)	0.08	0.86	1.23	2.57	1.22	0.16	0.29	1.77	1.29	1.22	2.41
Iron (++)	.	.	.	.	.	.	.	.	.	.	.
Manganese (++)	.	.	8	.	.	.	.	.	.	.	.
Oxidation/Reduction (mV)	193	274	290	184	202	262	105	99	212	181	179
Temperature (degrees C)	18.1	15.5	12.9	19.8	17.6	16.4	20.1	16	18.4	14.5	16.7
Turbidity (NTU)	.	.	5	.	.	.	.	21	.	.	.
pH	6.36	6.38	4.53	6.47	5.97	5.74	6.67	6.55	6	6.44	6.77
Miscellaneous Analytes											
Dissolved Solids (mg/L)	258	517	6,100	113	93	11,100	48,300	.	118	216	304
Suspended Solids (mg/L)	<	2	5	2	<	1	3	.	<	3	3
Major Ions (mg/L)											
Calcium	59.1	95.4	577	37.4	16.8	2120	9630	.	31.9	59.9	95.9
Magnesium	19	11.2	136	6.77	2.37	344	1410	.	4.76	6.07	9.32
Potassium	2.8	2.77	9.84	<	<	<	35.6	.	<	<	2.1
Sodium	13.1	10.2	128	13.2	9.43	240	123	.	7.48	6.14	5.48
Bicarbonate	195	162	58.4	516	64.2	653	66.7	.	81.6	169	236
Carbonate	<	<	<	<	<	<	<	.	<	<	<
Chloride	18.1	6.17	124	16.6	4.39	53.7	42.9	.	12.6	11	18.6
Fluoride	0.18	0.913	5.5	0.103	<	<	<	.	<	<	<
Nitrate as N	1.03	45.7	535	0.19	0.633	1,860	8,570	.	2.19	1.66	4.87
Sulfate	25.7	11.2	88.9	22.6	6.1	2.88	<	.	12.8	8.77	13.7
Charge balance error (%)	1.3	-5.8	0.9	-58 R	-4.4	-1.0	-1.0	.	-2.1	-3.0	-0.3
Trace Metals (mg/L)											
Aluminum	<	<	4.53	<	<	<	<	.	<	<	<
Antimony	<	<	<	<	<	<	<	.	<	<	<
Barium	0.05	0.0869	0.309	0.226	0.0555	13.3	151	.	0.134	0.176	0.224
Beryllium	<	<	0.0144	<	<	<	<	.	<	<	<
Boron	<	<	0.341	<	<	<	<	.	<	<	<
Cadmium	<	0.0935	4.37	<	<	<	<	.	<	<	<
Chromium	<	<	<	<	<	<	<	.	<	<	<
Cobalt	<	<	0.294	<	<	<	<	.	<	<	<
Copper	<	0.169	79.2	<	<	<	<	.	<	<	<
Iron	<	<	0.165	<	<	<	<	.	<	<	<
Lead	<	<	0.029	0.00053	<	<	<	.	<	0.00463	0.00065
Lithium	0.0105	<	<	<	<	0.0778	0.37	.	<	<	<
Manganese	0.256	2.5	53.9	<	<	59.1	1.77	.	0.00522	<	<
Mercury	<	<	.	<	<	<	<	.	<	<	<
Nickel	0.011	0.0236	2.67	<	<	0.142	0.266	.	0.00631	0.00626	0.00593
Strontium	0.0962	0.154	1.08	0.135	0.0401	6.5	74.3	.	0.13	0.163	0.246
Thallium	<	0.00167	<	<	<	<	<	.	<	<	<
Uranium	0.00384	0.00276	0.0053	<	<	0.0098	<	.	<	<	0.0012
Zinc	<	<	6.81	<	<	<	<	.	<	<	<

APPENDIX E.1: CY 2008 MONITORING DATA FOR THE UPPER EAST FORK POPLAR CREEK HYDROGEOLOGIC REGIME
Field Measurements, Miscellaneous Analytes, Major Ions, and Trace Metals

Sampling Point	GW-380		GW-381	GW-382		GW-383	GW-508		GW-605			
Functional Area	NHP		NHP	NHP		NHP	RG		EXP-I			
Date Sampled	02/28/08	08/12/08	08/21/08	02/28/08	08/13/08	08/18/08	05/13/08	12/22/08	01/07/08		07/08/08	
Program	BJC	BJC	GWPP	BJC	BJC	GWPP	GWPP	GWPP	BJC	BJC	BJC	BJC
Sample Type										Dup		Dup
Field Measurements												
Time Sampled	11:00	10:35	8:50	10:35	10:00	9:20	13:50	12:50	13:50	.	13:40	.
Measuring Point Elev. (ft)	913.55	913.55	913.36	913.17	913.17	908.77	1,010.74	1,010.74	919.06	.	919.06	.
Depth to Water (ft)	11.27	11.78	11.40	10.39	12.25	9.48	10.94	10.67	11.45	.	11.34	.
Groundwater Elevation (ft)	902.28	901.77	901.96	902.78	900.92	899.29	999.80	1,000.07	907.61	.	907.72	.
Conductivity (μ mho/cm)	535	522	736	435	1,278	592	186	170	1,429	.	900	.
Dissolved Oxygen (ppm)	5.85	1.4	0.25	2.3	2.38	0.35	0.68	2.88	0.72	.	0.15	.
Iron (++)	.	.	.	.	.	.	.	.	.	.	.	.
Manganese (++)	.	.	.	.	.	.	.	.	.	.	.	.
Oxidation/Reduction (mV)	87	131	-138	128	156	-40	64	135	80	.	90	.
Temperature (degrees C)	13.2	21.1	19.8	7.8	19.8	21.1	22.1	14.8	16.7	.	19.6	.
Turbidity (NTU)	78	17	.	21	3	.	.	.	1	.	1	.
pH	6.8	6.95	7.13	6.76	6.78	7.07	5.24	4.8	7.27	.	6.78	.
Miscellaneous Analytes												
Dissolved Solids (mg/L)	236	290	365	425	392	406	104	134	.	.	.	.
Suspended Solids (mg/L)	10	16	9	<	<	<	2	<	.	.	.	.
Major Ions (mg/L)												
Calcium	42.3	48.5	93.8	85.7	84	95.6	3.58	1.96	102	103	88.3	86.8
Magnesium	16.5	17.2	20.6	24.7	24.2	11.3	3.22	2.41	23.4	23.5	20.6	20.3
Potassium	1.45	1.43	3.14	3.76	3.37	2.78	<	<	2.57	2.44	2.24	2.24
Sodium	11.5	14.3	18.7	18	18	12.7	12.8	9.79	18.6	18.7	14.1	14
Bicarbonate	142	180	273	271	253	238	36.3	20	337	302	271	271
Carbonate	<	<	<	<	<	<	<	<	<	<	<	<
Chloride	16.8	15.5	61.3	68.2	64.6	35.1	32.3	32.7	32.2	31.9	25.3	27.8
Fluoride	<	0.17	<	<	0.14	<	<	<	0.1	<	0.1	0.11
Nitrate as N	1.6	1.6	<	0.094	0.12	<	<	<	0.16	0.16	1.3	1.3
Sulfate	25.1	27.5	2.62	3.9	3.6	18.7	<	0.828	33.2	32.7	31.3	31.9
Charge balance error (%)	0.7	-2.6	0.2	-1.6	0.6	1.5	-23.9 R	-29 R	-2.8	.	-0.8	.
Trace Metals (mg/L)												
Aluminum	<	<	<	<	<	<	<	<	<	<	<	<
Antimony	<	<	<	<	<	<	<	<	<	<	<	<
Barium	0.0281	0.0381	0.27	0.58	0.568	0.606	0.0933	0.0983	0.0547	0.058	0.0461	0.0455
Beryllium	<	<	<	<	<	<	<	0.000582	<	<	<	<
Boron	<	<	<	<	<	<	<	<	0.101	0.102	<	<
Cadmium	<	<	<	<	<	<	<	<	<	<	<	<
Chromium	1.15	2.02	<	<	<	<	0.371	1.35	<	<	<	<
Cobalt	<	<	<	<	<	<	0.0475	0.0494	<	<	<	<
Copper	<	<	<	<	<	<	<	0.0361	<	<	<	<
Iron	2.94	6.57	9.26	0.575	1.23	1.06	15.6	11.8	<	0.144	<	<
Lead	<	<	<	<	<	<	0.00078	0.000615	<	<	<	<
Lithium	<	<	<	<	<	0.0155	<	<	<	<	<	<
Manganese	0.007	0.0567	0.358	0.0234	0.0271	0.187	7.16	3.91	0.215	0.306	0.164	0.167
Mercury	.	.	<	<	<	<	<	0.0000607	.	.	.	.
Nickel	0.114	0.363	<	<	<	0.0111	0.609	1.14	<	<	<	<
Strontium	0.0554	0.0589	0.186	0.321	0.308	0.418	0.0179	0.0131	0.198	0.197	0.176	0.172
Thallium	<	<	<	<	<	<	<	<	<	<	<	<
Uranium	<	<	<	<	<	<	<	<	0.14	0.13	0.11	0.11
Zinc	<	<	<	<	<	<	<	<	<	<	<	<

APPENDIX E.1: CY 2008 MONITORING DATA FOR THE UPPER EAST FORK POPLAR CREEK HYDROGEOLOGIC REGIME
Field Measurements, Miscellaneous Analytes, Major Ions, and Trace Metals

Sampling Point	GW-606		GW-617	GW-618	GW-619		GW-620	GW-633	GW-656	GW-658	GW-686
Functional Area	EXP-I		EXP-E	EXP-E	FTF		FTF	RG	T0134	FF	CPT
Date Sampled	01/07/08	07/08/08	10/20/08	03/04/08	12/01/08		12/10/08	06/11/08	10/28/08	05/06/08	10/22/08
Program	BJC	BJC	GWPP	BJC	GWPP	GWPP	GWPP	GWPP	GWPP	BJC	GWPP
Sample Type						Dup					
Field Measurements											
Time Sampled	15:15	15:35	9:50	9:55	13:25	13:25	10:20	15:55	9:40	9:40	10:10
Measuring Point Elev. (ft)	919.59	919.59	985.28	985.14	1,015.42	1,015.42	1,015.57	996.43	954.79	944.81	963.76
Depth to Water (ft)	13.93	14.37	15.60	12.76	22.47	22.47	27.97	2.72	10.40	11.96	13.29
Groundwater Elevation (ft)	905.66	905.22	969.68	972.38	992.95	992.95	987.60	993.71	944.39	932.85	950.47
Conductivity (µmho/cm)	465	1,649	221	1,291	548	548	216	6,910	620	438	1,145
Dissolved Oxygen (ppm)	5	1.78	0.88	0.73	0.91	0.91	6.53	0.34	0.27	0.16	0.31
Iron (++)	.	.	.	0.34	.	.	.	.	.	.	.
Manganese (++)	.	.	.	0.2	.	.	.	.	.	.	.
Oxidation/Reduction (mV)	108	35	250	99	73	73	15	256	-8	-45	2
Temperature (degrees C)	16.4	20.2	17.6	17.4	14.1	14.1	15.5	26.8	20	19.8	18.1
Turbidity (NTU)	2	1	.	2	.	.	.	.	.	9	.
pH	7.41	7.33	5.62	6.78	8.36	8.36	9.97	5.3	6.47	6.12	6.6
Miscellaneous Analytes											
Dissolved Solids (mg/L)	.	.	89	397	66	82	42	30,800	350	.	689
Suspended Solids (mg/L)	.	.	6	<	1	1	<	1	9	.	<
Major Ions (mg/L)											
Calcium	90.8	84.8	19.3	97.9	31.8	30.4	2.85	1,110	118	.	203
Magnesium	41.9	41	5.85	8.91	3.97	3.84	<	109	5.73	.	28.2
Potassium	3.69	3.97	<	4.45	12.2	11.8	23.4	6.85	2.23	.	2.67
Sodium	6.61	6.63	6.16	13.2	2.16	2.12	2.83	85.1	14.4	.	16
Bicarbonate	307	303	79.2	281	101	101	19.4	303	219	.	337
Carbonate	<	<	<	<	<	<	18.5	<	<	.	<
Chloride	25.8	22.2	5.63	8.5	2.32	2.29	1.91	40.4	34.9	.	14.1
Fluoride	0.48	0.2	<	0.21	<	<	0.135	<	<	.	<
Nitrate as N	7.8	11.5	0.212	0.16	1.27	1.27	1.35	863	<	.	0.409
Sulfate	62.9	58.1	9.49	18.1	5.2	5.18	5.53	<	49.1	.	229
Charge balance error (%)	-2.3	-4.4	-6.5	0.4	0.7	-1.3	-13.1	-0.4	4.9	.	5.1
Trace Metals (mg/L)											
Aluminum	<	<	<	<	0.566	0.526	0.241	<	<	.	<
Antimony	<	<	<	<	<	<	<	<	<	.	<
Barium	0.198	0.199	0.0329	0.0416	0.00729	0.00744	0.0127	4.92	0.167	.	0.0832
Beryllium	<	<	<	<	<	<	<	<	<	.	<
Boron	<	<	0.11	0.107	<	<	<	<	<	.	<
Cadmium	<	<	<	0.0027	<	<	<	<	<	.	<
Chromium	<	<	<	<	<	<	0.0127	<	0.0573	.	<
Cobalt	<	<	<	<	<	<	<	<	<	.	<
Copper	<	<	<	<	<	<	<	<	<	.	<
Iron	<	<	0.176	0.42	<	<	<	<	2.15	.	1.5
Lead	<	<	<	<	<	<	<	<	<	.	<
Lithium	0.0109	0.0117	<	<	<	<	0.0269	0.141	<	.	<
Manganese	0.0128	0.0131	2.2	0.28	<	<	<	3.41	1.29	.	1.76
Mercury	.	.	<	.	<	<	<	<	<	.	<
Nickel	<	<	0.0107	<	<	<	<	0.205	0.0999	.	0.015
Strontium	0.613	0.624	0.0448	0.204	0.0803	0.0792	0.177	2.58	0.201	.	0.436
Thallium	<	<	<	<	<	<	<	<	<	.	<
Uranium	0.0052	0.0051	<	<	0.00062	0.00054	<	0.00077	<	.	0.00114
Zinc	<	<	<	<	<	<	<	<	<	.	<

APPENDIX E.1: CY 2008 MONITORING DATA FOR THE UPPER EAST FORK POPLAR CREEK HYDROGEOLOGIC REGIME
Field Measurements, Miscellaneous Analytes, Major Ions, and Trace Metals

Sampling Point	GW-690	GW-691	GW-692	GW-698			GW-700	GW-722-14		GW-722-17	
Functional Area	CPT	CPT	CPT	B8110			B8110	EXP-J		EXP-J	
Date Sampled	10/23/08	10/23/08	10/21/08	06/24/08		11/25/08	10/20/08	02/28/08	07/28/08	02/28/08	07/28/08
Program	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP	BJC	GWPP	BJC	GWPP
Sample Type					Dup						
Field Measurements											
Time Sampled	9:10	10:10	9:55	8:50	8:50	9:25	13:30	14:20	11:01	14:30	14:03
Measuring Point Elev. (ft)	967.36	968.59	964.38	970.09	970.09	970.09	960.18	953.71	953.71	953.71	953.71
Depth to Water (ft)	11.05	11.05	9.27	40.71	40.71	41.70	20.65	.	56.17	.	61.35
Groundwater Elevation (ft)	956.31	957.54	955.11	929.38	929.38	928.39	939.53	.	897.54	.	892.36
Conductivity (µmho/cm)	1,447	1,447	541	1,782	1,782	1,843	667	326	556	354	576
Dissolved Oxygen (ppm)	0.34	0.34	0.14	0.46	0.46	0.46	0.19	9.02	.	9.2	.
Iron (++)	.	.	.	.	.	.	.	.	.	.	.
Manganese (++)	.	.	.	.	.	.	.	.	.	.	.
Oxidation/Reduction (mV)	156	156	10	159	159	160	176	83	.	79	.
Temperature (degrees C)	16.9	16.9	19.2	18.7	18.7	16.4	18.5	12.7	18.4	14	19.3
Turbidity (NTU)	.	.	.	.	.	.	.	4	.	4	.
pH	6.74	6.74	7.16	6.9	6.9	7.09	6.57	7.66	7.19	7.78	7.3
Miscellaneous Analytes											
Dissolved Solids (mg/L)	1,060	1,700	290	1,350	1,380	1,140	387	.	308	.	315
Suspended Solids (mg/L)	1	2	8	14	14	7	8	.	<	.	<
Major Ions (mg/L)											
Calcium	271	387	70.8	243	238	241	127	.	64.1	.	49.1
Magnesium	31.4	56	16.4	67.1	65.8	69.5	9.89	.	28.3	.	26.6
Potassium	4.95	8.27	3.29	3.79	3.76	3.85	<	.	<	.	2.24
Sodium	8.19	12.5	11.5	25.2	24.8	26.4	14	.	16.5	.	36.9
Bicarbonate	281	232	152	257	262	263	252	.	276	.	218
Carbonate	<	<	<	<	<	<	<	.	<	.	<
Chloride	69.7	19.8	15	22.5	23.4	23.3	13.2	.	9.75	.	34.4
Fluoride	<	<	0.843	<	<	<	<	.	0.202	.	0.591
Nitrate as N	3.96	1.1	0.107	158	157	161	<	.	0.445	.	0.063
Sulfate	391	905	84.6	56.7	57.1	62.2	83.6	.	16.5	.	32.4
Charge balance error (%)	1.8	1.1	1.8	1.6	0.5	0.8	4.1	.	0.5	.	2.1
Trace Metals (mg/L)											
Aluminum	<	<	<	1.03	1.09	0.744	<	.	<	.	<
Antimony	<	<	<	<	<	<	<	.	<	.	<
Barium	0.0267	0.0138	0.0503	0.232	0.228	0.245	0.0449	.	0.121	.	0.114
Beryllium	<	<	<	<	<	<	<	.	<	.	<
Boron	<	0.229	<	<	<	<	<	.	0.13	.	0.154
Cadmium	<	<	<	<	<	<	<	.	<	.	<
Chromium	<	<	<	<	<	<	<	.	<	.	0.0153
Cobalt	<	<	<	<	<	<	<	.	<	.	<
Copper	<	<	<	<	<	<	<	.	<	.	<
Iron	<	<	1.92	0.936	0.951	0.582	0.0692	.	<	.	<
Lead	<	<	0.0006	0.00093	0.00079	0.00063	<	.	<	.	<
Lithium	0.0112	<	<	<	<	<	<	.	0.0184	.	0.0313
Manganese	0.00839	7.53	0.349	0.458	0.455	0.505	0.605	.	<	.	<
Mercury	<	<	0.00038	0.00244	0.00262	0.00109	<	.	<	.	<
Nickel	0.0179	0.0423	0.00731	0.0069	0.0089	0.0142	0.015	.	0.0103	.	0.00622
Strontium	0.367	0.63	0.197	0.687	0.675	0.745	0.169	.	0.731	.	1.17
Thallium	<	<	<	<	<	<	<	.	<	.	<
Uranium	<	0.00083	0.00067	0.00114	0.00113	0.00122	0.00064	.	<	.	<
Zinc	<	<	0.059	<	<	<	<	.	0.0773	.	0.275

APPENDIX E.1: CY 2008 MONITORING DATA FOR THE UPPER EAST FORK POPLAR CREEK HYDROGEOLOGIC REGIME
Field Measurements, Miscellaneous Analytes, Major Ions, and Trace Metals

Sampling Point	GW-722-20		GW-722-22		GW-722-33			GW-733		GW-744	GW-747
Functional Area	EXP-J		EXP-J		EXP-J			EXP-J		GRIDK1	GRIDK2
Date Sampled	02/28/08	07/16/08	02/28/08	07/16/08	02/28/08	07/15/08		01/03/08	07/08/08	08/13/08	08/14/08
Program	BJC	GWPP	BJC	GWPP	BJC	GWPP	GWPP	BJC	BJC	GWPP	GWPP
Sample Type							Dup				
Field Measurements											
Time Sampled	14:00	10:08	13:45	8:53	13:25	11:03	11:03	15:45	10:05	9:10	8:40
Measuring Point Elev. (ft)	953.71	953.71	953.71	953.71	953.71	953.71	953.71	959.84	959.84	907.43	911.06
Depth to Water (ft)	.	56.07	.	56.98	.	50.40	50.40	58.84	60.11	7.99	5.51
Groundwater Elevation (ft)	.	897.64	.	896.73	.	903.31	903.31	901.00	899.73	899.44	905.55
Conductivity (µmho/cm)	313	525	331	519	219	525	525	199	515	505	422
Dissolved Oxygen (ppm)	8.72	.	9.33	.	9.41	.	.	1.51	1.14	0.32	0.17
Iron (++)	.	.	.	.	.	.	.	.	.	.	.
Manganese (++)	.	.	.	.	.	.	.	.	.	.	.
Oxidation/Reduction (mV)	68	.	105	.	139	.	.	71	78	-169	-101
Temperature (degrees C)	11.7	17.5	13.5	16.9	8	17.8	17.8	12.1	21.8	19.9	19.5
Turbidity (NTU)	6	.	4	.	2	.	.	1	1	.	.
pH	7.74	7.18	7.72	7.17	7.55	7.08	7.08	7.83	7.44	7.47	7.31
Miscellaneous Analytes											
Dissolved Solids (mg/L)	.	223	.	260	.	299	234	.	.	343	262
Suspended Solids (mg/L)	.	6	.	2	.	4	3	.	.	<	<
Major Ions (mg/L)											
Calcium	.	53.3	.	57.7	.	85.1	83.2	.	.	53.2	40
Magnesium	.	28	.	27.4	.	16	15.9	.	.	11.8	9.66
Potassium	.	<	.	<	.	2.39	2.36	.	.	3.44	2.22
Sodium	.	15.6	.	13.6	.	3.08	3.05	.	.	37.1	33.8
Bicarbonate	.	240	.	253	.	251	231	.	.	239	207
Carbonate	.	<	.	<	.	<	<	.	.	<	<
Chloride	.	9.17	.	6.64	.	3.3	3.46	.	.	7.96	2.17
Fluoride	.	0.307	.	0.225	.	<	<	.	.	<	0.203
Nitrate as N	.	0.238	.	0.32	.	0.828	0.801	.	.	<	<
Sulfate	.	20.3	.	16.2	.	11.1	11.1	.	.	16.5	12.7
Charge balance error (%)	.	1.2	.	1.0	.	3.2	6.1	.	.	-0.2	-1.8
Trace Metals (mg/L)											
Aluminum	.	<	.	<	.	<	<	.	.	<	<
Antimony	.	<	.	<	.	<	<	.	.	<	<
Barium	.	0.0926	.	0.118	.	0.0409	0.0393	.	.	0.305	0.162
Beryllium	.	<	.	<	.	<	<	.	.	<	<
Boron	.	0.116	.	0.135	.	<	<	.	.	<	<
Cadmium	.	<	.	<	.	<	<	.	.	<	<
Chromium	.	<	.	<	.	0.0133	<	.	.	0.0152	<
Cobalt	.	<	.	<	.	<	<	.	.	<	<
Copper	.	<	.	<	.	<	<	.	.	<	<
Iron	.	0.0653	.	0.0918	.	<	<	.	.	<	0.188
Lead	.	<	.	<	.	<	<	.	.	<	<
Lithium	.	0.0182	.	0.0158	.	<	<	.	.	0.0295	0.0186
Manganese	.	<	.	<	.	<	<	.	.	0.0261	0.0145
Mercury	.	<	.	<	.	<	<	.	.	<	<
Nickel	.	0.00806	.	0.0101	.	0.00996	0.00898	.	.	<	<
Strontium	.	0.656	.	0.686	.	0.0782	0.077	.	.	1.39	0.684
Thallium	.	<	.	<	.	<	<	.	.	<	<
Uranium	.	<	.	<	.	<	<	.	.	<	<
Zinc	.	0.0859	.	0.442	.	0.244	<	.	.	0.263	<

APPENDIX E.1: CY 2008 MONITORING DATA FOR THE UPPER EAST FORK POPLAR CREEK HYDROGEOLOGIC REGIME
Field Measurements, Miscellaneous Analytes, Major Ions, and Trace Metals

Sampling Point	GW-748	GW-762				GW-763	GW-769		GW-770		GW-781
Functional Area	GRIDK2	GRIDJ3				GRIDJ3	GRIDG3		GRIDG3		GRIDE3
Date Sampled	08/14/08	02/27/08		08/13/08		08/18/08	06/04/08	12/03/08	06/04/08	12/09/08	12/18/08
Program	GWPP	BJC	BJC	BJC	BJC	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP
Sample Type			Dup		Dup						
Field Measurements											
Time Sampled	9:55	10:05	.	14:10	.	10:30	10:20	10:30	8:45	8:55	10:10
Measuring Point Elev. (ft)	911.19	915.56	.	915.56	.	915.03	944.43	944.43	944.72	944.72	947.89
Depth to Water (ft)	7.02	13.72	.	14.14	.	9.47	10.89	9.50	13.66	13.98	6.50
Groundwater Elevation (ft)	904.17	901.84	.	901.42	.	905.56	933.54	934.93	931.06	930.74	941.39
Conductivity (µmho/cm)	589	1,426	.	1,182	.	822	519	482	356	391	447
Dissolved Oxygen (ppm)	1.81	2.76	.	0.2	.	0.12	0.34	0.38	3.72	5.41	1.11
Iron (++)	.	.	.	.	.	.	.	.	.	.	.
Manganese (++)	.	.	.	.	.	.	.	.	.	.	.
Oxidation/Reduction (mV)	59	70	.	129	.	-93	26	17	191	185	61
Temperature (degrees C)	21	11.8	.	20.6	.	23	20.4	18	20.9	15.5	13.6
Turbidity (NTU)	.	1	.	1	.	.	.	.	.	.	.
pH	7.14	7.23	.	6.85	.	6.68	7.21	7.14	6.81	7.1	8.56
Miscellaneous Analytes											
Dissolved Solids (mg/L)	381	386	373	361	354	439	296	268	194	186	306
Suspended Solids (mg/L)	<	<	6	<	<	34	<	<	<	<	<
Major Ions (mg/L)											
Calcium	93.3	80.5	92.4	78.1	81.9	108	82.5	81.4	58.6	65.3	8.7
Magnesium	9.53	24.5	28.4	23.9	25.1	14.4	10	10.1	5.38	5.6	3.12
Potassium	3.49	4.32	5.34	6.01	6.47	<	2.72	3.15	2.21	2.78	5.5
Sodium	16.1	11.9	14.2	11.5	12.4	23.6	6.94	6.98	4.65	6.15	86.1
Bicarbonate	210	266	271	246	249	286	215	169	149	161	198
Carbonate	<	<	<	<	<	<	<	<	<	<	<
Chloride	25.9	38.2	38.3	38.8	39.9	76.7	17.3	17	2.8	3.74	6.76
Fluoride	0.1	<	<	<	<	0.25	<	<	0.184	0.216	<
Nitrate as N	0.0313	0.029	0.024	0.045	0.033	<	0.296	0.354	1.01	1.79	0.116
Sulfate	53	13.4	13.1	14.2	13.9	0.272	20.4	21.7	21.1	22	9
Charge balance error (%)	1.6	-0.1	.	1.6	.	-1.9	0.8	9.8	0.7	1.7	2.6
Trace Metals (mg/L)											
Aluminum	<	<	<	<	<	<	<	0.302	<	<	<
Antimony	<	<	<	<	<	<	<	<	<	<	<
Barium	0.162	0.539	0.624	0.515	0.537	0.0627	0.381	0.378	0.0622	0.0732	0.264
Beryllium	<	<	<	<	<	<	<	<	<	<	<
Boron	<	<	<	<	<	<	<	<	<	<	0.577
Cadmium	<	<	<	<	<	<	<	<	<	<	<
Chromium	<	<	<	<	<	<	<	<	<	<	<
Cobalt	<	<	<	<	<	<	<	<	<	<	<
Copper	<	<	<	<	<	<	<	<	<	<	<
Iron	0.103	<	<	<	<	24	0.0553	0.364	0.116	<	<
Lead	<	<	<	<	<	<	<	0.00081	0.00092	<	<
Lithium	<	0.0157	0.0195	0.0217	0.0229	<	0.014	0.0159	<	<	0.0646
Manganese	0.515	0.056	0.0613	0.0409	0.0478	0.53	0.00837	0.015	<	<	<
Mercury	<	.	.	.	.	<	<	<	<	<	<
Nickel	0.0133	<	<	<	<	0.00857	<	<	<	<	<
Strontium	0.257	0.755	0.87	0.715	0.751	0.231	0.379	0.398	0.0858	0.0937	0.508
Thallium	<	<	<	<	<	<	<	<	<	<	<
Uranium	<	<	<	<	<	<	<	<	0.00178	0.00176	<
Zinc	0.35	<	<	<	<	<	<	<	<	<	<

APPENDIX E.1: CY 2008 MONITORING DATA FOR THE UPPER EAST FORK POPLAR CREEK HYDROGEOLOGIC REGIME
Field Measurements, Miscellaneous Analytes, Major Ions, and Trace Metals

Sampling Point	GW-782	GW-783	GW-791	GW-792	GW-802	GW-816	GW-820			GW-832	
Functional Area	GRIDE3	GRIDE3	GRIDD2	GRIDD2	FF	EXP-SR	B9201-2			NHP	
Date Sampled	12/10/08	12/15/08	10/27/08	10/28/08	05/07/08	08/13/08	05/21/08	12/17/08		02/28/08	08/12/08
Program	GWPP	GWPP	GWPP	GWPP	BJC	GWPP	GWPP	GWPP	GWPP	BJC	BJC
Sample Type									Dup		
Field Measurements											
Time Sampled	14:10	13:30	10:50	10:50	15:00	10:35	9:05	14:20	14:20	9:15	9:15
Measuring Point Elev. (ft)	947.73	948.49	992.13	992.74	941.83	898.42	929.57	929.57	929.57	906.18	906.18
Depth to Water (ft)	7.77	10.45	24.61	25.75	7.04	12.83	10.04	9.45	9.45	7.09	7.31
Groundwater Elevation (ft)	939.96	938.04	967.52	966.99	934.79	885.59	919.53	920.12	920.12	899.09	898.87
Conductivity (µmho/cm)	583	498	424	453	677	459	534	531	531	577	410
Dissolved Oxygen (ppm)	0.31	5.17	1.45	1.33	2.57	0.13	0.37	0.72	0.72	5.15	2.6
Iron (++)	.	.	.	.	.	.	.	.	.	.	.
Manganese (++)	.	.	.	.	.	.	.	.	.	.	.
Oxidation/Reduction (mV)	76	74	28	176	98	-76	-22	-59	-59	79	79
Temperature (degrees C)	18	17.4	16.6	15.9	20.85	20	18.3	18.5	18.5	12.1	19.6
Turbidity (NTU)	.	.	.	.	1	.	.	.	.	65	3
pH	7.12	7.26	7.14	5.94	7.04	6.45	7.29	7.34	7.34	6.99	6.51
Miscellaneous Analytes											
Dissolved Solids (mg/L)	323	273	227	219	.	234	284	255	269	276	229
Suspended Solids (mg/L)	<	<	1	7	.	20	3	<	<	52	28
Major Ions (mg/L)											
Calcium	90.6	78	71.2	66.2	.	50.2	65.8	66.6	67.6	70.8	52.7
Magnesium	15.6	4.75	14.7	6.1	.	14.7	11.7	11.2	11.1	12.6	14.1
Potassium	5.3	<	2.07	<	.	4.67	2.3	2.84	2.92	2.21	1.95
Sodium	11.9	16.6	7.43	11.8	.	7.12	19.9	22.3	21.7	6.73	9.25
Bicarbonate	245	163	216	104	.	196	183	168	170	195	133
Carbonate	<	<	<	<	.	<	<	<	<	<	<
Chloride	31.3	35.9	8.75	39.2	.	10.9	31.1	30.3	30.5	9.8	10.8
Fluoride	<	<	<	0.103	.	0.12	0.258	0.241	0.238	<	0.25
Nitrate as N	0.535	1.08	<	3.94	.	<	0.0315	0.029	<	1.1	2
Sulfate	20.5	26.9	11	33.2	.	1.36	38.6	41.3	41.4	19.9	35.5
Charge balance error (%)	1.7	1.0	3.5	1.9	.	-1.4	-1.7	1.9	1.7	2.6	4.7
Trace Metals (mg/L)											
Aluminum	<	<	<	<	.	<	<	<	<	0.201	0.874
Antimony	<	<	<	<	.	<	0.00332	<	<	<	<
Barium	0.535	0.0985	0.263	0.121	.	0.0846	0.187	0.187	0.184	0.0568	0.0535
Beryllium	<	<	<	<	.	<	<	<	<	<	<
Boron	0.107	<	<	<	.	<	<	<	<	<	<
Cadmium	<	<	<	<	.	<	<	<	<	<	<
Chromium	<	0.0206	<	0.0224	.	<	<	<	<	<	<
Cobalt	<	<	<	<	.	<	<	<	<	<	<
Copper	<	<	<	<	.	<	<	<	<	<	<
Iron	<	0.172	<	0.422	.	17.9	0.111	0.444	0.454	0.289	1.22
Lead	<	<	<	<	.	<	<	<	<	<	0.0026
Lithium	0.0182	<	0.0121	0.0108	.	<	<	<	<	0.0112	0.0135
Manganese	0.0227	0.00866	0.0166	0.0203	.	1.21	0.376	0.354	0.36	0.0153	0.0594
Mercury	<	<	<	<	.	<	<	<	<	.	.
Nickel	<	0.152	<	0.0877	.	<	<	<	<	<	<
Strontium	1.14	0.172	0.425	0.116	.	0.0686	0.282	0.281	0.276	0.139	0.131
Thallium	<	<	<	<	.	<	0.00064	<	<	<	<
Uranium	0.00069	0.00098	<	<	.	<	<	<	<	0.0083	0.0046
Zinc	<	<	<	<	.	<	<	<	<	<	<

APPENDIX E.1: CY 2008 MONITORING DATA FOR THE UPPER EAST FORK POPLAR CREEK HYDROGEOLOGIC REGIME
Field Measurements, Miscellaneous Analytes, Major Ions, and Trace Metals

Sampling Point	GW-960		GHK2.51WSW	NPR12.0SW	NPR23.0SW	SCR7.1SP	SCR7.8SP	200A6	
Functional Area	GRIDF2		EXP-SW	EXP-SW	EXP-SW	EXP-SW	EXP-SW	EXP-SW	
Date Sampled	05/15/08	12/18/08	10/13/08	10/13/08	10/13/08	01/21/08	01/21/08	01/28/08	02/04/08
Program	GWPP	GWPP	GWPP	GWPP	GWPP	BJC	BJC	BJC	BJC
Sample Type									
Field Measurements									
Time Sampled	10:15	8:30	9:35	10:50	10:05	9:15	9:30	14:25	13:35
Measuring Point Elev. (ft)	963.26	963.26	.	.	.	.	.	.	.
Depth to Water (ft)	13.08	12.69	.	.	.	.	.	.	.
Groundwater Elevation (ft)	950.18	950.57	.	.	.	.	.	.	.
Conductivity (µmho/cm)	840	779	348	245	293	440	401	324	128
Dissolved Oxygen (ppm)	0.33	0.3	4.7	5.18	4.76	9.15	9.55	6.65	9.49
Iron (++)	.	.	.	.	.	.	.	.	.
Manganese (++)	.	.	.	.	.	.	.	.	.
Oxidation/Reduction (mV)	-33	-48	171	108	240	136.6	98.6	103.2	104.9
Temperature (degrees C)	16	15.2	14.7	16.2	14.9	7.79	6.62	19.4	10.52
Turbidity (NTU)	.	.	.	.	.	1.6	1.23	0.88	56.4
pH	7.11	7.17	7.08	7.38	7.3	7.07	7.75	7.69	7.71
Miscellaneous Analytes									
Dissolved Solids (mg/L)	449	434	203	168	175	321	466	222	123
Suspended Solids (mg/L)	8	2	3	103	<	<	<	<	41
Major Ions (mg/L)									
Calcium	104	93.6	42.9	24.3	35.6	.	.	47.6	19.7
Magnesium	19.1	18.5	14.9	12	11.2	.	.	10.9	3.67
Potassium	3.21	3.75	3.19	4.34	3.27	.	.	2.29	1.48
Sodium	24.5	25	3.13	7.15	4.35	.	.	9.76	3.67
Bicarbonate	253	250	129	111	124	.	.	.	.
Carbonate	<	<	<	<	<	.	.	.	.
Chloride	76.9	41.9	0.759	0.961	0.657	.	.	.	.
Fluoride	<	<	0.1	<	<	.	.	.	.
Nitrate as N	0.0403	<	<	0.0409	<	.	.	.	.
Sulfate	53.7	58.5	42.4	10.3	16.2	.	.	.	.
Charge balance error (%)	-2.7	-0.1	1.4	3.1	2.4	.	.	.	.
Trace Metals (mg/L)									
Aluminum	<	<	<	1.32	<	.	.	<	1.27
Antimony	<	<	<	<	<	.	.	<	<
Barium	0.151	0.125	0.0738	0.123	0.0732	.	.	0.0508	0.0311
Beryllium	<	0.00063	<	<	<	.	.	<	<
Boron	<	<	<	<	<	.	.	0.366	<
Cadmium	<	<	<	<	<	.	.	<	<
Chromium	<	<	<	<	<	.	.	<	<
Cobalt	<	<	<	<	<	.	.	<	<
Copper	<	<	<	<	<	.	.	<	<
Iron	8.29	0.906	0.175	2.74	0.125	.	.	0.0651	1.84
Lead	<	<	<	0.00125	<	.	.	<	0.0031
Lithium	0.0106	0.0143	<	0.0108	0.0108	.	.	0.163	0.0172
Manganese	0.521	0.243	0.019	0.412	0.0244	.	.	0.0425	0.0957
Mercury	<	<	<	<	<	.	.	.	.
Nickel	<	0.00752	<	<	<	.	.	<	<
Strontium	1.77	1.82	0.167	0.113	0.0993	.	.	0.141	0.0434
Thallium	0.00054	<	<	<	<	.	.	<	<
Uranium	<	<	<	<	<	.	.	0.034	0.023
Zinc	<	<	<	<	<	.	.	<	0.116

APPENDIX E.1: CY 2008 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	08/18/08	08/26/08	01/28/08	02/04/08	08/18/08	08/26/08
Program	BJC	BJC	BJC	BJC	BJC	BJC
Sample Type						
Field Measurements						
Time Sampled	10:40	9:20	14:40	13:15	10:25	9:05
Measuring Point Elev. (ft)	.	.	.	.	.	.
Depth to Water (ft)	.	.	.	.	.	.
Groundwater Elevation (ft)	.	.	.	.	.	.
Conductivity (µmho/cm)	450	197	263	138	363	235
Dissolved Oxygen (ppm)	5.81	6.26	8.54	10.1	7.97	6.91
Iron (++)	.	.	.	.	.	.
Manganese (++)	.	.	.	.	.	.
Oxidation/Reduction (mV)	84.3	80.9	102.4	106.8	93.1	85.4
Temperature (degrees C)	25.4	22.9	12.43	10.88	18.26	21.32
Turbidity (NTU)	1.85	16.3	10.1	43	4.25	12.6
pH	7.69	7.55	8.07	7.82	7.95	7.62
Miscellaneous Analytes						
Dissolved Solids (mg/L)	282	134	168	101	210	195
Suspended Solids (mg/L)	<	6	5	42	<	<
Major Ions (mg/L)						
Calcium	52.6	23.5	37.8	18.6	41.9	24.8
Magnesium	15.1	4.57	10.2	4.05	12.6	5.8
Potassium	2.67	1.37	2.38	1.21	2.1	1.48
Sodium	12.9	3.5	7.85	4.01	9.98	4.95
Bicarbonate	.	.	.	.	.	.
Carbonate	.	.	.	.	.	.
Chloride	.	.	.	.	.	.
Fluoride	.	.	.	.	.	.
Nitrate as N	.	.	.	.	.	.
Sulfate	.	.	.	.	.	.
Charge balance error (%)	.	.	.	.	.	.
Trace Metals (mg/L)						
Aluminum	<	0.204	0.231	0.927	<	0.26
Antimony	<	<	<	<	<	<
Barium	0.0547	0.029	0.0386	0.0281	0.0419	0.0292
Beryllium	<	<	<	<	<	<
Boron	<	<	<	<	<	<
Cadmium	<	<	<	<	<	<
Chromium	<	<	<	<	<	<
Cobalt	<	<	<	<	<	<
Copper	<	<	<	<	<	<
Iron	0.133	0.338	0.331	1.57	0.166	0.367
Lead	<	<	<	0.0035	<	<
Lithium	0.0241	0.0333	0.034	0.011	<	0.0258
Manganese	0.0258	0.0504	0.0527	0.131	0.0509	0.0665
Mercury	.	.	.	.	.	.
Nickel	<	<	<	<	<	<
Strontium	0.181	0.061	0.111	0.0424	0.144	0.0746
Thallium	<	<	<	<	<	<
Uranium	0.01	0.013	0.0074	0.012	<	0.006
Zinc	<	0.129	<	0.1	<	0.0826

APPENDIX E.2

VOLATILE ORGANIC COMPOUNDS

APPENDIX E.2: CY 2008 MONITORING DATA FOR THE UPPER EAST FORK POPLAR CREEK HYDROGEOLOGIC REGIME
Volatile Organic Compounds

Sampling Point	55-1A	55-2A	55-2B		55-2C	55-3A	55-3B	55-3C	55-6A	56-1A
Functional Area	GRIDB2	GRIDB3	GRIDB3		GRIDB3	B9201-5	B9201-5	B9201-5	B9103	Y12
Date Sampled	04/14/08	04/17/08	04/16/08		04/16/08	04/21/08	04/21/08	04/21/08	04/21/08	04/24/08
Program	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP
Sample Type				Dup						
Chloroethenes (µg/L)										
Tetrachloroethene	<	230	510	500	370	13,000	50,000	8,800	<	2 J
Trichloroethene	<	110	180	180	150	850	3,800	1,400	<	<
cis-1,2-Dichloroethene	<	300	560	510	550	860	740	1,400	<	<
trans-1,2-Dichloroethene	<	3 J	6	7	7	13	36	22	<	<
1,1-Dichloroethene	<	7	13	13	14	15	120	41	<	<
Vinyl chloride	<	3	12	12	10	25	170	140	<	<
Chloroethanes (µg/L)										
1,1,1,2-Tetrachloroethane	<	<	<	<	<	<	<	<	<	<
1,1,2,2-Tetrachloroethane	<	<	<	<	<	<	<	<	<	<
1,1,1-Trichloroethane	<	<	<	2 J	<	<	<	<	<	<
1,1,2-Trichloroethane	<	<	<	<	<	<	<	<	<	<
1,2-Dichloroethane	<	<	<	<	<	<	<	<	<	<
1,1-Dichloroethane	<	7	10	11	13	3 J	26	6	<	<
Chloroethane	<	<	<	<	<	<	<	<	<	<
Chloromethanes (µg/L)										
Carbon tetrachloride	<	<	<	<	<	<	<	<	<	<
Chloroform	<	<	<	<	<	<	<	<	<	2 J
Methylene chloride	<	<	<	<	<	<	<	<	<	<
Chloromethane	<	<	<	<	<	<	<	<	<	<
Petrol. Hydrocarb. (µg/L)										
Benzene	<	<	<	<	<	<	<	<	<	<
Ethylbenzene	<	<	<	<	<	<	<	<	<	<
Toluene	<	<	<	<	<	<	3 J	<	<	<
Total Xylene	<	<	<	<	<	<	<	<	<	<
Styrene	<	<	<	<	<	<	<	<	<	<
Miscellaneous (µg/L)										
1,1,2-Trichloro-1,2,2-trifluoroethane	<	150	230	180	200	16	<	9	<	<
Trichlorofluoromethane	<	<	<	<	<	<	<	<	<	<
1,4-Dichlorobenzene	<	<	<	<	<	<	<	<	<	<
4-Methyl-2-pentanone	<	<	<	<	<	<	<	<	<	<
Acetone	<	<	<	<	<	<	<	<	<	<
Acetonitrile	<	<	<	<	<	<	<	<	<	<
Bromodichloromethane	<	<	<	<	<	<	<	<	<	<
Bromoform	<	<	<	<	<	<	<	<	<	<
Bromomethane	<	<	<	<	<	<	<	<	<	<
Carbon disulfide	<	<	<	<	<	<	<	<	<	<
Chlorobenzene	<	<	<	<	<	<	<	<	<	<
Natural Attenuation (µg/L)										
Ethane	.	.	.	.	.	.	.	.	.	.
Ethylene	.	.	.	.	.	.	.	.	.	.
Methane	.	.	.	.	.	.	.	.	.	.

APPENDIX E.2: CY 2008 MONITORING DATA FOR THE UPPER EAST FORK POPLAR CREEK HYDROGEOLOGIC REGIME
Volatile Organic Compounds

Sampling Point	56-1C	56-2A	56-2B	56-2C	56-3A	56-3B	56-3C	56-4A	56-6A
Functional Area	Y12	GRIDC3	GRIDC3	GRIDC3	Y12	Y12	Y12	Y12	Y12
Date Sampled	04/28/08	04/23/08	04/23/08	04/23/08	05/01/08	05/01/08	05/01/08	04/30/08	04/29/08
Program	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP
Sample Type						Dup			
Chloroethenes (µg/L)									
Tetrachloroethene	2 J	5	1,300	350	46	24 Q	25 Q	220 Q	2 J
Trichloroethene	<	<	43	340	3 J	< Q	2 Q	13 Q	<
cis-1,2-Dichloroethene	<	<	64	900	6	1 Q	2 Q	26 Q	<
trans-1,2-Dichloroethene	<	<	<	9	<	<	<	<	<
1,1-Dichloroethene	<	<	<	17	<	<	<	<	<
Vinyl chloride	<	<	<	59	<	<	<	<	<
Chloroethanes (µg/L)									
1,1,1,2-Tetrachloroethane	<	<	<	<	<	<	<	<	<
1,1,2,2-Tetrachloroethane	<	<	<	<	<	<	<	<	<
1,1,1-Trichloroethane	<	<	<	<	<	<	<	<	<
1,1,2-Trichloroethane	<	<	<	<	<	<	<	<	<
1,2-Dichloroethane	<	<	<	<	<	<	<	<	<
1,1-Dichloroethane	<	<	<	<	<	<	<	<	<
Chloroethane	<	<	<	<	<	<	<	<	<
Chloromethanes (µg/L)									
Carbon tetrachloride	<	<	<	<	<	<	<	<	<
Chloroform	<	<	<	<	5 Q	17 Q	17 Q	10	<
Methylene chloride	<	<	<	<	<	<	<	<	<
Chloromethane	<	<	<	<	<	<	<	<	<
Petrol. Hydrocarb. (µg/L)									
Benzene	<	<	<	<	<	<	<	<	<
Ethylbenzene	<	<	<	<	<	<	<	<	<
Toluene	<	<	<	<	<	<	<	<	<
Total Xylene	<	<	<	<	<	<	<	<	<
Styrene	<	<	<	<	<	<	<	<	<
Miscellaneous (µg/L)									
1,1,2-Trichloro-1,2,2-trifluoroethane	<	<	<	<	<	<	<	<	<
Trichlorofluoromethane	<	<	<	<	<	<	<	<	<
1,4-Dichlorobenzene	<	<	<	<	<	<	<	<	<
4-Methyl-2-pentanone	<	<	<	<	<	<	<	<	<
Acetone	<	<	<	<	<	<	<	<	<
Acetonitrile	<	<	<	<	<	<	<	<	<
Bromodichloromethane	<	<	<	<	<	1 J	1 J	<	<
Bromoform	<	<	<	<	<	<	<	<	<
Bromomethane	<	<	<	<	<	<	<	<	<
Carbon disulfide	<	<	<	<	<	<	<	<	<
Chlorobenzene	<	<	<	<	<	<	<	<	<
Natural Attenuation (µg/L)									
Ethane	.	.	.	.	.	.	.	.	.
Ethylene	.	.	.	.	.	.	.	.	.
Methane	.	.	.	.	.	.	.	.	.

APPENDIX E.2: CY 2008 MONITORING DATA FOR THE UPPER EAST FORK POPLAR CREEK HYDROGEOLOGIC REGIME
Volatile Organic Compounds

Sampling Point	60-1A	GW-105	GW-106		GW-108		GW-109		GW-148	GW-151	
Functional Area	Y12	S3	S3		S3		S3		NHP	NHP	
Date Sampled	12/15/08	05/14/08	05/14/08		01/07/08	07/08/08	06/10/08	11/25/08	08/19/08	02/26/08	08/11/08
Program	GWPP	GWPP	GWPP	GWPP	BJC	BJC	GWPP	GWPP	GWPP	BJC	BJC
Sample Type				Dup							
Chloroethenes (µg/L)											
Tetrachloroethene	<	<	<	<	6	5 J	110	90	<	670	850
Trichloroethene	<	<	<	<	5	3 J	2 J	3 J	<	87	160
cis-1,2-Dichloroethene	<	<	<	<	0.6 J	<	<	<	81 Q	64 J	67 J
trans-1,2-Dichloroethene	<	<	<	<	<	<	<	<	<	0.6 J	0.7 J
1,1-Dichloroethene	<	<	<	<	2 J	<	<	<	<	2 J	2 J
Vinyl chloride	<	<	<	<	<	<	<	<	3 Q	0.4 J	0.6 J
Chloroethanes (µg/L)											
1,1,1,2-Tetrachloroethane	<	<	<	<	.	.	<	<	<	.	.
1,1,2,2-Tetrachloroethane	<	<	<	<	0.1 J	<	<	<	<	<	<
1,1,1-Trichloroethane	<	<	<	<	<	<	<	<	<	0.2 J	0.2 J
1,1,2-Trichloroethane	<	<	<	<	0.8 J	<	<	<	<	<	<
1,2-Dichloroethane	<	<	<	<	0.8 J	<	<	<	<	<	<
1,1-Dichloroethane	<	<	<	<	<	<	<	<	<	0.7 J	0.7 J
Chloroethane	<	<	<	<	<	<	<	<	<	<	<
Chloromethanes (µg/L)											
Carbon tetrachloride	<	<	<	<	<	<	<	<	<	990	1,300
Chloroform	<	<	<	<	34	35	8	3 J	<	62	72 J
Methylene chloride	<	<	<	<	52	50	13	14	<	<	<
Chloromethane	<	<	<	<	0.7 J	4 J	<	<	<	<	<
Petrol. Hydrocarb. (µg/L)											
Benzene	<	<	<	<	1 J	<	<	<	<	<	<
Ethylbenzene	<	<	<	<	<	<	<	<	<	<	<
Toluene	<	<	<	<	0.3 J	<	<	<	<	<	<
Total Xylene	<	<	<	<	<	<	<	<	<	<	<
Styrene	<	<	<	<	<	<	<	<	<	<	<
Miscellaneous (µg/L)											
1,1,2-Trichloro-1,2,2-trifluoroethane	<	<	<	<	.	.	2 J	3 J	<	.	.
Trichlorofluoromethane	<	<	<	<	.	.	<	<	<	.	.
1,4-Dichlorobenzene	<	<	<	<	.	.	<	<	<	.	.
4-Methyl-2-pentanone	<	<	<	<	<	<	<	<	<	<	<
Acetone	<	<	<	<	20	6 J	<	<	<	<	<
Acetonitrile	<	<	<	<	.	.	<	35	<	.	.
Bromodichloromethane	<	<	<	<	0.2 J	<	<	<	<	<	<
Bromoform	<	<	<	<	7	5	2 J	<	<	<	<
Bromomethane	<	<	<	<	2 J	<	<	<	<	<	<
Carbon disulfide	<	<	<	<	0.7 J	<	<	2 J	<	1 J	2 J
Chlorobenzene	<	<	<	<	<	<	<	<	<	<	<
Natural Attenuation (µg/L)											
Ethane	.	.	.	.	.	.	.	.	.	<	<
Ethylene	.	.	.	.	.	.	.	.	.	<	<
Methane	.	.	.	.	.	.	.	.	.	55	130

APPENDIX E.2: CY 2008 MONITORING DATA FOR THE UPPER EAST FORK POPLAR CREEK HYDROGEOLOGIC REGIME
Volatile Organic Compounds

Sampling Point	GW-153	GW-154		GW-169	GW-170				GW-171	GW-172
Functional Area	NHP	NHP		EXP-UV	EXP-UV				EXP-UV	EXP-UV
Date Sampled	08/20/08	02/27/08	08/11/08	02/26/08	02/26/08		08/13/08		02/27/08	02/27/08
Program	GWPP	BJC	BJC	BJC	BJC	BJC	BJC	BJC	BJC	BJC
Sample Type						Dup		Dup		
Chloroethenes (µg/L)										
Tetrachloroethene	3 J	<	<	1 J	1 J	1 J	1 J	1 J	<	<
Trichloroethene	1 J	<	<	0.1 J	1 J	1 J	2 J	2 J	<	<
cis-1,2-Dichloroethene	<	0.2 J	0.1 J	<	<	<	<	<	<	<
trans-1,2-Dichloroethene	<	<	<	<	<	<	<	<	<	<
1,1-Dichloroethene	<	<	<	<	<	<	<	<	<	<
Vinyl chloride	<	<	<	<	<	<	<	<	<	<
Chloroethanes (µg/L)										
1,1,1,2-Tetrachloroethane	<	.	.	.	.	.	.	.	.	.
1,1,2,2-Tetrachloroethane	<	<	<	<	<	<	<	<	<	<
1,1,1-Trichloroethane	<	<	<	<	<	<	<	<	<	<
1,1,2-Trichloroethane	<	<	<	<	<	<	<	<	<	<
1,2-Dichloroethane	<	<	<	<	<	<	<	<	<	<
1,1-Dichloroethane	<	<	<	<	<	<	<	<	<	<
Chloroethane	<	<	<	<	<	<	<	<	<	<
Chloromethanes (µg/L)										
Carbon tetrachloride	94	<	<	<	3	3	2	2 J	<	<
Chloroform	5 J	<	<	<	2 J	2 J	1 J	1 J	<	<
Methylene chloride	<	<	<	<	<	<	<	<	<	<
Chloromethane	<	<	<	<	<	<	<	<	<	<
Petrol. Hydrocarb. (µg/L)										
Benzene	<	<	<	<	1 J	1 J	1 J	1 J	<	<
Ethylbenzene	<	<	<	<	<	<	<	<	<	<
Toluene	<	<	<	<	0.2 J	0.2 J	0.2 J	0.2 J	<	<
Total Xylene	<	<	<	<	0.2 J	0.1 J	0.1 J	<	<	<
Styrene	<	<	<	<	<	<	<	<	<	<
Miscellaneous (µg/L)										
1,1,2-Trichloro-1,2,2-trifluoroethane	<	.	.	.	.	.	.	.	.	.
Trichlorofluoromethane	<	.	.	.	.	.	.	.	.	.
1,4-Dichlorobenzene	<	.	.	.	.	.	.	.	.	.
4-Methyl-2-pentanone	<	<	<	<	<	<	<	<	<	<
Acetone	<	<	<	<	<	<	<	<	<	<
Acetonitrile	<	.	.	.	.	.	.	.	.	.
Bromodichloromethane	<	<	<	<	<	<	<	<	<	<
Bromoform	<	<	<	<	<	<	<	<	<	<
Bromomethane	<	<	<	<	<	<	<	<	<	<
Carbon disulfide	<	<	<	<	3 J	<	<	<	<	<
Chlorobenzene	<	<	<	<	<	<	<	<	<	<
Natural Attenuation (µg/L)										
Ethane	.	1.5 J	<	.	.	.	.	.	.	.
Ethylene	.	<	<	.	.	.	.	.	.	.
Methane	.	59	30	.	.	.	.	.	.	.

APPENDIX E.2: CY 2008 MONITORING DATA FOR THE UPPER EAST FORK POPLAR CREEK HYDROGEOLOGIC REGIME
Volatile Organic Compounds

Sampling Point	GW-190	GW-192	GW-204	GW-220					GW-223	
Functional Area	B4	B4	T0134	NHP					NHP	
Date Sampled	05/07/08	05/05/08	10/27/08	03/24/08	06/10/08	08/19/08		12/02/08	02/27/08	08/13/08
Program	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP		GWPP	BJC	BJC
Sample Type							Dup			
Chloroethenes (µg/L)										
Tetrachloroethene	<	1 J	<	620	390	480	490	530	28	100
Trichloroethene	<	3 J	<	120	90	110	100	130	15	39
cis-1,2-Dichloroethene	<	22	<	58	49	67	59	70	68	82
trans-1,2-Dichloroethene	<	<	<	<	<	<	<	<	0.3 J	0.5 J
1,1-Dichloroethene	<	<	<	1 J	<	1 J	1 J	2 J	0.4 J	0.8 J
Vinyl chloride	<	<	<	<	<	<	<	<	5	7
Chloroethanes (µg/L)										
1,1,1,2-Tetrachloroethane	<	<	<	<	<	<	<	<	.	.
1,1,2,2-Tetrachloroethane	<	<	<	<	<	<	<	<	<	<
1,1,1-Trichloroethane	<	<	<	<	<	<	<	<	<	<
1,1,2-Trichloroethane	<	<	<	<	<	<	<	<	<	<
1,2-Dichloroethane	<	<	<	<	<	<	<	<	<	<
1,1-Dichloroethane	<	<	<	<	<	<	<	<	<	<
Chloroethane	<	<	<	<	<	<	<	<	<	<
Chloromethanes (µg/L)										
Carbon tetrachloride	<	<	<	1,400	640	950	920	870	<	0.5 J
Chloroform	2 J	<	<	75	60	77	70	87	<	0.6 J
Methylene chloride	<	<	<	<	<	<	<	<	<	<
Chloromethane	<	<	<	<	<	<	<	<	<	<
Petrol. Hydrocarb. (µg/L)										
Benzene	<	<	<	<	<	<	<	<	<	<
Ethylbenzene	<	<	<	<	<	<	<	<	<	<
Toluene	<	<	<	<	<	<	<	<	<	<
Total Xylene	<	<	<	<	<	<	<	<	<	<
Styrene	<	<	<	<	<	<	<	<	<	<
Miscellaneous (µg/L)										
1,1,2-Trichloro-1,2,2-trifluoroethane	<	<	<	<	<	<	<	2 J	.	.
Trichlorofluoromethane	<	<	<	<	<	1 J	1 J	2 J	.	.
1,4-Dichlorobenzene	<	<	<	<	<	<	<	<	.	.
4-Methyl-2-pentanone	<	<	<	<	<	<	<	<	<	<
Acetone	<	<	<	<	<	<	<	<	<	<
Acetonitrile	<	<	<	<	<	<	<	<	.	.
Bromodichloromethane	<	<	<	<	<	<	<	<	<	<
Bromoform	<	<	<	<	<	<	<	<	<	<
Bromomethane	<	<	<	<	<	<	<	<	<	<
Carbon disulfide	<	<	<	<	<	<	<	<	<	<
Chlorobenzene	<	<	<	<	<	<	<	<	<	<
Natural Attenuation (µg/L)										
Ethane	.	.	.	.	.	.	.	.	<	<
Ethylene	.	.	.	.	.	.	.	.	<	<
Methane	.	.	.	.	.	.	.	.	59	80

APPENDIX E.2: CY 2008 MONITORING DATA FOR THE UPPER EAST FORK POPLAR CREEK HYDROGEOLOGIC REGIME
Volatile Organic Compounds

Sampling Point	GW-230	GW-240	GW-251	GW-253	GW-265	GW-269	GW-274	GW-275	GW-281	GW-332
Functional Area	EXP-UV	NHP	S2	S2	SY	SY	SY	SY	FF	WC
Date Sampled	02/27/08	08/19/08	05/15/08	02/26/08	05/07/08	05/12/08	05/08/08	05/08/08	05/08/08	05/12/08
Program	BJC	GWPP	GWPP	BJC	GWPP	GWPP	GWPP	GWPP	BJC	GWPP
Sample Type										
Chloroethenes (µg/L)										
Tetrachloroethene	<	1 J	280	940	27	22	1,700	<	<	1,100
Trichloroethene	<	<	110	830	2 J	3 J	10	<	<	200
cis-1,2-Dichloroethene	6	<	12	310	<	44	27	<	<	1,000
trans-1,2-Dichloroethene	<	<	<	2 J	<	<	<	<	<	13
1,1-Dichloroethene	<	<	<	6	<	120	<	<	<	30
Vinyl chloride	2	<	<	110	<	<	<	<	<	16
Chloroethanes (µg/L)										
1,1,1,2-Tetrachloroethane	.	<	<	.	<	<	2 J	<	.	<
1,1,2,2-Tetrachloroethane	<	<	<	<	<	<	<	<	<	<
1,1,1-Trichloroethane	<	<	<	<	<	8	<	<	<	7
1,1,2-Trichloroethane	<	<	<	<	<	<	<	<	<	<
1,2-Dichloroethane	<	<	<	<	<	<	<	<	<	<
1,1-Dichloroethane	0.2 J	<	<	<	<	3 J	<	<	<	29
Chloroethane	0.3 J	<	<	<	<	<	<	<	<	<
Chloromethanes (µg/L)										
Carbon tetrachloride	<	5	<	36 J	<	<	<	<	<	<
Chloroform	<	<	10	50 J	1 J	2 J	15	<	<	<
Methylene chloride	<	<	<	<	<	<	26	<	<	<
Chloromethane	<	<	<	<	<	<	<	<	<	<
Petrol. Hydrocarb. (µg/L)										
Benzene	0.3 J	<	<	0.5 J	<	<	160	<	<	<
Ethylbenzene	<	<	<	<	<	<	<	<	<	<
Toluene	0.2 J	<	<	1 J	<	<	<	<	<	<
Total Xylene	<	<	<	0.8 J	<	<	<	<	<	<
Styrene	<	<	<	<	<	<	<	<	<	<
Miscellaneous (µg/L)										
1,1,2-Trichloro-1,2,2-trifluoroethane	.	<	<	.	<	28	<	<	.	4,600
Trichlorofluoromethane	.	<	<	.	<	<	<	<	.	<
1,4-Dichlorobenzene	.	<	<	.	<	<	<	<	.	<
4-Methyl-2-pentanone	<	<	<	<	<	<	<	<	<	<
Acetone	<	<	<	<	<	<	<	<	<	<
Acetonitrile	.	<	<	.	<	<	<	<	.	<
Bromodichloromethane	<	<	<	1 J	<	<	<	<	<	<
Bromoform	<	<	<	<	<	<	9	<	<	<
Bromomethane	<	<	<	<	<	<	<	<	<	<
Carbon disulfide	<	<	<	0.5 J	<	<	<	<	<	<
Chlorobenzene	1 J	<	<	0.5 J	<	<	<	<	<	<
Natural Attenuation (µg/L)										
Ethane	.	.	.	1.8 J	.	.	.	.	.	.
Ethylene	.	.	.	<	.	.	.	.	.	.
Methane	.	.	.	10	.	.	.	.	.	.

APPENDIX E.2: CY 2008 MONITORING DATA FOR THE UPPER EAST FORK POPLAR CREEK HYDROGEOLOGIC REGIME
Volatile Organic Compounds

Sampling Point	GW-336	GW-337	GW-380		GW-381	GW-382		GW-383	GW-508	
Functional Area	WC	WC	NHP		NHP	NHP		NHP	RG	
Date Sampled	05/13/08	05/13/08	02/28/08	08/12/08	08/21/08	02/28/08	08/13/08	08/18/08	05/13/08	12/22/08
Program	GWPP	GWPP	BJC	BJC	GWPP	BJC	BJC	GWPP	GWPP	GWPP
Sample Type										
Chloroethenes (µg/L)										
Tetrachloroethene	250	480	0.5 J	0.6 J	<	14 J	17 J	400	<	1 J
Trichloroethene	210	350	0.1 J	<	<	3 J	3 J	160	<	<
cis-1,2-Dichloroethene	990	1,300	<	<	2 J	7 J	6 J	240	<	<
trans-1,2-Dichloroethene	11	16	<	<	<	<	<	2 J	<	<
1,1-Dichloroethene	60	52	<	<	<	<	<	4 J	<	<
Vinyl chloride	23	16	<	<	<	<	<	4	<	<
Chloroethanes (µg/L)										
1,1,1,2-Tetrachloroethane	<	<	.	.	<	.	.	<	<	<
1,1,2,2-Tetrachloroethane	<	<	<	<	<	<	<	<	<	<
1,1,1-Trichloroethane	15	47	<	<	<	<	<	<	<	<
1,1,2-Trichloroethane	<	<	<	<	<	<	<	<	<	<
1,2-Dichloroethane	<	<	<	<	<	<	<	<	<	<
1,1-Dichloroethane	34	43	<	<	<	<	<	<	<	<
Chloroethane	<	<	<	<	<	<	<	<	<	<
Chloromethanes (µg/L)										
Carbon tetrachloride	2 J	<	0.3 J	0.2 J	2 J	350	370	<	<	<
Chloroform	<	<	0.7 J	0.5 J	<	120	120	<	<	<
Methylene chloride	<	<	<	<	<	8 J	10 J	<	<	<
Chloromethane	<	<	<	<	<	<	<	<	<	<
Petrol. Hydrocarb. (µg/L)										
Benzene	<	<	<	<	<	<	<	<	410	240
Ethylbenzene	<	<	<	<	<	<	<	<	470	320
Toluene	<	<	<	<	<	<	<	<	1,200	460
Total Xylene	<	<	<	<	<	<	<	<	2,300	2,300
Styrene	<	<	<	<	<	<	<	<	7	5
Miscellaneous (µg/L)										
1,1,2-Trichloro-1,2,2-trifluoroethane	1,100	630	.	.	<	.	.	<	<	<
Trichlorofluoromethane	<	<	.	.	<	.	.	<	<	<
1,4-Dichlorobenzene	<	<	.	.	<	.	.	<	<	<
4-Methyl-2-pentanone	<	<	<	<	<	<	<	<	<	10
Acetone	<	<	<	<	<	<	<	<	9	57
Acetonitrile	<	<	.	.	<	.	.	<	<	<
Bromodichloromethane	<	<	<	<	<	<	<	<	<	<
Bromoform	<	<	<	<	<	<	<	<	<	<
Bromomethane	<	<	<	<	<	<	<	<	<	<
Carbon disulfide	<	<	<	<	<	<	<	<	<	<
Chlorobenzene	<	<	<	<	<	<	<	<	<	<
Natural Attenuation (µg/L)										
Ethane	.	.	<	<	.	<	<	.	.	.
Ethylene	.	.	<	<	.	<	<	.	.	.
Methane	.	.	<	<	.	450	590	.	.	.

APPENDIX E.2: CY 2008 MONITORING DATA FOR THE UPPER EAST FORK POPLAR CREEK HYDROGEOLOGIC REGIME
Volatile Organic Compounds

Sampling Point	GW-605				GW-606		GW-617	GW-618	GW-619	
Functional Area	EXP-I				EXP-I		EXP-E	EXP-E	FTF	
Date Sampled	01/07/08		07/08/08		01/07/08	07/08/08	10/20/08	03/04/08	12/01/08	
Program	BJC	BJC	BJC	BJC	BJC	BJC	GWPP	BJC	GWPP	GWPP
Sample Type		Dup		Dup						Dup
Chloroethenes (µg/L)										
Tetrachloroethene	66	63	91	98	5	5 J	<	7	35	36
Trichloroethene	61	58	96	99	0.2 J	<	<	8	9	10
cis-1,2-Dichloroethene	88	84	160	170	0.1 J	<	<	10	7	9
trans-1,2-Dichloroethene	1 J	1 J	<	1 J	<	<	<	0.2 J	<	<
1,1-Dichloroethene	0.9 J	1 J	<	<	<	<	<	<	1 J	<
Vinyl chloride	1	2	<	<	<	<	<	0.4 J	<	<
Chloroethanes (µg/L)										
1,1,1,2-Tetrachloroethane	.	.	.	.	.	.	<	.	<	<
1,1,2,2-Tetrachloroethane	<	<	<	<	<	<	<	<	<	<
1,1,1-Trichloroethane	<	<	<	<	<	<	<	<	<	<
1,1,2-Trichloroethane	<	<	<	<	<	<	<	<	<	<
1,2-Dichloroethane	<	<	<	<	<	<	<	<	<	<
1,1-Dichloroethane	0.4 J	0.4 J	<	<	<	<	<	<	<	<
Chloroethane	<	<	<	<	<	<	<	<	<	<
Chloromethanes (µg/L)										
Carbon tetrachloride	66	60	80	82	47	45	<	<	<	<
Chloroform	16	19	17	18	47	55	<	<	<	<
Methylene chloride	<	<	<	<	<	<	<	<	<	<
Chloromethane	<	<	<	<	<	<	<	<	<	<
Petrol. Hydrocarb. (µg/L)										
Benzene	<	<	<	<	0.4 J	<	<	<	<	<
Ethylbenzene	<	<	<	<	<	<	<	<	<	<
Toluene	<	<	<	<	<	<	<	<	<	<
Total Xylene	<	<	<	<	<	<	<	<	<	<
Styrene	<	<	<	<	<	<	<	<	<	<
Miscellaneous (µg/L)										
1,1,2-Trichloro-1,2,2-trifluoroethane	.	.	.	.	.	.	<	.	<	<
Trichlorofluoromethane	.	.	.	.	.	.	<	.	<	<
1,4-Dichlorobenzene	.	.	.	.	.	.	<	.	<	<
4-Methyl-2-pentanone	<	<	<	<	<	<	<	<	<	<
Acetone	<	<	<	<	<	<	<	<	<	<
Acetonitrile	.	.	.	.	.	.	<	.	<	<
Bromodichloromethane	<	<	<	<	<	<	<	<	<	<
Bromoform	<	<	<	<	<	<	<	<	<	<
Bromomethane	<	<	<	<	<	<	<	<	<	<
Carbon disulfide	<	<	<	<	<	<	<	<	<	<
Chlorobenzene	<	<	<	<	<	<	<	<	<	<
Natural Attenuation (µg/L)										
Ethane	.	.	.	.	.	.	.	<	.	.
Ethylene	.	.	.	.	.	.	.	<	.	.
Methane	.	.	.	.	.	.	.	39	.	.

APPENDIX E.2: CY 2008 MONITORING DATA FOR THE UPPER EAST FORK POPLAR CREEK HYDROGEOLOGIC REGIME
Volatile Organic Compounds

Sampling Point	GW-620	GW-633	GW-656	GW-658	GW-686	GW-690	GW-691	GW-692	GW-698		
Functional Area	FTF	RG	T0134	FF	CPT	CPT	CPT	CPT	B8110		
Date Sampled	12/10/08	06/11/08	10/28/08	05/06/08	10/22/08	10/23/08	10/23/08	10/21/08	06/24/08	11/25/08	
Program	GWPP	GWPP	GWPP	BJC	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP
Sample Type										Dup	
Chloroethenes (µg/L)											
Tetrachloroethene	3 J	280	33	<	<	81	1,300	6	180	170	200
Trichloroethene	<	6	2,000	<	<	4 J	8	3 J	620	680	770
cis-1,2-Dichloroethene	<	11	170	<	34	6	11	11	93	89	120
trans-1,2-Dichloroethene	<	<	23	<	<	<	<	<	1 J	1 J	2 J
1,1-Dichloroethene	<	1 J	200	<	<	<	<	<	<	<	<
Vinyl chloride	<	<	6	<	2 J	<	<	<	<	<	<
Chloroethanes (µg/L)											
1,1,1,2-Tetrachloroethane	<	<	<	.	<	<	<	<	<	<	<
1,1,2,2-Tetrachloroethane	<	<	<	<	<	<	<	<	<	<	<
1,1,1-Trichloroethane	<	<	<	<	<	<	<	<	<	<	<
1,1,2-Trichloroethane	<	<	<	72 J	<	<	<	<	<	<	<
1,2-Dichloroethane	<	<	<	470	<	<	<	<	<	<	<
1,1-Dichloroethane	<	<	13	<	<	<	<	<	<	<	<
Chloroethane	<	<	<	<	<	<	<	<	<	<	<
Chloromethanes (µg/L)											
Carbon tetrachloride	<	<	<	<	<	<	<	<	7	8	7
Chloroform	<	12	<	<	<	<	<	8	21	20	16
Methylene chloride	<	16	<	<	<	<	<	<	<	<	<
Chloromethane	<	<	<	<	<	<	<	<	<	<	<
Petrol. Hydrocarb. (µg/L)											
Benzene	<	1,800	<	7,700	<	<	<	<	<	<	<
Ethylbenzene	<	1 J	<	1,000	<	<	<	<	<	<	<
Toluene	<	<	<	3,100	<	<	<	<	<	<	<
Total Xylene	<	51	<	8,300	<	<	<	<	<	<	<
Styrene	<	<	<	<	<	<	<	<	<	<	<
Miscellaneous (µg/L)											
1,1,2-Trichloro-1,2,2-trifluoroethane	<	<	<	.	<	<	<	<	44	46	75
Trichlorofluoromethane	<	<	<	.	<	<	<	<	<	<	<
1,4-Dichlorobenzene	<	<	<	.	<	<	<	<	<	<	<
4-Methyl-2-pentanone	<	<	<	<	<	<	<	<	<	<	<
Acetone	<	<	<	17	<	<	<	<	<	<	<
Acetonitrile	<	<	<	.	<	<	<	<	<	<	<
Bromodichloromethane	<	<	<	<	<	<	<	<	<	<	<
Bromoform	<	2 J	<	<	<	<	<	<	<	<	<
Bromomethane	<	<	<	<	<	<	<	<	<	<	<
Carbon disulfide	<	<	<	<	<	<	<	<	<	<	<
Chlorobenzene	<	<	<	<	<	<	<	<	<	<	<
Natural Attenuation (µg/L)											
Ethane	.	.	.	.	.	.	.	.	.	.	.
Ethylene	.	.	.	.	.	.	.	.	.	.	.
Methane	.	.	.	.	.	.	.	.	.	.	.

APPENDIX E.2: CY 2008 MONITORING DATA FOR THE UPPER EAST FORK POPLAR CREEK HYDROGEOLOGIC REGIME
Volatile Organic Compounds

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	10/20/08	02/28/08	07/28/08	02/28/08	07/28/08	02/28/08	07/16/08	02/28/08	07/16/08
Program	GWPP	BJC	GWPP	BJC	GWPP	BJC	GWPP	BJC	GWPP
Sample Type									
Chloroethenes (µg/L)									
Tetrachloroethene	82	3	3 J	6	6	8	11	5	6
Trichloroethene	16	1 J	<	2	1 J	2	2 J	2	2 J
cis-1,2-Dichloroethene	54	0.2 J	<	0.4 J	<	0.7 J	<	0.3 J	<
trans-1,2-Dichloroethene	<	<	<	<	<	<	<	<	<
1,1-Dichloroethene	<	<	<	<	<	<	<	<	<
Vinyl chloride	<	<	<	<	<	<	<	<	<
Chloroethanes (µg/L)									
1,1,1,2-Tetrachloroethane	<	.	<	.	<	.	<	.	<
1,1,2,2-Tetrachloroethane	<	<	<	<	<	<	<	<	<
1,1,1-Trichloroethane	<	<	<	<	<	<	<	<	<
1,1,2-Trichloroethane	<	<	<	<	<	<	<	<	<
1,2-Dichloroethane	<	<	<	<	<	<	<	<	<
1,1-Dichloroethane	1 J	<	<	<	<	<	<	<	<
Chloroethane	<	<	<	<	<	<	<	<	<
Chloromethanes (µg/L)									
Carbon tetrachloride	<	29	23	28	58	49	64	22	30
Chloroform	<	4 J	2 J	9	9	14	11	3 J	2 J
Methylene chloride	<	<	<	<	<	<	<	<	<
Chloromethane	<	<	<	<	<	<	<	<	<
Petrol. Hydrocarb. (µg/L)									
Benzene	<	<	<	<	<	<	<	<	<
Ethylbenzene	<	0.1 J	<	<	<	0.2 J	<	0.2 J	<
Toluene	<	<	<	<	<	<	<	0.1 J	<
Total Xylene	<	<	<	<	<	<	<	<	<
Styrene	<	<	<	<	<	0.1 J	<	<	<
Miscellaneous (µg/L)									
1,1,2-Trichloro-1,2,2-trifluoroethane	4 J	.	<	.	<	.	<	.	<
Trichlorofluoromethane	<	.	<	.	<	.	<	.	<
1,4-Dichlorobenzene	<	.	<	.	<	.	<	.	<
4-Methyl-2-pentanone	<	<	<	<	<	<	<	<	<
Acetone	<	8 J	<	<	<	10	<	<	<
Acetonitrile	<	.	<	.	<	.	<	.	<
Bromodichloromethane	<	<	<	<	<	<	<	<	<
Bromoform	<	<	<	<	<	<	<	<	<
Bromomethane	<	<	<	<	<	<	<	<	<
Carbon disulfide	<	<	<	<	<	<	<	<	<
Chlorobenzene	<	<	<	<	<	<	<	<	<
Natural Attenuation (µg/L)									
Ethane	.	.	.	.	.	.	.	.	.
Ethylene	.	.	.	.	.	.	.	.	.
Methane	.	.	.	.	.	.	.	.	.

APPENDIX E.2: CY 2008 MONITORING DATA FOR THE UPPER EAST FORK POPLAR CREEK HYDROGEOLOGIC REGIME
Volatile Organic Compounds

Sampling Point	GW-722-33			GW-733		GW-744	GW-747	GW-748	GW-762	
Functional Area	EXP-J			EXP-J		GRIDK1	GRIDK2	GRIDK2	GRIDJ3	
Date Sampled	02/28/08	07/15/08		01/03/08	07/08/08	08/13/08	08/14/08	08/14/08	02/27/08	
Program	BJC	GWPP	GWPP	BJC	BJC	GWPP	GWPP	GWPP	BJC	BJC
Sample Type			Dup							Dup
Chloroethenes (µg/L)										
Tetrachloroethene	<	<	<	0.3 J	0.2 J	<	<	<	2,600	2,600
Trichloroethene	0.3 J	<	<	0.2 J	0.1 J	<	<	<	170 J	160 J
cis-1,2-Dichloroethene	<	<	<	<	<	<	<	<	54 J	64 J
trans-1,2-Dichloroethene	<	<	<	<	<	<	<	<	3 J	3 J
1,1-Dichloroethene	<	<	<	<	<	<	<	<	48 J	54 J
Vinyl chloride	<	<	<	<	<	<	<	<	6	6
Chloroethanes (µg/L)										
1,1,1,2-Tetrachloroethane	.	<	<	.	.	<	<	<	.	.
1,1,2,2-Tetrachloroethane	<	<	<	<	<	<	<	<	<	<
1,1,1-Trichloroethane	<	<	<	<	<	<	<	<	2 J	2 J
1,1,2-Trichloroethane	<	<	<	<	<	<	<	<	<	<
1,2-Dichloroethane	<	<	<	<	<	<	<	<	<	<
1,1-Dichloroethane	<	<	<	<	<	<	<	<	17	16
Chloroethane	<	<	<	<	<	<	<	<	<	<
Chloromethanes (µg/L)										
Carbon tetrachloride	<	<	<	12	4	<	<	<	0.3 J	0.3 J
Chloroform	0.6 J	1 J	<	1 J	1 J	<	<	<	0.6 J	0.5 J
Methylene chloride	<	<	<	<	<	<	<	<	<	<
Chloromethane	<	<	<	<	<	<	<	<	<	<
Petrol. Hydrocarb. (µg/L)										
Benzene	<	<	<	0.1 J	<	<	<	<	<	<
Ethylbenzene	<	<	<	<	<	<	<	<	<	<
Toluene	<	<	<	<	<	<	<	<	<	<
Total Xylene	<	<	<	<	<	<	<	<	<	<
Styrene	<	<	<	<	<	<	<	<	<	<
Miscellaneous (µg/L)										
1,1,2-Trichloro-1,2,2-trifluoroethane	.	<	<	.	.	<	<	<	.	.
Trichlorofluoromethane	.	<	<	.	.	<	<	<	.	.
1,4-Dichlorobenzene	.	<	<	.	.	<	<	<	.	.
4-Methyl-2-pentanone	<	<	<	<	<	<	<	<	<	<
Acetone	<	<	<	<	<	<	<	<	<	<
Acetonitrile	.	<	<	.	.	<	<	<	.	.
Bromodichloromethane	<	<	<	<	<	<	<	<	<	<
Bromoform	<	<	<	<	<	<	<	<	<	<
Bromomethane	<	<	<	<	<	<	<	<	<	<
Carbon disulfide	<	<	<	<	<	<	<	<	<	<
Chlorobenzene	<	<	<	<	<	<	<	<	<	<
Natural Attenuation (µg/L)										
Ethane	.	.	.	.	.	.	.	.	<	<
Ethylene	.	.	.	.	.	.	.	.	<	<
Methane	.	.	.	.	.	.	.	.	16	16

APPENDIX E.2: CY 2008 MONITORING DATA FOR THE UPPER EAST FORK POPLAR CREEK HYDROGEOLOGIC REGIME
Volatile Organic Compounds

Sampling Point	GW-762		GW-763	GW-769		GW-770		GW-781	GW-782	GW-783
Functional Area	GRIDJ3		GRIDJ3	GRIDG3		GRIDG3		GRIDE3	GRIDE3	GRIDE3
Date Sampled	08/13/08		08/18/08	06/04/08	12/03/08	06/04/08	12/09/08	12/18/08	12/10/08	12/15/08
Program	BJC	BJC	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP
Sample Type		Dup								
Chloroethenes (µg/L)										
Tetrachloroethene	2,600	2,800	<	20	18	1 J	1 J	1 J	55	6
Trichloroethene	190 J	200 J	<	4 J	3 J FP	<	<	<	30	<
cis-1,2-Dichloroethene	51 J	53 J	<	4 J	3 J	<	<	<	19	3 J
trans-1,2-Dichloroethene	3 J	3 J	<	<	<	<	<	<	4 J	0.9 J
1,1-Dichloroethene	41 J	51 J	<	2 J	2 J	<	<	<	20	2 J
Vinyl chloride	4	4	<	<	<	<	<	<	<	<
Chloroethanes (µg/L)										
1,1,1,2-Tetrachloroethane	.	.	<	<	<	<	<	<	<	<
1,1,2,2-Tetrachloroethane	<	<	<	<	<	<	<	<	<	<
1,1,1-Trichloroethane	2 J	2 J	<	<	<	<	<	<	1 J	<
1,1,2-Trichloroethane	<	<	<	<	<	<	<	<	<	<
1,2-Dichloroethane	<	<	<	<	<	<	<	<	<	<
1,1-Dichloroethane	13	13	<	<	<	<	<	<	37	4 J
Chloroethane	<	<	<	<	<	<	<	<	<	<
Chloromethanes (µg/L)										
Carbon tetrachloride	<	<	<	110	170	27	39	<	2 J	<
Chloroform	0.5 J	0.5 J	<	4 J	4 J	3 J	4 J	<	<	<
Methylene chloride	<	<	<	<	<	<	<	<	<	<
Chloromethane	<	<	<	<	<	<	<	<	<	<
Petrol. Hydrocarb. (µg/L)										
Benzene	<	<	<	<	<	<	<	<	<	<
Ethylbenzene	<	<	<	<	<	<	<	<	<	<
Toluene	<	<	<	<	<	<	<	<	<	<
Total Xylene	<	<	<	<	<	<	<	<	<	<
Styrene	<	<	<	<	<	<	<	<	<	<
Miscellaneous (µg/L)										
1,1,2-Trichloro-1,2,2-trifluoroethane	.	.	<	2 J	3 J	<	<	<	<	<
Trichlorofluoromethane	.	.	<	<	<	<	<	<	<	<
1,4-Dichlorobenzene	.	.	<	<	<	<	<	<	<	<
4-Methyl-2-pentanone	<	<	<	<	<	<	<	<	<	<
Acetone	<	<	<	<	<	<	<	<	<	<
Acetonitrile	.	.	<	<	<	<	<	<	<	<
Bromodichloromethane	<	<	<	<	<	<	<	<	<	<
Bromoform	<	<	<	<	<	<	<	<	<	<
Bromomethane	<	<	<	<	<	<	<	<	<	<
Carbon disulfide	<	<	<	<	<	<	<	<	<	<
Chlorobenzene	<	<	<	<	<	<	<	<	<	<
Natural Attenuation (µg/L)										
Ethane	<	<	.	.	.	.	.	.	.	.
Ethylene	<	<	.	.	.	.	.	.	.	.
Methane	7.1	7.7	.	.	.	.	.	.	.	.

APPENDIX E.2: CY 2008 MONITORING DATA FOR THE UPPER EAST FORK POPLAR CREEK HYDROGEOLOGIC REGIME
Volatile Organic Compounds

Sampling Point	GW-791	GW-792	GW-802	GW-816	GW-820			GW-832		GW-960	
Functional Area	GRIDD2	GRIDD2	FF	EXP-SR	B9201-2			NHP		GRIDF2	
Date Sampled	10/27/08	10/28/08	05/07/08	08/13/08	05/21/08	12/17/08		02/28/08	08/12/08	05/15/08	12/18/08
Program	GWPP	GWPP	BJC	GWPP	GWPP	GWPP	GWPP	BJC	BJC	GWPP	GWPP
Sample Type						Dup					
Chloroethenes (µg/L)											
Tetrachloroethene	33	4 J	<	<	4,100	2,700	2,800	7	6	<	<
Trichloroethene	<	2 J	<	<	750	560	710	1 J	1 J	<	<
cis-1,2-Dichloroethene	<	<	<	<	960	770	780	0.8 J	0.6 J	<	<
trans-1,2-Dichloroethene	<	<	<	<	7	5 J	5 J	<	<	<	<
1,1-Dichloroethene	<	<	<	<	4 J	4 J	3 J	<	<	<	<
Vinyl chloride	<	<	<	<	70	26	26	<	<	<	<
Chloroethanes (µg/L)											
1,1,1,2-Tetrachloroethane	<	<	.	<	<	<	<	.	.	<	<
1,1,2,2-Tetrachloroethane	<	<	<	<	<	<	<	<	<	<	<
1,1,1-Trichloroethane	<	<	<	<	<	<	<	<	<	<	<
1,1,2-Trichloroethane	<	<	<	<	<	<	<	<	<	<	<
1,2-Dichloroethane	<	<	<	<	<	<	<	<	<	<	<
1,1-Dichloroethane	<	<	<	<	<	<	<	<	<	<	<
Chloroethane	<	<	<	<	<	<	<	<	<	<	<
Chloromethanes (µg/L)											
Carbon tetrachloride	<	<	<	<	<	<	<	17	7	<	<
Chloroform	<	<	<	<	<	<	<	2 J	2 J	<	<
Methylene chloride	<	<	<	<	<	<	<	<	<	<	<
Chloromethane	<	<	<	<	<	<	<	<	<	<	<
Petrol. Hydrocarb. (µg/L)											
Benzene	<	<	<	<	<	<	<	0.1 J	<	<	<
Ethylbenzene	<	<	<	<	<	<	<	0.1 J	<	<	<
Toluene	<	<	<	<	<	<	<	1 J	<	<	<
Total Xylene	<	<	<	<	<	<	<	0.6 J	<	<	<
Styrene	<	<	<	<	<	<	<	<	<	<	<
Miscellaneous (µg/L)											
1,1,2-Trichloro-1,2,2-trifluoroethane	<	<	.	<	70	40	43	.	.	<	<
Trichlorofluoromethane	<	<	.	<	<	<	<	.	.	<	<
1,4-Dichlorobenzene	<	<	.	<	2 J	3 J	2 J	.	.	<	<
4-Methyl-2-pentanone	<	<	<	<	<	<	<	<	<	<	<
Acetone	<	<	<	<	<	<	<	<	<	<	<
Acetonitrile	<	<	.	<	<	<	<	.	.	<	<
Bromodichloromethane	<	<	<	<	<	<	<	<	<	<	<
Bromoform	<	<	<	<	<	<	<	<	<	<	<
Bromomethane	<	<	<	<	<	<	<	<	<	<	<
Carbon disulfide	<	<	<	<	<	<	<	<	<	<	<
Chlorobenzene	<	<	<	<	<	<	<	<	<	<	<
Natural Attenuation (µg/L)											
Ethane	.	.	.	.	.	.	.	1.1 J	<	.	.
Ethylene	.	.	.	.	.	.	.	<	<	.	.
Methane	.	.	.	.	.	.	.	92	<	.	.

APPENDIX E.2: CY 2008 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
Functional Area	EXP-SW	EXP-SW	EXP-SW	EXP-SW	EXP-SW
Date Sampled	10/13/08	10/13/08	10/13/08	01/21/08	01/21/08
Program	GWPP	GWPP	GWPP	BJC	BJC
Sample Type					
Chloroethenes (µg/L)					
Tetrachloroethene	<	<	<	<	0.1 J
Trichloroethene	<	<	<	0.4 J	<
cis-1,2-Dichloroethene	<	<	<	<	<
trans-1,2-Dichloroethene	<	<	<	<	<
1,1-Dichloroethene	<	<	<	<	<
Vinyl chloride	<	<	<	<	<
Chloroethanes (µg/L)					
1,1,1,2-Tetrachloroethane	<	<	<	.	.
1,1,2,2-Tetrachloroethane	<	<	<	<	<
1,1,1-Trichloroethane	<	<	<	<	<
1,1,2-Trichloroethane	<	<	<	<	<
1,2-Dichloroethane	<	<	<	<	<
1,1-Dichloroethane	<	<	<	<	<
Chloroethane	<	<	<	<	<
Chloromethanes (µg/L)					
Carbon tetrachloride	<	<	<	<	<
Chloroform	<	<	<	<	<
Methylene chloride	<	<	<	<	<
Chloromethane	<	<	<	<	<
Petrol. Hydrocarb. (µg/L)					
Benzene	<	<	<	<	<
Ethylbenzene	<	<	<	<	<
Toluene	<	<	<	<	<
Total Xylene	<	<	<	<	<
Styrene	<	<	<	<	<
Miscellaneous (µg/L)					
1,1,2-Trichloro-1,2,2-trifluoroethane	<	<	<	.	.
Trichlorofluoromethane	<	<	<	.	.
1,4-Dichlorobenzene	<	<	<	.	.
4-Methyl-2-pentanone	<	<	<	<	<
Acetone	<	<	<	<	<
Acetonitrile	<	<	<	.	.
Bromodichloromethane	<	<	<	<	<
Bromoform	<	<	<	<	<
Bromomethane	<	<	<	<	<
Carbon disulfide	<	<	<	<	<
Chlorobenzene	<	<	<	<	<
Natural Attenuation (µg/L)					
Ethane	.	.	.	.	.
Ethylene	.	.	.	.	.
Methane	.	.	.	.	.

APPENDIX E.3
RADIOLOGICAL ANALYTES

APPENDIX E.3: CY 2008 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	Gross Alpha (pCi/L)			Gross Beta (pCi/L)		
				Activity	TPU	MDA	Activity	TPU	MDA
55-1A	GRIDB2	04/14/08	GWPP	<	.	4.3	<	.	6.2
55-2A	GRIDB3	04/17/08	GWPP	<	.	3.9	10	4	6.2
55-2B	GRIDB3	04/16/08	GWPP	<	.	6	11	4.4	7.4
55-2B Dup	GRIDB3	04/16/08	GWPP	<	.	7.3	<	.	10
55-2C	GRIDB3	04/16/08	GWPP	<	.	4.6	15	4.8	7.3
55-3A	B9201-5	04/21/08	GWPP	4.6	4.2	3.2	<	.	8.6
55-3B	B9201-5	04/21/08	GWPP	<	.	4.8	92 Q	8.4	7.6
55-3C	B9201-5	04/21/08	GWPP	<	.	3.7	<	.	7.1
55-6A	B9103	04/21/08	GWPP	<	.	3.1	<	.	7.8
56-1A	Y12	04/24/08	GWPP	<	.	3.9	11	4.4	7.2
56-1C	Y12	04/28/08	GWPP	5.6	3.9	3.3	12	5.1	8.9
56-2A	GRIDC3	04/23/08	GWPP	<	.	5.2	<	.	7.4
56-2B	GRIDC3	04/23/08	GWPP	4.75	4.2	3.5	<	.	8.8
56-2C	GRIDC3	04/23/08	GWPP	<	.	4.8	<	.	7.4
56-3A	Y12	05/01/08	GWPP	<	.	3.3	<	.	8.3
56-3B	Y12	05/01/08	GWPP	<	.	3.6	<	.	7
56-3B Dup	Y12	05/01/08	GWPP	<	.	3.4	<	.	8.2
56-3C	Y12	05/01/08	GWPP	<	.	3.1	<	.	8.1
56-4A	Y12	04/30/08	GWPP	<	.	4.9	<	.	7.2
56-6A	Y12	04/29/08	GWPP	<	.	3.8	8.2	4.2	7.3
60-1A	Y12	12/15/08	GWPP	<	.	3.1	<	.	6.8
GW-105	S3	05/14/08	GWPP	<	.	12	<	.	27
GW-106	S3	05/14/08	GWPP	<	.	14	24	14	23
GW-106 Dup	S3	05/14/08	GWPP	<	.	13	<	.	27
GW-108	S3	01/07/08	BJC	230	99.2	138	21,300	3,410	225
GW-108	S3	07/08/08	BJC	129	33	32.7	13,900	2,220	36.7
GW-109	S3	06/10/08	GWPP	<	.	270	4,000	530	670
GW-109	S3	11/25/08	GWPP	<	.	230	1,400	260	350
GW-148	NHP	08/19/08	GWPP	2.9 R	3.9	2.5	<	.	5.6
GW-151	NHP	02/26/08	BJC	<	.	2.16	<	.	3
GW-151	NHP	08/11/08	BJC	<	.	2.4	<	.	4
GW-153	NHP	08/20/08	GWPP	<	.	2.2	7	3	6
GW-154	NHP	02/27/08	BJC	431	69.8	2.14	64	11.5	7.26
GW-154	NHP	08/11/08	BJC	429	69.3	2.43	125	20.5	6.12
GW-169	EXP-UV	02/26/08	BJC	<	.	1.61	<	.	3.12
GW-170	EXP-UV	02/26/08	BJC	<	.	1.71	12	3	2.96
GW-170 Dup	EXP-UV	02/26/08	BJC	<	.	2.48	13	3.08	3.72
GW-170	EXP-UV	08/13/08	BJC	<	.	1.89	11	3.13	4.65
GW-170 Dup	EXP-UV	08/13/08	BJC	<	.	1.71	13	3.28	4.54
GW-190	B4	05/07/08	GWPP	6	3.4	2.3	6.5	3.7	6.5
GW-192	B4	05/05/08	GWPP	<	.	3.5	8.2	4	7
GW-204	T0134	10/27/08	GWPP	27	4.4	3.5	<	.	6.4
GW-220	NHP	03/24/08	GWPP	4.3	3.6	3.9	<	.	7.2
GW-220	NHP	06/10/08	GWPP	<	.	2.5	8.2	4.1	7.2
GW-220	NHP	08/19/08	GWPP	<	.	2.1	<	.	6.2
GW-220 Dup	NHP	08/19/08	GWPP	<	.	3.5	<	.	5.9
GW-220	NHP	12/02/08	GWPP	3.8	2.7	3.1	<	.	6.5
GW-223	NHP	02/27/08	BJC	9.97	3.19	2.14	6.56	2.38	3.77
GW-223	NHP	08/13/08	BJC	12	3.95	2.69	12.1	3.62	5.08

APPENDIX E.3: CY 2008 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	Gross Alpha (pCi/L)			Gross Beta (pCi/L)		
				Activity	TPU	MDA	Activity	TPU	MDA
GW-240	NHP	08/19/08	GWPP	4	3.1	2.4	<	.	4.8
GW-251	S2	05/15/08	GWPP	7.7	3.8	2.1	8.9	4.3	7.3
GW-253	S2	02/26/08	BJC	31.6	7.46	6.31	26.5	7.82	10.2
GW-265	SY	05/07/08	GWPP	<	.	2.6	7.3	3.8	6.7
GW-269	SY	05/12/08	GWPP	3.2	3.2	2.3	10	4.2	7.2
GW-274	SY	05/08/08	GWPP	<	.	57	4,400	150	69
GW-275	SY	05/08/08	GWPP	<	.	320	<	.	510
GW-332	WC	05/12/08	GWPP	<	.	2.9	<	.	5.1
GW-336	WC	05/13/08	GWPP	<	.	2.6	<	.	5.6
GW-337	WC	05/13/08	GWPP	<	.	2.9	<	.	5.7
GW-380	NHP	02/28/08	BJC	<	.	1.83	3.61	1.87	3.51
GW-380	NHP	08/12/08	BJC	3.12	1.81	2.63	<	.	4.2
GW-381	NHP	08/21/08	GWPP	2.9 R	3.2	2.5	<	.	4.9
GW-382	NHP	02/28/08	BJC	<	.	1.95	<	.	3.96
GW-382	NHP	08/13/08	BJC	<	.	1.97	5	2.16	4.02
GW-383	NHP	08/18/08	GWPP	2.3 R	3.1	2.3	<	.	5.8
GW-508	RG	05/13/08	GWPP	<	.	2.6	<	.	5.6
GW-508	RG	12/22/08	GWPP	<	.	3.3	<	.	6.9
GW-605	EXP-I	01/07/08	BJC	66.8	12.4	2.48	16	3.89	4.65
GW-605 Dup	EXP-I	01/07/08	BJC	61.4	12.1	2.88	15.3	3.94	4.67
GW-605	EXP-I	07/08/08	BJC	44	8.6	2.43	19.2	4.25	4.67
GW-605 Dup	EXP-I	07/08/08	BJC	53.3	10.1	2.27	14.9	3.9	5.23
GW-606	EXP-I	01/07/08	BJC	4.9	2.1	2.25	5.32	2.13	3.59
GW-606	EXP-I	07/08/08	BJC	12.7	3.23	1.98	7	2.25	3.68
GW-617	EXP-E	10/20/08	GWPP	<	.	3.1	<	.	7.3
GW-618	EXP-E	03/04/08	BJC	<	.	2.05	4.74	2.13	3.88
GW-619	FTF	12/01/08	GWPP	5.4	2.9	2.4	12	3.8	5.6
GW-619 Dup	FTF	12/01/08	GWPP	<	.	2.7	8.3	3.8	6.7
GW-620	FTF	12/10/08	GWPP	<	.	1.5	<	.	5.6
GW-633	RG	06/11/08	GWPP	34 R	35	25	1,500	88	65
GW-656	T0134	10/28/08	GWPP	<	.	3.6	<	.	7.4
GW-686	CPT	10/22/08	GWPP	7.2	3.9	4.1	8.1	3.9	6.8
GW-690	CPT	10/23/08	GWPP	<	.	7	<	.	15
GW-691	CPT	10/23/08	GWPP	<	.	9.4	<	.	14
GW-692	CPT	10/21/08	GWPP	<	.	2.9	<	.	7
GW-698	B8110	06/24/08	GWPP	<	.	5.2	12	4.4	7.1
GW-698 Dup	B8110	06/24/08	GWPP	7.3	5.6	4.8	12	5.2	9.1
GW-698	B8110	11/25/08	GWPP	<	.	2.9	<	.	7.7
GW-700	B8110	10/20/08	GWPP	<	.	4	<	.	6.6
GW-722-14	EXP-J	07/28/08	GWPP	<	.	4.2	<	.	6.8
GW-722-17	EXP-J	07/28/08	GWPP	3.4	2.8	0.6	<	.	6
GW-722-20	EXP-J	07/16/08	GWPP	4.3	3.2	2.9	<	.	5.6
GW-722-22	EXP-J	07/16/08	GWPP	<	.	2.9	9.4	3.6	5.9
GW-722-33	EXP-J	07/15/08	GWPP	<	.	3.1	<	.	5.1
GW-722-33 Dup	EXP-J	07/15/08	GWPP	<	.	2.7	<	.	5.6
GW-733	EXP-J	01/03/08	BJC	<	.	1.4	<	.	3.78
GW-733	EXP-J	07/08/08	BJC	<	.	1.86	<	.	4.27

APPENDIX E.3: CY 2008 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	Gross Alpha (pCi/L)			Gross Beta (pCi/L)		
				Activity	TPU	MDA	Activity	TPU	MDA
GW-744	GRIDK1	08/13/08	GWPP	8.3	4.1	4	7	3.3	5.3
GW-747	GRIDK2	08/14/08	GWPP	2.4 R	2.8	0.43	<	.	5.2
GW-748	GRIDK2	08/14/08	GWPP	<	.	4	<	.	5.6
GW-762	GRIDJ3	02/27/08	BJC	<	.	1.83	5.27	2.03	3.47
GW-762 Dup	GRIDJ3	02/27/08	BJC	<	.	1.92	<	.	3.7
GW-762	GRIDJ3	08/13/08	BJC	<	.	2.24	6.61	2.57	4.5
GW-762 Dup	GRIDJ3	08/13/08	BJC	<	.	2.39	5.06	2.03	3.57
GW-763	GRIDJ3	08/18/08	GWPP	<	.	3	<	.	4.4
GW-769	GRIDG3	06/04/08	GWPP	<	.	2.8	<	.	5.7
GW-769	GRIDG3	12/03/08	GWPP	5.9	3.3	3.4	7.4	4	7.4
GW-770	GRIDG3	06/04/08	GWPP	5.9	3.5	2.4	7.2	3.7	6.1
GW-770	GRIDG3	12/09/08	GWPP	<	.	2.3	<	.	4.5
GW-781	GRIDE3	12/18/08	GWPP	<	.	3	6.1	3.3	5.5
GW-782	GRIDE3	12/10/08	GWPP	20	3.3	2.2	5	2.8	4.5
GW-783	GRIDE3	12/15/08	GWPP	<	.	2.6	<	.	5.7
GW-791	GRIDD2	10/27/08	GWPP	<	.	2.9	<	.	6.7
GW-792	GRIDD2	10/28/08	GWPP	<	.	2.2	<	.	7.3
GW-816	EXP-SR	08/13/08	GWPP	4.1	3.2	0.49	7.5	3.2	5
GW-820	B9201-2	05/21/08	GWPP	3.1 R	3.4	2.7	8.1	3.8	6.7
GW-820	B9201-2	12/17/08	GWPP	9.6	3.6	3.4	<	.	7.4
GW-820 Dup	B9201-2	12/17/08	GWPP	4.1	3	3.8	<	.	6.5
GW-832	NHP	02/28/08	BJC	2.95	1.79	2.62	5.41	2.19	3.75
GW-832	NHP	08/12/08	BJC	<	.	1.83	5.62	2.04	3.38
GW-960	GRIDF2	05/15/08	GWPP	<	.	4.4	<	.	6.4
GW-960	GRIDF2	12/18/08	GWPP	<	.	4.2	<	.	6.9
GHK2.51WSW	EXP-SW	10/13/08	GWPP	<	.	3	<	.	6.4
NPR12.0SW	EXP-SW	10/13/08	GWPP	<	.	3.4	<	.	6.5
NPR23.0SW	EXP-SW	10/13/08	GWPP	3.1	2.7	2.4	<	.	7.1
STATION 8	EXP-SW	01/28/08	BJC	4.84	1.95	1.8	5.84	2.44	4.27
STATION 8	EXP-SW	02/04/08	BJC	3.81	1.88	2.01	6.56	2.53	4.31
STATION 8	EXP-SW	08/18/08	BJC	<	.	2.29	<	.	3.74
STATION 8	EXP-SW	08/26/08	BJC	4.14	1.87	1.88	5.36	2.11	3.57

APPENDIX E.3: CY 2008 MONITORING DATA FOR THE UPPER EAST FORK POPLAR CREEK HYDROGEOLOGIC REGIME
Radiological Analytes: Isotopic Analyses

Sampling Point	GW-108						GW-109					
Functional Area	S3						S3					
Date Sampled	01/07/08			07/08/08			06/10/08			11/25/08		
Program	BJC			BJC			GWPP			GWPP		
Sample Type												
Result (pCi/L)	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA
Gross Alpha	230	99.2	138	129	33	32.7	<MDA	.	270	<MDA	.	230
Gross Beta	21,300	3,410	225	13,900	2,220	36.7	4,000	530	670	1,400	260	350
Technetium-99	30,800	4,920	165	29,600	4,730	62.7	8,900	56	15	4,000	36	14
Uranium-234	.	.	.	.	.	.	<MDA	.	6	3.5	1.2	2
Uranium-235	.	.	.	.	.	.	<MDA	.	0.77	<MDA	.	0.43
Uranium-236	.	.	.	.	.	.	<MDA	.	0.39	<MDA	.	0.24
Uranium-238	.	.	.	.	.	.	6.2	1.2	0.54	4.5	0.96	0.67

Sampling Point	GW-151						GW-154					
Functional Area	NHP						NHP					
Date Sampled	02/26/08			08/11/08			02/27/08			08/11/08		
Program	BJC			BJC			BJC			BJC		
Sample Type												
Result (pCi/L)	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA
Gross Alpha	<MDA	.	2.16	<MDA	.	2.4	431	69.8	2.14	429	69.3	2.43
Gross Beta	<MDA	.	3.29	<MDA	.	4.05	64	11.5	7.26	125	20.5	6.12
Technetium-99	.	.	.	.	.	.	.	.	.	.	.	.
Uranium-234	0.909	0.551	0.586	<MDA	.	0.595	360	59.1	0.473	341	56.8	0.864
Uranium-235	<MDA	.	0.416	<MDA	.	0.477	23.5	4.88	0.556	20.9	5.17	1.13
Uranium-236	.	.	.	.	.	.	.	.	.	.	.	.
Uranium-238	<MDA	.	0.452	<MDA	.	0.336	164	27.6	0.72	140	24.6	1.02

Sampling Point	GW-193						GW-223					
Functional Area	T2331						NHP					
Date Sampled	01/03/08			07/08/08			02/27/08			08/13/08		
Program	BJC			BJC			BJC			BJC		
Sample Type												
Result (pCi/L)	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA
Gross Alpha	.	.	.	.	.	.	9.97	3.19	2.14	12	3.95	2.69
Gross Beta	.	.	.	.	.	.	6.56	2.38	3.77	12.1	3.62	5.08
Technetium-99	<MDA	.	10.4	<MDA	.	10	.	.	.	.	.	.
Uranium-234	.	.	.	.	.	.	5.15	1.48	0.877	5.54	1.53	0.422
Uranium-235	.	.	.	.	.	.	<MDA	.	0.511	0.757	0.473	0.187
Uranium-236	.	.	.	.	.	.	.	.	.	.	.	.
Uranium-238	.	.	.	.	.	.	13.7	2.94	0.627	14.6	3.1	0.379

APPENDIX E.3: CY 2008 MONITORING DATA FOR THE UPPER EAST FORK POPLAR CREEK HYDROGEOLOGIC REGIME
Radiological Analytes: Isotopic Analyses

Sampling Point	GW-274			GW-275			GW-605					
Functional Area	SY			SY			EXP-I					
Date Sampled	05/08/08			05/08/08			01/07/08					
Program	GWPP			GWPP			BJC					
Sample Type										Dup		
Result (pCi/L)	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA
Gross Alpha	<MDA	.	57	<MDA	.	320	66.8	12.4	2.48	61.4	12.1	2.88
Gross Beta	4,400	150	69	<MDA	.	510	15.5	3.89	4.65	15.3	3.94	4.67
Technetium-99	7,800	51	15	<MDA	.	15	<MDA	.	9.83	<MDA	.	9.89
Uranium-234	6.6	1	1.3	1.1	0.55	1	.	.	.	.	.	.
Uranium-235	<MDA	.	0.32	<MDA	.	0.3	.	.	.	.	.	.
Uranium-236	<MDA	.	0.17	<MDA	.	0.19	.	.	.	.	.	.
Uranium-238	3.1	0.57	0.68	<MDA	.	0.45	.	.	.	.	.	.

Sampling Point	GW-605						GW-606					
Functional Area	EXP-I						EXP-I					
Date Sampled	07/08/08						01/07/08			07/08/08		
Program	BJC						BJC			BJC		
Sample Type				Dup								
Result (pCi/L)	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA
Gross Alpha	44	8.6	2.43	53.3	10.1	2.27	4.9	2.1	2.25	12.7	3.23	1.98
Gross Beta	19.2	4.25	4.67	14.9	3.9	5.23	5.32	2.13	3.59	6.62	2.25	3.68
Technetium-99	<MDA	.	10.3	<MDA	.	9.93	<MDA	.	11	<MDA	.	10.5
Uranium-234	.	.	.	.	.	.	.	.	.	.	.	.
Uranium-235	.	.	.	.	.	.	.	.	.	.	.	.
Uranium-236	.	.	.	.	.	.	.	.	.	.	.	.
Uranium-238	.	.	.	.	.	.	.	.	.	.	.	.

Sampling Point	GW-619						GW-633			GW-733		
Functional Area	FTF						RG			EXP-J		
Date Sampled	12/01/08						06/11/08			01/03/08		
Program	GWPP						GWPP			BJC		
Sample Type				Dup								
Result (pCi/L)	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA
Gross Alpha	5.4	2.9	2.4	<MDA	.	2.7	<MDA	.	25	<MDA	.	1.4
Gross Beta	12	3.8	5.6	8.3	3.8	6.7	1,500	88	65	<MDA	.	3.78
Technetium-99	<MDA	.	14	<MDA	.	15	3,800	37	15	<MDA	.	10
Uranium-234	.	.	.	.	.	.	.	.	.	.	.	.
Uranium-235	.	.	.	.	.	.	.	.	.	.	.	.
Uranium-236	.	.	.	.	.	.	.	.	.	.	.	.
Uranium-238	.	.	.	.	.	.	.	.	.	.	.	.

APPENDIX E.3: CY 2008 MONITORING DATA FOR THE UPPER EAST FORK POPLAR CREEK HYDROGEOLOGIC REGIME
Radiological Analytes: Isotopic Analyses

Sampling Point	GW-733			GW-832						STATION 8		
Functional Area	EXP-J			NHP						EXP-SW		
Date Sampled	07/08/08			02/28/08			08/12/08			01/28/08		
Program	BJC			BJC			BJC			BJC		
Sample Type												
Result (pCi/L)	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA
Gross Alpha	<MDA	.	1.86	2.95	1.79	2.62	<MDA	.	1.83	4.84	1.95	1.8
Gross Beta	<MDA	.	4.27	5.41	2.19	3.75	5.62	2.04	3.38	5.84	2.44	4.27
Technetium-99	<MDA	.	10.1	.	.	.	.	.	.	.	.	.
Uranium-234	.	.	.	3.19	1.06	0.368	1.42	0.65	0.467	4.42	1.22	0.33
Uranium-235	.	.	.	<MDA	.	0.53	<MDA	.	0.441	<MDA	.	0.277
Uranium-236	.	.	.	.	.	.	.	.	.	.	.	.
Uranium-238	.	.	.	2.58	0.945	0.555	1.44	0.651	0.412	2.35	0.819	0.37

Sampling Point	STATION 8								
Functional Area	EXP-SW								
Date Sampled	02/04/08			08/18/08			08/26/08		
Program	BJC			BJC			BJC		
Sample Type									
Result (pCi/L)	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA
Gross Alpha	3.81	1.88	2.01	<MDA	.	2.29	4.14	1.87	1.88
Gross Beta	6.56	2.53	4.31	<MDA	.	3.74	5.36	2.11	3.57
Technetium-99	.	.	.	.	.	.	.	.	.
Uranium-234	2.95	0.984	0.302	1.33	0.661	0.496	2.47	0.938	0.439
Uranium-235	0.541	0.389	0.356	<MDA	.	0.189	<MDA	.	0.439
Uranium-236	.	.	.	.	.	.	.	.	.
Uranium-238	4.59	1.3	0.302	0.937	0.544	0.427	2.04	0.841	0.439

APPENDIX F

CY 2008 MONITORING DATA FOR THE CHESTNUT RIDGE HYDROGEOLOGIC REGIME

EXPLANATION

Sampling Point:

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

Location:

- CDLVI - Construction/Demolition Landfill VI
- 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:

- BJC - monitoring program managed by Bechtel Jacobs Company LLC
- GWPP - managed by the Y-12 Groundwater Protection Program

Sample Type:

- Dup - Field Duplicate Sample

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, 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	BJC		GWPP	BJC
Cations			Anions		
Calcium	0.2	0.25	Bicarbonate	1.0	NS
Magnesium	0.2	0.05	Carbonate	1.0	NS
Potassium	2.0	0.25	Chloride	0.2	0.1
Sodium	0.2	0.25	Fluoride	0.1	0.05
			Nitrate (as Nitrogen)	0.028	0.1
			Sulfate	0.25	0.1
Note: NS = not specified					

The major ion results are qualitative because the ion charge balance error (percent) exceeds 20% for the July sample from well GW-205 and the January sample from spring SCR1.25SP. In both cases, the alkalinity results (bicarbonate and/or carbonate) are the suspected source of the elevated error.

The Y-12 GWPP SAP (BWXT 2007a) 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 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 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 reporting limits (BJC 2007) 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	BJC		GWPP	BJC
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	0.0002**	0.0002
Barium	0.004	0.005	Molybdenum	0.05	0.01*
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 BJC reporting limit; ** - reporting limit for mercury was lowered to 0.00005 mg/L beginning in October 2008; "NS" - not specified.					

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

- . - Not analyzed or not applicable
- < - Analyzed but not detected at the project reporting level
- J - Positively identified; estimated concentration (BJC results)
- Q - Inconsistent with historical measurements for a sampling location (e.g., low arsenic at MCK 2.05)
- R - Result does not meet data quality objectives (duplicate samples vary by an order of magnitude: iron at MCK 2.05)

EXPLANATION (continued)

F.2 Volatile Organic Compounds:

The reporting limits for volatile organic compounds shown in Table B.5 and those used for monitoring programs managed by BJC 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, 15 compounds were detected in groundwater samples collected in the Chestnut Ridge Regime during CY 2008. Results for these compounds are grouped by similar chemical composition (e.g., chloroethenes) in Appendix F.2.

Compound	No. Detected	Maximum (µg/L)	Compound	No. Detected	Maximum (µg/L)
1,1-Dichloroethane	11	88	1,2-Dichlorobenzene	2	0.29 J
1,1-Dichloroethene	11	75	Carbon disulfide	1	0.66 J
1,1,1-Trichloroethane	11	27	Carbon tetrachloride	1	0.6 J
Tetrachloroethene	10	8.8	Methylene chloride	1	0.33 J
Trichlorofluoromethane	7	37	Dibromochloromethane	1	0.32 J
1,1,2-Trichloro-1,2,2-trifluoroethane	5	5 J	1,2-Dichloropropane	1	0.16 J
Trichloroethene	3	0.88 J	trans-1,2-Dichloroethene	1	0.15 J
cis-1,2-Dichloroethene	2	8.9			

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

- . - Not analyzed
- < - Analyzed but not detected at the project reporting level (also false-positive results for data provided by BJC)
- J - Positively identified; estimated concentration
- Q - Inconsistent with historical measurements for a sampling location
(first detection of 1,1,2-Trichloro-1,2,2-trifluoroethane at spring SCR2.1SP)

EXPLANATION (continued)

F.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 2008 in the Chestnut Ridge Regime.

Analyte	No. of Results	No. Detected	Analyte	No. of Results	No. Detected
Gross Alpha	93	8	Strontium-89/90	8	1
Gross Beta	83	25	Technetium-99	2	0
Cesium-137	4	0	Uranium-234	8	4
Cobalt-60	4	0	Uranium-235	8	1
Potassium-40	4	0	Uranium-238	8	2
Note: * = Reported by BJC 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
- R - Result does not meet data quality objectives: exceeds the MDA but is less than the TPU.

APPENDIX F.1

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

APPENDIX F.1: CY 2008 MONITORING DATA FOR THE CHESTNUT RIDGE HYDROGEOLOGIC REGIME
Field Measurements, Miscellaneous Analytes, Major Ions, and Trace Metals

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	03/03/08	08/13/08	01/24/08	07/16/08	07/09/08	07/09/08	07/10/08	07/14/08		07/14/08
Program	BJC	BJC	BJC	BJC	BJC	BJC	BJC	BJC	BJC	BJC
Sample Type									Dup	
Field Measurements										
Time Sampled	15:45	14:45	9:45	9:25	15:15	13:20	14:30	11:10	.	14:05
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)	51.00	60.35	97.65	99.60	83.08	83.18	23.34	143.67	.	118.49
Groundwater Elevation (ft)	1,053.48	1,044.13	1,088.58	1,086.63	830.90	830.36	816.90	905.61	.	932.89
Conductivity (µmho/cm)	426	1,052	302	490	536	514	1,039	704	.	510
Dissolved Oxygen (ppm)	2.32	1.96	10.46	7.91	5.01	3.9	6.3	5.44	.	3.38
Oxidation/Reduction (mV)	136	15	161	121	42	73	99	156	.	93
Temperature (degrees C)	16.7	19.8	12.2	22.3	28.1	17.3	18.1	17.9	.	21.8
Turbidity (NTU)	1	2	3	3	4	1	1	1	.	1
pH	7	7.26	7.4	7.22	7.92	7.03	7.56	6.91	.	7.21
Miscellaneous Analytes										
Dissolved Solids (mg/L)	304	274	200	200	265	244	296	384	373	217
Suspended Solids (mg/L)	<	<	<	<	<	<	<	<	<	<
Major Ions (mg/L)										
Calcium	53	54.5	43	42	28.3	53.1	40.8	64.4	64.9	40.5
Magnesium	31.5	32.2	26	25	24.2	17.9	34	40.4	40.5	24.2
Potassium	0.859	0.84	<	<	16.4	1.73	11.1	20	20.2	0.868
Sodium	5.91	5.97	<	<	20	1.21	4.03	5	5.02	0.508
Bicarbonate	242	246	210	200	.	.	.	.	.	.
Carbonate	<	<	<	<	.	.	.	.	.	.
Chloride	11.9	11.2	<	<	.	.	.	.	.	.
Fluoride	<	<	<	<	.	.	.	.	.	.
Nitrate as N	0.42	0.74	<	<	.	.	.	.	.	.
Sulfate	2.6	2.9	<	<	.	.	.	.	.	.
Charge balance error (%)	2.4	2.8	1	1.9	.	.	.	.	.	.
Trace Metals (mg/L)										
Aluminum	<	<	<	<	<	<	<	<	<	<
Arsenic	<	<	<	<	<	<	<	<	<	<
Barium	0.0257	0.0264	0.017	0.016	0.0462	0.0509	0.0832	0.033	0.0328	0.0113
Beryllium	<	<	<	<	<	<	<	<	<	<
Boron	<	<	<	<	0.802	<	0.225	<	<	<
Chromium	<	<	<	0.011	<	<	<	<	<	<
Copper	<	<	<	<	<	<	0.0396	<	<	<
Iron	<	<	<	<	0.491	<	<	<	<	<
Lead	<	<	<	<	<	<	<	<	<	<
Lithium	<	<	.	.	0.313	0.0271	0.109	<	<	<
Manganese	<	<	<	<	0.0097	<	0.0075	<	<	<
Nickel	<	<	<	<	<	<	<	<	<	<
Strontium	0.024	0.0241	0.013	0.015	2.8	0.112	6.65	0.0265	0.0266	0.0152
Thallium	<	<	<	<	<	<	<	<	<	<
Uranium	<	<	<	<	<	<	0.011	<	<	<

APPENDIX F.1: CY 2008 MONITORING DATA FOR THE CHESTNUT RIDGE HYDROGEOLOGIC REGIME
Field Measurements, Miscellaneous Analytes, Major Ions, and Trace Metals

Sampling Point	GW-161		GW-173			GW-175	GW-177		GW-178
Functional Area	ECRWP		CRSP			CRSP	CRSP		CRSP
Date Sampled	01/07/08	07/09/08	04/14/08	11/13/08		11/11/08	01/09/08	08/12/08	11/11/08
Program	BJC	BJC	GWPP	GWPP	GWPP	GWPP	BJC	BJC	GWPP
Sample Type					Dup				
Field Measurements									
Time Sampled	10:40	16:10	9:45	8:30	8:30	9:10	10:45	14:45	13:45
Measuring Point Elev. (ft)	1,093.54	1,093.54	1,115.00	1,115.00	1,115.00	1,084.19	1,158.20	1,158.20	1,143.49
Depth to Water (ft)	162.65	162.07	137.65	161.25	161.25	129.45	121.80	120.22	101.90
Groundwater Elevation (ft)	930.89	931.47	977.35	953.75	953.75	954.74	1,036.40	1,037.98	1,041.59
Conductivity (µmho/cm)	229	482	430	439	439	386	273	913	506
Dissolved Oxygen (ppm)	1.68	1.24	6.34	5.81	5.81	5.12	4.51	3.08	0.98
Oxidation/Reduction (mV)	117	-90	289	195	195	182	92	36	98
Temperature (degrees C)	14.4	17.1	12	14.4	14.4	11.3	15.8	22.5	13.3
Turbidity (NTU)	61	49	.	.	.	.	1	3	.
pH	7.75	7.29	7.47	7.28	7.28	7.18	7.54	6.96	7.55
Miscellaneous Analytes									
Dissolved Solids (mg/L)	.	.	200	24	194	168	246	262	266
Suspended Solids (mg/L)	.	.	1	<	<	<	<	<	<
Major Ions (mg/L)									
Calcium	39.6	34.3	44.8	46.2	46.3	51.8	49.8	49.3	55.2
Magnesium	25.8	21.8	25.5	27.2	27	31.7	30.7	29.8	33.8
Potassium	3.26	3.57	2.36	<	<	<	4.21	3.67	<
Sodium	2.34	2.55	1.27	1.14	1.15	1.73	1.51	1.24	1.84
Bicarbonate	194	199	217	214	213	247	.	.	262
Carbonate	<	<	<	<	<	<	.	.	<
Chloride	3	2.5	1.24	1.23	1.24	2.12	.	.	2.02
Fluoride	0.11	<	<	<	<	<	.	.	<
Nitrate as N	<	<	0.793	0.829	0.826	0.363	.	.	0.327
Sulfate	<	<	6.35	5.97	6.05	0.885	.	.	1.99
Charge balance error (%)	3.8	-4.4	-1.2	1.1	1.2	2.2	.	.	2.3
Trace Metals (mg/L)									
Aluminum	<	<	<	<	<	<	<	<	<
Arsenic	<	<	<	<	<	<	<	<	<
Barium	0.0138	0.0102	0.0134	0.0123	0.012	0.0715	0.0172	0.0174	0.0124
Beryllium	<	<	<	<	<	<	<	<	<
Boron	<	<	<	<	<	<	<	<	<
Chromium	<	<	<	<	<	<	0.0142	0.0134	<
Copper	<	<	<	<	<	<	<	<	<
Iron	4.73	10.2 Q	<	0.0569	0.0805	<	0.0593	0.0952	<
Lead	<	<	<	<	<	<	<	0.0027	<
Lithium	<	<	<	<	<	<	<	<	<
Manganese	0.0983	0.0639	<	<	<	<	<	0.0063	<
Nickel	<	<	<	<	<	<	<	<	<
Strontium	0.0169	0.0155	0.019	0.0192	0.0192	0.0162	0.0199	0.0186	0.0234
Thallium	<	<	<	<	<	<	0.002	<	<
Uranium	<	<	<	<	<	<	<	<	<

APPENDIX F.1: CY 2008 MONITORING DATA FOR THE CHESTNUT RIDGE HYDROGEOLOGIC REGIME
Field Measurements, Miscellaneous Analytes, Major Ions, and Trace Metals

Sampling Point	GW-203		GW-205		GW-217		GW-221		GW-231	
Functional Area	UNCS		UNCS		LIV		UNCS		KHQ	
Date Sampled	02/28/08	08/18/08	03/03/08	08/14/08	01/22/08	07/16/08	02/28/08	08/14/08	07/09/08	
Program	BJC	BJC	BJC	BJC	BJC	BJC	BJC	BJC	BJC	BJC
Sample Type										Dup
Field Measurements										
Time Sampled	14:40	10:05	12:25	12:00	15:00	13:20	14:10	10:30	9:30	.
Measuring Point Elev. (ft)	1,105.45	1,105.45	1,104.14	1,104.14	1,177.03	1,177.03	1,106.16	1,106.16	849.67	.
Depth to Water (ft)	87.00	87.67	82.35	84.23	111.28	117.47	86.05	88.73	18.91	.
Groundwater Elevation (ft)	1,018.45	1,017.78	1,021.79	1,019.91	1,065.75	1,059.56	1,020.11	1,017.43	830.76	.
Conductivity (µmho/cm)	730	593	327	733	237	436	229	491	534	.
Dissolved Oxygen (ppm)	5.52	3.59	3.12	2.72	6.95	7.2	5.15	4.88	2.19	.
Oxidation/Reduction (mV)	45	146	49	157	179	66	122	145	93	.
Temperature (degrees C)	12.3	19.2	17.1	19.5	4.8	25.9	14.7	17.1	15.5	.
Turbidity (NTU)	2	1	2	1	1	2	2	1	1	.
pH	7.61	7.28	10.01	10.01	8.24	7.87	7.42	7.32	6.84	.
Miscellaneous Analytes										
Dissolved Solids (mg/L)	236	187	206	283	180	190	193	151	243	252
Suspended Solids (mg/L)	<	<	<	<	<	<	<	<	<	<
Major Ions (mg/L)										
Calcium	35.3	35.9	1.6	1.27	36 J	35	30.3	30.7	47.8	48.1
Magnesium	20.1	20	11.2	12.6	22 J	21	18	18	24.6	24.8
Potassium	0.749	0.84	69.6	68.6	<	<	0.817	0.872	2.1	2.11
Sodium	0.646	0.624	11.6	9.69	5.5 J	4.5	0.447	0.448	0.796	0.729
Bicarbonate	160	164	149	122	180	180	149	147	.	.
Carbonate	<	<	4	82.8	<	<	<	<	.	.
Chloride	3.3	2.9	2.6	2.9	<	<	1.4	1.6	.	.
Fluoride	<	<	<	<	<	<	<	<	.	.
Nitrate as N	0.34	0.41	0.046	0.054	<	<	0.33	0.4	.	.
Sulfate	1.7	1.7	4.5	3.5	5.6	<	1.2	1.3	.	.
Charge balance error (%)	1.6	0.9	-0.7	-14.1	1.7	1	-0.5	0.3	.	.
Trace Metals (mg/L)										
Aluminum	<	<	<	<	<	<	<	<	<	<
Arsenic	<	<	<	<	<	<	<	<	<	<
Barium	0.0124	0.0118	<	<	0.031	0.031	0.0077	0.0073	0.1	0.0994
Beryllium	<	<	<	<	<	<	<	<	<	<
Boron	<	<	<	<	<	<	<	<	<	<
Chromium	<	<	<	<	<	<	<	<	<	<
Copper	<	<	<	<	<	<	<	<	<	<
Iron	0.104	<	<	<	<	<	<	<	<	<
Lead	<	<	<	<	<	<	<	<	<	<
Lithium	<	<	0.152	0.157	.	.	<	<	<	<
Manganese	<	<	<	<	<	<	<	<	<	<
Nickel	<	<	<	<	<	<	<	<	<	<
Strontium	0.0121	0.0118	0.0067	<	0.018 J	0.016	0.0101	0.0097	0.0542	0.0537
Thallium	<	<	<	<	<	<	<	<	<	<
Uranium	<	<	<	<	<	<	<	<	<	<

APPENDIX F.1: CY 2008 MONITORING DATA FOR THE CHESTNUT RIDGE HYDROGEOLOGIC REGIME
Field Measurements, Miscellaneous Analytes, Major Ions, and Trace Metals

Sampling Point	GW-294				GW-296		GW-298		GW-301	
Functional Area	ECRWP				ECRWP		ECRWP		CRBAWP	
Date Sampled	01/08/08		07/10/08		01/08/08	07/10/08	01/08/08	07/10/08	01/09/08	
Program	BJC	BJC	BJC	BJC	BJC	BJC	BJC	BJC	BJC	BJC
Sample Type		Dup		Dup						Dup
Field Measurements										
Time Sampled	12:00	.	11:20	.	14:40	15:00	14:15	11:25	9:45	.
Measuring Point Elev. (ft)	1,083.60	.	1,083.60	.	1,090.99	1,090.99	1,049.01	1,049.01	1,086.55	.
Depth to Water (ft)	99.95	.	102.08	.	119.75	119.68	111.58	111.05	137.82	.
Groundwater Elevation (ft)	983.65	.	981.52	.	971.24	971.31	937.43	937.96	948.73	.
Conductivity (µmho/cm)	278	.	1,076	.	282	596	579	444	375	.
Dissolved Oxygen (ppm)	17.08	.	3.84	.	11.7	6.84	2.4	1.1	5.78	.
Oxidation/Reduction (mV)	99	.	62	.	182	102	102	80	141	.
Temperature (degrees C)	14.3	.	19.3	.	16.9	16.7	16.5	18.8	13.2	.
Turbidity (NTU)	1	.	1	.	4	1	4	2	6	.
pH	7.54	.	7.42	.	7.56	6.85	8.05	7.77	7.59	.
Miscellaneous Analytes										
Dissolved Solids (mg/L)	.	.	.	.	.	.	.	.	.	.
Suspended Solids (mg/L)	.	.	.	.	.	.	.	.	.	.
Major Ions (mg/L)										
Calcium	51.8	50.9	51.2	51.4	55.8	49.1	36.7	34.5	.	.
Magnesium	31.4	30.8	31.4	31.5	34.4	30.1	21.5	20.4	.	.
Potassium	1.23	1.14	1.29	1.29	0.981	0.822	1.11	1.04	.	.
Sodium	4.91	4.7	4.91	4.7	1.74	1.79	1.22	1.42	.	.
Bicarbonate	229	246	242	242	242	246	171	170	.	.
Carbonate	<	<	<	<	<	<	<	<	.	.
Chloride	9.7	10	8.9	8.7	2.9	3.5	0.99	0.99	.	.
Fluoride	0.11	<	<	<	<	<	0.11	<	.	.
Nitrate as N	1.3	0.77	1.6	1.6	0.45	0.22	0.092	0.091	.	.
Sulfate	2.3	2.2	2.7	2.7	1.8	1	5.8	5.8	.	.
Charge balance error (%)	4	.	1.2	.	6.8	-0.3	1.4	-0.9	.	.
Trace Metals (mg/L)										
Aluminum	<	<	<	<	<	<	<	<	.	.
Arsenic	<	<	<	<	<	<	<	<	.	.
Barium	0.012	0.0113	0.013	0.0132	0.0129	0.0128	0.017	0.0165	.	.
Beryllium	<	<	<	<	<	<	<	<	.	.
Boron	<	<	<	<	<	<	<	<	.	.
Chromium	<	<	<	<	<	<	<	<	.	.
Copper	<	<	0.0255	0.0307	<	<	<	<	.	.
Iron	0.0714	0.0673	<	<	<	<	<	<	.	.
Lead	<	<	<	<	<	<	<	<	.	.
Lithium	<	<	<	<	<	<	<	<	.	.
Manganese	<	<	<	<	<	<	<	<	.	.
Nickel	<	<	<	<	<	<	<	<	.	.
Strontium	0.0249	0.0242	0.0278	0.027	0.0196	0.0185	0.0253	0.0247	.	.
Thallium	<	<	<	<	<	<	<	<	.	.
Uranium	<	<	<	<	<	<	<	<	.	.

APPENDIX F.1: CY 2008 MONITORING DATA FOR THE CHESTNUT RIDGE HYDROGEOLOGIC REGIME
Field Measurements, Miscellaneous Analytes, Major Ions, and Trace Metals

Sampling Point	GW-301		GW-305		GW-322	GW-514	GW-521		GW-522	
Functional Area	CRBAWP		LIV		CRSP	FCAP	LIV		LIV	
Date Sampled	07/10/08		01/28/08	07/15/08	11/12/08	11/18/08	01/28/08	07/15/08	01/23/08	
Program	BJC	BJC	BJC	BJC	GWPP	GWPP	BJC	BJC	BJC	BJC
Sample Type		Dup								Dup
Field Measurements										
Time Sampled	15:45	.	12:00	12:00	14:30	10:00	15:05	14:40	10:15	.
Measuring Point Elev. (ft)	1,086.55	.	1,183.72	1,183.72	1,134.98	1,001.22	1,182.88	1,182.88	1,175.48	.
Depth to Water (ft)	136.56	.	124.63	128.29	169.85	36.77	90.80	88.55	106.67	.
Groundwater Elevation (ft)	949.99	.	1,059.09	1,055.43	965.13	964.45	1,092.08	1,094.33	1,068.81	.
Conductivity (µmho/cm)	505	.	407	416	552	316	377	357	231	.
Dissolved Oxygen (ppm)	7.72	.	6.42	7.36	3.14	0.37	2.87	6.48	6.61	.
Oxidation/Reduction (mV)	100	.	193	118	115	-161	151	35	139	.
Temperature (degrees C)	17.2	.	8.6	20.5	15.3	11.3	14.9	19	11.2	.
Turbidity (NTU)	1	.	0	4	.	.	3	3	5	.
pH	7.73	.	7.87	7.87	7.14	7.56	8.87	7.98	7.8	.
Miscellaneous Analytes										
Dissolved Solids (mg/L)	.	.	170	180	250	193	130	170	200	200
Suspended Solids (mg/L)	.	.	<	<	1	4	11	<	<	<
Major Ions (mg/L)										
Calcium	.	.	33	35	61.2	34.7	16	29	42 J	42 J
Magnesium	.	.	21	20	38.3	23.7	23	22	25 J	26 J
Potassium	.	.	<	<	<	<	<	<	<	<
Sodium	.	.	<	<	0.751	0.511	4.3	2.8	2 J	2 J
Bicarbonate	.	.	160	170	289	183	130	160	210	210
Carbonate	.	.	<	<	<	<	11	<	<	<
Chloride	.	.	<	3.6	1.9	1.05	<	<	<	<
Fluoride	.	.	<	<	<	<	<	<	<	<
Nitrate as N	.	.	<	<	0.498	<	<	<	<	<
Sulfate	.	.	<	<	1.44	<	<	<	<	<
Charge balance error (%)	.	.	2.7	-1.6	2.8	0.2	0.9	2.7	0.5	.
Trace Metals (mg/L)										
Aluminum	.	.	<	<	0.224	<	<	<	<	<
Arsenic	.	.	<	<	<	<	<	<	<	<
Barium	.	.	<	<	0.0184	0.0156	<	<	0.012	0.012
Beryllium	.	.	<	<	<	<	<	<	<	<
Boron	.	.	<	<	<	<	<	<	<	<
Chromium	.	.	<	<	<	<	<	<	<	<
Copper	.	.	<	<	<	<	<	<	<	<
Iron	.	.	<	<	0.254	6.42	<	<	<	<
Lead	.	.	<	<	<	<	<	<	<	<
Lithium	.	.	.	.	<	<	.	.	.	.
Manganese	.	.	<	<	0.00803	0.0395	<	<	<	<
Nickel	.	.	0.097	0.11	<	<	<	<	<	<
Strontium	.	.	0.014	0.018	0.0215	0.0199	<	0.01	0.016 J	0.016 J
Thallium	.	.	<	<	<	<	<	<	<	<
Uranium	.	.	<	<	<	<	<	<	<	<

APPENDIX F.1: CY 2008 MONITORING DATA FOR THE CHESTNUT RIDGE HYDROGEOLOGIC REGIME
Field Measurements, Miscellaneous Analytes, Major Ions, and Trace Metals

Sampling Point	GW-522		GW-540		GW-557		GW-560		GW-562	
Functional Area	LIV		LII		LV		CDLVII		CDLVII	
Date Sampled	07/15/08		01/29/08	07/15/08	01/23/08	07/17/08	01/29/08	07/21/08	01/24/08	07/21/08
Program	BJC	BJC	BJC	BJC	BJC	BJC	BJC	BJC	BJC	BJC
Sample Type		Dup								
Field Measurements										
Time Sampled	11:00	.	13:30	14:00	13:00	9:20	13:35	13:50	13:30	14:30
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)	110.89	.	88.04	88.20	126.27	126.17	55.00	55.07	18.77	18.79
Groundwater Elevation (ft)	1,064.59	.	984.27	984.11	955.09	955.19	894.05	893.98	915.92	915.90
Conductivity (µmho/cm)	492	.	280	702	204	276	491	303	226	477
Dissolved Oxygen (ppm)	7.22	.	1.79	1.3	5.98	7.37	5.78	5.08	5.97	5.47
Oxidation/Reduction (mV)	113	.	28	16	173	127	189	59	114	125
Temperature (degrees C)	16.1	.	13.7	21	14	17.5	14.1	19.8	10	18.8
Turbidity (NTU)	0	.	1	1	3	1	0	2	8	1
pH	7.1	.	7.9	7.5	7.84	7.22	7.26	7.1	7.61	7.59
Miscellaneous Analytes										
Dissolved Solids (mg/L)	190	200	250	250	160	180	180	170	180	190
Suspended Solids (mg/L)	<	<	<	<	<	<	4	<	10	11
Major Ions (mg/L)										
Calcium	37	37	41	41	35 J	34	41	40	39	38
Magnesium	22	22	27	27	20 J	20	18	17	22	22
Potassium	<	<	2.1	2.3	<	<	<	<	<	<
Sodium	<	<	16	17	2 J	<	<	<	3.2	2.2
Bicarbonate	180	180	240	250	170	150	170	170	200	190
Carbonate	<	<	<	<	<	<	<	<	<	<
Chloride	<	<	<	<	<	<	<	<	<	<
Fluoride	<	<	<	<	<	<	<	<	<	<
Nitrate as N	<	<	<	<	<	<	<	<	<	<
Sulfate	<	<	6.3	6.7	<	<	<	<	<	<
Charge balance error (%)	0.8	.	0.9	-0.7	1.2	5.4	1.9	0	-1.3	0.1
Trace Metals (mg/L)										
Aluminum	<	<	<	<	<	<	<	<	0.29	0.67
Arsenic	<	<	<	<	<	<	<	<	<	<
Barium	0.01	0.011	0.012	0.012	<	0.01	0.23	0.23	0.012	0.012
Beryllium	<	<	<	<	<	<	<	<	<	<
Boron	<	<	<	<	<	<	<	<	<	<
Chromium	<	<	<	<	<	<	<	<	<	<
Copper	<	<	<	<	<	<	<	<	<	<
Iron	<	<	<	<	<	<	<	<	0.35	0.39
Lead	<	<	<	<	<	<	<	<	<	<
Lithium	.	.	.	.	.	.	.	.	.	.
Manganese	<	<	<	<	<	<	<	<	<	<
Nickel	<	<	<	<	<	<	<	<	<	<
Strontium	0.015	0.016	0.029	0.032	0.016 J	0.017	0.025	0.025	0.021	0.021
Thallium	<	<	<	<	<	<	<	<	<	<
Uranium	<	<	<	<	<	<	<	<	<	<

APPENDIX F.1: CY 2008 MONITORING DATA FOR THE CHESTNUT RIDGE HYDROGEOLOGIC REGIME
Field Measurements, Miscellaneous Analytes, Major Ions, and Trace Metals

Sampling Point	GW-564				GW-608	GW-609	GW-612	GW-709		GW-731
Functional Area	CDLVII				CRSP	CRSP	CRSP	LII		CRSDB
Date Sampled	01/31/08		07/21/08		11/17/08	11/17/08	11/12/08	01/29/08	07/16/08	07/15/08
Program	BJC	BJC	BJC	BJC	GWPP	GWPP	GWPP	BJC	BJC	BJC
Sample Type		Dup		Dup						
Field Measurements										
Time Sampled	10:00	.	9:45	.	10:30	14:05	9:20	10:15	14:00	13:50
Measuring Point Elev. (ft)	938.07	.	938.07	.	1,075.38	1,112.31	1,131.03	906.81	906.81	1,049.38
Depth to Water (ft)	13.45	.	12.93	.	140.82	171.40	134.41	29.54	30.11	125.75
Groundwater Elevation (ft)	924.62	.	925.14	.	934.56	940.91	996.62	877.27	876.70	923.63
Conductivity (µmho/cm)	394	.	335	.	378	377	466	495	615	238
Dissolved Oxygen (ppm)	4.5	.	7.64	.	2.35	4.56	0.75	2.47	5.02	4.58
Oxidation/Reduction (mV)	179	.	87	.	102	130	-9	179	58	49
Temperature (degrees C)	13.8	.	16.7	.	13.5	14.7	12	12	23.7	17.9
Turbidity (NTU)	3	.	4	.	.	.	.	0	2	1
pH	6.16	.	6.68	.	7.63	7.57	7.49	8.03	8.06	8.14
Miscellaneous Analytes										
Dissolved Solids (mg/L)	140	140	140	150	14	213	198	180	180	183
Suspended Solids (mg/L)	<	<	<	<	<	<	2	<	<	11
Major Ions (mg/L)										
Calcium	32	31	33	32	41.5	42.9	49	28	28	29.1
Magnesium	11	11	11	11	24.6	25.6	31.1	27	27	17.1
Potassium	<	<	<	<	5.93	<	2.5	<	<	1.6 J
Sodium	2.3	2.2	<	<	1.81	1.24	0.705	3.2	2.9	0.856
Bicarbonate	100	100	110	110	208	202	237	170	170	.
Carbonate	<	<	<	<	<	<	<	<	<	.
Chloride	4.7	4.6	3.6	3.6	2.53	1.13	1.69	<	<	.
Fluoride	<	<	<	<	<	<	<	<	<	.
Nitrate as N	1.9	1.9	<	<	0.347	0.912	<	<	<	.
Sulfate	21	20	14	14	5.14	3.41	3.33	9	8.5	.
Charge balance error (%)	-1.9	.	-0.8	.	-0.4	1.1	2.5	2.3	2.3	.
Trace Metals (mg/L)										
Aluminum	<	<	<	<	<	<	<	<	<	0.548
Arsenic	<	<	<	<	<	<	<	<	<	<
Barium	0.029	0.028	0.023	0.023	0.0221	0.013	0.0211	0.54	0.59	0.0103
Beryllium	<	<	<	<	<	<	<	<	<	<
Boron	<	<	<	<	<	<	0.179	<	<	<
Chromium	<	<	<	<	<	<	<	<	<	<
Copper	<	<	<	<	<	<	<	<	<	<
Iron	<	<	<	<	<	<	2.1	<	<	0.475
Lead	<	<	<	<	<	<	0.00281	<	<	<
Lithium	.	.	.	.	0.029	<	<	.	.	<
Manganese	<	<	<	<	<	<	0.17	<	<	0.0114
Nickel	<	<	<	<	<	<	<	<	<	<
Strontium	0.085	0.082	0.072	0.071	0.0824	0.0146	0.0287	0.04	0.043	0.0216
Thallium	<	<	<	<	<	<	<	<	<	<
Uranium	<	<	<	<	0.00156	<	<	<	<	<

APPENDIX F.1: CY 2008 MONITORING DATA FOR THE CHESTNUT RIDGE HYDROGEOLOGIC REGIME
Field Measurements, Miscellaneous Analytes, Major Ions, and Trace Metals

Sampling Point	GW-732	GW-757		GW-796		GW-797		GW-798	
Functional Area	CRSDB	LII		LV		LV		CDLVII	
Date Sampled	07/14/08	01/30/08	07/16/08	01/23/08	07/17/08	01/24/08	07/21/08	01/30/08	07/21/08
Program	BJC	BJC	BJC	BJC	BJC	BJC	BJC	BJC	BJC
Sample Type									
Field Measurements									
Time Sampled	15:15	10:50	9:45	14:00	10:55	11:45	10:50	13:50	13:30
Measuring Point Elev. (ft)	1,064.29	961.64	961.64	1,052.62	1,052.62	1,060.00	1,060.00	1,006.00	1,006.00
Depth to Water (ft)	158.09	87.37	85.05	88.21	85.44	78.27	78.62	89.42	88.47
Groundwater Elevation (ft)	906.20	874.27	876.59	964.41	967.18	981.73	981.38	916.58	917.53
Conductivity (µmho/cm)	683	356	442	337	201	700	1,068	409	526
Dissolved Oxygen (ppm)	5.39	6.62	2.78	8.15	6.9	5.56	4.12	5.14	4.92
Oxidation/Reduction (mV)	65	177	106	142	87	172	82	148	73
Temperature (degrees C)	16.2	5.4	18.8	14.1	18	9.1	22.4	15.3	20.6
Turbidity (NTU)	1	1	2	5	3	2	1	1	0
pH	7.67	8.2	8.2	8.17	8.1	7.4	7.45	7.68	7.28
Miscellaneous Analytes									
Dissolved Solids (mg/L)	176	150	160	120	130	300	310	100	140
Suspended Solids (mg/L)	<	<	6	<	<	<	<	<	<
Major Ions (mg/L)									
Calcium	34.2	31	5.3	25 J	23	57	56	27	29
Magnesium	21.9	19	13	15 J	14	33	33	17	16
Potassium	1.36	2.4	16	<	2.3	<	<	<	<
Sodium	0.708	3.2	27	2 J	<	4.7	5.1	<	<
Bicarbonate	.	150	92	120	120	210	210	140	130
Carbonate	.	<	35	<	<	<	<	<	<
Chloride	.	<	<	<	<	7.8	7.7	<	<
Fluoride	.	1.5	1.3	<	<	<	<	<	<
Nitrate as N	.	<	<	<	<	3	3	0.59	0.62
Sulfate	.	9.7	10	<	<	58	57	<	<
Charge balance error (%)	.	0.5	1.8	3.4	-0.9	-0.7	-0.7	-1.7	2.2
Trace Metals (mg/L)									
Aluminum	<	<	<	<	<	<	<	<	<
Arsenic	<	<	<	<	<	<	<	<	<
Barium	0.0106	0.28	0.17	<	<	0.012	0.012	0.011	<
Beryllium	<	<	<	<	<	<	<	<	<
Boron	<	<	<	<	<	<	<	<	<
Chromium	<	<	0.012	<	<	<	<	<	<
Copper	0.0388	<	<	<	<	<	<	<	<
Iron	<	<	<	0.11	<	<	<	<	<
Lead	<	<	<	<	<	<	<	<	<
Lithium	<	.	.	.	.	.	.	.	.
Manganese	<	<	<	<	<	<	<	<	<
Nickel	<	<	<	<	<	<	<	<	<
Strontium	0.0152	0.78	0.43	0.013 J	0.013	0.032	0.033	0.017	0.016
Thallium	<	<	<	<	<	<	<	<	<
Uranium	<	<	<	<	<	<	<	<	<

APPENDIX F.1: CY 2008 MONITORING DATA FOR THE CHESTNUT RIDGE HYDROGEOLOGIC REGIME
Field Measurements, Miscellaneous Analytes, Major Ions, and Trace Metals

Sampling Point	GW-799		GW-801		GW-831		MCK 2.0		MCK 2.05	
Functional Area	LV		LV		FCAP		EXP-SW		EXP-SW	
Date Sampled	01/24/08	07/17/08	01/23/08	07/21/08	01/09/08	07/10/08	01/16/08	08/19/08	01/16/08	
Program	BJC	BJC	BJC	BJC	BJC	BJC	BJC	BJC	BJC	BJC
Sample Type										Dup
Field Measurements										
Time Sampled	14:45	13:35	10:30	10:05	13:45	14:30	9:50	8:55	9:30	.
Measuring Point Elev. (ft)	981.29	981.29	1,097.16	1,097.16	1,091.29	1,091.29	.	.	.	.
Depth to Water (ft)	26.88	26.96	122.35	121.94	134.61	132.62	.	.	.	.
Groundwater Elevation (ft)	954.41	954.33	974.81	975.22	956.68	958.67	.	.	.	.
Conductivity (µmho/cm)	391	241	380	253	210	388	341	419	341	.
Dissolved Oxygen (ppm)	2.98	3.62	8.08	6.62	2.01	5.64	9.83	5.83	2.55	.
Oxidation/Reduction (mV)	173	53	158	118	87	69	54.3	95.9	2.6	.
Temperature (degrees C)	12.8	18.4	10.5	16.7	14	20.8	5.55	17.74	9.88	.
Turbidity (NTU)	2	4	1	1	3	4	2.15	17.8	20.1	.
pH	8.21	8.1	7.5	7.28	8.4	8.3	7.96	7.36	6.97	.
Miscellaneous Analytes										
Dissolved Solids (mg/L)	140	150	150	150	.	.	251	226	232	231
Suspended Solids (mg/L)	<	<	8	<	.	.	5	26	21	16
Major Ions (mg/L)										
Calcium	31	30	32 J	32	.	.	51.5	46.9	49	47.1
Magnesium	17	16	18 J	19	.	.	17.1	15.2	18.2	17.5
Potassium	<	<	<	<	.	.	4.62	4.66	4.14	4.02
Sodium	<	<	2 J	<	.	.	1.88	2.09	1.74	1.69
Bicarbonate	140	130	150	160	.	.	174	178	178	174
Carbonate	<	<	<	<	.	.	<	<	<	<
Chloride	<	<	<	<	.	.	1.7	1.9	1.6	1.7
Fluoride	<	<	<	<	.	.	<	0.14	<	<
Nitrate as N	1	0.95	<	<	.	.	.	.	.	.
Sulfate	<	<	<	<	.	.	22.2	24.2	14	14.7
Charge balance error (%)	1.3	2.7	2.7	-0.6	.	.	2.3	-4.1	2.9	.
Trace Metals (mg/L)										
Aluminum	<	<	<	<	.	.	0.947	0.51	<	<
Arsenic	<	<	<	<	.	.	0.043	0.0338	0.676	0.692
Barium	<	<	<	<	.	.	0.14	0.121	0.165	0.164
Beryllium	<	<	<	<	.	.	<	<	<	<
Boron	<	<	<	<	.	.	0.206	0.195	0.206	0.198
Chromium	0.032	0.029	<	<	.	.	<	<	<	<
Copper	<	<	<	<	.	.	<	<	<	<
Iron	<	<	<	<	.	.	2.16	1.36	26.9	28.5
Lead	<	<	<	<	.	.	<	<	<	<
Lithium	.	.	.	.	.	.	0.0672	0.0683	0.0656	0.0624
Manganese	<	<	<	<	.	.	2.19	1.74	1.47	1.42
Nickel	<	<	<	<	.	.	<	<	<	<
Strontium	0.019	0.02	0.016 J	0.017	.	.	0.958	0.897	0.884	0.852
Thallium	<	<	<	<	.	.	<	<	<	<
Uranium	<	<	<	<	.	.	<	<	<	<

APPENDIX F.1: CY 2008 MONITORING DATA FOR THE CHESTNUT RIDGE HYDROGEOLOGIC REGIME
Field Measurements, Miscellaneous Analytes, Major Ions, and Trace Metals

Sampling Point	MCK 2.05		S17	SCR1.25SP		SCR1.5SW	SCR2.1SP	SCR2.2SP	
Functional Area	EXP-SW		EXP-SW	EXP-SW		EXP-SW	EXP-SW	EXP-SW	
Date Sampled	08/19/08		04/15/08	01/16/08	08/19/08	04/15/08	04/15/08	04/15/08	
Program	BJC	BJC	GWPP	BJC	BJC	GWPP	GWPP	GWPP	GWPP
Sample Type		Dup							Dup
Field Measurements									
Time Sampled	9:10	.	8:25	10:30	10:15	8:45	10:30	9:15	9:15
Measuring Point Elev. (ft)	.	.	.	.	.	.	.	.	.
Depth to Water (ft)	.	.	.	.	.	.	.	.	.
Groundwater Elevation (ft)	.	.	.	.	.	.	.	.	.
Conductivity (µmho/cm)	394	.	314	241	397	254	245	319	319
Dissolved Oxygen (ppm)	4.3	.	5.64	8.37	6.82	6.19	5.67	5.16	5.16
Oxidation/Reduction (mV)	80.6	.	197	69.5	98.1	170	163	175	175
Temperature (degrees C)	16.3	.	11.8	8.41	17.9	9.6	11.8	11.6	11.6
Turbidity (NTU)	5.2	.	.	1.57	12.7	.	.	.	.
pH	6.86	.	7.5	7.15	7.16	7.13	7.1	6.97	6.97
Miscellaneous Analytes									
Dissolved Solids (mg/L)	226	222	98	160	201	10	119	157	155
Suspended Solids (mg/L)	<	<	<	13	<	<	<	<	<
Major Ions (mg/L)									
Calcium	46.3	47.4	38.2	33	43.3	31.6	29.1	49	47.3
Magnesium	15	15.3	14.7	12.8	19.3	11.8	11	10.5	9.72
Potassium	4.39	4.44	<	0.912	1.14	<	<	<	<
Sodium	1.95	1.97	0.86	1.45	1.32	1.13	1.62	1.67	1.59
Bicarbonate	174	172	147	123	195	124	118	153	153
Carbonate	<	<	<	<	<	<	<	<	<
Chloride	1.8	1.9	1.56	2.8	2.8	1.88	2.52	2.44	2.51
Fluoride	0.15	0.15	<	<	<	<	<	<	<
Nitrate as N	.	.	2.17	0.12	0.094	0.053	0.0829	0.807	0.827
Sulfate	23.3	23.9	5.85	13.9	5.7	6.74	6.2	8.51	8.61
Charge balance error (%)	-3.6	.	-1.7	-0.9	-3.4	-1.5	-2.7	0.3	-2.1
Trace Metals (mg/L)									
Aluminum	<	<	<	<	<	<	<	<	<
Arsenic	0.0601 Q	0.479	<	<	<	<	<	<	<
Barium	0.0942	0.199	0.0507	0.046	0.0787	0.037	0.0262	0.0297	0.0275
Beryllium	0.0016	<	<	<	<	<	<	<	<
Boron	0.199	0.202	<	<	<	<	<	<	<
Chromium	<	<	<	<	<	<	<	<	<
Copper	<	<	<	<	<	<	<	<	<
Iron	1.76 R	18.3 R	0.0706	0.275	0.412	0.0574	<	0.0562	0.0728
Lead	<	<	0.0017	<	<	0.00232	<	<	0.00051
Lithium	0.068	0.0688	<	<	<	<	<	<	<
Manganese	1.18	3.35	0.00967	0.0357	0.107	<	<	<	<
Nickel	<	<	<	<	<	<	<	<	<
Strontium	0.899	0.934	0.0462	0.0434	0.0551	0.0378	0.0348	0.0626	0.0585
Thallium	<	<	<	<	<	<	<	<	<
Uranium	<	<	0.00073	<	<	0.00058	0.00171	0.00057	0.00052

APPENDIX F.1: CY 2008 MONITORING DATA FOR THE CHESTNUT RIDGE HYDROGEOLOGIC REGIME
Field Measurements, Miscellaneous Analytes, Major Ions, and Trace Metals

Sampling Point	SCR3.5SP		SCR3.5SW	SCR4.3SP		UNC SW-1	
Functional Area	EXP-SW		EXP-SW	EXP-SW		EXP-SW	
Date Sampled	01/16/08	08/19/08	04/15/08	01/23/08	07/16/08	03/03/08	08/27/08
Program	BJC	BJC	GWPP	BJC	BJC	BJC	BJC
Sample Type							
Field Measurements							
Time Sampled	8:50	9:45	9:45	13:30	14:25	12:50	10:20
Measuring Point Elev. (ft)	.	.	.	.	.	.	.
Depth to Water (ft)	.	.	.	.	.	.	.
Groundwater Elevation (ft)	.	.	.	.	.	.	.
Conductivity (µmho/cm)	327	384	328	166	253	94	242
Dissolved Oxygen (ppm)	9.77	6.92	5.68	6.23	8.13	5.97	4.7
Oxidation/Reduction (mV)	88.4	95.7	165	151	98	129	87.5
Temperature (degrees C)	7.03	17.7	10.3	12	21.4	19.82	18.7
Turbidity (NTU)	2.04	4.61	.	18	35	5.2	21.8
pH	7.86	7.62	7.55	7.17	7.01	6.09	6.33
Miscellaneous Analytes							
Dissolved Solids (mg/L)	214	212	113	150	190	.	.
Suspended Solids (mg/L)	5	15	<	6.8	16	.	.
Major Ions (mg/L)							
Calcium	48.5	49.7	44.6	35 J	39	8.48	31.3
Magnesium	14.9	16.7	13.7	10 J	11	2.59	7.03
Potassium	1.81	2.31	2.09	<	2.4	0.501	0.873
Sodium	1.15	1.49	1.21	2 J	2	3.05	2.39
Bicarbonate	164	188	150	110	110	20.2	87.4
Carbonate	<	<	<	<	<	<	<
Chloride	1.8	1.8	1.39	4.3	3.9	5.4	3.4
Fluoride	<	0.16	0.103	<	<	<	<
Nitrate as N	0.52	0.15	0.298	0.91	<	0.11	0.18
Sulfate	17	10.8	17	20	29	8.2	21.5
Charge balance error (%)	0.3	-0.9	0.6	-2.7	1.5	3.2	-0.8
Trace Metals (mg/L)							
Aluminum	<	0.728	<	0.31	0.89	0.243	1.81
Arsenic	<	0.0057	<	<	<	<	<
Barium	0.0735	0.101	0.073	0.082	0.1	0.019	0.0527
Beryllium	<	<	<	<	<	<	<
Boron	<	<	<	<	<	<	<
Chromium	<	<	<	<	<	<	<
Copper	<	<	<	<	<	<	<
Iron	0.0662	1.19	0.0721	0.36	0.61	0.196	1.46
Lead	<	<	<	<	<	<	0.0062
Lithium	0.0131	0.023	0.0156	.	.	<	<
Manganese	0.025	0.186	0.0253	<	<	0.0132	0.0476
Nickel	<	<	<	<	<	<	<
Strontium	0.266	0.354	0.27	0.097 J	0.13	0.0229	0.0725
Thallium	<	<	<	<	<	<	<
Uranium	<	<	<	<	<	.	.

APPENDIX F.2
VOLATILE ORGANIC COMPOUNDS

APPENDIX F.2: CY 2008 MONITORING DATA FOR THE CHESTNUT RIDGE HYDROGEOLOGIC REGIME
Volatile Organic Compounds

Sampling Point	GW-141		GW-143	GW-144	GW-145	GW-161	
Functional Area	LIV		KHQ	KHQ	KHQ	ECRWP	
Date Sampled	01/24/08	07/16/08	07/09/08	07/09/08	07/10/08	01/07/08	07/09/08
Program	BJC	BJC	BJC	BJC	BJC	BJC	BJC
Sample Type							
Chloroethenes (µg/L)							
Tetrachloroethene	<	<	<	<	<	<	<
Trichloroethene	<	<	<	<	<	<	<
cis-1,2-Dichloroethene	<	<	<	<	<	<	<
trans-1,2-Dichloroethene	<	<	<	<	<	<	<
1,1-Dichloroethene	<	<	<	<	<	<	<
Chloroethanes (µg/L)							
1,1,1-Trichloroethane	<	<	<	<	<	<	<
1,1-Dichloroethane	<	<	<	<	<	<	<
Chloromethanes (µg/L)							
Carbon tetrachloride	<	<	<	<	<	<	<
Methylene chloride	<	<	<	<	<	<	<
Miscellaneous (µg/L)							
1,1,2-Trichloro-1,2,2-trifluoroethane	.	.	.	.	.	.	.
Trichlorofluoromethane	<	<	.	.	.	.	.
1,2-Dichlorobenzene	<	<	.	.	.	.	.
1,2-Dichloropropane	<	<	<	<	<	<	<
Carbon disulfide	<	<	<	<	<	<	<
Dibromochloromethane	0.32 J	<	<	<	<	<	<

APPENDIX F.2: CY 2008 MONITORING DATA FOR THE CHESTNUT RIDGE HYDROGEOLOGIC REGIME
Volatile Organic Compounds

Sampling Point	GW-173			GW-175	GW-177		GW-178	GW-217	
Functional Area	CRSP			CRSP	CRSP		CRSP	LIV	
Date Sampled	04/14/08	11/13/08		11/11/08	01/09/08	08/12/08	11/11/08	01/22/08	07/16/08
Program	GWPP	GWPP	GWPP	GWPP	BJC	BJC	GWPP	BJC	BJC
Sample Type			Dup						
Chloroethenes (µg/L)									
Tetrachloroethene	4 J	5 J	5 J	5 J	0.3 J	1 J	<	<	<
Trichloroethene	<	<	<	<	<	0.1 J	<	<	<
cis-1,2-Dichloroethene	<	<	<	<	<	<	<	<	<
trans-1,2-Dichloroethene	<	<	<	<	<	<	<	<	<
1,1-Dichloroethene	<	<	<	<	8	9	5 J	<	<
Chloroethanes (µg/L)									
1,1,1-Trichloroethane	<	<	<	<	9	9	4 J	<	<
1,1-Dichloroethane	<	<	<	<	36	34	9	<	<
Chloromethanes (µg/L)									
Carbon tetrachloride	<	<	<	<	<	0.6 J	<	<	<
Methylene chloride	<	<	<	<	<	<	<	<	<
Miscellaneous (µg/L)									
1,1,2-Trichloro-1,2,2-trifluoroethane	2 J	3 J	3 J	<	.	.	<	.	.
Trichlorofluoromethane	2 J	3 J	3 J	4 J	.	.	<	<	<
1,2-Dichlorobenzene	<	<	<	<	.	.	<	<	<
1,2-Dichloropropane	<	<	<	<	<	<	<	<	<
Carbon disulfide	<	<	<	<	<	<	<	<	<
Dibromochloromethane	<	<	<	<	<	<	<	<	<

APPENDIX F.2: CY 2008 MONITORING DATA FOR THE CHESTNUT RIDGE HYDROGEOLOGIC REGIME
Volatile Organic Compounds

Sampling Point	GW-231		GW-294				GW-296	
Functional Area	KHQ		ECRWP				ECRWP	
Date Sampled	07/09/08		01/08/08		07/10/08		01/08/08	07/10/08
Program	BJC	BJC	BJC	BJC	BJC	BJC	BJC	BJC
Sample Type		Dup		Dup		Dup		
Chloroethenes (µg/L)								
Tetrachloroethene	<	<	<	<	<	<	<	<
Trichloroethene	<	<	<	<	<	<	<	<
cis-1,2-Dichloroethene	<	<	<	<	<	<	<	<
trans-1,2-Dichloroethene	<	<	<	<	<	<	<	<
1,1-Dichloroethene	<	<	<	<	<	<	<	<
Chloroethanes (µg/L)								
1,1,1-Trichloroethane	<	<	<	<	<	<	<	<
1,1-Dichloroethane	<	<	<	<	<	<	<	<
Chloromethanes (µg/L)								
Carbon tetrachloride	<	<	<	<	<	<	<	<
Methylene chloride	<	<	<	<	<	<	<	<
Miscellaneous (µg/L)								
1,1,2-Trichloro-1,2,2-trifluoroethane	.	.	.	.	.	.	.	.
Trichlorofluoromethane	.	.	.	.	.	.	.	.
1,2-Dichlorobenzene	.	.	.	.	.	.	.	.
1,2-Dichloropropane	<	<	<	<	<	<	<	<
Carbon disulfide	<	<	<	<	<	<	<	<
Dibromochloromethane	<	<	<	<	<	<	<	<

APPENDIX F.2: CY 2008 MONITORING DATA FOR THE CHESTNUT RIDGE HYDROGEOLOGIC REGIME
Volatile Organic Compounds

Sampling Point	GW-298		GW-301				GW-305		GW-322
Functional Area	ECRWP		CRBAWP				LIV		CRSP
Date Sampled	01/08/08	07/10/08	01/09/08		07/10/08		01/28/08	07/15/08	11/12/08
Program	BJC	BJC	BJC	BJC	BJC	BJC	BJC	BJC	GWPP
Sample Type				Dup		Dup			
Chloroethenes (µg/L)									
Tetrachloroethene	<	<	<	<	<	<	<	<	7
Trichloroethene	<	<	<	<	<	<	<	<	<
cis-1,2-Dichloroethene	<	<	<	<	<	<	<	<	<
trans-1,2-Dichloroethene	<	<	<	<	<	<	<	<	<
1,1-Dichloroethene	<	<	<	<	<	<	6.4	5.5	75
Chloroethanes (µg/L)									
1,1,1-Trichloroethane	<	<	<	<	<	<	13	12	27
1,1-Dichloroethane	<	<	<	<	<	<	24	25	88
Chloromethanes (µg/L)									
Carbon tetrachloride	<	<	<	<	<	<	<	<	<
Methylene chloride	<	<	<	<	<	<	<	<	<
Miscellaneous (µg/L)									
1,1,2-Trichloro-1,2,2-trifluoroethane	.	.	.	.	.	.	.	.	5 J
Trichlorofluoromethane	.	.	.	.	.	.	<	<	37
1,2-Dichlorobenzene	.	.	.	.	.	.	<	<	<
1,2-Dichloropropane	<	<	<	<	<	<	<	<	<
Carbon disulfide	<	<	<	<	<	<	<	<	<
Dibromochloromethane	<	<	<	<	<	<	<	<	<

APPENDIX F.2: CY 2008 MONITORING DATA FOR THE CHESTNUT RIDGE HYDROGEOLOGIC REGIME
Volatile Organic Compounds

Sampling Point	GW-514	GW-521		GW-522				GW-540	
Functional Area	FCAP	LIV		LIV				LII	
Date Sampled	11/18/08	01/28/08	07/15/08	01/23/08		07/15/08		01/29/08	07/15/08
Program	GWPP	BJC	BJC	BJC	BJC	BJC	BJC	BJC	BJC
Sample Type				Dup			Dup		
Chloroethenes (µg/L)									
Tetrachloroethene	<	<	<	<	<	<	<	<	<
Trichloroethene	<	<	<	<	<	<	<	<	<
cis-1,2-Dichloroethene	<	<	<	<	<	<	<	<	<
trans-1,2-Dichloroethene	<	<	<	<	<	<	<	<	<
1,1-Dichloroethene	<	<	<	<	<	<	<	<	<
Chloroethanes (µg/L)									
1,1,1-Trichloroethane	<	<	<	<	<	<	<	<	<
1,1-Dichloroethane	<	<	<	<	<	<	<	<	<
Chloromethanes (µg/L)									
Carbon tetrachloride	<	<	<	<	<	<	<	<	<
Methylene chloride	<	<	<	<	<	<	<	<	<
Miscellaneous (µg/L)									
1,1,2-Trichloro-1,2,2-trifluoroethane	<	.	.	.	.	.	.	.	.
Trichlorofluoromethane	<	<	<	<	<	<	<	<	<
1,2-Dichlorobenzene	<	<	<	<	<	<	<	<	<
1,2-Dichloropropane	<	<	<	<	<	<	<	<	<
Carbon disulfide	<	<	<	<	<	<	<	<	<
Dibromochloromethane	<	<	<	<	<	<	<	<	<

APPENDIX F.2: CY 2008 MONITORING DATA FOR THE CHESTNUT RIDGE HYDROGEOLOGIC REGIME
Volatile Organic Compounds

Sampling Point	GW-557		GW-560		GW-562		GW-564	
Functional Area	LV		CDLVII		CDLVII		CDLVII	
Date Sampled	01/23/08	07/17/08	01/29/08	07/21/08	01/24/08	07/21/08	01/31/08	
Program	BJC	BJC	BJC	BJC	BJC	BJC	BJC	BJC
Sample Type								Dup
Chloroethenes (µg/L)								
Tetrachloroethene	<	<	<	<	<	<	<	<
Trichloroethene	<	<	<	<	<	<	<	<
cis-1,2-Dichloroethene	<	<	<	<	<	<	<	<
trans-1,2-Dichloroethene	<	<	<	<	<	<	<	<
1,1-Dichloroethene	<	<	<	<	<	<	<	<
Chloroethanes (µg/L)								
1,1,1-Trichloroethane	<	<	<	<	<	<	<	<
1,1-Dichloroethane	<	<	<	<	<	<	<	<
Chloromethanes (µg/L)								
Carbon tetrachloride	<	<	<	<	<	<	<	<
Methylene chloride	<	<	<	<	<	<	<	0.33 J
Miscellaneous (µg/L)								
1,1,2-Trichloro-1,2,2-trifluoroethane	.	.	.	.	.	.	.	.
Trichlorofluoromethane	<	<	<	<	<	<	<	<
1,2-Dichlorobenzene	<	<	0.29 J	<	<	<	<	<
1,2-Dichloropropane	<	<	<	<	<	<	<	<
Carbon disulfide	<	<	<	<	<	<	<	<
Dibromochloromethane	<	<	<	<	<	<	<	<

APPENDIX F.2: CY 2008 MONITORING DATA FOR THE CHESTNUT RIDGE HYDROGEOLOGIC REGIME
Volatile Organic Compounds

Sampling Point	GW-564		GW-608	GW-609	GW-612	GW-709		GW-757	
Functional Area	CDLVII		CRSP	CRSP	CRSP	LII		LII	
Date Sampled	07/21/08		11/17/08	11/17/08	11/12/08	01/29/08	07/16/08	01/30/08	07/16/08
Program	BJC	BJC	GWPP	GWPP	GWPP	BJC	BJC	BJC	BJC
Sample Type		Dup							
Chloroethenes (µg/L)									
Tetrachloroethene	<	<	<	<	2 J	<	<	<	<
Trichloroethene	<	<	<	<	<	<	<	<	<
cis-1,2-Dichloroethene	<	<	<	<	<	<	<	<	<
trans-1,2-Dichloroethene	<	<	<	<	<	<	<	<	<
1,1-Dichloroethene	<	<	<	<	26	<	<	<	<
Chloroethanes (µg/L)									
1,1,1-Trichloroethane	<	<	<	<	8	<	<	<	<
1,1-Dichloroethane	<	<	<	<	41	<	<	<	<
Chloromethanes (µg/L)									
Carbon tetrachloride	<	<	<	<	<	<	<	<	<
Methylene chloride	<	<	<	<	<	<	<	<	<
Miscellaneous (µg/L)									
1,1,2-Trichloro-1,2,2-trifluoroethane	.	.	<	<	<	.	.	.	.
Trichlorofluoromethane	<	<	<	<	<	<	<	<	<
1,2-Dichlorobenzene	<	<	<	<	<	<	<	<	<
1,2-Dichloropropane	<	<	<	<	<	<	<	<	<
Carbon disulfide	<	<	<	<	<	<	<	<	<
Dibromochloromethane	<	<	<	<	<	<	<	<	<

APPENDIX F.2: CY 2008 MONITORING DATA FOR THE CHESTNUT RIDGE HYDROGEOLOGIC REGIME
Volatile Organic Compounds

Sampling Point	GW-796		GW-797		GW-798		GW-799	
Functional Area	LV		LV		CDLVII		LV	
Date Sampled	01/23/08	07/17/08	01/24/08	07/21/08	01/30/08	07/21/08	01/24/08	07/17/08
Program	BJC	BJC	BJC	BJC	BJC	BJC	BJC	BJC
Sample Type								
Chloroethenes (µg/L)								
Tetrachloroethene	<	<	<	<	5.8	8.8	<	<
Trichloroethene	<	<	<	<	0.73 J	0.88 J	<	<
cis-1,2-Dichloroethene	<	<	<	<	6	8.9	<	<
trans-1,2-Dichloroethene	<	<	<	<	<	0.15 J	<	<
1,1-Dichloroethene	0.19 J	0.14 J	<	<	3.6 J	4.7 J	<	<
Chloroethanes (µg/L)								
1,1,1-Trichloroethane	0.39 J	0.44 J	<	<	1.7 J	2.1 J	<	<
1,1-Dichloroethane	0.27 J	0.32 J	<	<	2.5 J	3.4 J	<	<
Chloromethanes (µg/L)								
Carbon tetrachloride	<	<	<	<	<	<	<	<
Methylene chloride	<	<	<	<	<	<	<	<
Miscellaneous (µg/L)								
1,1,2-Trichloro-1,2,2-trifluoroethane	.	.	.	.	.	.	.	.
Trichlorofluoromethane	<	<	<	<	9.3	11	<	<
1,2-Dichlorobenzene	<	<	<	<	0.27 J	<	<	<
1,2-Dichloropropane	<	<	<	<	0.16 J	<	<	<
Carbon disulfide	<	<	<	<	<	<	<	<
Dibromochloromethane	<	<	<	<	<	<	<	<

APPENDIX F.2: CY 2008 MONITORING DATA FOR THE CHESTNUT RIDGE HYDROGEOLOGIC REGIME
Volatile Organic Compounds

Sampling Point	GW-801		GW-831		S17	SCR1.25SP		SCR1.5SW
Functional Area	LV		FCAP		EXP-SW	EXP-SW		EXP-SW
Date Sampled	01/23/08	07/21/08	01/09/08	07/10/08	04/15/08	01/16/08	08/19/08	04/15/08
Program	BJC	BJC	BJC	BJC	GWPP	BJC	BJC	GWPP
Sample Type								
Chloroethenes (µg/L)								
Tetrachloroethene	<	<	<	<	<	<	<	<
Trichloroethene	<	<	<	<	<	<	<	<
cis-1,2-Dichloroethene	<	<	<	<	<	<	<	<
trans-1,2-Dichloroethene	<	<	<	<	<	<	<	<
1,1-Dichloroethene	<	<	<	<	<	<	<	<
Chloroethanes (µg/L)								
1,1,1-Trichloroethane	<	<	<	<	<	<	<	<
1,1-Dichloroethane	<	<	<	<	<	<	<	<
Chloromethanes (µg/L)								
Carbon tetrachloride	<	<	<	<	<	<	<	<
Methylene chloride	<	<	<	<	<	<	<	<
Miscellaneous (µg/L)								
1,1,2-Trichloro-1,2,2-trifluoroethane	.	.	.	.	<	.	.	<
Trichlorofluoromethane	<	<	.	.	<	.	.	<
1,2-Dichlorobenzene	<	<	.	.	<	.	.	<
1,2-Dichloropropane	<	<	<	<	<	<	<	<
Carbon disulfide	0.66 J	<	<	<	<	<	<	<
Dibromochloromethane	<	<	<	<	<	<	<	<

APPENDIX F.2: CY 2008 MONITORING DATA FOR THE CHESTNUT RIDGE HYDROGEOLOGIC REGIME
Volatile Organic Compounds

Sampling Point	SCR2.1SP	SCR2.2SP		SCR3.5SP		SCR3.5SW	SCR4.3SP	
Functional Area	EXP-SW	EXP-SW		EXP-SW		EXP-SW	EXP-SW	
Date Sampled	04/15/08	04/15/08		01/16/08	08/19/08	04/15/08	01/23/08	07/16/08
Program	GWPP	GWPP	GWPP	BJC	BJC	GWPP	BJC	BJC
Sample Type			Dup					
Chloroethenes (µg/L)								
Tetrachloroethene	<	<	<	<	<	<	<	<
Trichloroethene	<	<	<	<	<	<	<	<
cis-1,2-Dichloroethene	<	<	<	<	<	<	<	<
trans-1,2-Dichloroethene	<	<	<	<	<	<	<	<
1,1-Dichloroethene	<	<	<	<	<	<	<	<
Chloroethanes (µg/L)								
1,1,1-Trichloroethane	<	<	<	<	<	<	<	<
1,1-Dichloroethane	<	<	<	<	<	<	<	<
Chloromethanes (µg/L)								
Carbon tetrachloride	<	<	<	<	<	<	<	<
Methylene chloride	<	<	<	<	<	<	<	<
Miscellaneous (µg/L)								
1,1,2-Trichloro-1,2,2-trifluoroethane	2 Q	<	<	.	.	<	.	.
Trichlorofluoromethane	<	<	<	.	.	<	<	<
1,2-Dichlorobenzene	<	<	<	.	.	<	<	<
1,2-Dichloropropane	<	<	<	<	<	<	<	<
Carbon disulfide	<	<	<	<	<	<	<	<
Dibromochloromethane	<	<	<	<	<	<	<	<

APPENDIX F.3
RADIOLOGICAL ANALYTES

APPENDIX F.3: CY 2008 MONITORING DATA FOR THE CHESTNUT RIDGE HYDROGEOLOGIC REGIME
Radiological Analytes: Gross Alpha and Gross Beta Activity

Sampling Point	Functional Area	Date Sampled	Program	Gross Alpha (pCi/L)			Gross Beta (pCi/L)		
				Result	TPU	MDA	Result	TPU	MDA
1090	UNCS	03/03/08	BJC	<	.	2.47	<	.	3.67
1090	UNCS	08/13/08	BJC	<	.	2.91	<	.	4.81
GW-141	LIV	01/24/08	BJC	<	.	2.9	<	.	1.9
GW-141	LIV	07/16/08	BJC	<	.	1.8	<	.	1.7
GW-143	KHQ	07/09/08	BJC	1.72	1.1	1.63	17.3	3.5	2.85
GW-144	KHQ	07/09/08	BJC	<	.	1.65	<	.	2.78
GW-145	KHQ	07/10/08	BJC	8.45	2.83	2.06	17.5	4.1	4.45
GW-161	ECRWP	01/07/08	BJC	<	.	1.85	.	.	.
GW-161	ECRWP	07/09/08	BJC	<	.	2.04	.	.	.
GW-173	CRSP	04/14/08	GWPP	<	.	3.4	<	.	7.2
GW-173	CRSP	11/13/08	GWPP	<	.	2.6	<	.	6.9
GW-173 Dup	CRSP	11/13/08	GWPP	<	.	3.5	<	.	6.9
GW-175	CRSP	11/11/08	GWPP	<	.	2.5	<	.	5.6
GW-177	CRSP	01/09/08	BJC	<	.	2.42	<	.	3.99
GW-177	CRSP	08/12/08	BJC	<	.	2.03	<	.	3.3
GW-178	CRSP	11/11/08	GWPP	<	.	2.8	<	.	6.7
GW-203	UNCS	02/28/08	BJC	<	.	2.29	<	.	3.53
GW-203	UNCS	08/18/08	BJC	<	.	2.13	<	.	3.76
GW-205	UNCS	03/03/08	BJC	<	.	2.24	56	9.89	3.86
GW-205	UNCS	08/14/08	BJC	<	.	2.08	68.2	11.8	3.53
GW-217	LIV	01/22/08	BJC	<	.	1.4	<	.	1.6
GW-217	LIV	07/16/08	BJC	<	.	1.7	1.4	0.77	1.1
GW-221	UNCS	02/28/08	BJC	<	.	2.46	<	.	3.9
GW-221	UNCS	08/14/08	BJC	<	.	2.78	<	.	3.61
GW-231	KHQ	07/09/08	BJC	<	.	1.4	<	.	2.71
GW-231 Dup	KHQ	07/09/08	BJC	<	.	1.7	<	.	2.96
GW-294	ECRWP	01/08/08	BJC	<	.	2.29	.	.	.
GW-294 Dup	ECRWP	01/08/08	BJC	<	.	2.21	.	.	.
GW-294	ECRWP	07/10/08	BJC	<	.	2.03	.	.	.
GW-294 Dup	ECRWP	07/10/08	BJC	<	.	2.11	.	.	.
GW-296	ECRWP	01/08/08	BJC	<	.	1.95	.	.	.
GW-296	ECRWP	07/10/08	BJC	<	.	1.7	.	.	.
GW-298	ECRWP	01/08/08	BJC	<	.	1.4	.	.	.
GW-298	ECRWP	07/10/08	BJC	<	.	1.96	.	.	.
GW-305	LIV	01/28/08	BJC	<	.	1.2	<	.	1.6
GW-305	LIV	07/15/08	BJC	<	.	1.7	<	.	1
GW-322	CRSP	11/12/08	GWPP	<	.	2.9	<	.	7.4
GW-514	FCAP	11/18/08	GWPP	<	.	2.6	<	.	6.8
GW-521	LIV	01/28/08	BJC	<	.	1.5	2.1	1	1.5
GW-521	LIV	07/15/08	BJC	<	.	1.5	<	.	1.2
GW-522	LIV	01/23/08	BJC	<	.	2.5	<	.	1.6
GW-522 Dup	LIV	01/23/08	BJC	<	.	2.7	<	.	1.7
GW-522	LIV	07/15/08	BJC	<	.	2	1.52	0.78	1.1
GW-522 Dup	LIV	07/15/08	BJC	<	.	2.1	<	.	1.2
GW-540	LII	01/29/08	BJC	<	.	2.1	<	.	2.3
GW-540	LII	07/15/08	BJC	<	.	2.5	<	.	1.4
GW-557	LV	01/23/08	BJC	<	.	2.2	<	.	1.3
GW-557	LV	07/17/08	BJC	<	.	2.1	1.56	0.86	1.3
GW-560	CDLVII	01/29/08	BJC	<	.	1.7	<	.	1.4
GW-560	CDLVII	07/21/08	BJC	<	.	2.2	<	.	1.2
GW-562	CDLVII	01/24/08	BJC	<	.	2.2	<	.	1.5
GW-562	CDLVII	07/21/08	BJC	<	.	2.7	1.48	0.92	1.4

APPENDIX F.3: CY 2008 MONITORING DATA FOR THE CHESTNUT RIDGE HYDROGEOLOGIC REGIME
Radiological Analytes: Gross Alpha and Gross Beta Activity

Sampling Point	Functional Area	Date Sampled	Program	Gross Alpha (pCi/L)			Gross Beta (pCi/L)		
				Result	TPU	MDA	Result	TPU	MDA
GW-564	CDLVII	01/31/08	BJC	<	.	1.2	2.4	1	1.5
GW-564 Dup	CDLVII	01/31/08	BJC	<	.	1.2	2.2	1	1.5
GW-564	CDLVII	07/21/08	BJC	<	.	2.3	1.45	0.68	0.94
GW-564 Dup	CDLVII	07/21/08	BJC	<	.	1.9	1.07	0.64	0.94
GW-608	CRSP	11/17/08	GWPP	<	.	3	7.3	3.6	6.4
GW-609	CRSP	11/17/08	GWPP	<	.	3.5	<	.	6.4
GW-612	CRSP	11/12/08	GWPP	<	.	3	<	.	6.4
GW-709	LII	01/29/08	BJC	2	1.4	1.9	<	.	1.2
GW-709	LII	07/16/08	BJC	2.7	1.5	1.8	1.46	0.72	0.99
GW-757	LII	01/30/08	BJC	<	.	1.6	<	.	0.98
GW-757	LII	07/16/08	BJC	2.4	1.2	1.4	13.4	1.7	1.2
GW-796	LV	01/23/08	BJC	<	.	1.4	1.34	0.83	1.2
GW-796	LV	07/17/08	BJC	<	.	1.4	<	.	1.1
GW-797	LV	01/24/08	BJC	<	.	3.5	<	.	1.7
GW-797	LV	07/21/08	BJC	<	.	2.8	<	.	1.8
GW-798	CDLVII	01/30/08	BJC	4.6	1.7	1.7	2.29	0.79	0.95
GW-798	CDLVII	07/21/08	BJC	<	.	1.5	1.18	0.68	1
GW-799	LV	01/24/08	BJC	<	.	1.7	<	.	1
GW-799	LV	07/17/08	BJC	<	.	2.1	1.68	0.86	1.2
GW-801	LV	01/23/08	BJC	<	.	1.7	<	.	1.2
GW-801	LV	07/21/08	BJC	<	.	1.8	<	.	1.2
MCK 2.0	EXP-SW	01/16/08	BJC	<	.	1.34	<	.	3.5
MCK 2.0	EXP-SW	08/19/08	BJC	<	.	3.53	<	.	4.66
MCK 2.05	EXP-SW	01/16/08	BJC	<	.	3.1	4.32	2.03	3.67
MCK 2.05 Dup	EXP-SW	01/16/08	BJC	<	.	1.83	4.33	2.02	3.71
MCK 2.05	EXP-SW	08/19/08	BJC	<	.	2.03	4.82	2.36	4.31
MCK 2.05 Dup	EXP-SW	08/19/08	BJC	<	.	3.4	<	.	4.97
S17	EXP-SW	04/15/08	GWPP	3.7	3	2.8	<	.	6.6
SCR1.25SP	EXP-SW	01/16/08	BJC	<	.	1.91	<	.	3.89
SCR1.25SP	EXP-SW	08/19/08	BJC	<	.	2.36	<	.	4.21
SCR1.5SW	EXP-SW	04/15/08	GWPP	<	.	2.2	<	.	5.3
SCR2.1SP	EXP-SW	04/15/08	GWPP	<	.	3	<	.	6.5
SCR2.2SP	EXP-SW	04/15/08	GWPP	<	.	3.4	<	.	8.1
SCR2.2SP Dup	EXP-SW	04/15/08	GWPP	<	.	2.9	<	.	5.8
SCR3.5SP	EXP-SW	01/16/08	BJC	<	.	3.12	<	.	3.98
SCR3.5SP	EXP-SW	08/19/08	BJC	<	.	2.57	<	.	4.18
SCR3.5SW	EXP-SW	04/15/08	GWPP	<	.	3.1	<	.	5.9
SCR4.3SP	EXP-SW	01/23/08	BJC	<	.	1.6	<	.	0.98
SCR4.3SP	EXP-SW	07/16/08	BJC	<	.	1.6	2.67	0.88	1.1
UNC SW-1	EXP-SW	03/03/08	BJC	<	.	1.95	<	.	3.79
UNC SW-1	EXP-SW	08/27/08	BJC	4.18	1.77	1.94	7.15	2.29	3.42

APPENDIX F.3: CY 2008 MONITORING DATA FOR THE CHESTNUT RIDGE HYDROGEOLOGIC REGIME
Radiological Analytes: Isotopic Analyses

Sampling Point	1090						GW-203					
Functional Area	UNCS						UNCS					
Date Sampled	03/03/08			08/13/08			02/28/08			08/18/08		
Program	BJC			BJC			BJC			BJC		
Sample Type												
Result (pCi/L)	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA
Gross Alpha	<MDA	.	2.47	<MDA	.	2.91	<MDA	.	2.29	<MDA	.	2.13
Gross Beta	<MDA	.	3.67	<MDA	.	4.81	<MDA	.	3.53	<MDA	.	3.76
Cesium-137	.	.	.	.	.	.	.	.	.	.	.	.
Cobalt-60	.	.	.	.	.	.	.	.	.	.	.	.
Potassium-40	.	.	.	.	.	.	.	.	.	.	.	.
Strontium-89/90	<MDA	.	1.72	<MDA	.	1.89	<MDA	.	2.11	<MDA	.	2.04
Technetium-99	.	.	.	.	.	.	.	.	.	.	.	.
Uranium-234	0.691	0.448	0.444	0.69	0.496	0.54	0.974	0.588	0.479	<MDA	.	0.664
Uranium-235	<MDA	.	0.415	0.303 R	0.307	0.206	<MDA	.	0.366	0.336	0.317	0.326
Uranium-238	<MDA	.	0.415	0.49	0.412	0.465	0.441	0.392	0.43	<MDA	.	0.464

Sampling Point	GW-205						GW-221					
Functional Area	UNCS						UNCS					
Date Sampled	03/03/08			08/14/08			02/28/08			08/14/08		
Program	BJC			BJC			BJC			BJC		
Sample Type												
Result (pCi/L)	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA
Gross Alpha	<MDA	.	2.24	<MDA	.	2.08	<MDA	.	2.46	<MDA	.	2.78
Gross Beta	56	9.89	3.86	68.2	11.8	3.53	<MDA	.	3.9	<MDA	.	3.61
Cesium-137	<MDA	.	8.7	<MDA	.	6.72	.	.	.	.	.	.
Cobalt-60	<MDA	.	8.28	<MDA	.	9.44	.	.	.	.	.	.
Potassium-40	<MDA	.	152	<MDA	.	150	.	.	.	.	.	.
Strontium-89/90	<MDA	.	1.84	<MDA	.	2.12	2.49	1.26	2.17	<MDA	.	2.08
Technetium-99	<MDA	.	9.62	<MDA	.	10.5	.	.	.	.	.	.
Uranium-234	<MDA	.	0.388	0.608	0.42	0.394	<MDA	.	0.552	<MDA	.	0.545
Uranium-235	<MDA	.	0.422	0.193 R	0.228	0.174	<MDA	.	0.402	<MDA	.	0.358
Uranium-238	<MDA	.	0.451	<MDA	.	0.354	0.219 R	0.257	0.198	<MDA	.	0.545

Sampling Point	UNC SW-1					
Functional Area	UNCS					
Date Sampled	03/03/08			08/14/08		
Program	BJC			BJC		
Sample Type						
Result (pCi/L)	Activity	TPU	MDA	Activity	TPU	MDA
Gross Alpha	<MDA	.	1.95	4.18	1.77	1.94
Gross Beta	<MDA	.	3.79	7.15	2.29	3.42
Cesium-137	<MDA	.	8.87	<MDA	.	9.98
Cobalt-60	<MDA	.	10.9	<MDA	.	9.01
Potassium-40	<MDA	.	164	<MDA	.	180
Strontium-89/90	.	.	.	.	.	.
Technetium-99	.	.	.	.	.	.
Uranium-234	.	.	.	.	.	.
Uranium-235	.	.	.	.	.	.
Uranium-238	.	.	.	.	.	.

APPENDIX G

CY 2008 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., 53-1A)
- 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 2008. 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, acetone (three samples), styrene (one sample), trichloroethene (two samples), and/or tetrachloroethene (one sample) was detected in five of the trip blank samples.

Sampling Point	Trip Blank Sample No.	Date Collected	Compound	Trip Blank Result (µg/L)	False-Positive Result (µg/L)
BC Regime					
GW-310	A073440145	02/14/08	Acetone	1 J	.
GW-259	A073440152	03/10/08	Styrene	3 J	.
GW-367	A073440147	02/25/08	Acetone	35	.
GW-626	A073440148	02/26/08	Acetone	28	.
GW-626	A082820124	12/02/08	Tetrachloroethene	2 J	.
GW-626	A082820124	12/02/08	Trichloroethene	4 J	.
EF Regime					
GW-220	A082820124	12/02/08	Tetrachloroethene	2 J	.
GW-220	A082820124	12/02/08	Trichloroethene	4 J	.
GW-769	A082820123	12/03/08	Trichloroethene	4 J	3 J
Note: J - estimated concentration					

EXPLANATION (continued)

One result for a groundwater sample was screened as a false positive based on the contamination in the trip blank samples. The blank qualification result for trichloroethene (used for comparison to the result for the groundwater sample) is 5X the concentration in the blank sample.

A field blank sample was collected during the second and fourth quarters of CY 2008. These samples were collected at wells 55-3A (04/21/08) and GW-322 (11/12/08) in the East Fork Regime. The field blank samples were analyzed for VOCs and none of the compounds were detected in either sample.

Two equipment rinsate samples were collected during CY 2008: one in the Bear Creek Regime at well GW-124 (first quarter), and the other in the East Fork Regime at Westbay well GW-722 (third quarter). The rinsate sample for well GW-124 was analyzed for the same analytes as the associated groundwater sample (see Appendix D), and the rinsate for GW-722-17 was analyzed only for VOCs. None of the analytes were detected in the rinsate sample from well GW-124, and only the VOCs shown below were detected in rinsate sample from well GW-722.

Well/Port	Sample Number	Date Sampled	Analyte	Result	Units
GW-722-17	A081890176	07/28/08	2-Butanone Acetone	14 6	µg/L µg/L

APPENDIX G: CY 2008 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
55-1A	EF	4/14/2008	A080930264	A080950189	Q081330057
55-2A	EF	4/17/2008	A080930254	A080950186	Q081350425
55-2B	EF	4/16/2008	A080930253	A080950187	Q081340109
55-2B D	EF	4/16/2008	A080930151	A080950187	Q081340109
55-2C	EF	4/16/2008	A080930252	A080950187	Q081340109
55-3A	EF	4/21/2008	A080930251	A080950185	Q081430013
55-3B	EF	4/21/2008	A080930250	A080950185	Q081350425
55-3C	EF	4/21/2008	A080930249	A080950185	Q081350425
55-6A	EF	4/21/2008	A080930248	A080950185	Q081350425
56-1A	EF	4/24/2008	A080930247	A080950183	Q081430017
56-1C	EF	4/28/2008	A080930246	A080950182	Q081430181
56-2A	EF	4/23/2008	A080930245	A080950184	Q081430017
56-2B	EF	4/23/2008	A080930177	A080950184	Q081430017
56-2C	EF	4/23/2008	A080930176	A080950184	Q081430017
56-3A	EF	5/1/2008	A080930175	A080950179	Q081500004
56-3B	EF	5/1/2008	A080930174	A080950179	Q081500004
56-3B D	EF	5/1/2008	A080930150	A080950179	Q081500004
56-3C	EF	5/1/2008	A080930173	A080950179	Q081500004
56-4A	EF	4/30/2008	A080930172	A080950180	Q081430181
56-6A	EF	4/29/2008	A080930171	A080950181	Q081430181
60-1A	EF	12/15/2008	A082770016	A083460119	Q090090019
GW-006	BC	3/12/2008	A073440048	A073440154	Q081000042
GW-006	BC	7/29/2008	A081890094	A081890147	Q082380094
GW-014	BC	9/17/2008	A081890093	A081890170	Q082880050
GW-058	BC	1/23/2008	A073440049	A073440137	Q080520172
GW-065	BC	3/3/2008	A073440093	A073440149	Q080910078
GW-065	BC	8/6/2008	A081890092	A081890162	Q082460012
GW-068	BC	9/16/2008	A081890091	A081890171	Q082880049
GW-071	BC	3/25/2008	A073440092	A080780114	Q081050087
GW-071	BC	9/16/2008	A081890090	A081890171	Q082880049
GW-082	BC	9/25/2008	A081890089	A081890166	Q082910197
GW-085	BC	3/13/2008	A073440091	A073440155	Q081000042
GW-085	BC	8/5/2008	A081890088	A081890163	Q082460012
GW-089	BC	9/24/2008	A081890087	A081890167	Q082910176
GW-098	BC	3/11/2008	A073440090	A073440153	Q081000038
GW-105	EF	5/14/2008	A080930170	A080930259	Q081610197
GW-106	EF	5/14/2008	A080930169	A080930259	Q081610197
GW-106 D	EF	5/14/2008	A080930149	A080930259	Q081410037
GW-109	EF	6/10/2008	A080930168	A081540129	Q081900140
GW-109	EF	6/9/2008	A081420056	A081540130	Q081890099
GW-109	EF	11/25/2008	A082770025	A082820126	Q083580121
GW-109	EF	11/24/2008	A082770026	A082820127	Q083500159
GW-122	BC	3/11/2008	A073440089	A073440153	Q081000038
GW-148	EF	8/19/2008	A081890086	A081890156	Q082550072
GW-153	EF	8/20/2008	A081890085	A081890155	Q082550068
GW-173	CR	4/14/2008	A080930167	A080950189	Q081330057
GW-173	CR	11/13/2008	A082770043	A082820130	Q083450071
GW-173 D	CR	11/13/2008	A082770042	A082820130	Q083450071

APPENDIX G: CY 2008 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-175	CR	11/11/2008	A082770049	A082820132	Q083440297
GW-178	CR	11/11/2008	A082770048	A082820132	Q083440297
GW-190	EF	5/7/2008	A080930166	A080950177	Q081550010
GW-192	EF	5/5/2008	A080930165	A080950178	Q081550010
GW-204	EF	10/27/2008	A082770028	A082820134	Q083370239
GW-220	EF	3/24/2008	A073440088	A080780113	Q081070134
GW-220	EF	6/10/2008	A081420052	A081540129	Q081900140
GW-220	EF	6/9/2008	A081420051	A081540130	Q081890099
GW-220	EF	8/19/2008	A081890084	A081890156	Q082550072
GW-220	EF	8/18/2008	A081890081	A081890157	Q082550064
GW-220	EF	12/2/2008	A082770008	A082820124	Q083650119
GW-220	EF	12/1/2008	A082770009	A082820125	Q083580121
GW-220 D	EF	8/19/2008	A081890083	A081890156	Q082550072
GW-225	BC	1/28/2008	A073440087	A073440138	Q080450175
GW-225	BC	7/29/2008	A081890123	A081890147	Q082380094
GW-226	BC	2/4/2008	A073440086	A073440139	Q080450306
GW-226	BC	7/29/2008	A081890122	A081890147	Q082380094
GW-227	BC	2/5/2008	A073440085	A073440140	Q080450306
GW-229	BC	2/6/2008	A073440126	A073440141	Q080640143
GW-229	BC	6/17/2008	A081420058	A081540126	Q081960000
GW-229	BC	6/16/2008	A081420057	A081540127	Q081920186
GW-229	BC	12/11/2008	A082770004	A082820120	Q090090019
GW-229	BC	12/10/2008	A082770005	A082820121	Q090090015
GW-229 D	BC	2/6/2008	A073440125	A073440141	Q080640143
GW-240	EF	8/19/2008	A081890121	A081890156	Q082550072
GW-246	BC	3/12/2008	A073440084	A073440154	Q081000042
GW-246	BC	6/10/2008	A081420048	A081540129	Q081900140
GW-246	BC	6/9/2008	A081420047	A081540130	Q081890099
GW-246	BC	8/7/2008	A081890120	A081890161	Q082480365
GW-246	BC	12/10/2008	A082940058	A082820121	Q090090015
GW-246	BC	12/9/2008	A082940059	A082820122	Q090090015
GW-251	EF	5/15/2008	A080930164	A080930258	Q081410037
GW-257	BC	9/23/2008	A081890118	A081890168	Q082910176
GW-259	BC	3/10/2008	A073440107	A073440152	Q080930312
GW-259	BC	9/23/2008	A081890117	A081890168	Q082910176
GW-265	EF	5/7/2008	A080930163	A080950177	Q081550010
GW-269	EF	5/12/2008	A080930162	A080930261	Q081610193
GW-274	EF	5/8/2008	A080930161	A080930262	Q081550010
GW-275	EF	5/8/2008	A080930160	A080930262	Q081550010
GW-289	BC	9/24/2008	A081890116	A081890167	Q082910176
GW-306	BC	3/6/2008	A073440106	A073440151	Q080930312
GW-306	BC	7/31/2008	A081890115	A081890145	Q082460004
GW-309	BC	3/5/2008	A073440105	A073440150	Q080930312
GW-309	BC	7/30/2008	A081890080	A081890146	Q082460004
GW-309 D	BC	7/30/2008	A081890079	A081890146	Q082460004
GW-310	BC	2/14/2008	A073440104	A073440145	Q080710000
GW-312	BC	2/19/2008	A073440103	A073440146	Q080710127
GW-314	BC	3/24/2008	A073440102	A080780113	Q081060197
GW-314	BC	8/4/2008	A081890102	A081890144	Q082460008

APPENDIX G: CY 2008 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-315	BC	2/19/2008	A073440101	A073440146	Q080710127
GW-322	CR	11/12/2008	A082770045	A082820131	Q083450071
GW-322	CR	11/11/2008	A082770044	A082820132	Q083440297
GW-332	EF	5/12/2008	A080950191	A080930261	Q081610193
GW-336	EF	5/13/2008	A080950190	A080930260	Q081610193
GW-337	EF	5/13/2008	A080930159	A080930260	Q081610193
GW-365	BC	1/28/2008	A073440100	A073440138	Q080450175
GW-367	BC	2/25/2008	A073440099	A073440147	Q080840027
GW-367	BC	7/30/2008	A081890133	A081890146	Q082460004
GW-369	BC	3/5/2008	A073440128	A073440150	Q080930312
GW-369 D	BC	3/5/2008	A073440127	A073440150	Q080930312
GW-381	EF	8/21/2008	A081890132	A081890154	Q082620005
GW-383	EF	8/18/2008	A081890131	A081890157	Q082550068
GW-508	EF	5/13/2008	A080930158	A080930260	Q081610193
GW-508	EF	12/22/2008	A082770027	A083570104	Q090140016
GW-514	CR	11/18/2008	A082770038	A082820128	Q083500159
GW-531	BC	8/5/2008	A081890130	A081890163	Q082460012
GW-537	BC	8/5/2008	A081890129	A081890163	Q082460012
GW-608	CR	11/17/2008	A082770039	A082820129	Q083500159
GW-609	CR	11/17/2008	A082770041	A082820129	Q083500159
GW-612	CR	11/12/2008	A082770047	A082820131	Q083450071
GW-612	CR	11/11/2008	A082770046	A082820132	Q083440297
GW-615	BC	8/11/2008	A081890128	A081890160	Q082480365
GW-616	BC	8/11/2008	A081890127	A081890160	Q082480365
GW-617	EF	10/20/2008	A082770037	A082820138	Q083220132
GW-619	EF	12/1/2008	A082770024	A082820125	Q083580121
GW-619 D	EF	12/1/2008	A082770023	A082820125	Q083580121
GW-620	EF	12/10/2008	A082770022	A082820121	Q090090015
GW-623	BC	3/18/2008	A073440098	A073440156	Q081060197
GW-623	BC	9/22/2008	A081890126	A081890169	Q082880054
GW-626	BC	2/26/2008	A073440117	A073440148	Q080840027
GW-626	BC	6/3/2008	A081420050	A080930255	Q081780164
GW-626	BC	6/2/2008	A081420049	A080930256	Q081780164
GW-626	BC	9/17/2008	A081890125	A081890170	Q082880054
GW-626	BC	9/16/2008	A081890124	A081890171	Q082880050
GW-626	BC	9/16/2008	A081890143	A081890171	Q082880054
GW-626	BC	12/2/2008	A082770006	A082820124	Q083650116
GW-626	BC	12/1/2008	A082770007	A082820125	Q083580121
GW-627	BC	3/18/2008	A073440116	A073440156	Q081060197
GW-627	BC	9/22/2008	A081890142	A081890169	Q082880054
GW-629	BC	3/18/2008	A073440115	A073440156	Q081060197
GW-629	BC	9/2/2008	A081890141	A081890173	Q082750152
GW-633	EF	6/11/2008	A080930157	A081540128	Q081900140
GW-648	BC	2/13/2008	A073440114	A073440144	Q080710000
GW-653	BC	9/25/2008	A081890078	A081890166	Q082910197
GW-653 D	BC	9/25/2008	A081890077	A081890166	Q082910197
GW-656	EF	10/28/2008	A082770029	A082820133	Q083370239
GW-686	EF	10/22/2008	A082770035	A082820136	Q083220132

APPENDIX G: CY 2008 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-690	EF	10/23/2008	A082770034	A082820135	Q083220132
GW-691	EF	10/23/2008	A082770033	A082820135	Q083220132
GW-692	EF	10/21/2008	A082770032	A082820137	Q083220132
GW-694	BC	1/23/2008	A073440113	A073440137	Q080520172
GW-698	EF	6/23/2008	A081420055	A081540125	Q081960073
GW-698	EF	6/24/2008	A080930156	A081690196	Q081990047
GW-698	EF	11/25/2008	A082770020	A082820126	Q083580121
GW-698	EF	11/24/2008	A082770021	A082820127	Q083500159
GW-698 D	EF	6/24/2008	A080930148	A081690196	Q081990047
GW-700	EF	10/20/2008	A082770036	A082820138	Q083220132
GW-703	BC	1/23/2008	A073440112	A073440137	Q080520172
GW-722-14	EF	7/28/2008	A081890140	A081890148	Q082380094
GW-722-17	EF	7/28/2008	A081890139	A081890148	Q082380094
GW-722-20	EF	7/16/2008	A081890138	A081890149	Q082100210
GW-722-22	EF	7/16/2008	A081890137	A081890149	Q082100210
GW-722-33	EF	7/15/2008	A081890076	A081890150	Q082100210
GW-722-33 D	EF	7/15/2008	A081890075	A081890150	Q082100210
GW-724	BC	3/6/2008	A073440111	A073440151	Q080930312
GW-725	BC	2/7/2008	A073440130	A073440142	Q080640143
GW-725 D	BC	2/7/2008	A073440129	A073440142	Q080640143
GW-738	BC	2/12/2008	A073440110	A073440143	Q080710000
GW-740	BC	2/12/2008	A073440109	A073440143	Q080710000
GW-740	BC	6/25/2008	A081420059	A081690197	Q081960073
GW-740	BC	6/26/2008	A081420060	A081690198	Q081990043
GW-740	BC	12/17/2008	A082770002	A083460117	Q090140000
GW-740	BC	12/16/2008	A082770003	A083460118	Q090090019
GW-744	EF	8/13/2008	A081890136	A081890159	Q082550064
GW-747	EF	8/14/2008	A081890135	A081890158	Q082550064
GW-748	EF	8/14/2008	A081890134	A081890158	Q082550064
GW-763	EF	8/18/2008	A081890153	A081890157	Q082550068
GW-769	EF	6/3/2008	A081420054	A080930255	Q081780164
GW-769	EF	6/4/2008	A080930155	A081540131	Q081780168
GW-769	EF	12/3/2008	A082770011	A082820123	Q083650119
GW-769	EF	12/2/2008	A082940060	A082820124	Q083650116
GW-770	EF	6/4/2008	A080930154	A081540131	Q081780168
GW-770	EF	12/9/2008	A082770010	A082820122	Q090090015
GW-781	EF	12/18/2008	A082770019	A083460116	Q090140000
GW-782	EF	12/10/2008	A082770018	A082820121	Q090090015
GW-783	EF	12/15/2008	A082770017	A083460119	Q090090019
GW-791	EF	10/27/2008	A082770031	A082820134	Q083370239
GW-792	EF	10/28/2008	A082770030	A082820133	Q083370239
GW-816	EF	8/13/2008	A081890152	A081890159	Q082550064
GW-820	EF	5/21/2008	A080930153	A080930257	Q081690044
GW-820	EF	12/17/2008	A082770015	A083460117	Q090140000
GW-820 D	EF	12/17/2008	A082770014	A083460117	Q090140000
GW-829	BC	8/4/2008	A081890151	A081890144	Q082460008
GW-960	EF	5/15/2008	A080930152	A080930258	Q081410037
GW-960	EF	12/18/2008	A082770013	A083460116	Q090140016

APPENDIX G: CY 2008 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	1/14/2008	A073440133	A073440136	Q080420068
GHK2.51WSW	EF	10/13/2008	A082770052	A082820139	Q083010036
NPR12.0SW	EF	10/13/2008	A082770051	A082820139	Q083010036
NPR23.0SW	EF	10/13/2008	A082770050	A082820139	Q083010036
NT-01	BC	1/14/2008	A073440108	A073440136	Q080420068
S17	CR	4/15/2008	A080920234	A080950188	Q081340109
SCR1.5SW	CR	4/15/2008	A080920233	A080950188	Q081340109
SCR2.1SP	CR	4/15/2008	A080920232	A080950188	Q081340109
SCR2.2SP	CR	4/15/2008	A080920231	A080950188	Q081330057
SCR2.2SP D	CR	4/15/2008	A080920229	A080950188	Q081330057
SCR3.5SW	CR	4/15/2008	A080920230	A080950188	Q081330057
SS-4	BC	1/14/2008	A073440132	A073440136	Q080420068
SS-4 D	BC	1/14/2008	A073440131	A073440136	Q080420068
SS-5	BC	1/14/2008	A073440134	A073440136	Q080420068

APPENDIX H
Y-12 GROUNDWATER PROTECTION PROGRAM
EVALUATION OF PASSIVE GROUNDWATER SAMPLING METHODS

APPENDIX H

Y-12 GROUNDWATER PROTECTION PROGRAM

EVALUATION OF PASSIVE GROUNDWATER SAMPLING METHODS

H.1 INTRODUCTION

Collection and laboratory analyses of groundwater samples from selected groundwater monitoring wells was performed during each quarter of calendar year (CY) 2008 to support qualitative and quantitative evaluation of “passive” sampling methods that may prove suitable for the purposes of groundwater quality monitoring at the U.S. Department of Energy Y-12 National Security Complex in Oak Ridge, Tennessee. Passive sampling methods do not involve purging groundwater from a well before a sample is collected, which reduces sampling labor, eliminates the need for purge water management (i.e., containment and treatment/disposal), and reduces long-term sampling costs. To evaluate the passive sampling methods, results of laboratory analyses of unfiltered groundwater samples obtained with Passive Diffusion Bag (PDB) and HYDRASleeve™ (HS) sampling methods were compared to corresponding analytical results for samples obtained with the low-flow (LF) minimal drawdown sampling method (hereafter referenced as LF sampling). The LF sampling method has been used by the Y-12 Groundwater Protection Program (GWPP) since October 1997, and involves purging groundwater (as little as possible) before sampling each well. The primary objective of this evaluation is to determine if laboratory analytical results for groundwater samples collected using PDB and HS sampling methods are consistent with analytical results for samples collected with the LF sampling method.

H.2 BACKGROUND

This sampling method evaluation supplements large-scale studies of passive sampling methods performed at other locations with favorable results when compared to traditional purge and sample results. The following technical documentation pertaining to PDB sampling methods provide extensive information regarding the use and implementation of PDB samplers and associated advantages and disadvantages compared to other sampling methods:

- *Users Guide for Polyethylene-Based Passive Diffusion Bag Samplers to Obtain Volatile Organic Compound Concentrations in Wells*, United States Geological Survey Water-Resources Investigations Report 01-4060, 2001;
- *Passive Diffusion Bag Samplers for VOC Sample Collection from Groundwater Monitoring Wells*, Northeast Waste Management Officials' Association (NEWMOA) Technology Review Committee Advisory Opinion, February 2002; and
- *Technical Decision Analysis for the Potential Use of Passive Diffusion Bag Samplers for Long-Term Monitoring*, Interstate Technology and Regulatory Council (ITRC), May 2002.

The following technical documents describe rigorous, statistics-based evaluation of analytical results for HS and other sampling methods, including PDB samplers and LF sampling:

- *Final Results Report for the Demonstration of No-Purge Groundwater Sampling Devices at Former McClellan Air Force Base, California*, U.S. Army Corp of Engineers, Air Force Center For Environmental Excellence, and Air Force Real Property Agency, October 2005; and
- *Protocol for Use of Five Passive Samplers to Sample for a Variety of Contaminants in Groundwater*, ITRC, February 2007

H.3 WELL SELECTION

Ten monitoring wells at Y-12 were selected for the passive groundwater sampling method evaluation, including eight wells (GW-109, GW-220, GW-229, GW-246, GW-626, GW-698, GW-740, and GW-769) located in Bear Creek Valley (BCV) and two wells (GW-322 and GW-612) located on Chestnut Ridge. As summarized below in Table H.1, six wells have screened monitored intervals (slotted polyvinyl chloride [PVC] or spiral wound stainless steel [SS]) and four wells have open-hole monitored intervals. The mid-point depths of the wells range from less than 50 ft below ground surface (bgs) to more than 200 ft bgs. Four of the wells yield groundwater from low-permeability, shale-dominated bedrock (Nolichucky Shale) and the remaining six wells yield groundwater from higher permeability carbonate (karst) dominated bedrock (Maynardville Limestone and overlying Copper Ridge Dolomite). All ten wells yield contaminated groundwater, with volatile organic compounds (VOCs) being present in each of the wells. Inorganic contaminants (nitrate, uranium, and/or trace metals) and/or radiological contaminants (gross alpha activity and gross beta activity) are present in the groundwater from four of the wells. The LF method has been used to collect groundwater samples from each of the wells, with two wells (GW-246 and GW-322) having the fewest (four) previous LF sampling events and four wells (GW-220, GW-698, GW-740, and GW-769) having the most (14 or more) previous LF sampling events.

Table H.1. Wells included in the Y-12 GWPP evaluation of passive groundwater sampling methods

WELL NO.	MONITORED INTERVAL		HYDROGEOLOGIC UNIT	GROUNDWATER CONTAMINANTS		
	TYPE	DEPTH* (ft bgs)		INORGANICS	VOCs	RADIO-LOGICAL
GW-109	PVC Screen	112.6	Shale	•	•	•
GW-220	PVC Screen	38.1	Carbonate	.	•	.
GW-229	Open	47.5	Carbonate	.	•	•
GW-246	PVC Screen	55.1	Shale	•	•	•
GW-322	Open	160.5	Carbonate	.	•	.
GW-612	Open	242.3	Carbonate	.	•	.
GW-626	SS Screen	70.5	Shale	.	•	.
GW-698	SS Screen	69.0	Carbonate	•	•	.
GW-740	Open	177.8	Carbonate	.	•	.
GW-769	SS Screen	54.3	Shale	.	•	.

Note: * - Depth of monitored interval midpoint in ft below ground surface.

H.4 SAMPLING METHODS

The LF sampling method involves pumping groundwater from the well at a flow rate low enough (<300 milliliters per minute) to minimize drawdown of the water column in the well. Dedicated sampling equipment (Well Wizard™) in each well is used to purge the groundwater. Groundwater samples are collected (i.e., sample bottles are filled from the discharge line) when water-level drawdown and field measurements for indicator parameters (e.g., water temperature) have stabilized. Contaminated groundwater purged from applicable wells is containerized and uncontaminated groundwater is discharged to the ground surface at the well head. Groundwater samples obtained with the LF method are suitable for all laboratory analyses required by the Y-12 GWPP: inorganic analytes (trace metals, major ions, and indicator parameters), VOCs, and radiological analytes (gross alpha activity, gross beta activity, and radionuclides).

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 deionized 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 deionized water in the PDB and the surrounding contaminated groundwater induces VOCs in the groundwater to diffuse through the bag into the deionized water until equilibrium conditions are achieved. When retrieved, the water in the PDB is decanted into VOC sample bottles.

A HS sampler consists of a collapsible polyethylene sleeve that is sealed at the bottom end and has a one-way reed valve at the top end. The empty HS is lowered to the monitored interval of the well and stays collapsed from hydrostatic pressure until sample collection. Each HS sampler remains suspended in the well for a prescribed period (at least two weeks) to allow groundwater conditions to stabilize. To collect a groundwater sample, field personnel retrieve the HS sampler (at a rate of 1-2 ft per second), which allows water to pass through the check valve and fill the polyethylene sleeve. Once the HS sampler is filled, no more water can enter the sleeve. Thus, the water sample obtained the HS sampler is obtained from a known depth interval. As with the PDB, water in the retrieved HS sampler is decanted into sample bottles and, like LF sampling, the groundwater samples are suitable for all inorganic analytes, VOCs, and radiological analyses.

H.5 SAMPLING SCHEDULE

As summarized in Table H.2, groundwater samples were collected during each quarter of CY 2008, with three wells sampled during the first quarter, eight wells sampled during the second quarter, two wells sampled during the third quarter, and all ten wells sampled during the fourth quarter. Groundwater samples from each well were obtained first by either the PDB or HS and then by the LF method. This “paired” sampling approach facilitated direct comparison of the analytical laboratory results for the samples obtained with each method.

Table H.2. Sampling schedule and paired sampling methods

WELL NUMBER	QUARTER OF CY 2008 AND SAMPLING METHOD											
	Q1			Q2			Q3			Q4		
	LF	PDB	HS	LF	PDB	HS	LF	PDB	HS	LF	PDB	HS
GW-109	.	.	.	●	.	●	.	.	.	●	.	●
GW-220	●	●	.	●	.	●	●	●*	●*	●	.	●
GW-229	.	.	.	●	.	●	.	.	.	●	.	●
GW-246	.	.	.	●	.	●	.	.	.	●	.	●
GW-322	.	.	.	.	.	.	.	.	.	●	●	.
GW-612	.	.	.	.	.	.	.	.	.	●	●	.
GW-626	●	●	.	●	.	●	●	●*	●*	●	.	●
GW-698	.	.	.	●	.	●	.	.	.	●	.	●
GW-740	●	●	.	●	.	●	.	.	.	●	.	●
GW-769	.	.	.	●	.	●	.	.	.	●	.	●
Notes: ● = sample obtained using the collection method above; * = sampling results excluded from evaluation.												

H.6 DATA ANALYSIS

As detailed in the attached analysis (hereafter referenced as the Attachment), a combination of tabular, graphical, and statistical (parametric and nonparametric) methods were used to compare laboratory analytical results for the groundwater samples obtained with the PDB and HS sampler to the corresponding analytical results for the “paired” samples obtained with the LF method. For the statistical comparison, it was assumed that the sampling method would not significantly influence the concentration of each measured laboratory analyte such that there should be little or no difference between the respective analytical results obtained from either method (i.e., the relative percent difference should be close to zero). Additionally, to evaluate whether analytical results from PDB and HS sampling are consistent with data from historical LF sampling, time-series scatter plots of the historical analytical results for selected representative VOCs — tetrachloroethene (PCE), trichloroethene (TCE), and 1,2-dichloroethene (12DCE) — detected in the PDB and HS samples were compared to upper and lower 95% confidence limits defined by linear regression of the respective historical time-series data for each applicable well and VOC.

H.7 PDB SAMPLING RESULTS

Statistical comparison (t-test) of the VOC results for groundwater samples obtained from paired PDB and LF sampling indicates no statistically significant difference between the concentrations of each VOC detected in the respective samples except for 1,1-dichloroethane (11DCA). Considering the variable mixture of dissolved VOCs in the groundwater from the wells included in the sampling method evaluation, it is not clear why statistically significant differences are evident only for 11DCA. Technical guidance indicates that 11DCA has been detected in field demonstrations, but was not laboratory tested to prove favorable diffusion into the PDB.

Comparison of the PDB sampling results for PCE, TCE, and 12DCE to respective historical (LF sampling) data for each applicable well shows only two (6%) of the PDB sampling results fall outside the range expected from linear regression of the LF sampling data, one above the upper confidence limit and one below the lower confidence limit (see Attachment). These findings, together with results of the statistical comparison of the paired PDB and LF sampling results, suggest that the PDBs tend to yield groundwater samples (from applicable wells) containing VOC concentrations that are equivalent to and consistent with the VOC concentrations in samples obtained with the LF method.

H.8 HS SAMPLING RESULTS

Field personnel found the HS samplers somewhat difficult to use. The HS sampler was torn during retrieval from two wells with an open-hole monitored interval and most of the groundwater drained out. The HS sampler was probably torn by contact with a burr or continuous contact with the carbon steel riser casing. Transferring groundwater from the sleeve into sample bottles proved challenging without personal contact with the groundwater. Several of the samples obtained with HS samplers had high turbidity. Additionally, samples collected from applicable wells during the third quarterly sampling event were obtained from above the monitored interval in each well (Table H2); these results were excluded from the statistical and historical data analyses noted in Sect. H.6.

Statistical comparison of the paired HS and LF sampling results for inorganic analytes shows significantly higher concentrations of aluminum, iron, lead, and total suspended solids (TSS) and significantly lower concentrations of chloride in samples obtained with the HS (see Attachment). Differences between the paired sampling results for these trace metals are attributable to the higher turbidity (i.e., TSS) of the samples obtained with the HS method, whereby the acid preservative in the unfiltered samples dissolved aluminum, iron, and lead ions from the suspended materials and substantially increased the total concentration of each metal relative to results reported for the much less turbid samples obtained with the LF method.

Chemical reactions associated with the preservation of the turbid unfiltered samples obtained with the HS also may account for the statistically lower levels of chloride relative to the paired LF sampling results. Chloride is a natural component of the groundwater at Y-12, particularly the sodium-chloride type groundwater typically encountered below approximately 100 ft bgs in the shale formations underlying BCV. Elevated chloride concentrations often occur in VOC-contaminated groundwater as a result of chemical and/or biologically-mediated degradation of the chlorinated hydrocarbons in the groundwater. Also, the difficulty field personnel reported in using the HS ultimately may have resulted in the inadvertent collection of samples of water within the water column above the monitored interval, which may have lower chloride levels than evident in the monitored interval.

Statistical comparison of the paired HS and LF sampling results for VOCs indicates no statistically significant difference between the respective sampling results for all detected compounds except chloroform, with significantly lower mean chloroform concentrations calculated from the HS sampling results. Assuming both methods obtained groundwater samples from the same water-producing features intercepted by the monitored interval in each well, it is unclear as to why the concentrations of chloroform (or any other VOC) would either be lower in samples obtained with the HS, or higher in samples obtained

from LF sampling. Moreover, considering the statistical consistency of the paired HS and LF sampling results for other VOCs (PCE, TCE, or 12DCE) detected in the samples, it seems unlikely that sampling-related bias accounts for the statistically significant difference between the paired HS and LF sampling results for chloroform.

Statistical comparison of the paired HS and LF sampling results for radiological analytes indicates no statistically significant difference between the respective sampling results for gross alpha activity or gross beta activity detected (i.e., exceeds the sample-specific minimum detectable activity and associated counting error) in samples from the applicable wells (Table H.1).

Comparison of the HS sampling results to historical (LF sampling) data shows almost half the results for detected inorganic analytes are outside the upper and lower range expected from linear regression of the historical LF sampling results for each applicable well (see Attachment). Most of the HS sampling results outside the confidence limits are for the previously noted trace metals and TSS, with the majority (65%) of these results exceeding the upper confidence limit. The HS sampling results for VOCs (PCE, TCE, and 12DCE) that exceed the confidence limits are evenly split above and below the upper and lower limits, indicating no particular sampling-related bias toward higher or lower VOC concentrations.

The HS sampling results for various laboratory analytes appear to exhibit greater variability, although there are no readily apparent spatial or temporal patterns evident for the HS sampling results that fall outside the upper and lower confidence intervals calculated from historical LF sampling data. Also, the HS sampling results for VOCs exhibit greater relative variability than evident for the VOC results reported for samples obtained with PDBs. However, there are insufficient HS sampling results to determine if the variability is statistically significant.

H.9 RECOMMENDATIONS

PDB Sampling Method: The PDBs generally performed favorably in the field. Overall, the PDB sampling results for VOCs most closely matched the paired LF sampling results and exhibited less temporal variability than the HS sampling results for VOCs.

Technical guidance documents referenced in Section H.2 caution against the use of PDBs in low-permeability groundwater flow systems and note that development of microbiologic films on the PDBs may be sufficient to deter or restrict diffusion of VOCs. Nevertheless, aside from this limitation and in accordance with the criteria specified below, the PDBs are a technically acceptable and appropriate method for monitoring VOC-contaminated groundwater in applicable wells at Y-12.

For the purposes of the Y-12 GWPP, the PDBs may be best suited for wells that meet all of the following criteria:

- Yield groundwater in which VOCs are the principal contaminants (or the only contaminants of concern);
- Completed at a relatively shallow depth (i.e., <100 ft bgs) with a monitored interval (open-hole or screen/filter pack) no more than 10 ft in length; and

- Do not monitor low-yield water-producing intervals in the bedrock (shale or carbonate) as indicated by available well-specific data (e.g., falling head permeability tests and water-level recovery characteristics).

Alternative or additional criteria also may apply. Whatever the final selection criteria, all wells that meet the criteria should be formally identified in the applicable GWPP Sampling and Analysis Plan (SAP), with PDBs designated as the sampling method for VOC analyses. Because of the limited number of wells included in this evaluation, analytical results obtained with PDBs should be evaluated with respect to historical data for each monitoring well to determine the appropriateness for continued use. Based on the results of the statistical analysis, this historical comparison is especially applicable for 11DCA results.

Deployment of PDBs in wells that meet the criteria and are scheduled to be sampled during CY 2010 should be integrated into the planned groundwater sampling activities per the Y-12 GWPP SAP for CY 2010 (B&W Y-12 2009). For instance, PDBs could be deployed in all the candidate wells early in the year (e.g., January 2010) and left in place until retrieval (and replaced, if applicable) per the sampling schedule specified in the SAP. Preferably, the PDB would remain in each well for several months, which will enable the GWPP to evaluate PDB performance characteristics under the long-term deployment conditions that maximize sampling efficiency.

HS Sampling Method: The HS sampling method performed less favorably in the field than the PDBs, although further experience with the method by sampling personnel may be expected to improve skill with this sampling method. However, the apparent tendency to return highly turbid unfiltered groundwater samples is a critical drawback to the HS sampling method because the elevated TSS levels are sampling artifacts that bias the laboratory analyses for some trace metals and may cause analytical interferences for radiological analytes. It is not clear if the turbidity of the samples is an inherent characteristic of the HS sampling method when used in older monitoring wells, a function of sampler skill at retrieving the HS (which should improve with experience), or a combination of both. Without full confidence in the collection of representative (i.e., low turbidity and TSS) unfiltered groundwater samples suitable for trace metal and/or radiological (gross alpha and gross beta activity) analyses, the HS sampling method loses any objective advantage over the PDB or the LF sampling method. Based on this uncertainty, the HS is not recommended as a preferred passive sampling method for the groundwater quality monitoring purposes of the Y-12 GWPP.

H.10 REFERENCE

B&W Y-12 2009. *Y-12 Groundwater Protection Program Groundwater and Surface Water Sampling and Analysis Plan for Calendar Year 2010*, Y/SUB/09-068789/2. September 2009.

**COMPARISON OF RESULTS FOR DIFFERENT SAMPLING METHODS
Y-12 GROUNDWATER PROTECTION PROGRAM**

Comparison of Results for Different Sampling Methods Y-12 Groundwater Protection Program CY2008

Purpose

Groundwater samples were taken in CY2008 by the passive diffusion bag (PDB) and Hydrasleeve (HS) methods as well as by the normal low flow technique (LF) to determine if the water chemistry was affected by the sampling method. Sixteen HS samples and five PDB samples were taken from ten different wells over the year. Two HS and two PDB samples taken in August and September were not included in the comparisons because of problems encountered during sampling. HS samples were analyzed for volatile organics, radionuclides, metals and general chemistry parameters. PDB samples were analyzed for volatile organics only.

The analytical results for each test sampling method (HS or PDB) were compared to the results for the standard LF method for the same well and sampling quarter by tabular, graphical and statistical methods.

Pair-wise Comparisons

Results for all analytes detected in at least one sample are presented in Table 1 (volatiles) and Table 2 (radionuclides, metals, and general chemistry). The percent difference has been calculated when both results for a well were detects. Note that when concentrations are close to zero, a small absolute difference in concentration may result in a large percentage difference.

Summary statistics were calculated by test pairs where a test pair was the result from the test method (HS or PDB) paired with the result from the LF sample for the same analyte and sampling period. Table 3 presents the number of test pairs, number of test pairs with one detect, number of test pairs with both detects, number of pairs with test method greater than the LF method. For test pairs with both results detected, the following statistics are presented: the minimum percent difference, maximum percent difference, average percent difference, standard deviation of the percent difference, the two-sided p-value from the t-test testing the null hypothesis that the mean percent difference is zero, and the probability for the Shapiro-Wilk normality test for distribution of percent differences. For all test pairs including nondetects the following statistics are presented: the sign test statistic for the absolute difference between sampling methods, the two-sided p-value from the sign test, and the direction of the difference when the probability for the sign test was less than 0.05. If both results of the test pair were nondetects they were treated as tied for the Sign test.

If the sampling method did not affect the measured chemistry, the percent differences should be close to zero. The t-test may be used to test whether the mean percent difference is significantly different from zero. The t-test is a parametric test meaning that it relies on the assumption that the underlying distribution of the percent differences is normally distributed. If the distribution is not normal, the probabilities calculated for the t-test will not be accurate. The Shapiro-Wilk normality test indicates that for some analytes the distribution of percent differences is different from normal at the 0.05 probability level. While not significantly different from normal, many of the distributions are skewed. The Shapiro-Wilk normality test will have little power to detect departures from normality with such small sample sizes, so the null hypothesis of normality will not be rejected often. The nonparametric sign test was, therefore, used to confirm the results of the t-test. The sign test uses the binomial distribution to test the hypothesis that the number of samples where the test method result exceeds the LF result equals the number of samples where

the LF result exceeds the test method result. The sign test considers only the direction of the difference and not the magnitude. At least five pairs of samples are needed to detect a statistical difference with 95% confidence. Since this is a nonparametric test, no underlying assumption of normality is required as in the parametric t-test. The sign test also allows the use of non-detects. If the result for one method is a detect and the other is not, the result for the detect would be considered greater than the nondetect (assuming that the detection limits are the same for each sample pair). We care only that the test method result is below the LF result or vice versa for the nonparametric sign test.

Notice that there were both positive and negative differences for the comparisons with the HS method for most analytes as can be seen by comparing the minimum to the maximum percent difference in Table 3. This means that sometimes the HS method gave higher results and sometimes the LF method gave the higher results. For most analytes the probabilities for the t-test and for the sign test were greater than 0.05, indicating no significant differences. Although with the small sample sizes available for these tests, there is little statistical power to detect significant differences.

There were a few analytes for which the statistical tests indicated a significant difference between the HS and the LF methods. For chloroform and chloride the mean percent difference was significantly different from zero at the 0.05 probability level based on the t-test. The negative average percent difference indicates that the HS method resulted in lower chloroform and chloride concentrations than the LF method. This was confirmed with the sign test. It is difficult to think of a reason why these analytes would tend to be at lower concentrations in the HS samples unless there is some source of contamination for them in the LF sampling process or if there was a gradient in the groundwater that resulted in sampling of water with different chemistry.

There were four analytes for which the HS samples had statistically significant higher concentrations than the LF samples: aluminum, iron, lead, and total suspended solids. The method for taking HS samples has the potential of suspending sediment from the bottom or sides of the well. The higher values for these analytes are consistent with an increase in suspended particulates.

For the five PDB comparisons, the PDB results tended to be equal to or lower than the LF results. The mean percent difference between the PDB and LF method for 1,1-dichloroethane was significantly different from zero at the 0.05 probability level based on the t-test. There were too few samples to test for a difference with 95% confidence using the Sign test.

Scatter plots were constructed for volatiles with at least three comparisons with a detect and for selected metals and general chemistry parameters (see Figure 1 through 29.) A reference line with a slope of one is included in each plot. Points plotting on the reference line indicate perfect agreement between the test sampling method and the LF method. Points plotting below the reference line indicate that the test method resulted in lower concentrations than the LF method. Points plotting above the line indicate that the test method resulted in higher concentrations than the LF method. Generally the results were scattered about the reference line with the exception of aluminum (Fig. 15), iron (Fig. 16), lead (Fig. 17) and total suspended solids (Fig. 22) for which the sign test indicated that the HS results were generally higher than the LF results and for chloroform (Fig. 8) and chloride (Fig. 20) for which the sign test indicated that the HS results were generally lower than the LF results. The scatter plots confirm the patterns indicated by the Sign test.

Historical Comparisons

The comparisons displayed in the scatter plots and summary statistics represent results from wells over a wide range of concentrations. The results show reasonably good agreement across this range of wells with the exception of situations in which the HS method collected more suspended solids than the LF method. Another consideration is how closely the test sampling methods results compare to previous LF results from the same well. This was examined by plotting the results for the test methods along with historical results for the LF method. How closely the test method results matched the LF results was quantified by calculating the upper and lower 95% confidence limits on the predicted LF values based on a simple linear regression of the historical LF data.

Table 4 provides summary statistics for each well for analytes that had at least one detected result for a test sampling method. Table 4 lists the number of LF results, the number of LF detects, the percent LF results detected, the number of HS detects, and the number of PDB detects to provide information on the frequency of detection. Of the 281 well/analyte combinations reported, 75% had all LF results detected. Table 4 also reports the minimum and maximum detect for each sampling method to provide information on the magnitude and the range of the results. The table also has columns to indicate if the results for the test method fell outside the 95% confidence limits of the linear regression of concentration over time for each well and analyte. The column has a '+' if the upper limit was exceeded and a '-' if a result was below the lower limit. The expectation was that the results for the test methods would fall within the 95% confidence limits of the regression model. The table shows, however, that of the 269 well/analyte combinations with an HS detect, 131 had HS results outside the 95% confidence limits. That means that for almost 50% of the tests, the results for the HS sampling method were outside the range that would be expected given the LF results. Eighty-six results exceeded the upper 95% confidence limit and 45 were below the lower 95% confidence limit. Most of the upper exceedance were for metals which may be explained by increases particulates in the HS samples. For volatile organics there were 13 results exceeding the upper limit and 13 below the lower limit. So the results for volatiles did not appear to be biased high or low but were more different from the LF sample results than expected. For the PDB comparisons, only 2 results of 34 well/analyte combinations (6%) fell outside the 95% confidence limits of the regression. One result was above the confidence limits and one was below.

Plots of concentration over time were constructed to provide a visual comparison of the results for the different sampling methods (Figures 30 through 66). The available LF results from 1997 through CY2008 were included. Each plot represents the data for one well for one analyte. The predicted value line for a best-fit linear regression of the LF concentration data with time was plotted along with the upper and lower 95% confidence limits of the prediction. (Note that if the upper and/or lower confidence limit lines do not appear on the graph, they fall outside the area displayed in the plot.) The results for HS and PDB samples when available were plotted as points on the graph. The LF results are represented by blue squares, HS results by red triangles and PDB results by green diamonds in the plots. Rather than presenting plots for all 281 well/analyte combinations from Table 4, plots were constructed for representative analytes (total 1,2-dichloroethene, trichloroethene, tetrachloroethene, total suspended solids, chloride, iron, and uranium-238) for wells with all detected results (Figures 30 through 66). Frequently detected analytes were chosen that represent different types of parameters: volatile organics, metals, radionuclides, and general chemistry. Total suspended solids, chloride, and iron were also analytes that had statistically significant differences in the sign tests.

Figure 30 provides an example where an HS result exceeded the upper confidence limit. The HS chloride concentration at GW-109 exceeded the 95% upper confidence limit in June 2008 but was very close to the predicted LF value in November 2008. For GW-220, GW-229, GW-626, and GW-698 all HS results were very close to the predicted value (Figures 31, 32, 34, and 35). For well GW-246 the June result was close to the LF value but the December result was below the confidence limit (Figure 33). For wells GW-740 and GW-769 the June result was below the lower confidence limit and the December result was close to the predicted value (Figures 36 and 37). There does not appear to be a particular pattern by well or time period related to results that fall outside the confidence limits of the regression. It may just be that the HS results are more variable than the LF results but there are too few HS results available per well to statistically test that hypothesis. HS results for total suspended solids and iron (Figures 38 to 45) appear to be much more variable than the LF results. The HS uranium-238 results were within the 95% confidence limits of the LF results (Figures 46 and 47). For total 1,2-dichloroethene (Figures 48 to 53) the PDB results were always within the LF 95% confidence limits while HS results were below in GW-220 and above in GW-740 and GW-769. Similar variability may be observed for tetrachloroethene (Figures 54 to 60) and trichloroethene (Figures 61 to 66).

Conclusions

Pair-wise comparisons between results for the test methods and the LF method showed that the HS method may result in samples with higher concentrations of suspended solids and the metals associated with suspended solids. Comparisons with LF results over time indicate that the HS results may be more variable than the LF results. HS results fell outside the 95% confidence limits of the LF results in almost 50% of the comparisons. The PDB results were outside the 95% confidence limits of the LF results in only 6% of the comparisons. The PDB results appeared to more closely match the LF results than the HS results.

**Table 1. Results for Volatile Organic Analyses for
Comparison of Sampling Methods CY2008**

SampleID		A080930168		A081420056			A082770025		A082770026		
Sample Date		06/10/2008		06/09/2008			11/25/2008		11/24/2008		
Well		GW-109		GW-109			GW-109		GW-109		
Sample Method		LF		HS			LF		HS		
Analyte	Units	Conc	Qual	Conc	Qual	% Difference	Conc	Qual	Conc	Qual	% Difference
Volatile Organics											
1,1,1-Trichloroethane	ug/L	5	U	5	U		5	U	5	U	
1,1,2-Trichloro-1,2,2-trifluoroethane	ug/L	2	J	2	J	0	3	J	4	J	33
1,1,2-Trichloroethane	ug/L	5	U	5	U		5	U	5	U	
1,1-Dichloroethane	ug/L	5	U	5	U		5	U	5	U	
1,1-Dichloroethene	ug/L	5	U	5	U		5	U	1	J	
1,2-Dichloroethane	ug/L	5	U	5	U		5	U	5	U	
1,2-Dichloroethene (Total)	ug/L	5	U	5	U		5	U	5	U	
1,2-Dichloropropane	ug/L	5	U	5	U		5	U	5	U	
1,4-Dichlorobenzene	ug/L	5	U	5	U		5	U	5	U	
2-Butanone	ug/L	5	U	5	U		5	U	5	U	
Acetone	ug/L	5	U	51	=		10	U	10	=	
Acetonitrile	ug/L	5	U	5	U		35	=	40	=	14
Benzene	ug/L	5	U	5	U		5	U	5	U	
Bromoform	ug/L	2	J	1	J	-50	5	U	5	U	
Carbon disulfide	ug/L	5	U	5	U		2	J	5	U	
Carbon tetrachloride	ug/L	5	U	2	J		5	U	5	U	
Chlorobenzene	ug/L	5	U	5	U		5	U	5	U	
Chloroethane	ug/L	5	U	5	U		5	U	5	U	
Chloroform	ug/L	8	=	7	=	-13	3	J	3	J	0
Dibromochloromethane	ug/L	5	U	5	U		5	U	65	=	
Dichlorodifluoromethane	ug/L	5	U	5	U		5	U	5	U	
Ethylbenzene	ug/L	5	U	5	U		5	U	5	U	
Methylene chloride	ug/L	13	=	9	=	-31	14	=	11	=	-21
Tetrachloroethene	ug/L	110	=	67	=	-39	90	=	100	=	11
Toluene	ug/L	5	U	5	U		5	U	5	U	
Trichloroethene	ug/L	2	J	2	J	0	3	J	2	J	-33
Trichlorofluoromethane	ug/L	5	U	5	U		5	U	5	U	
Vinyl chloride	ug/L	2	U	2	U		2	U	2	U	
cis-1,2-Dichloroethene	ug/L	5	U	5	U		5	U	5	U	
trans-1,2-Dichloroethene	ug/L	5	U	5	U		5	U	5	U	

**Table 1. Results for Volatile Organic Analyses for
Comparison of Sampling Methods CY2008**

SampleID	A073440088		A080380063			A081420052		A081420051		
Sample Date	03/24/2008		03/24/2008			06/10/2008		06/09/2008		
Well	GW-220		GW-220			GW-220		GW-220		
Sample Method	LF		PDB			LF		HS		
Analyte	Conc	Qual	Conc	Qual	% Difference	Conc	Qual	Conc	Qual	% Difference
Volatile Organics										
1,1,1-Trichloroethane	5	U	5	U		5	U	5	U	
1,1,2-Trichloro-1,2,2-trifluoroethane	5	U	5	U		5	U	5	U	
1,1,2-Trichloroethane	5	U	5	U		5	U	5	U	
1,1-Dichloroethane	5	U	5	U		5	U	5	U	
1,1-Dichloroethene	1	J	1	J	0	5	U	5	U	
1,2-Dichloroethane	5	U	5	U		5	U	5	U	
1,2-Dichloroethene (Total)	58	=	58	=	0	49	=	31	=	-37
1,2-Dichloropropane	5	U	5	U		5	U	5	U	
1,4-Dichlorobenzene	5	U	5	U		5	U	5	U	
2-Butanone	5	U	5	U		5	U	5	U	
Acetone	10	U	10	U		5	U	10	U	
Acetonitrile	5	U	5	U		5	U	5	U	
Benzene	5	U	5	U		5	U	5	U	
Bromoform	5	U	5	U		5	U	5	U	
Carbon disulfide	5	U	5	U		5	U	5	U	
Carbon tetrachloride	1400	=	1100	=	-21	640	=	530	=	-17
Chlorobenzene	5	U	5	U		5	U	5	U	
Chloroethane	5	U	5	U		5	U	5	U	
Chloroform	75	=	77	=	3	60	=	38	=	-37
Dibromochloromethane	5	U	5	U		5	U	5	U	
Dichlorodifluoromethane	5	U	5	U		5	U	5	U	
Ethylbenzene	5	U	5	U		5	U	5	U	
Methylene chloride	5	U	5	U		5	U	5	U	
Tetrachloroethene	620	=	400	=	-35	390	=	400	=	3
Toluene	5	U	5	U		5	U	5	U	
Trichloroethene	120	=	110	=	-8	90	=	70	=	-22
Trichlorofluoromethane	5	U	5	U		5	U	5	U	
Vinyl chloride	2	U	2	U		2	U	2	U	
cis-1,2-Dichloroethene	58	=	58	=	0	49	=	31	=	-37
trans-1,2-Dichloroethene	5	U	5	U		5	U	5	U	

**Table 1. Results for Volatile Organic Analyses for
Comparison of Sampling Methods CY2008**

SampleID	A082770008		A082770009			A081420058		A081420057		
Sample Date	12/02/2008		12/01/2008			06/17/2008		06/16/2008		
Well	GW-220		GW-220			GW-229		GW-229		
Sample Method	LF		HS			LF		HS		
Analyte	Conc	Qual	Conc	Qual	% Difference	Conc	Qual	Conc	Qual	% Difference
Volatile Organics										
1,1,1-Trichloroethane	5	U	5	U		7	=	5	J	-29
1,1,2-Trichloro-1,2,2-trifluoroethane	2	J	2	J	0	40	=	35	=	-13
1,1,2-Trichloroethane	5	U	5	U		5	U	5	U	
1,1-Dichloroethane	5	U	5	U		8	=	6	=	-25
1,1-Dichloroethene	2	J	2	J	0	44	=	33	=	-25
1,2-Dichloroethane	5	U	5	U		5	U	5	U	
1,2-Dichloroethene (Total)	70	=	66	=	-6	320	=	220	=	-31
1,2-Dichloropropane	5	U	5	U		5	U	5	U	
1,4-Dichlorobenzene	5	U	5	U		4	J	3	J	-25
2-Butanone	5	U	5	U		5	U	5	U	
Acetone	10	U	10	U		5	U	5	U	
Acetonitrile	5	U	5	U		5	U	5	U	
Benzene	5	U	5	U		11	=	9	=	-18
Bromoform	5	U	5	U		5	U	5	U	
Carbon disulfide	5	U	5	U		5	U	5	U	
Carbon tetrachloride	870	=	1200	=	38	5	U	5	U	
Chlorobenzene	5	U	5	U		14	=	11	=	-21
Chloroethane	5	U	5	U		5	U	5	U	
Chloroform	87	=	70	=	-20	5	U	5	U	
Dibromochloromethane	5	U	5	U		5	U	5	U	
Dichlorodifluoromethane	5	U	5	U		5	U	5	U	
Ethylbenzene	5	U	5	U		5	U	5	U	
Methylene chloride	5	U	5	U		5	U	5	U	
Tetrachloroethene	530	=	650	=	23	5	U	5	U	
Toluene	5	U	5	U		5	U	5	U	
Trichloroethene	130	=	120	=	-8	9	=	6	=	-33
Trichlorofluoromethane	2	J	1	J	-50	5	U	5	U	
Vinyl chloride	2	U	2	U		20	=	26	=	30
cis-1,2-Dichloroethene	70	=	66	=	-6	320	=	220	=	-31
trans-1,2-Dichloroethene	5	U	5	U		5	U	5	U	

**Table 1. Results for Volatile Organic Analyses for
Comparison of Sampling Methods CY2008**

SampleID	A082770004		A082770005			A081420048		A081420047		
Sample Date	12/11/2008		12/10/2008			06/10/2008		06/09/2008		
Well	GW-229		GW-229			GW-246		GW-246		
Sample Method	LF		HS			LF		HS		
Analyte	Conc	Qual	Conc	Qual	% Difference	Conc	Qual	Conc	Qual	% Difference
Volatile Organics										
1,1,1-Trichloroethane	2	J	4	J	100	5	U	5	U	
1,1,2-Trichloro-1,2,2-trifluoroethane	18	=	5	U		41	=	33	=	-20
1,1,2-Trichloroethane	5	U	5	U		5	U	5	U	
1,1-Dichloroethane	11	=	11	=	0	5	U	5	U	
1,1-Dichloroethene	28	=	47	=	68	2	J	2	J	0
1,2-Dichloroethane	5	U	5	U		5	U	5	U	
1,2-Dichloroethene (Total)	260	=	340	=	31	5	U	1	J	
1,2-Dichloropropane	5	U	5	U		5	U	5	U	
1,4-Dichlorobenzene	3	J	3	J	0	5	U	5	U	
2-Butanone	5	U	5	U		5	U	5	U	
Acetone	10	U	10	U		5	U	10	U	
Acetonitrile	5	U	5	U		5	U	5	U	
Benzene	9	=	9	=	0	5	U	5	U	
Bromoform	5	U	5	U		5	U	5	U	
Carbon disulfide	5	U	5	U		5	U	5	U	
Carbon tetrachloride	5	U	5	U		5	U	5	U	
Chlorobenzene	12	=	11	=	-8	5	U	5	U	
Chloroethane	5	U	5	U		5	U	5	U	
Chloroform	5	U	5	U		30	=	27	=	-10
Dibromochloromethane	5	U	5	U		5	U	5	U	
Dichlorodifluoromethane	5	U	5	U		5	U	5	U	
Ethylbenzene	5	U	5	U		5	U	5	U	
Methylene chloride	5	U	5	U		11	=	11	=	0
Tetrachloroethene	5	U	5	U		100	=	110	=	10
Toluene	5	U	5	U		5	U	5	U	
Trichloroethene	3	J	5	J	67	1	J	1	J	0
Trichlorofluoromethane	5	U	5	U		5	U	5	U	
Vinyl chloride	73	=	57	=	-22	2	U	2	U	
cis-1,2-Dichloroethene	260	=	340	=	31	5	U	1	J	
trans-1,2-Dichloroethene	1	J	2	J	100	5	U	5	U	

**Table 1. Results for Volatile Organic Analyses for
Comparison of Sampling Methods CY2008**

SampleID	A082940058		A082940059			A082770045		A082770044		
Sample Date	12/10/2008		12/09/2008			11/12/2008		11/11/2008		
Well	GW-246		GW-246			GW-322		GW-322		
Sample Method	LF		HS			LF		PDB		
Analyte	Conc	Qual	Conc	Qual	% Difference	Conc	Qual	Conc	Qual	% Difference
Volatile Organics										
1,1,1-Trichloroethane	5	U	5	U		27	=	21	=	-22
1,1,2-Trichloro-1,2,2-trifluoroethane	30	=	5	U		5	J	3	J	-40
1,1,2-Trichloroethane	5	U	5	U		5	U	5	U	
1,1-Dichloroethane	5	U	5	U		88	=	82	=	-7
1,1-Dichloroethene	2	J	5	U		75	=	63	=	-16
1,2-Dichloroethane	5	U	5	U		5	U	5	U	
1,2-Dichloroethene (Total)	5	U	5	U		5	U	5	U	
1,2-Dichloropropane	5	U	5	U		5	U	5	U	
1,4-Dichlorobenzene	5	U	5	U		5	U	5	U	
2-Butanone	5	U	5	U		5	U	10	U	
Acetone	10	U	10	U		10	U	10	U	
Acetonitrile	5	U	5	U		5	U	5	U	
Benzene	5	U	5	U		5	U	5	U	
Bromoform	5	U	5	U		5	U	5	U	
Carbon disulfide	5	U	5	U		5	U	5	U	
Carbon tetrachloride	5	U	5	U		5	U	5	U	
Chlorobenzene	5	U	5	U		5	U	5	U	
Chloroethane	5	U	5	U		5	U	5	U	
Chloroform	22	=	1	J	-95	5	U	5	U	
Dibromochloromethane	5	U	5	U		5	U	5	U	
Dichlorodifluoromethane	5	U	5	U		5	U	5	U	
Ethylbenzene	5	U	5	U		5	U	5	U	
Methylene chloride	11	=	3	J	-73	5	U	5	U	
Tetrachloroethene	74	=	3	J	-96	7	=	4	J	-43
Toluene	5	U	5	U		5	U	5	U	
Trichloroethene	5	U	5	U		5	U	5	U	
Trichlorofluoromethane	5	U	5	U		37	=	25	=	-32
Vinyl chloride	2	U	2	U		2	U	2	U	
cis-1,2-Dichloroethene	5	U	5	U		5	U	5	U	
trans-1,2-Dichloroethene	5	U	5	U		5	U	5	U	

**Table 1. Results for Volatile Organic Analyses for
Comparison of Sampling Methods CY2008**

SampleID	A082770047		A082770046			A073440117		A080380062		
Sample Date	11/12/2008		11/11/2008			02/26/2008		02/26/2008		
Well	GW-612		GW-612			GW-626		GW-626		
Sample Method	LF		PDB			LF		PDB		
Analyte	Conc	Qual	Conc	Qual	% Difference	Conc	Qual	Conc	Qual	% Difference
Volatile Organics										
1,1,1-Trichloroethane	8	=	6	=	-25	37	=	35	=	-5
1,1,2-Trichloro-1,2,2-trifluoroethane	5	U	5	U		590	=	250	J	-58
1,1,2-Trichloroethane	5	U	5	U		3	J	3	J	0
1,1-Dichloroethane	41	=	39	=	-5	520	=	480	=	-8
1,1-Dichloroethene	26	=	25	=	-4	140	J	110	J	-21
1,2-Dichloroethane	5	U	5	U		5	U	5	U	
1,2-Dichloroethene (Total)	5	U	5	U		14000	=	13000	=	-7
1,2-Dichloropropane	5	U	5	U		5	U	2	J	
1,4-Dichlorobenzene	5	U	5	U		5	U	5	U	
2-Butanone	5	U	10	U		5	U	5	U	
Acetone	10	U	10	U		10	U	10	U	
Acetonitrile	5	U	5	U		5	U	5	U	
Benzene	5	U	5	U		380	=	360	=	-5
Bromoform	5	U	5	U		5	U	5	U	
Carbon disulfide	5	U	5	U		5	U	5	U	
Carbon tetrachloride	5	U	5	U		5	U	5	U	
Chlorobenzene	5	U	5	U		5	U	5	U	
Chloroethane	5	U	5	U		5	U	5	U	
Chloroform	5	U	5	U		120	=	120	=	0
Dibromochloromethane	5	U	5	U		5	U	5	U	
Dichlorodifluoromethane	5	U	5	U		44	=	46	=	5
Ethylbenzene	5	U	5	U		5	U	5	U	
Methylene chloride	5	U	5	U		5	U	5	U	
Tetrachloroethene	2	J	5	U		200	=	1200	=	500
Toluene	5	U	5	U		5	U	5	U	
Trichloroethene	5	U	5	U		910	=	870	=	-4
Trichlorofluoromethane	5	U	5	U		5	U	5	U	
Vinyl chloride	2	U	2	U		3700	=	3800	=	3
cis-1,2-Dichloroethene	5	U	5	U		14000	=	13000	=	-7
trans-1,2-Dichloroethene	5	U	5	U		34	=	32	=	-6

**Table 1. Results for Volatile Organic Analyses for
Comparison of Sampling Methods CY2008**

SampleID	A081420050		A081420049			A082770006		A082770007		
Sample Date	06/03/2008		06/02/2008			12/02/2008		12/01/2008		
Well	GW-626		GW-626			GW-626		GW-626		
Sample Method	LF		HS			LF		HS		
Analyte	Conc	Qual	Conc	Qual	% Difference	Conc	Qual	Conc	Qual	% Difference
Volatile Organics										
1,1,1-Trichloroethane	17	=	10	=	-41	5	U	21	=	
1,1,2-Trichloro-1,2,2-trifluoroethane	190	=	110	=	-42	180	=	260	=	44
1,1,2-Trichloroethane	1	J	5	U		2	J	5	U	
1,1-Dichloroethane	180	=	150	=	-17	300	=	290	=	-3
1,1-Dichloroethene	90	=	50	=	-44	130	=	99	=	-24
1,2-Dichloroethane	18	=	11	=	-39	5	U	5	U	
1,2-Dichloroethene (Total)	4600	=	2600	=	-43	8500	=	8100	=	-5
1,2-Dichloropropane	5	U	5	U		5	U	5	U	
1,4-Dichlorobenzene	5	U	5	U		5	U	5	U	
2-Butanone	5	U	5	U		5	U	5	U	
Acetone	5	U	5	U		10	U	10	U	
Acetonitrile	5	U	5	U		5	U	5	U	
Benzene	140	=	82	=	-41	220	=	250	=	14
Bromoform	5	U	5	U		5	U	5	U	
Carbon disulfide	5	U	5	U		5	U	5	U	
Carbon tetrachloride	5	U	5	U		5	U	5	U	
Chlorobenzene	5	U	5	U		5	U	5	U	
Chloroethane	5	U	5	U		5	U	5	U	
Chloroform	55	=	36	=	-35	92	=	80	=	-13
Dibromochloromethane	5	U	5	U		5	U	5	U	
Dichlorodifluoromethane	5	U	5	U		5	U	5	U	
Ethylbenzene	5	U	5	U		5	U	5	U	
Methylene chloride	5	U	5	U		5	U	5	U	
Tetrachloroethene	640	=	440	=	-31	820	=	1100	=	34
Toluene	5	U	5	U		5	U	5	U	
Trichloroethene	330	=	200	=	-39	560	=	690	=	23
Trichlorofluoromethane	5	U	5	U		5	U	2	J	
Vinyl chloride	1100	=	580	=	-47	1900	=	2200	=	16
cis-1,2-Dichloroethene	4600	=	2600	=	-43	8500	=	8100	=	-5
trans-1,2-Dichloroethene	12	=	8	=	-33	16	=	14	=	-13

**Table 1. Results for Volatile Organic Analyses for
Comparison of Sampling Methods CY2008**

SampleID	A080930156		A081420055			A082770020		A082770021		
Sample Date	06/24/2008		06/23/2008			11/25/2008		11/24/2008		
Well	GW-698		GW-698			GW-698		GW-698		
Sample Method	LF		HS			LF		HS		
Analyte	Conc	Qual	Conc	Qual	% Difference	Conc	Qual	Conc	Qual	% Difference
Volatile Organics										
1,1,1-Trichloroethane	5	U	5	U		5	U	5	U	
1,1,2-Trichloro-1,2,2-trifluoroethane	44	=	16	=	-64	75	=	58	=	-23
1,1,2-Trichloroethane	5	U	5	U		5	U	5	U	
1,1-Dichloroethane	5	U	5	U		5	U	5	U	
1,1-Dichloroethene	5	U	5	U		5	U	2	J	
1,2-Dichloroethane	5	U	5	U		5	U	5	U	
1,2-Dichloroethene (Total)	94	=	22	=	-77	120	=	60	=	-50
1,2-Dichloropropane	5	U	5	U		5	U	5	U	
1,4-Dichlorobenzene	5	U	5	U		5	U	5	U	
2-Butanone	5	U	5	U		5	U	5	U	
Acetone	5	U	5	U		10	U	10	U	
Acetonitrile	5	U	5	U		5	U	5	U	
Benzene	5	U	5	U		5	U	5	U	
Bromoform	5	U	5	U		5	U	5	U	
Carbon disulfide	5	U	5	U		5	U	5	U	
Carbon tetrachloride	7	=	3	J	-57	7	=	6	=	-14
Chlorobenzene	5	U	5	U		5	U	5	U	
Chloroethane	5	U	5	U		5	U	5	U	
Chloroform	21	=	8	=	-62	16	=	16	=	0
Dibromochloromethane	5	U	5	U		5	U	5	U	
Dichlorodifluoromethane	5	U	5	U		5	U	3	J	
Ethylbenzene	5	U	5	U		5	U	5	U	
Methylene chloride	5	U	5	U		5	U	5	U	
Tetrachloroethene	180	=	94	=	-48	200	=	170	=	-15
Toluene	5	U	5	U		5	U	5	U	
Trichloroethene	620	=	280	=	-55	770	=	580	=	-25
Trichlorofluoromethane	5	U	5	U		5	U	5	U	
Vinyl chloride	2	U	2	U		2	U	2	U	
cis-1,2-Dichloroethene	93	=	22	=	-76	120	=	59	=	-51
trans-1,2-Dichloroethene	1	J	5	U		2	J	2	J	0

**Table 1. Results for Volatile Organic Analyses for
Comparison of Sampling Methods CY2008**

SampleID	A073440109		A080380061			A081420060		A081420059		
Sample Date	02/12/2008		02/12/2008			06/26/2008		06/25/2008		
Well	GW-740		GW-740			GW-740		GW-740		
Sample Method	LF		PDB			LF		HS		
Analyte	Conc	Qual	Conc	Qual	% Difference	Conc	Qual	Conc	Qual	% Difference
Volatile Organics										
1,1,1-Trichloroethane	5	U	5	U		5	U	5	U	
1,1,2-Trichloro-1,2,2-trifluoroethane	5	U	5	U		5	U	5	U	
1,1,2-Trichloroethane	5	U	5	U		5	U	5	U	
1,1-Dichloroethane	5	U	5	U		5	U	5	U	
1,1-Dichloroethene	5	U	5	U		5	U	5	U	
1,2-Dichloroethane	5	U	5	U		5	U	5	U	
1,2-Dichloroethene (Total)	1	J	1	J	0	2	J	16	=	700
1,2-Dichloropropane	5	U	5	U		5	U	5	U	
1,4-Dichlorobenzene	5	U	5	U		5	U	5	U	
2-Butanone	5	U	5	U		5	U	5	U	
Acetone	5	U	5	U		5	U	5	U	
Acetonitrile	5	U	5	U		5	U	5	U	
Benzene	5	U	5	U		5	U	5	U	
Bromoform	5	U	5	U		5	U	5	U	
Carbon disulfide	5	U	5	U		5	U	5	U	
Carbon tetrachloride	5	U	5	U		1	J	5	U	
Chlorobenzene	5	U	5	U		5	U	5	U	
Chloroethane	5	U	5	U		5	U	5	U	
Chloroform	5	U	5	U		5	U	5	U	
Dibromochloromethane	5	U	5	U		5	U	5	U	
Dichlorodifluoromethane	5	U	5	U		5	U	5	U	
Ethylbenzene	5	U	5	U		5	U	5	U	
Methylene chloride	5	U	5	U		5	U	5	U	
Tetrachloroethene	5	U	5	U		5	U	5	U	
Toluene	5	U	5	U		5	U	5	U	
Trichloroethene	42	=	35	=	-17	47	=	23	=	-51
Trichlorofluoromethane	5	U	5	U		5	U	5	U	
Vinyl chloride	2	U	2	U		2	U	2	U	
cis-1,2-Dichloroethene	1	J	1	J	0	2	J	16	Q	700
trans-1,2-Dichloroethene	5	U	5	U		5	U	5	U	

**Table 1. Results for Volatile Organic Analyses for
Comparison of Sampling Methods CY2008**

SampleID	A082770002		A082770003			A080930155		A081420054		
Sample Date	12/17/2008		12/16/2008			06/04/2008		06/03/2008		
Well	GW-740		GW-740			GW-769		GW-769		
Sample Method	LF		HS			LF		HS		
Analyte	Conc	Qual	Conc	Qual	% Difference	Conc	Qual	Conc	Qual	% Difference
Volatile Organics										
1,1,1-Trichloroethane	5	U	5	U		5	U	5	U	
1,1,2-Trichloro-1,2,2-trifluoroethane	5	U	5	U		2	J	5	U	
1,1,2-Trichloroethane	5	U	5	U		5	U	5	U	
1,1-Dichloroethane	5	U	5	U		5	U	5	U	
1,1-Dichloroethene	5	U	5	U		2	J	5	U	
1,2-Dichloroethane	5	U	5	U		5	U	5	U	
1,2-Dichloroethene (Total)	1	J	2	J	100	4	J	2	J	-50
1,2-Dichloropropane	5	U	5	U		5	U	5	U	
1,4-Dichlorobenzene	5	U	5	U		5	U	5	U	
2-Butanone	5	U	5	U		10	U	5	U	
Acetone	10	U	10	U		5	U	5	U	
Acetonitrile	5	U	5	U		5	U	5	U	
Benzene	5	U	5	U		5	U	5	U	
Bromoform	5	U	5	U		5	U	5	U	
Carbon disulfide	5	U	5	U		5	U	5	U	
Carbon tetrachloride	1	J	1	J	0	110	=	60	=	-45
Chlorobenzene	5	U	5	U		5	U	5	U	
Chloroethane	5	U	5	U		5	U	5	U	
Chloroform	5	U	5	U		4	J	2	J	-50
Dibromochloromethane	5	U	5	U		5	U	5	U	
Dichlorodifluoromethane	5	U	5	U		5	U	5	U	
Ethylbenzene	5	U	5	U		5	U	5	U	
Methylene chloride	5	U	5	U		5	U	5	U	
Tetrachloroethene	5	U	5	U		20	=	12	=	-40
Toluene	5	U	5	U		5	U	5	U	
Trichloroethene	43	=	44	=	2	4	J	2	J	-50
Trichlorofluoromethane	5	U	5	U		5	U	5	U	
Vinyl chloride	2	U	2	U		2	U	2	U	
cis-1,2-Dichloroethene	1	J	2	J	100	4	J	2	J	-50
trans-1,2-Dichloroethene	5	U	5	U		5	U	5	U	

**Table 1. Results for Volatile Organic Analyses for
Comparison of Sampling Methods CY2008**

SampleID	A082770011		A082940060		
Sample Date	12/03/2008		12/02/2008		
Well	GW-769		GW-769		
Sample Method	LF		HS		
Analyte	Conc	Qual	Conc	Qual	% Difference
Volatile Organics					
1,1,1-Trichloroethane	5	U	5	U	
1,1,2-Trichloro-1,2,2-trifluoroethane	3	J	5	J	67
1,1,2-Trichloroethane	5	U	5	U	
1,1-Dichloroethane	5	U	5	U	
1,1-Dichloroethene	2	J	3	J	50
1,2-Dichloroethane	5	U	5	U	
1,2-Dichloroethene (Total)	3	J	8	=	167
1,2-Dichloropropane	5	U	5	U	
1,4-Dichlorobenzene	5	U	5	U	
2-Butanone	5	U	5	U	
Acetone	10	U	10	U	
Acetonitrile	5	U	5	U	
Benzene	5	U	5	U	
Bromoform	5	U	5	U	
Carbon disulfide	5	U	5	U	
Carbon tetrachloride	170	=	180	=	6
Chlorobenzene	5	U	5	U	
Chloroethane	5	U	5	U	
Chloroform	4	J	6	=	50
Dibromochloromethane	5	U	5	U	
Dichlorodifluoromethane	5	U	5	U	
Ethylbenzene	5	U	5	U	
Methylene chloride	5	U	5	U	
Tetrachloroethene	18	=	31	=	72
Toluene	5	U	5	U	
Trichloroethene	3	U	9	U	
Trichlorofluoromethane	5	U	5	U	
Vinyl chloride	2	U	2	U	
cis-1,2-Dichloroethene	3	J	8	=	167
trans-1,2-Dichloroethene	5	U	5	U	

**Table 2. Results for Radionuclides, Metals and General Chemistry Analyses for
Comparison of Sampling Methods CY2008**

SampleID		A080930168			A081420056			A082770025			A082770026		
Sample Date		06/10/2008			06/09/2008			11/25/2008			11/24/2008		
Well		GW-109			GW-109			GW-109			GW-109		
Sample Method		LF			HS			LF			HS		
Analyte	Units	Conc	Qual		Conc	Qual	% Difference	Conc	Qual		Conc	Qual	% Difference
Radionuclides													
Gross Alpha	pCi/L	20	U		120	U		92	U		140	U	
Gross Beta	pCi/L	4000	=		420	U		1400	=		4000	=	186
Technetium-99	pCi/L	8900	=		31000	=	248	4000	=		5200	=	30
Uranium-234	pCi/L	4	U		2.2	U		3.5	=		7	=	100
Uranium-235	pCi/L	0.27	U		0.1	U		0.28	U		0.51	=	
Uranium-236	pCi/L	0.035	U		-0.04	U		0.14	U		0.3	=	
Uranium-238	pCi/L	6.2	=		5.3	=	-15	4.5	=		6.9	=	53
Metals													
Aluminum	mg/L	4	U		7.87	=		5.06	=		7.29	=	44
Antimony	mg/L	0.025	U		0.025	U		0.05	U		0.05	U	
Arsenic	mg/L	0.05	U		0.05	U		0.1	U		0.1	U	
Barium	mg/L	90.1	=		53.5	=	-41	67.9	=		102	=	50
Beryllium	mg/L	0.01	U		0.0102	=		0.01	U		0.01	U	
Boron	mg/L	2	U		2	U		2	U		2	U	
Cadmium	mg/L	1.03	=		2.39	=	132	1.28	=		1.12	=	-13
Calcium	mg/L	10500	=		9500	=	-10	10400	=		11500	=	11
Chromium	mg/L	0.1	U		0.1	U		0.2	U		0.2	U	
Cobalt	mg/L	0.4	U		0.797	=		0.4	U		0.4	U	
Copper	mg/L	0.4	U		0.4	U		0.4	U		0.4	U	
Iron	mg/L	1	U		1	U		1	U		2.38	=	
Lead	mg/L	0.005	U		0.00845	=		0.01	U		0.01	U	
Lithium	mg/L	0.626	=		0.468	=	-25	0.85	=		0.686	=	-19
Magnesium	mg/L	1270	=		1270	=	0	1430	=		1350	=	-6
Manganese	mg/L	70.1	=		145	=	107	76	=		68.3	=	-10
Mercury	mg/L	0.0157	=		0.00332	=	-79	0.0166	=		0.0321	=	93
Nickel	mg/L	1.71	=		5.18	=	203	1.52	=		1.44	=	-5
Potassium	mg/L	81.9	=		108	=	32	98.4	=		84.9	=	-14
Selenium	mg/L	0.1	U		0.1	U		0.2	U		0.2	U	
Sodium	mg/L	387	=		571	=	48	447	=		394	=	-12
Strontium	mg/L	64.5	=		38.5	=	-40	61.4	=		71.1	=	16
Thallium	mg/L	0.005	U		0.005	U		0.01	U		0.01	U	
Uranium	mg/L	0.0264	=		0.0252	=	-5	0.0146	=		0.0292	=	100
Zinc	mg/L	1	U		1	U		1	U		1	U	
General Chemistry													
Alkalinity	mg/L	476	=		565	=	19	455	=		417	=	-8
Bicarbonate	mg/L	476	=		565	=	19	455	=		417	=	-8
Chloride	mg/L	111	=		148	=	33	111	=		103	=	-7
Dissolved Solids	mg/L	53500	=		45100	=	-16	49900	=		50300	=	1
Fluoride	mg/L	4.76	=		12	=	152	7.36	=		3.34	=	-55
Nitrate Nitrogen	mg/L	9190	=		8480	=	-8	9630	=		11200	=	16
Sulfate	mg/L	2.5	U		9.98	=		2.5	U		2.5	U	
Total Suspended Solids	mg/L	13	=		5	=	-62	14	=		81	=	479

**Table 2. Results for Radionuclides, Metals and General Chemistry Analyses for
Comparison of Sampling Methods CY2008**

SampleID	A073440088		A080380063			A081420052		A081420051		
Sample Date	03/24/2008		03/24/2008			06/10/2008		06/09/2008		
Well	GW-220		GW-220			GW-220		GW-220		
Sample Method	LF		PDB			LF		HS		
Analyte	Conc	Qual	Conc	Qual	% Difference	Conc	Qual	Conc	Qual	% Difference
Radionuclides										
Gross Alpha	4.3	=				0.44	U	4.7	=	
Gross Beta	4.3	U				8.2	=	5.5	=	-33
Technetium-99										
Uranium-234										
Uranium-235										
Uranium-236										
Uranium-238										
Metals										
Aluminum	0.2	U				0.2	U	0.359	=	
Antimony	0.0025	U				0.0025	U	0.0025	U	
Arsenic	0.005	U				0.005	U	0.005	U	
Barium	0.11	=				0.11	=	0.111	=	1
Beryllium	0.0005	U				0.0005	U	0.0005	U	
Boron	0.1	U				0.1	U	0.1	U	
Cadmium	0.0025	U				0.0025	U	0.0025	U	
Calcium	64.7	=				61.6	=	64.1	=	4
Chromium	0.01	U				0.01	U	0.01	U	
Cobalt	0.02	U				0.02	U	0.02	U	
Copper	0.02	U				0.02	U	0.02	U	
Iron	0.0732	=				0.05	U	0.166	=	
Lead	0.0005	U				0.0005	U	0.00114	=	
Lithium	0.01	U				0.01	U	0.01	U	
Magnesium	26.6	=				26.2	=	26.1	=	0
Manganese	0.0156	=				0.0159	=	0.0744	=	368
Mercury	0.0002	U				0.0002	U	0.0002	U	
Nickel	0.005	U				0.005	U	0.005	U	
Potassium	2.39	=				2.52	=	2.45	=	-3
Selenium	0.01	U				0.01	U	0.01	U	
Sodium	5.36	=				5.57	=	5.5	=	-1
Strontium	0.451	=				0.44	=	0.443	=	1
Thallium	0.0005	U				0.0005	U	0.0005	U	
Uranium	0.0005	U				0.0005	U	0.0005	U	
Zinc	0.05	U				0.05	U	0.05	U	
General Chemistry										
Alkalinity	246	=				228	=	224	=	-2
Bicarbonate	246	=				228	=	224	=	-2
Chloride	16.3	=				17.1	=	17	=	-1
Dissolved Solids	226	=				325	=	348	=	7
Fluoride	0.1	U				0.1	U	0.1	U	
Nitrate Nitrogen	0.583	=				0.55	=	0.534	=	-3
Sulfate	16.2	=				16.6	=	17.2	=	4
Total Suspended Solids	2	=				6	=	12	=	100

**Table 2. Results for Radionuclides, Metals and General Chemistry Analyses for
Comparison of Sampling Methods CY2008**

SampleID	A082770008		A082770009			A081420058		A081420057		
Sample Date	12/02/2008		12/01/2008			06/17/2008		06/16/2008		
Well	GW-220		GW-220			GW-229		GW-229		
Sample Method	LF		HS			LF		HS		
Analyte	Conc	Qual	Conc	Qual	% Difference	Conc	Qual	Conc	Qual	% Difference
Radionuclides										
Gross Alpha	3.8	=	-0.026	U		48	=	60	=	25
Gross Beta	4.2	U	5	U		53	=	90	=	70
Technetium-99										
Uranium-234										
Uranium-235										
Uranium-236										
Uranium-238										
Metals										
Aluminum	0.2	U	0.346	=		0.2	U	0.2	U	
Antimony	0.0025	U	0.0025	U		0.0025	U	0.0025	U	
Arsenic	0.005	U	0.005	U		0.0116	=	0.0638	Q	450
Barium	0.111	=	0.114	=	3	1.42	=	1.12	=	-21
Beryllium	0.0005	U	0.0005	U		0.0005	U	0.0005	U	
Boron	0.1	U	0.1	U		3.55	=	2.84	=	-20
Cadmium	0.0025	U	0.0025	U		0.0025	U	0.0025	U	
Calcium	64.4	=	69.6	=	8	191	=	156	=	-18
Chromium	0.01	U	0.01	U		0.01	U	0.01	U	
Cobalt	0.02	U	0.02	U		0.02	U	0.05	Q	
Copper	0.02	U	0.02	U		0.02	U	0.02	U	
Iron	0.198	=	0.211	=	7	28.4	=	46.9	=	65
Lead	0.0005	U	0.000585	=		0.000575	=	0.0005	U	
Lithium	0.01	U	0.01	U		0.126	=	0.108	=	-14
Magnesium	27.3	=	27.5	=	1	35.3	=	29.6	=	-16
Manganese	0.00595	=	0.0246	=	313	7.3	=	5.8	=	-21
Mercury	0.00005	U	0.00005	U		0.0002	U	0.0002	U	
Nickel	0.005	U	0.005	U		0.053	=	0.0576	=	9
Potassium	2.67	=	2.47	=	-7	14.7	=	13.1	=	-11
Selenium	0.01	U	0.01	U		0.01	U	0.01	U	
Sodium	5.73	=	5.84	=	2	83.1	=	70.1	=	-16
Strontium	0.455	=	0.471	=	4	0.577	=	0.469	=	-19
Thallium	0.0005	U	0.0005	U		0.0005	U	0.0005	U	
Uranium	0.0005	U	0.0005	U		0.167	=	0.156	=	-7
Zinc	0.05	U	0.05	U		0.05	U	0.05	U	
General Chemistry										
Alkalinity	233	=	231	=	-1	643	=	524	=	-19
Bicarbonate	233	=	231	=	-1	643	=	524	=	-19
Chloride	18.5	=	18.3	=	-1	147	=	130	=	-12
Dissolved Solids	266	=	236	=	-11	26300	Q	26100	Q	-1
Fluoride	0.1	U	0.1	U		0.128	=	0.124	=	-3
Nitrate Nitrogen	0.492	=	0.54	=	10	0.028	U	0.14	U	
Sulfate	16.8	=	17.6	=	5	14.8	=	9.88	=	-33
Total Suspended Solids	1	U	8	=		7	=	95	Q	1257

**Table 2. Results for Radionuclides, Metals and General Chemistry Analyses for
Comparison of Sampling Methods CY2008**

SampleID	A082770004		A082770005			A081420048		A081420047		
Sample Date	12/11/2008		12/10/2008			06/10/2008		06/09/2008		
Well	GW-229		GW-229			GW-246		GW-246		
Sample Method	LF		HS			LF		HS		
Analyte	Conc	Qual	Conc	Qual	% Difference	Conc	Qual	Conc	Qual	% Difference
Radionuclides										
Gross Alpha	44	=	54	=	23	52	U	290	=	
Gross Beta	46	=	60	=	30	9300	=	7700	=	-17
Technetium-99						28000	=	28000	=	0
Uranium-234						62	=	60	=	-3
Uranium-235						3.3	=	2.8	=	-15
Uranium-236						1.7	=	2.2	=	29
Uranium-238						150	=	140	=	-7
Metals										
Aluminum	0.2	U	0.2	U		47.9	=	51.3	=	7
Antimony	0.0025	U	0.0025	U		0.012	U	0.012	U	
Arsenic	0.00847	=	0.0104	=	23	0.025	U	0.025	U	
Barium	1.35	=	1.26	=	-7	5.88	=	5.77	=	-2
Beryllium	0.0005	U	0.0005	U		0.0252	=	0.0281	=	12
Boron	3.44	=	3.14	=	-9	1	U	1	U	
Cadmium	0.0025	U	0.0025	U		0.329	=	0.33	=	0
Calcium	196	=	187	=	-5	2800	=	2940	=	5
Chromium	0.01	U	0.01	U		0.05	U	0.05	U	
Cobalt	0.02	U	0.02	U		0.452	=	0.467	=	3
Copper	0.02	U	0.02	U		0.2	U	0.2	U	
Iron	20.7	=	24.3	=	17	0.5	U	0.5	U	
Lead	0.0005	U	0.0005	U		0.0025	U	0.0025	U	
Lithium	0.118	=	0.113	=	-4	0.58	=	0.631	=	9
Magnesium	36.8	=	34.5	=	-6	570	=	599	=	5
Manganese	4.86	=	4.95	=	2	102	=	107	=	5
Mercury	0.00005	U	0.00005	U		0.000836	=	0.000317	=	-62
Nickel	0.0581	=	0.054	=	-7	3.53	=	3.58	=	1
Potassium	14	=	13.1	=	-6	37.1	=	40	=	8
Selenium	0.01	U	0.01	U		0.05	U	0.05	U	
Sodium	80.5	=	75	=	-7	457	=	484	=	6
Strontium	0.635	=	0.582	=	-8	10.1	=	10.7	=	6
Thallium	0.0005	U	0.0005	U		0.0025	U	0.0025	U	
Uranium	0.157	=	0.149	=	-5	0.504	=	0.522	=	4
Zinc	0.05	U	0.05	U		0.5	U	0.5	U	
General Chemistry										
Alkalinity	619	=	522	=	-16	56.4	=	54.2	=	-4
Bicarbonate	619	=	522	=	-16	56.4	=	54.2	=	-4
Chloride	148	=	128	=	-14	292	=	298	=	2
Dissolved Solids	904	=	902	=	0	17800	=	17500	=	-2
Fluoride	0.139	=	0.136	=	-2	4.65	=	4.48	=	-4
Nitrate Nitrogen	0.028	U	0.028	U		2990	=	2870	=	-4
Sulfate	15.5	=	14.7	=	-5	21.3	=	21	=	-1
Total Suspended Solids	42	=	48	=	14	8	=	5	=	-38

**Table 2. Results for Radionuclides, Metals and General Chemistry Analyses for
Comparison of Sampling Methods CY2008**

SampleID	A082940058		A082940059			A082770045		A082770044		
Sample Date	12/10/2008		12/09/2008			11/12/2008		11/11/2008		
Well	GW-246		GW-246			GW-322		GW-322		
Sample Method	LF		HS			LF		PDB		
Analyte	Conc	Qual	Conc	Qual	% Difference	Conc	Qual	Conc	Qual	% Difference
Radionuclides										
Gross Alpha	420	=	67	=	-84	0.63	U			
Gross Beta	9600	=	620	=	-94	-0.57	U			
Technetium-99	29000	=	1200	=	-96					
Uranium-234	2.9	=	-0.2	U						
Uranium-235	0.028	U	-0.1	U						
Uranium-236	0.046	U	-0.043	U						
Uranium-238	3.2	=	0.087	U						
Metals										
Aluminum	33	=	4.74	=	-86	0.224	=			
Antimony	0.01	U	0.01	U		0.0025	U			
Arsenic	0.02	U	0.02	U		0.005	U			
Barium	5.41	=	49.6	=	817	0.0184	=			
Beryllium	0.0175	=	0.005	U		0.0005	U			
Boron	1	U	1	U		0.1	U			
Cadmium	0.3	=	0.01	U		0.0025	U			
Calcium	2900	=	3660	=	26	61.2	=			
Chromium	0.04	U	0.04	U		0.01	U			
Cobalt	0.404	=	0.2	U		0.02	U			
Copper	0.2	U	0.2	U		0.02	U			
Iron	0.5	U	0.5	U		0.254	=			
Lead	0.002	U	0.002	U		0.0005	U			
Lithium	0.584	=	0.35	=	-40	0.01	U			
Magnesium	593	=	666	=	12	38.3	=			
Manganese	94.4	=	3.15	=	-97	0.00803	=			
Mercury	0.000448	=	0.00142	=	217	0.00005	U			
Nickel	3.82	=	0.197	=	-95	0.005	U			
Potassium	34.8	=	20	U		2	U			
Selenium	0.04	U	0.04	U		0.01	U			
Sodium	440	=	148	=	-66	0.751	=			
Strontium	10.9	=	14.5	=	33	0.0215	=			
Thallium	0.002	U	0.002	U		0.0005	U			
Uranium	0.444	=	0.158	=	-64	0.0005	U			
Zinc	0.5	U	0.5	U		0.05	U			
General Chemistry										
Alkalinity	72.9	=	227	=	211	289	=			
Bicarbonate	72.9	=	227	=	211	289	=			
Chloride	286	=	221	=	-23	1.9	=			
Dissolved Solids	16300	=	19000	=	17	250	=			
Fluoride	1.69	=	0.833	=	-51	0.1	U			
Nitrate Nitrogen	3027	=	4233	=	40	0.498	=			
Sulfate	19.6	=	5	=	-74	1.44	=			
Total Suspended Solids	1	U	1	U		1	=			

**Table 2. Results for Radionuclides, Metals and General Chemistry Analyses for
Comparison of Sampling Methods CY2008**

SampleID	A082770047		A082770046			A073440117		A080380062		
Sample Date	11/12/2008		11/11/2008			02/26/2008		02/26/2008		
Well	GW-612		GW-612			GW-626		GW-626		
Sample Method	LF		PDB			LF		PDB		
Analyte	Conc	Qual	Conc	Qual	% Difference	Conc	Qual	Conc	Qual	% Difference
Radionuclides										
Gross Alpha	-0.29	U				1	U			
Gross Beta	0.035	U				3.1	U			
Technetium-99										
Uranium-234										
Uranium-235										
Uranium-236										
Uranium-238										
Metals										
Aluminum	0.2	U				0.2	U			
Antimony	0.0025	U				0.0025	U			
Arsenic	0.005	U				0.005	U			
Barium	0.0211	=				0.499	=			
Beryllium	0.0005	U				0.0005	U			
Boron	0.179	=				0.1	U			
Cadmium	0.0025	U				0.0025	U			
Calcium	49	=				147	=			
Chromium	0.01	U				0.01	U			
Cobalt	0.02	U				0.0266	=			
Copper	0.02	U				0.02	U			
Iron	2.1	=				0.106	=			
Lead	0.00281	=				0.0005	U			
Lithium	0.01	U				0.0238	=			
Magnesium	31.1	=				9.99	=			
Manganese	0.17	=				0.005	U			
Mercury	0.00005	U				0.0002	U			
Nickel	0.005	U				0.176	=			
Potassium	2.5	=				2	U			
Selenium	0.01	U				0.01	U			
Sodium	0.705	=				9.22	=			
Strontium	0.0287	=				0.326	=			
Thallium	0.0005	U				0.0005	U			
Uranium	0.0005	U				0.0005	U			
Zinc	0.05	U				0.05	U			
General Chemistry										
Alkalinity	237	=				292	=			
Bicarbonate	237	=				292	=			
Chloride	1.69	=				75.6	=			
Dissolved Solids	198	=				497	=			
Fluoride	0.1	U				0.1	U			
Nitrate Nitrogen	0.028	U				0.028	U			
Sulfate	3.33	=				6.33	=			
Total Suspended Solids	2	=				1	U			

**Table 2. Results for Radionuclides, Metals and General Chemistry Analyses for
Comparison of Sampling Methods CY2008**

SampleID	A081420050		A081420049			A082770006		A082770007		
Sample Date	06/03/2008		06/02/2008			12/02/2008		12/01/2008		
Well	GW-626		GW-626			GW-626		GW-626		
Sample Method	LF		HS			LF		HS		
Analyte	Conc	Qual	Conc	Qual	% Difference	Conc	Qual	Conc	Qual	% Difference
Radionuclides										
Gross Alpha			5.3	=		0.0013	U	1.9	U	
Gross Beta	2.2	U	1.9	U		-0.67	U	2	U	
Technetium-99										
Uranium-234										
Uranium-235										
Uranium-236										
Uranium-238										
Metals										
Aluminum	0.2	U	0.2	U		0.2	U	0.321	=	
Antimony	0.0025	U	0.0025	U		0.0025	U	0.0025	U	
Arsenic	0.005	U	0.005	U		0.005	U	0.005	U	
Barium	0.302	=	0.259	=	-14	0.396	=	0.396	=	0
Beryllium	0.0005	U	0.0005	U		0.0005	U	0.0005	U	
Boron	0.1	U	0.1	U		0.1	U	0.1	U	
Cadmium	0.0025	U	0.0025	U		0.0025	U	0.0025	U	
Calcium	99.1	=	83.4	=	-16	122	=	131	=	7
Chromium	0.01	U	0.01	U		0.01	U	0.0552	=	
Cobalt	0.02	U	0.02	U		0.02	U	0.02	U	
Copper	0.02	U	0.02	U		0.02	U	0.0292	=	
Iron	0.0707	=	0.287	=	306	0.05	U	1.3	=	
Lead	0.0005	U	0.0005	U		0.0005	U	0.00264	=	
Lithium	0.0168	=	0.0142	=	-15	0.019	=	0.0213	=	12
Magnesium	6.43	=	5.37	=	-16	8.09	=	7.91	=	-2
Manganese	0.005	U	0.00626	=		0.005	U	0.0229	=	
Mercury	0.0002	U	0.0002	U		0.00005	U	0.00005	U	
Nickel	0.0694	=	0.0472	=	-32	0.0986	=	0.126	=	28
Potassium	2	U	2.96	=		2	U	6.93	=	
Selenium	0.01	U	0.01	U		0.01	U	0.01	U	
Sodium	6.38	=	6.27	=	-2	7.41	=	7.62	=	3
Strontium	0.2	=	0.17	=	-15	0.26	=	0.272	=	5
Thallium	0.0005	U	0.0005	U		0.0005	U	0.0005	U	
Uranium	0.0005	U	0.0005	U		0.0005	U	0.0005	U	
Zinc	0.05	U	0.05	U		0.05	U	0.05	U	
General Chemistry										
Alkalinity	239	=	203	=	-15	278	=	258	=	-7
Bicarbonate	239	=	203	=	-15	278	=	258	=	-7
Chloride	33.8	=	18.7	=	-45	41.9	=	40.2	=	-4
Dissolved Solids	332	=	246	=	-26	372	=	346	=	-7
Fluoride	0.1	U	0.1	U		0.1	U	0.1	U	
Nitrate Nitrogen	0.028	U	0.028	U		0.028	U	0.028	U	
Sulfate	3.47	=	2.69	=	-22	4.49	=	4.37	=	-3
Total Suspended Solids	2	=	2	=	0	1	U	56	=	

**Table 2. Results for Radionuclides, Metals and General Chemistry Analyses for
Comparison of Sampling Methods CY2008**

SampleID	A080930156		A081420055			A082770020		A082770021		
Sample Date	06/24/2008		06/23/2008			11/25/2008		11/24/2008		
Well	GW-698		GW-698			GW-698		GW-698		
Sample Method	LF		HS			LF		HS		
Analyte	Conc	Qual	Conc	Qual	% Difference	Conc	Qual	Conc	Qual	% Difference
Radionuclides										
Gross Alpha	4	U	12	=		-0.43	U	5.9	=	
Gross Beta	12	=	19	=	58	3.3	U	6.4	U	
Technetium-99										
Uranium-234										
Uranium-235										
Uranium-236										
Uranium-238										
Metals										
Aluminum	1.03	=	11.1	Q	978	0.744	=	3.18	=	327
Antimony	0.0025	U	0.0025	U		0.0025	U	0.0025	U	
Arsenic	0.005		0.005	U		0.005	U	0.005	U	
Barium	0.232	=	0.281	=	21	0.245	=	0.29	=	18
Beryllium	0.0005	U	0.0005	U		0.0005	U	0.0005	U	
Boron	0.1	U	0.1	U		0.1	U	0.1	U	
Cadmium	0.0025	U	0.0025	U		0.0025	U	0.0025	U	
Calcium	243	=	160	=	-34	241	=	254	=	5
Chromium	0.01	U	0.0279	=		0.01	U	0.01	U	
Cobalt	0.02	U	0.02	U		0.02	U	0.02	U	
Copper	0.02	U	0.0437	Q		0.02	U	0.02	U	
Iron	0.936	=	10.7	Q	1043	0.582	=	3.1	=	433
Lead	0.00093	=	0.0133	Q	1330	0.00063	=	0.00406	=	544
Lithium	0.01	U	0.0117	=		0.01	U	0.01	U	
Magnesium	67.1	=	50.6	=	-25	69.5	=	75.7	=	9
Manganese	0.458	=	3.58	Q	682	0.505	=	1.18	=	134
Mercury	0.00244	=	0.0403	Q	1552	0.00109	=	0.00637	=	484
Nickel	0.0069	=	0.0272	=	294	0.0142	=	0.0195	=	37
Potassium	3.79	=	6.53	=	72	3.85	=	4.55	=	18
Selenium	0.01	U	0.01	U		0.01	U	0.01	U	
Sodium	25.2	=	16.6	=	-34	26.4	=	27.9	=	6
Strontium	0.687	=	0.394	=	-43	0.745	=	0.792	=	6
Thallium	0.0005	U	0.0005	U		0.0005	U	0.0005	U	
Uranium	0.00114	=	0.00132	=	16	0.00122	=	0.00118	=	-3
Zinc	0.05	U	0.05	U		0.05	U	0.05	U	
General Chemistry										
Alkalinity	257	=	286	=	11	263	=	266	=	1
Bicarbonate	257	=	286	=	11	263	=	266	=	1
Chloride	22.5	=	21.1	=	-6	23.3	=	23.1	=	-1
Dissolved Solids	1350	=	854	=	-37	1140	=	968	=	-15
Fluoride	0.1	U	0.1	U		0.1	U	0.1	U	
Nitrate Nitrogen	158	=	74.3	=	-53	161	=	166	=	3
Sulfate	56.7	=	27.4	=	-52	62.2	=	49	=	-21
Total Suspended Solids	14	=	220	Q	1471	7	=	24	=	243

**Table 2. Results for Radionuclides, Metals and General Chemistry Analyses for
Comparison of Sampling Methods CY2008**

SampleID	A073440109		A080380061			A081420060		A081420059		
Sample Date	02/12/2008		02/12/2008			06/26/2008		06/25/2008		
Well	GW-740		GW-740			GW-740		GW-740		
Sample Method	LF		PDB			LF		HS		
Analyte	Conc	Qual	Conc	Qual	% Difference	Conc	Qual	Conc	Qual	% Difference
Radionuclides										
Gross Alpha	3.2	U				6.7	=	0.74	U	
Gross Beta	4.3	U				11	=	5	U	
Technetium-99										
Uranium-234										
Uranium-235										
Uranium-236										
Uranium-238										
Metals										
Aluminum	0.2	U				0.2	U	0.2	U	
Antimony	0.0025	U				0.0025	U	0.0025	U	
Arsenic	0.005	U				0.005	U	0.005	U	
Barium	0.0951	=				0.0969	=	0.0401	=	-59
Beryllium	0.0005	U				0.0005	U	0.0005	U	
Boron	0.1	U				0.1	U	0.1	U	
Cadmium	0.0025	U				0.0025	U	0.0025	U	
Calcium	72.1	=				71.2	=	30.9	=	-57
Chromium	0.01	U				0.0116	=	0.01	U	
Cobalt	0.02	U				0.02	U	0.02	U	
Copper	0.02	U				0.02	U	0.02	U	
Iron	1.95	=				1.21	=	9.23	Q	663
Lead	0.0005	U				0.0005	U	0.000885	=	
Lithium	0.0156	=				0.0173	=	0.0191	=	10
Magnesium	34.2	=				32.3	=	28.4	=	-12
Manganese	0.00903	=				0.0105	=	0.0801	Q	663
Mercury	0.0002	U				0.0002	U	0.0002	U	
Nickel	0.005	U				0.005	U	0.005	U	
Potassium	2	U				2	U	5.9	Q	
Selenium	0.01	U				0.01	U	0.01	U	
Sodium	2.39	=				2.23	=	2.42	=	9
Strontium	0.0595	=				0.0562	=	0.0247	=	-56
Thallium	0.0005	U				0.0005	U	0.0005	U	
Uranium	0.0005	U				0.0005	U	0.0005	U	
Zinc	0.05	U				0.231	=	0.183	Q	-21
General Chemistry										
Alkalinity	278	=				271	=	195	=	-28
Bicarbonate	278	=				271	=	195	=	-28
Chloride	7.66	=				7.3	=	6.03	=	-17
Dissolved Solids	314	=				209	=	245	=	17
Fluoride	0.175	=				0.181	=	0.127	=	-30
Nitrate Nitrogen	1.84	=				1.77	=	0.5	=	-72
Sulfate	12	=				11.9	=	3.94	=	-67
Total Suspended Solids	1	=				2	=	18	Q	800

**Table 2. Results for Radionuclides, Metals and General Chemistry Analyses for
Comparison of Sampling Methods CY2008**

SampleID	A082770002		A082770003			A080930155		A081420054		
Sample Date	12/17/2008		12/16/2008			06/04/2008		06/03/2008		
Well	GW-740		GW-740			GW-769		GW-769		
Sample Method	LF		HS			LF		HS		
Analyte	Conc	Qual	Conc	Qual	% Difference	Conc	Qual	Conc	Qual	% Difference
Radionuclides										
Gross Alpha	1.6	U	1.3	U		0.79	U	-0.17	U	
Gross Beta	4.7	U	8.6	=		3.9	U	7.4	=	
Technetium-99										
Uranium-234										
Uranium-235										
Uranium-236										
Uranium-238										
Metals										
Aluminum	0.2	U	0.244	=		0.2	U	0.2	U	
Antimony	0.0025	U	0.0025	U		0.0025	U	0.0025	U	
Arsenic	0.005	U	0.005	U		0.005	U	0.005	U	
Barium	0.0985	=	0.108	=	10	0.381	=	0.176	=	-54
Beryllium	0.0005	U	0.0005	U		0.0005	U	0.0005	U	
Boron	0.1	U	0.1	U		0.1	U	0.1	U	
Cadmium	0.0025	U	0.0025	U		0.0025	U	0.0025	U	
Calcium	76.5	=	74.6	=	-2	82.5	=	18.5	Q	-78
Chromium	0.01	U	0.01	U		0.01	U	0.0324	=	
Cobalt	0.02	U	0.02	U		0.02	U	0.02	U	
Copper	0.02	U	0.02	U		0.02	U	0.02	U	
Iron	0.855	=	28.8	=	3268	0.0553	=	0.114	=	106
Lead	0.0009	=	0.0154	=	1611	0.0005	U	0.00838	=	
Lithium	0.0171	=	0.0169	=	-1	0.014	=	0.0171	=	22
Magnesium	35	=	34.2	=	-2	10	=	9.85	=	-2
Manganese	0.00664	=	0.182	=	2641	0.00837	=	0.005	U	
Mercury	0.00005	U	0.00005	U		0.0002	U	0.0002	U	
Nickel	0.0051	=	0.005	U		0.005	U	0.005	U	
Potassium	2	U	2	U		2.72	=	5.23	=	92
Selenium	0.01	U	0.01	U		0.01	U	0.01	U	
Sodium	2.68	=	2.67	=	0	6.94	=	7.74	=	12
Strontium	0.061	=	0.0597	=	-2	0.379	=	0.268	=	-29
Thallium	0.0005	U	0.0005	U		0.0005	U	0.0005	U	
Uranium	0.0005	U	0.000665	=		0.0005	U	0.0005	U	
Zinc	0.05	U	0.05	U		0.05	U	0.05	U	
General Chemistry										
Alkalinity	274	=	229	=	-16	215	=	83.5	=	-61
Bicarbonate	274	=	229	=	-16	215	=	83.5	Q	-61
Chloride	8.5	=	7.53	=	-11	17.3	=	8.09	=	-53
Dissolved Solids	274	=	330	=	20	296	=	94	Q	-68
Fluoride	0.183	=	0.152	=	-17	0.1	U	0.1	U	
Nitrate Nitrogen	1.87	=	1.13	=	-40	0.296	=	0.384	=	30
Sulfate	12.8	=	7.61	=	-41	20.4	=	13	=	-36
Total Suspended Solids	2	=	20	=	900	1	U	1	U	

**Table 2. Results for Radionuclides, Metals and General Chemistry Analyses for
Comparison of Sampling Methods CY2008**

SampleID	A082770011		A082940060		
Sample Date	12/03/2008		12/02/2008		
Well	GW-769		GW-769		
Sample Method	LF		HS		
Analyte	Conc	Qual	Conc	Qual	% Difference
Radionuclides					
Gross Alpha	5.9	=	7.6	=	29
Gross Beta	7.4	=	19	=	157
Technetium-99					
Uranium-234					
Uranium-235					
Uranium-236					
Uranium-238					
Metals					
Aluminum	0.302	=	1.27	=	321
Antimony	0.0025	U	0.0025	U	
Arsenic	0.005	U	0.005	U	
Barium	0.378	=	0.409	=	8
Beryllium	0.0005	U	0.0005	U	
Boron	0.1	U	0.1	U	
Cadmium	0.0025	U	0.0025	U	
Calcium	81.4	=	74.9	=	-8
Chromium	0.01	U	0.0544	=	
Cobalt	0.02	U	0.02	U	
Copper	0.02	U	0.02	U	
Iron	0.364	=	12.4	=	3307
Lead	0.000805	=	0.00248	=	208
Lithium	0.0159	=	0.0185	=	16
Magnesium	10.1	=	9.71	=	-4
Manganese	0.015	=	0.0785	=	423
Mercury	0.00005	U	0.00005	U	
Nickel	0.005	U	0.0122	=	
Potassium	3.15	=	3.89	=	23
Selenium	0.01	U	0.01	U	
Sodium	6.98	=	7.54	=	8
Strontium	0.398	=	0.353	=	-11
Thallium	0.0005	U	0.0005	U	
Uranium	0.0005	U	0.0005	U	
Zinc	0.05	U	0.05	U	
General Chemistry					
Alkalinity	169	=	200	=	18
Bicarbonate	169	=	200	=	18
Chloride	17	=	15.3	=	-10
Dissolved Solids	268	=	238	=	-11
Fluoride	0.1	U	0.1	U	
Nitrate Nitrogen	0.354	=	0.483	=	36
Sulfate	21.7	=	22.6	=	4
Total Suspended Solids	1	U	62	=	

**Table 3. Summary Statistics for
Comparison of Sampling Methods CY2008**

Analysis Type	Analysis	Number of Test Pairs*	Number with One Detect	Number with Both Detects#	Number with Test Method>LF	Minimum Percent Difference	Maximum Percent Difference	Average Percent Difference	Std. Dev. Percent Difference	Probability for T Test	Probability for Normality Test	Sign Statistic	Probability for Sign Test	Direction for Sign Test
Comparisons Between Hydrasleeve and Low Flow Methods														
Volatile Organics	1,1,1-Trichloroethane	16	1	3	2	-41	100	10	78.12	0.84	0.15	0.00	1.00	
Volatile Organics	1,1,2-Trichloro-1,2,2-trifluoroethane	16	3	10	3	-64	67	-2	39.97	0.90	0.90	-2.50	0.23	
Volatile Organics	1,1,2-Trichloroethane	16	2	0	0							-1.00	0.50	
Volatile Organics	1,1-Dichloroethane	16	0	4	0	-25	0	-11	11.66	0.15	0.56	-1.50	0.25	
Volatile Organics	1,1-Dichloroethene	16	4	7	4	-44	68	4	41.21	0.83	0.37	-0.50	1.00	
Volatile Organics	1,2-Dichloroethane	16	0	1	0	-39	-39	-39				-0.50	1.00	
Volatile Organics	1,2-Dichloroethene (Total)	16	1	12	5	-77	700	58	213.87	0.37	0.00	-1.50	0.58	
Volatile Organics	1,4-Dichlorobenzene	16	0	2	0	-25	0	-13	17.68	0.50	1.00	-0.50	1.00	
Volatile Organics	Acetone	16	2	0	2							1.00	0.50	
Volatile Organics	Acetonitrile	16	0	1	1	14	14	14				0.50	1.00	
Volatile Organics	Benzene	16	0	4	1	-41	14	-11	23.84	0.41	0.90	-0.50	1.00	
Volatile Organics	Bromoform	16	0	1	0	-50	-50	-50				-0.50	1.00	
Volatile Organics	Carbon disulfide	16	1	0	0							-0.50	1.00	
Volatile Organics	Carbon tetrachloride	16	2	7	3	-57	38	-13	31.99	0.33	0.91	-1.00	0.73	
Volatile Organics	Chlorobenzene	16	0	2	0	-21	-8	-15	9.26	0.26	1.00	-1.00	0.50	
Volatile Organics	Chloroform	16	0	12	1	-95	50	-24	36.41	0.05	0.80	-4.00	0.02	LF>HS
Volatile Organics	Dibromochloromethane	16	1	0	1							0.50	1.00	
Volatile Organics	Dichlorodifluoromethane	16	1	0	1							0.50	1.00	
Volatile Organics	Methylene chloride	16	0	4	0	-73	0	-31	30.52	0.13	0.72	-1.50	0.25	
Volatile Organics	Tetrachloroethene	16	0	12	6	-96	72	-10	44.53	0.47	0.99	0.00	1.00	
Volatile Organics	Trichloroethene	16	0	14	3	-55	67	-16	33.33	0.10	0.14	-3.00	0.15	
Volatile Organics	Trichlorofluoromethane	16	1	1	1	-50	-50	-50				0.00	1.00	
Volatile Organics	Vinyl chloride	16	0	4	2	-47	30	-6	35.25	0.76	0.69	0.00	1.00	
Volatile Organics	cis-1,2-Dichloroethene	16	1	12	5	-76	700	58	213.90	0.37	0.00	-1.50	0.58	
Volatile Organics	trans-1,2-Dichloroethene	16	1	4	1	-33	100	14	59.26	0.68	0.18	-1.00	0.63	
Radionuclides	Gross Alpha	15	6	4	7	-84	29	-2	54.84	0.95	0.01	2.00	0.34	
Radionuclides	Gross Beta	16	4	8	7	-94	186	45	94.44	0.22	0.88	1.00	0.77	
Radionuclides	Technetium-99	4	0	4	2	-96	248	46	145.40	0.57	0.54	0.50	1.00	
Radionuclides	Uranium-234	4	1	2	1	-3	100	48	72.99	0.52	1.00	-0.50	1.00	
Radionuclides	Uranium-235	4	1	1	1	-15	-15	-15				0.00	1.00	
Radionuclides	Uranium-236	4	1	1	2	29	29	29				1.00	0.50	
Radionuclides	Uranium-238	4	1	3	1	-15	53	11	37.12	0.67	0.20	-1.00	0.63	
Metals	Aluminum	16	5	6	10	-86	978	265	388.11	0.16	0.14	4.50	0.01	HS>LF
Metals	Arsenic	16	0	2	2	23	450	236	302.09	0.47	1.00	1.00	0.50	
Metals	Barium	16	0	16	8	-59	817	46	207.52	0.39	0.00	0.50	1.00	
Metals	Beryllium	16	2	1	2	12	12	12				0.50	1.00	
Metals	Boron	16	0	2	0	-20	-9	-14	7.98	0.24	1.00	-1.00	0.50	
Metals	Cadmium	16	1	3	2	-13	132	40	80.01	0.48	0.15	0.00	1.00	
Metals	Calcium	16	0	16	7	-78	26	-10	26.51	0.15	0.02	-1.00	0.80	
Metals	Chromium	16	5	0	4							1.50	0.38	
Metals	Cobalt	16	3	1	3	3	3	3				1.00	0.63	
Metals	Copper	16	2	0	2							1.00	0.50	
Metals	Iron	16	3	10	13	7	3307	921	1288.80	0.05	0.00	6.50	0.00	HS>LF
Metals	Lead	16	7	4	10	208	1611	923	656.67	0.07	0.58	4.50	0.01	HS>LF

*Number of test pairs used for Sign test.

#Number of test pairs used for t-test.

Historical_comp_tab3_062909.xls

**Table 3. Summary Statistics for
Comparison of Sampling Methods CY2008**

Analysis Type	Analysis	Number of Test Pairs*	Number with One Detect	Number with Both Detects#	Number with Test Method>LF	Minimum Percent Difference	Maximum Percent Difference	Average Percent Difference	Std. Dev. Percent Difference	Probability for T Test	Probability for Normality Test	Sign Statistic	Probability for Sign Test	Direction for Sign Test
Metals	Lithium	16	1	12	6	-40	22	-4	18.97	0.46	0.76	-0.50	1.00	
Metals	Magnesium	16	0	16	4	-25	12	-4	9.59	0.11	0.69	-3.50	0.12	
Metals	Manganese	16	3	13	12	-97	2641	401	721.26	0.07	0.00	4.00	0.08	
Metals	Mercury	16	0	6	4	-79	1552	368	616.02	0.20	0.03	1.00	0.69	
Metals	Nickel	16	2	10	7	-95	294	43	116.10	0.27	0.02	1.00	0.77	
Metals	Potassium	16	4	11	9	-14	92	19	35.08	0.11	0.03	1.50	0.61	
Metals	Sodium	16	0	16	8	-66	48	-3	23.78	0.63	0.02	0.00	1.00	
Metals	Strontium	16	0	16	7	-56	33	-10	23.37	0.12	0.76	-1.00	0.80	
Metals	Uranium	16	1	8	4	-64	100	4	45.28	0.79	0.04	-0.50	1.00	
Metals	Zinc	16	0	1	0	-21	-21	-21				-0.50	1.00	
General Chemistry	Alkalinity	16	0	16	5	-61	211	5	58.20	0.72	0.00	-3.00	0.21	
General Chemistry	Bicarbonate	16	0	16	5	-61	211	5	58.20	0.72	0.00	-3.00	0.21	
General Chemistry	Chloride	16	0	16	2	-53	33	-11	19.38	0.05	0.06	-6.00	0.00	LF>HS
General Chemistry	Dissolved Solids	16	0	16	5	-68	20	-8	22.23	0.16	0.09	-3.00	0.21	
General Chemistry	Fluoride	16	0	8	1	-55	152	-1	65.34	0.96	0.00	-3.00	0.07	
General Chemistry	Nitrate Nitrogen	16	0	12	6	-72	40	-4	35.18	0.73	0.35	0.00	1.00	
General Chemistry	Sulfate	16	1	14	4	-74	5	-25	26.85	0.00	0.13	-3.50	0.12	
General Chemistry	Total Suspended Solids	16	3	11	11	-62	1471	470	554.39	0.02	0.07	4.50	0.02	HS>LF
Comparisons Between Passive Diffusion Bag and Low Flow Methods														
Volatile Organics	1,1,1-Trichloroethane	5	0	3	0	-25	-5	-18	10.60	0.10	0.25	-1.50	0.25	
Volatile Organics	1,1,2-Trichloro-1,2,2-trifluoroethane	5	0	2	0	-58	-40	-49	12.46	0.11	1.00	-1.00	0.50	
Volatile Organics	1,1,2-Trichloroethane	5	0	1	0	0	0	0						
Volatile Organics	1,1-Dichloroethane	5	0	3	0	-8	-5	-6	1.44	0.02	0.59	-1.50	0.25	
Volatile Organics	1,1-Dichloroethene	5	0	4	0	-21	0	-10	10.07	0.13	0.55	-1.50	0.25	
Volatile Organics	1,2-Dichloroethene (Total)	5	0	3	0	-7	0	-2	4.12	0.42	0.00	-0.50	1.00	
Volatile Organics	1,2-Dichloropropane	5	1	0	1							0.50	1.00	
Volatile Organics	Benzene	5	0	1	0	-5	-5	-5				-0.50	1.00	
Volatile Organics	Carbon tetrachloride	5	0	1	0	-21	-21	-21				-0.50	1.00	
Volatile Organics	Chloroform	5	0	2	1	0	3	1	1.89	0.50	1.00	0.50	1.00	
Volatile Organics	Dichlorodifluoromethane	5	0	1	1	5	5	5				0.50	1.00	
Volatile Organics	Tetrachloroethene	5	1	3	1	-43	500	141	311.31	0.52	0.02	-1.00	0.63	
Volatile Organics	Trichloroethene	5	0	3	0	-17	-4	-10	6.27	0.11	0.61	-1.50	0.25	
Volatile Organics	Trichlorofluoromethane	5	0	1	0	-32	-32	-32				-0.50	1.00	
Volatile Organics	Vinyl chloride	5	0	1	1	3	3	3				0.50	1.00	
Volatile Organics	cis-1,2-Dichloroethene	5	0	3	0	-7	0	-2	4.12	0.42	0.00	-0.50	1.00	
Volatile Organics	trans-1,2-Dichloroethene	5	0	1	0	-6	-6	-6				-0.50	1.00	

*Number of test pairs used for Sign test.

#Number of test pairs used for t-test.

Historical_comp_tab3_062909.xls

Table 4. Comparison of Test Method Results to Historical LF Results

Well Name	Analysis Type		Number of LF Results	Number of LF Detects	Percent LF Detects	Number of HS Detects	Number of PDB Detects	Minimum LF Detect	Maximum LF Detect	Minimum HS Detect	Maximum HS Detect	HS Outside 95% Limits?	Minimum PDB Detect	Maximum PDB Detect	PDB Outside 95% Limits?
GW-109	Volatile Organics	1,1,2-Trichloro-1,2,2-trifluoroethane	6	6	100	2	0	2	4	2	4	+			
GW-109	Volatile Organics	1,1-Dichloroethene	4	2	50	1	0	1	2	1	1				
GW-109	Volatile Organics	Acetone	7	5	71	2	0	14	90	10	51				
GW-109	Volatile Organics	Acetonitrile	2	1	50	1	0	35	35	40	40	+			
GW-109	Volatile Organics	Bromoform	6	5	83	1	0	2	4	1	1				
GW-109	Volatile Organics	Carbon tetrachloride	2	0	0	1	0			2	2	+			
GW-109	Volatile Organics	Chloroform	9	9	100	2	0	3	14	3	7				
GW-109	Volatile Organics	Dibromochloromethane	2	0	0	1	0			65	65	+			
GW-109	Volatile Organics	Methylene chloride	9	9	100	2	0	12	22	9	11				
GW-109	Volatile Organics	Tetrachloroethene	9	9	100	2	0	90	170	67	100				
GW-109	Volatile Organics	Trichloroethene	9	9	100	2	0	2	6	2	2				
GW-109	Radionuclides	Gross Beta	9	9	100	1	0	1400	19000	4000	4000				
GW-109	Radionuclides	Technetium-99	6	6	100	2	0	4000	21000	5200	31000	+			
GW-109	Radionuclides	Uranium-234	4	3	75	1	0	3.2	4.8	7	7				
GW-109	Radionuclides	Uranium-235	2	0	0	1	0			0.51	0.51	+			
GW-109	Radionuclides	Uranium-236	2	0	0	1	0			0.3	0.3	+			
GW-109	Radionuclides	Uranium-238	4	4	100	2	0	4.5	6.2	5.3	6.9				
GW-109	Metals	Aluminum	7	6	86	2	0	4.49	6.31	7.29	7.87				
GW-109	Metals	Barium	9	9	100	2	0	59.8	95	53.5	102	-			
GW-109	Metals	Beryllium	2	0	0	1	0			0.0102	0.0102	+			
GW-109	Metals	Cadmium	9	9	100	2	0	0.966	2.19	1.12	2.39	+			
GW-109	Metals	Calcium	9	9	100	2	0	10400	11900	9500	11500				
GW-109	Metals	Cobalt	7	5	71	1	0	0.439	0.584	0.797	0.797	+			
GW-109	Metals	Iron	2	0	0	1	0			2.38	2.38	+			
GW-109	Metals	Lead	9	7	78	1	0	0.00487	0.00855	0.00845	0.00845	+			
GW-109	Metals	Lithium	9	9	100	2	0	0.537	0.85	0.468	0.686	-			
GW-109	Metals	Magnesium	9	9	100	2	0	1260	1460	1270	1350				
GW-109	Metals	Manganese	9	9	100	2	0	70.1	114	68.3	145	+			
GW-109	Metals	Mercury	8	8	100	2	0	0.0027	0.0166	0.00332	0.0321	+			
GW-109	Metals	Nickel	11	11	100	2	0	1.52	4.36	1.44	5.18	+			
GW-109	Metals	Potassium	8	8	100	2	0	81.9	98.4	84.9	108	+			
GW-109	Metals	Sodium	9	9	100	2	0	383	546	394	571	+			
GW-109	Metals	Strontium	9	9	100	2	0	51.6	69	38.5	71.1	-			
GW-109	Metals	Uranium	9	9	100	2	0	0.00948	0.0264	0.0252	0.0292				
GW-109	General Chemistry	Alkalinity	2	2	100	2	0	455	476	417	565	+			
GW-109	General Chemistry	Bicarbonate	4	4	100	2	0	455	546	417	565	+			
GW-109	General Chemistry	Chloride	9	9	100	2	0	111	177	103	148	+			
GW-109	General Chemistry	Dissolved Solids	9	9	100	2	0	49800	54600	45100	50300	-			
GW-109	General Chemistry	Fluoride	9	9	100	2	0	2.87	16.6	3.34	12				
GW-109	General Chemistry	Nitrate Nitrogen	9	9	100	2	0	8750	10400	8480	11200	+			
GW-109	General Chemistry	Sulfate	7	5	71	1	0	2.65	14.3	9.98	9.98				
GW-109	General Chemistry	Total Suspended Solids	9	9	100	2	0	1	14	5	81	+			
GW-220	Volatile Organics	1,1,2-Trichloro-1,2,2-trifluoroethane	4	1	25	1	0	2	2	2	2				
GW-220	Volatile Organics	1,1-Dichloroethene	9	8	89	1	1	1	2	2	2		1	1	
GW-220	Volatile Organics	1,2-Dichloroethene (Total)	25	25	100	2	1	2	70	31	66	-	58	58	

Table 4. Comparison of Test Method Results to Historical LF Results

Well Name	Analysis Type		Number of LF Results	Number of LF Detects	Percent LF Detects	Number of HS Detects	Number of PDB Detects	Minimum LF Detect	Maximum LF Detect	Minimum HS Detect	Maximum HS Detect	HS Outside 95% Limits?	Minimum PDB Detect	Maximum PDB Detect	PDB Outside 95% Limits?
GW-220	Volatile Organics	Carbon tetrachloride	25	25	100	2	1	410	1400	530	1200	-	1100	1100	
GW-220	Volatile Organics	Chloroform	25	25	100	2	1	23	87	38	70	-	77	77	
GW-220	Volatile Organics	Tetrachloroethene	25	25	100	2	1	26	650	400	650		400	400	
GW-220	Volatile Organics	Trichloroethene	25	25	100	2	1	5	130	70	120	-	110	110	
GW-220	Volatile Organics	Trichlorofluoromethane	11	9	82	1	0	1	2	1	1				
GW-220	Volatile Organics	cis-1,2-Dichloroethene	25	25	100	2	1	2	70	31	66	-	58	58	
GW-220	Radionuclides	Gross Alpha	6	4	67	1	0	2.9	4.3	4.7	4.7				
GW-220	Radionuclides	Gross Beta	6	3	50	1	0	5.7	8.2	5.5	5.5				
GW-220	Metals	Aluminum	13	10	77	2	0	0.098	0.53	0.346	0.359				
GW-220	Metals	Barium	25	25	100	2	0	0.0981	0.113	0.111	0.114				
GW-220	Metals	Calcium	25	25	100	2	0	55.8	65.8	64.1	69.6	+			
GW-220	Metals	Iron	22	21	95	2	0	0.053	0.425	0.166	0.211				
GW-220	Metals	Lead	11	7	64	2	0	0.000639	0.00838	0.000585	0.00114				
GW-220	Metals	Magnesium	25	25	100	2	0	24.4	27.3	26.1	27.5				
GW-220	Metals	Manganese	15	15	100	2	0	0.00529	0.0187	0.0246	0.0744	+			
GW-220	Metals	Potassium	25	25	100	2	0	2.22	3.36	2.45	2.47				
GW-220	Metals	Sodium	25	25	100	2	0	4.7	5.73	5.5	5.84				
GW-220	Metals	Strontium	25	25	100	2	0	0.415	0.455	0.443	0.471	+			
GW-220	General Chemistry	Alkalinity	4	4	100	2	0	228	246	224	231				
GW-220	General Chemistry	Bicarbonate	8	8	100	2	0	225	246	224	231				
GW-220	General Chemistry	Chloride	25	25	100	2	0	11.237	19	17	18.3				
GW-220	General Chemistry	Dissolved Solids	25	25	100	2	0	217	325	236	348	+			
GW-220	General Chemistry	Nitrate Nitrogen	25	25	100	2	0	0.492	0.959	0.534	0.54				
GW-220	General Chemistry	Sulfate	25	25	100	2	0	13.7	17.6	17.2	17.6				
GW-220	General Chemistry	Total Suspended Solids	19	18	95	2	0	1	10	8	12	+			
GW-229	Volatile Organics	1,1,1-Trichloroethane	9	9	100	2	0	1	7	4	5				
GW-229	Volatile Organics	1,1,2-Trichloro-1,2,2-trifluoroethane	13	13	100	1	0	5	40	35	35				
GW-229	Volatile Organics	1,1-Dichloroethane	13	13	100	2	0	6	11	6	11	-			
GW-229	Volatile Organics	1,1-Dichloroethene	13	13	100	2	0	10	46	33	47				
GW-229	Volatile Organics	1,2-Dichloroethene (Total)	13	13	100	2	0	100	380	220	340				
GW-229	Volatile Organics	1,4-Dichlorobenzene	5	5	100	2	0	3	4	3	3				
GW-229	Volatile Organics	Benzene	13	13	100	2	0	6	11	9	9				
GW-229	Volatile Organics	Chlorobenzene	13	13	100	2	0	7	14	11	11				
GW-229	Volatile Organics	Trichloroethene	11	11	100	2	0	3	25	5	6				
GW-229	Volatile Organics	Vinyl chloride	13	13	100	2	0	20	73	26	57				
GW-229	Volatile Organics	cis-1,2-Dichloroethene	13	13	100	2	0	100	380	220	340				
GW-229	Volatile Organics	trans-1,2-Dichloroethene	4	3	75	1	0	1	1	2	2				
GW-229	Radionuclides	Gross Alpha	13	13	100	2	0	44	150	54	60				
GW-229	Radionuclides	Gross Beta	13	13	100	2	0	44	120	60	90				
GW-229	Metals	Arsenic	13	13	100	2	0	0.00754	0.0139	0.0104	0.0638	+			
GW-229	Metals	Barium	13	13	100	2	0	1.16	1.46	1.12	1.26	-			
GW-229	Metals	Boron	13	13	100	2	0	2.98	4.29	2.84	3.14				
GW-229	Metals	Calcium	13	13	100	2	0	154	196	156	187	-			
GW-229	Metals	Cobalt	3	0	0	1	0			0.05	0.05	+			
GW-229	Metals	Iron	13	13	100	2	0	18.4	28.4	24.3	46.9	+			

Table 4. Comparison of Test Method Results to Historical LF Results

Well Name	Analysis Type		Number of LF Results	Number of LF Detects	Percent LF Detects	Number of HS Detects	Number of PDB Detects	Minimum LF Detect	Maximum LF Detect	Minimum HS Detect	Maximum HS Detect	HS Outside 95% Limits?	Minimum PDB Detect	Maximum PDB Detect	PDB Outside 95% Limits?
GW-229	Metals	Lithium	13	13	100	2	0	0.111	0.148	0.108	0.113				
GW-229	Metals	Magnesium	13	13	100	2	0	29.8	36.8	29.6	34.5	-			
GW-229	Metals	Manganese	13	13	100	2	0	4.44	7.37	4.95	5.8				
GW-229	Metals	Nickel	15	15	100	2	0	0.0428	0.0671	0.054	0.0576				
GW-229	Metals	Potassium	13	13	100	2	0	11.4	14.7	13.1	13.1				
GW-229	Metals	Sodium	13	13	100	2	0	65	84.3	70.1	75				
GW-229	Metals	Strontium	13	13	100	2	0	0.496	0.635	0.469	0.582	-			
GW-229	Metals	Uranium	13	13	100	2	0	0.151	0.266	0.149	0.156				
GW-229	General Chemistry	Alkalinity	3	3	100	2	0	601	643	522	524				
GW-229	General Chemistry	Bicarbonate	5	5	100	2	0	601	645	522	524	-			
GW-229	General Chemistry	Chloride	13	13	100	2	0	119	160	128	130				
GW-229	General Chemistry	Dissolved Solids	13	13	100	2	0	751	26300	902	26100	+			
GW-229	General Chemistry	Fluoride	13	13	100	2	0	0.11	0.207	0.124	0.136				
GW-229	General Chemistry	Sulfate	13	13	100	2	0	14.4	31.5	9.88	14.7				
GW-229	General Chemistry	Total Suspended Solids	13	13	100	2	0	7	42	48	95	+			
GW-246	Volatile Organics	1,1,2-Trichloro-1,2,2-trifluoroethane	10	10	100	1	0	30	100	33	33				
GW-246	Volatile Organics	1,1-Dichloroethene	10	10	100	1	0	2	4	2	2				
GW-246	Volatile Organics	1,2-Dichloroethene (Total)	7	4	57	1	0	1	2	1	1				
GW-246	Volatile Organics	Chloroform	10	10	100	2	0	22	40	1	27	-			
GW-246	Volatile Organics	Methylene chloride	10	10	100	2	0	11	21	3	11	-			
GW-246	Volatile Organics	Tetrachloroethene	10	10	100	2	0	74	170	3	110	-			
GW-246	Volatile Organics	Trichloroethene	10	9	90	1	0	1	2	1	1				
GW-246	Volatile Organics	cis-1,2-Dichloroethene	7	4	57	1	0	1	2	1	1				
GW-246	Radionuclides	Gross Alpha	9	8	89	2	0	140	670	67	290				
GW-246	Radionuclides	Gross Beta	10	10	100	2	0	5600	24000	620	7700				
GW-246	Radionuclides	Technetium-99	10	10	100	2	0	22000	140000	1200	28000				
GW-246	Radionuclides	Uranium-234	10	10	100	1	0	2.9	110	60	60				
GW-246	Radionuclides	Uranium-235	10	9	90	1	0	2.8	6	2.8	2.8				
GW-246	Radionuclides	Uranium-236	7	6	86	1	0	1.5	4.2	2.2	2.2				
GW-246	Radionuclides	Uranium-238	10	10	100	1	0	3.2	250	140	140				
GW-246	Metals	Aluminum	10	10	100	2	0	33	98.4	4.74	51.3				
GW-246	Metals	Barium	10	10	100	2	0	2.31	10.8	5.77	49.6	+			
GW-246	Metals	Beryllium	10	10	100	1	0	0.0175	0.0481	0.0281	0.0281				
GW-246	Metals	Cadmium	10	10	100	1	0	0.3	0.57	0.33	0.33				
GW-246	Metals	Calcium	10	10	100	2	0	2740	2980	2940	3660	+			
GW-246	Metals	Cobalt	10	10	100	1	0	0.404	0.701	0.467	0.467				
GW-246	Metals	Lithium	10	10	100	2	0	0.58	0.865	0.35	0.631	-			
GW-246	Metals	Magnesium	10	10	100	2	0	570	630	599	666	+			
GW-246	Metals	Manganese	10	10	100	2	0	94.4	145	3.15	107	-			
GW-246	Metals	Mercury	10	10	100	2	0	0.000318	0.00265	0.000317	0.00142				
GW-246	Metals	Nickel	10	10	100	2	0	3.3	7.79	0.197	3.58	-			
GW-246	Metals	Potassium	9	8	89	1	0	33.7	39.9	40	40				
GW-246	Metals	Sodium	10	10	100	2	0	440	586	148	484	-			
GW-246	Metals	Strontium	10	10	100	2	0	9.89	11.1	10.7	14.5	+			
GW-246	Metals	Uranium	10	10	100	2	0	0.441	1.01	0.158	0.522				

Table 4. Comparison of Test Method Results to Historical LF Results

Well Name	Analysis Type		Number of LF Results	Number of LF Detects	Percent LF Detects	Number of HS Detects	Number of PDB Detects	Minimum LF Detect	Maximum LF Detect	Minimum HS Detect	Maximum HS Detect	HS Outside 95% Limits?	Minimum PDB Detect	Maximum PDB Detect	PDB Outside 95% Limits?
GW-246	General Chemistry	Alkalinity	4	4	100	2	0	29.7	72.9	54.2	227	+			
GW-246	General Chemistry	Bicarbonate	8	8	100	2	0	29.7	72.9	54.2	227	+			
GW-246	General Chemistry	Chloride	10	10	100	2	0	275	322	221	298	-			
GW-246	General Chemistry	Dissolved Solids	10	10	100	2	0	15900	19100	17500	19000	+			
GW-246	General Chemistry	Fluoride	10	10	100	2	0	0.988	31.6	0.833	4.48				
GW-246	General Chemistry	Nitrate Nitrogen	10	10	100	2	0	2810	3200	2870	4233	+			
GW-246	General Chemistry	Sulfate	10	10	100	2	0	18.3	37.3	5	21	-			
GW-246	General Chemistry	Total Suspended Solids	8	7	88	1	0	1	8	5	5				
GW-322	Volatile Organics	1,1,1-Trichloroethane	5	5	100	0	1	27	220				21	21	
GW-322	Volatile Organics	1,1,2-Trichloro-1,2,2-trifluoroethane	4	4	100	0	1	5	6				3	3	
GW-322	Volatile Organics	1,1-Dichloroethane	5	5	100	0	1	88	160				82	82	
GW-322	Volatile Organics	1,1-Dichloroethene	5	5	100	0	1	71	170				63	63	
GW-322	Volatile Organics	Tetrachloroethene	5	5	100	0	1	6	10				4	4	
GW-322	Volatile Organics	Trichlorofluoromethane	5	5	100	0	1	34	54				25	25	
GW-612	Volatile Organics	1,1,1-Trichloroethane	7	7	100	0	1	8	26				6	6	
GW-612	Volatile Organics	1,1-Dichloroethane	7	7	100	0	1	34	71				39	39	
GW-612	Volatile Organics	1,1-Dichloroethene	7	7	100	0	1	22	41				25	25	
GW-626	Volatile Organics	1,1,1-Trichloroethane	11	10	91	2	1	2	44	10	21		35	35	
GW-626	Volatile Organics	1,1,2-Trichloro-1,2,2-trifluoroethane	11	11	100	2	1	4	590	110	260		250	250	
GW-626	Volatile Organics	1,1,2-Trichloroethane	7	6	86	0	1	1	3				3	3	
GW-626	Volatile Organics	1,1-Dichloroethane	12	12	100	2	1	3	520	150	290		480	480	
GW-626	Volatile Organics	1,1-Dichloroethene	12	12	100	2	1	2	140	50	99		110	110	
GW-626	Volatile Organics	1,2-Dichloroethane	9	6	67	1	0	2	32	11	11				
GW-626	Volatile Organics	1,2-Dichloroethene (Total)	12	12	100	2	1	54	14000	2600	8100		13000	13000	
GW-626	Volatile Organics	1,2-Dichloropropane	4	0	0	0	1						2	2	+
GW-626	Volatile Organics	Benzene	10	10	100	2	1	4	380	82	250		360	360	
GW-626	Volatile Organics	Chloroform	11	11	100	2	1	7	120	36	80		120	120	
GW-626	Volatile Organics	Dichlorodifluoromethane	8	5	63	0	1	4	44				46	46	
GW-626	Volatile Organics	Tetrachloroethene	12	12	100	2	1	13	940	440	1100		1200	1200	
GW-626	Volatile Organics	Trichloroethene	12	12	100	2	1	9	910	200	690		870	870	
GW-626	Volatile Organics	Trichlorofluoromethane	5	1	20	1	0	3	3	2	2	+			
GW-626	Volatile Organics	Vinyl chloride	10	10	100	2	1	42	3700	580	2200		3800	3800	
GW-626	Volatile Organics	cis-1,2-Dichloroethene	12	12	100	2	1	54	14000	2600	8100		13000	13000	
GW-626	Volatile Organics	trans-1,2-Dichloroethene	10	10	100	2	1	2	34	8	14		32	32	
GW-626	Radionuclides	Gross Alpha	3	1	33	1	0	3.7	3.7	5.3	5.3	+			
GW-626	Metals	Aluminum	4	0	0	1	0			0.321	0.321	+			
GW-626	Metals	Barium	12	12	100	2	0	0.156	0.499	0.259	0.396				
GW-626	Metals	Calcium	12	12	100	2	0	35.3	147	83.4	131				
GW-626	Metals	Chromium	4	0	0	1	0			0.0552	0.0552	+			
GW-626	Metals	Copper	4	0	0	1	0			0.0292	0.0292	+			
GW-626	Metals	Iron	6	5	83	2	0	0.0664	0.106	0.287	1.3	+			
GW-626	Metals	Lead	6	2	33	1	0	0.00052	0.00122	0.00264	0.00264	+			
GW-626	Metals	Lithium	12	12	100	2	0	0.0112	0.0238	0.0142	0.0213				
GW-626	Metals	Magnesium	12	12	100	2	0	2.86	9.99	5.37	7.91				
GW-626	Metals	Manganese	4	0	0	2	0			0.00626	0.0229	+			

Table 4. Comparison of Test Method Results to Historical LF Results

Well Name	Analysis Type		Number of LF Results	Number of LF Detects	Percent LF Detects	Number of HS Detects	Number of PDB Detects	Minimum LF Detect	Maximum LF Detect	Minimum HS Detect	Maximum HS Detect	HS Outside 95% Limits?	Minimum PDB Detect	Maximum PDB Detect	PDB Outside 95% Limits?
GW-626	Metals	Nickel	10	10	100	2	0	0.0226	0.176	0.0472	0.126				
GW-626	Metals	Potassium	5	1	20	2	0	6.2	6.2	2.96	6.93	+			
GW-626	Metals	Sodium	12	12	100	2	0	4.57	9.22	6.27	7.62				
GW-626	Metals	Strontium	12	12	100	2	0	0.101	0.326	0.17	0.272				
GW-626	General Chemistry	Alkalinity	4	4	100	2	0	239	292	203	258				
GW-626	General Chemistry	Bicarbonate	8	8	100	2	0	203	292	203	258				
GW-626	General Chemistry	Chloride	12	12	100	2	0	1.39	75.6	18.7	40.2				
GW-626	General Chemistry	Dissolved Solids	12	12	100	2	0	144	497	246	346				
GW-626	General Chemistry	Sulfate	12	12	100	2	0	1.55	7.14	2.69	4.37				
GW-626	General Chemistry	Total Suspended Solids	4	1	25	2	0	2	2	2	56	+			
GW-698	Volatile Organics	1,1,2-Trichloro-1,2,2-trifluoroethane	12	12	100	2	0	7	75	16	58				
GW-698	Volatile Organics	1,1-Dichloroethene	2	0	0	1	0			2	2	+			
GW-698	Volatile Organics	1,2-Dichloroethene (Total)	16	16	100	2	0	3	120	22	60				
GW-698	Volatile Organics	Carbon tetrachloride	15	15	100	2	0	3	18	3	6				
GW-698	Volatile Organics	Chloroform	15	15	100	2	0	5	25	8	16	-			
GW-698	Volatile Organics	Dichlorodifluoromethane	2	0	0	1	0			3	3	+			
GW-698	Volatile Organics	Tetrachloroethene	16	16	100	2	0	18	210	94	170				
GW-698	Volatile Organics	Trichloroethene	16	16	100	2	0	34	770	280	580				
GW-698	Volatile Organics	cis-1,2-Dichloroethene	16	16	100	2	0	3	120	22	59				
GW-698	Volatile Organics	trans-1,2-Dichloroethene	3	3	100	1	0	1	2	2	2				
GW-698	Radionuclides	Gross Alpha	5	3	60	2	0	2.8	40	5.9	12				
GW-698	Radionuclides	Gross Beta	4	3	75	1	0	7.3	21	19	19				
GW-698	Metals	Aluminum	9	9	100	2	0	0.205	1.48	3.18	11.1	+			
GW-698	Metals	Barium	16	16	100	2	0	0.0841	0.352	0.281	0.29				
GW-698	Metals	Calcium	16	16	100	2	0	77.2	295	160	254				
GW-698	Metals	Chromium	3	1	33	1	0	0.00362	0.00362	0.0279	0.0279	+			
GW-698	Metals	Copper	2	0	0	1	0			0.0437	0.0437	+			
GW-698	Metals	Iron	15	15	100	2	0	0.0726	1.23	3.1	10.7	+			
GW-698	Metals	Lead	4	4	100	2	0	0.00063	0.0027	0.00406	0.0133	+			
GW-698	Metals	Lithium	2	0	0	1	0			0.0117	0.0117	+			
GW-698	Metals	Magnesium	16	16	100	2	0	33.2	91.2	50.6	75.7				
GW-698	Metals	Manganese	16	16	100	2	0	0.0326	0.505	1.18	3.58	+			
GW-698	Metals	Mercury	14	14	100	2	0	0.000271	0.00382	0.00637	0.0403	+			
GW-698	Metals	Nickel	7	7	100	2	0	0.00536	0.0144	0.0195	0.0272	+			
GW-698	Metals	Potassium	15	15	100	2	0	2.53	4.86	4.55	6.53	+			
GW-698	Metals	Sodium	16	16	100	2	0	5.94	36	16.6	27.9				
GW-698	Metals	Strontium	16	16	100	2	0	0.13	1.02	0.394	0.792				
GW-698	Metals	Uranium	15	15	100	2	0	0.000855	0.00182	0.00118	0.00132				
GW-698	General Chemistry	Alkalinity	2	2	100	2	0	257	263	266	286	+			
GW-698	General Chemistry	Bicarbonate	6	6	100	2	0	243	287	266	286				
GW-698	General Chemistry	Chloride	16	16	100	2	0	8.92	24.4	21.1	23.1				
GW-698	General Chemistry	Dissolved Solids	16	16	100	2	0	364	1610	854	968				
GW-698	General Chemistry	Nitrate Nitrogen	16	16	100	2	0	8.74	221	74.3	166				
GW-698	General Chemistry	Sulfate	16	16	100	2	0	18.4	68.3	27.4	49	-			
GW-698	General Chemistry	Total Suspended Solids	11	11	100	2	0	2	19	24	220	+			

Table 4. Comparison of Test Method Results to Historical LF Results

Well Name	Analysis Type		Number of LF Results	Number of LF Detects	Percent LF Detects	Number of HS Detects	Number of PDB Detects	Minimum LF Detect	Maximum LF Detect	Minimum HS Detect	Maximum HS Detect	HS Outside 95% Limits?	Minimum PDB Detect	Maximum PDB Detect	PDB Outside 95% Limits?
GW-740	Volatile Organics	1,2-Dichloroethene (Total)	15	15	100	2	1	1	3	2	16	+	1	1	
GW-740	Volatile Organics	Carbon tetrachloride	9	8	89	1	0	1	3	1	1				
GW-740	Volatile Organics	Trichloroethene	21	21	100	2	1	42	72	23	44	-	35	35	-
GW-740	Volatile Organics	cis-1,2-Dichloroethene	19	19	100	2	1	1	3	2	16	+	1	1	
GW-740	Radionuclides	Gross Beta	8	6	75	1	0	8.4	13	8.6	8.6				
GW-740	Metals	Aluminum	3	0	0	1	0			0.244	0.244	+			
GW-740	Metals	Barium	21	21	100	2	0	0.084	0.16	0.0401	0.108	-			
GW-740	Metals	Calcium	21	21	100	2	0	61.7	123	30.9	74.6	-			
GW-740	Metals	Iron	19	19	100	2	0	0.051	1.95	9.23	28.8	+			
GW-740	Metals	Lead	7	5	71	2	0	0.000672	0.0014	0.000885	0.0154	+			
GW-740	Metals	Lithium	21	21	100	2	0	0.0135	0.0271	0.0169	0.0191				
GW-740	Metals	Magnesium	21	21	100	2	0	30.4	62.2	28.4	34.2				
GW-740	Metals	Manganese	5	5	100	2	0	0.0013	0.0105	0.0801	0.182	+			
GW-740	Metals	Potassium	4	1	25	1	0	1.2	1.2	5.9	5.9	+			
GW-740	Metals	Sodium	21	21	100	2	0	1.7	3	2.42	2.67				
GW-740	Metals	Strontium	21	21	100	2	0	0.0527	0.102	0.0247	0.0597	-			
GW-740	Metals	Uranium	7	4	57	1	0	0.000522	0.000676	0.000665	0.000665	+			
GW-740	Metals	Zinc	4	2	50	1	0	0.0024	0.231	0.183	0.183				
GW-740	General Chemistry	Alkalinity	3	3	100	2	0	271	278	195	229	-			
GW-740	General Chemistry	Bicarbonate	5	5	100	2	0	257	278	195	229	-			
GW-740	General Chemistry	Chloride	21	21	100	2	0	5.132	8.5	6.03	7.53	-			
GW-740	General Chemistry	Dissolved Solids	21	21	100	2	0	209	333	245	330				
GW-740	General Chemistry	Fluoride	21	21	100	2	0	0.161	0.237	0.127	0.152	-			
GW-740	General Chemistry	Nitrate Nitrogen	21	21	100	2	0	1.77	2.75	0.5	1.13	-			
GW-740	General Chemistry	Sulfate	21	21	100	2	0	11.04	13.9	3.94	7.61	-			
GW-740	General Chemistry	Total Suspended Solids	5	5	100	2	0	1	2	18	20	+			
GW-769	Volatile Organics	1,1,2-Trichloro-1,2,2-trifluoroethane	8	8	100	1	0	1	4	5	5				
GW-769	Volatile Organics	1,1-Dichloroethene	14	14	100	1	0	1	2	3	3	+			
GW-769	Volatile Organics	1,2-Dichloroethene (Total)	18	18	100	2	0	1	6	2	8	+			
GW-769	Volatile Organics	Carbon tetrachloride	23	23	100	2	0	7	170	60	180	-			
GW-769	Volatile Organics	Chloroform	21	21	100	2	0	2	6	2	6	-			
GW-769	Volatile Organics	Tetrachloroethene	23	23	100	2	0	4	22	12	31	+			
GW-769	Volatile Organics	Trichloroethene	20	19	95	1	0	1	6	2	2				
GW-769	Volatile Organics	cis-1,2-Dichloroethene	19	19	100	2	0	1	6	2	8	+			
GW-769	Radionuclides	Gross Alpha	6	5	83	1	0	2.9	14	7.6	7.6				
GW-769	Radionuclides	Gross Beta	6	5	83	2	0	5.7	16	7.4	19				
GW-769	Metals	Aluminum	4	3	75	1	0	0.023	0.658	1.27	1.27				
GW-769	Metals	Barium	23	23	100	2	0	0.356	0.43	0.176	0.409	-			
GW-769	Metals	Calcium	23	23	100	2	0	71.8	83.6	18.5	74.9	-			
GW-769	Metals	Chromium	3	1	33	2	0	0.00531	0.00531	0.0324	0.0544	+			
GW-769	Metals	Iron	7	7	100	2	0	0.054	0.612	0.114	12.4	+			
GW-769	Metals	Lead	5	4	80	2	0	0.00064	0.00114	0.00248	0.00838	+			
GW-769	Metals	Lithium	22	22	100	2	0	0.0128	0.017	0.0171	0.0185	+			
GW-769	Metals	Magnesium	23	23	100	2	0	8.7	10.4	9.71	9.85				
GW-769	Metals	Manganese	21	21	100	1	0	0.00603	0.0187	0.0785	0.0785	+			

Table 4. Comparison of Test Method Results to Historical LF Results

Well Name	Analysis Type		Number of LF Results	Number of LF Detects	Percent LF Detects	Number of HS Detects	Number of PDB Detects	Minimum LF Detect	Maximum LF Detect	Minimum HS Detect	Maximum HS Detect	HS Outside 95% Limits?	Minimum PDB Detect	Maximum PDB Detect	PDB Outside 95% Limits?
GW-769	Metals	Nickel	2	0	0	1	0			0.0122	0.0122	+			
GW-769	Metals	Potassium	23	23	100	2	0	2.52	3.15	3.89	5.23	+			
GW-769	Metals	Sodium	23	23	100	2	0	6.51	8.68	7.54	7.74				
GW-769	Metals	Strontium	23	23	100	2	0	0.345	0.43	0.268	0.353	-			
GW-769	General Chemistry	Alkalinity	2	2	100	2	0	169	215	83.5	200	+			
GW-769	General Chemistry	Bicarbonate	6	6	100	2	0	169	224	83.5	200	-			
GW-769	General Chemistry	Chloride	23	23	100	2	0	11	27.4	8.09	15.3	-			
GW-769	General Chemistry	Dissolved Solids	23	23	100	2	0	258	328	94	238	-			
GW-769	General Chemistry	Nitrate Nitrogen	23	23	100	2	0	0.0679	0.655	0.384	0.483				
GW-769	General Chemistry	Sulfate	23	23	100	2	0	15.2	29.3	13	22.6	-			
GW-769	General Chemistry	Total Suspended Solids	5	3	60	1	0	1	3	62	62	+			

Scatter Plots for Selected Analytes

Figure 1. Results for 1,1,1-Trichloroethane for HS and LF samples.

Figure 2. Results for 1,1,2-Trichloro-1,2,2-trifluoroethane for HS and LF samples.

Figure 3. Results for 1,1-Dichloroethane for HS and LF samples.

Figure 4. Results for 1,1-Dichloroethene for HS and LF samples.

Figure 5. Results for 1,2-Dichloroethene (Total) for HS and LF samples.

Figure 6. Results for Benzene for HS and LF samples.

Figure 7. Results for Carbon tetrachloride for HS and LF samples.

Figure 8. Results for Chloroform for HS and LF samples.

Figure 9. Results for Methylene chloride for HS and LF samples.

Figure 10. Results for Tetrachloroethene for HS and LF samples.

Figure 11. Results for Trichloroethene for HS and LF samples.

Figure 12. Results for Vinyl chloride for HS and LF samples.

Figure 13. Results for cis-1,2-Dichloroethene for HS and LF samples.

Figure 14. Results for trans-1,2-Dichloroethene for HS and LF samples.

Figure 15. Results for Aluminum for HS and LF samples.

Figure 16. Results for Iron for HS and LF samples.

Figure 17. Results for Lead for HS and LF samples.

Figure 18. Results for Strontium for HS and LF samples.

Figure 19. Results for Uranium for HS and LF samples.

Figure 20. Results for Chloride for HS and LF samples.

Figure 21. Results for Dissolved Solids for HS and LF samples.

Figure 22. Results for Total Suspended Solids for HS and LF samples.

Figure 23. Results for 1,1,1-Trichloroethane for PDB and LF samples.

Figure 24. Results for 1,1-Dichloroethane for PDB and LF samples.

Figure 25. Results for 1,1-Dichloroethene for PDB and LF samples.

Figure 26. Results for 1,2-Dichloroethene (Total) for PDB and LF samples.

Figure 27. Results for Tetrachloroethene for PDB and LF samples.

Figure 28. Results for Trichloroethene for PDB and LF samples.

Figure 29. Results for cis-1,2-Dichloroethene for PDB and LF samples.

Time Trend Plots for Selected Analytes.

GW-109

Figure 30. Chloride results for well GW-109.

GW-220

Figure 31. Chloride results for well GW-220.

Figure 32. Chloride results for well GW-229.

Figure 33. Chloride results for well GW-246.

Figure 34. Chloride results for well GW-626.

Figure 35. Chloride results for well GW-698.

Figure 36. Chloride results for well GW-740.

Figure 37. Chloride results for well GW-769.

GW-109

Figure 38. Total Suspended Solids results for well GW-109.

GW-229

Figure 39. Total Suspended Solids results for well GW-229.

GW-698

Figure 40. Total Suspended Solids results for well GW-698.

GW-740

Figure 41. Total Suspended Solids results for well GW-740.

Figure 42. Iron results for well GW-229.

Figure 43. Iron results for well GW-698.

Figure 44. Iron results for well GW-740.

Figure 45. Iron results for well GW-769.

Figure 46. Uranium-238 results for well GW-109.

Figure 47. Uranium-238 results for well GW-246.

Figure 48. 1,2-Dichloroethene (Total) results for well GW-220.

Figure 49. 1,2-Dichloroethene (Total) results for well GW-229.

Figure 50. 1,2-Dichloroethene (Total) results for well GW-626.

Figure 51. 1,2-Dichloroethene (Total) results for well GW-698.

Figure 52. 1,2-Dichloroethene (Total) results for well GW-740.

Figure 53. 1,2-Dichloroethene (Total) results for well GW-769.

Figure 54. Tetrachloroethene results for well GW-109.

Figure 55. Tetrachloroethene results for well GW-220.

Figure 56. Tetrachloroethene results for well GW-246.

Figure 57. Tetrachloroethene results for well GW-322.

Figure 58. Tetrachloroethene results for well GW-626.

Figure 59. Tetrachloroethene results for well GW-698.

Figure 60. Tetrachloroethene results for well GW-769.

Figure 61. Trichloroethene results for well GW-109.

Figure 62. Trichloroethene results for well GW-220.

Figure 63. Trichloroethene results for well GW-229.

Figure 64. Trichloroethene results for well GW-626.

Figure 65. Trichloroethene results for well GW-698.

GW-740

Figure 66. Trichloroethene results for well GW-740.

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