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B&W Y-12 technical services LLC

Y-12 NATIONAL SECURITY COMPLEX

CALENDAR YEAR 2009 GROUNDWATER MONITORING REPORT, U.S. DEPARTMENT OF ENERGY Y-12 NATIONAL SECURITY COMPLEX, OAK RIDGE, TENNESSEE

December 2010

Prepared by

Elvado Environmental LLC
Under Subcontract No. 4300073231

for the

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

Managed by

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

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

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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
GWQAP	Groundwater Quality Assessment Plan
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
mg/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
NOV	Notice of Violation
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) 2009 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 2009 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 2009 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 2009 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 2009 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 2009 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). These sections include a short description of the topography and geology in each regime; an overview of the hydrogeologic system in each regime; and a discussion of the extent of groundwater contamination in each regime.

2.1 TOPOGRAPHY AND BEDROCK GEOLOGY

The hydrogeologic regimes at Y-12 are located in the Valley and Ridge Physiographic Province, which is characterized by long parallel valleys and ridges formed from folding and thrust faulting that occurred during Paleozoic orogenic events. The geologic strike of the formations generally 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 dominate the central part of the broad southern flank of Chestnut Ridge, which gently slopes toward Bethel Valley.

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

In BCV, unweathered bedrock is overlain by up to 40 ft of several unconsolidated materials, including alluvium, colluvium, fine-grained residuum, and saprolite (weathered bedrock). Where undisturbed, the saprolite often retains primary textural features of the unweathered bedrock, including fractures (Solomon et al. 1992). However, extensive areas of cut-and-fill within Y-12 have substantially altered the shallow subsurface in BCV throughout much of the East Fork Regime. Most of the fill, which contains many voids and generally consists of 5 to 25 ft of a heterogeneous mixture of building debris and re-compacted soil/residuum (Sutton and Field 1995), was placed in the tributaries and main channel of UEFPC (Figure A.3).

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

2.2 SURFACE WATER DRAINAGE

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

2.2.1 Bear Creek

Surface water in the Bear Creek Regime is drained by Bear Creek and its tributaries (Figure A.2). From its headwaters near the west end of Y-12, Bear Creek flows southwest for approximately 4.5 miles, where it turns northward 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) 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 2010).

2.3.1.2 Knox Group

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

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

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

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

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

Groundwater elevations on Chestnut Ridge generally mirror surface topography (Figure A.6). Along the crest of the ridge, which is a recharge area and a flow divide, groundwater generally flows from west to east (parallel to geologic strike), with radial components of flow north into BCV and south toward tributary headwaters on the southern flank of the ridge (across geologic strike). The central part of the regime is characterized by radial flow directions from local groundwater flow divides along hilltops between tributaries. Groundwater flow directions in the southern part of the regime are generally south toward Melton Hill Lake. The overall directions of groundwater flow throughout the Chestnut Ridge Regime do not significantly change during seasonal groundwater flow conditions. Horizontal hydraulic gradients throughout the year are highest along the steep northern flank of Chestnut Ridge (i.e., across geologic strike) and in the upper reaches of tributaries on the southern ridge flank, and are nearly flat along the southern boundary of the regime.

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

2.3.2 Aquitard

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

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

Recharge to the water table interval in the aquitard promotes strike-parallel groundwater flow toward nearby discharge areas, which include the subsurface drainage network in the East Fork Regime and the northern tributaries of Bear Creek in the Bear Creek Regime. Although the presence of contaminants in groundwater more than 200 ft bgs in the Nolichucky Shale clearly indicates permeable flowpaths at depth, flow is most active at depths less than 100 ft bgs, and only a small percentage of total flow ultimately recharges the deeper bedrock, where upward hydraulic gradients predominate. In the Bear Creek Regime, about 94% of the available groundwater in the aquitard discharges to Bear Creek tributaries, about 5% flows along cross-cutting fractures into the aquifer, and about 1% flows through strike-parallel pathways in the deeper subsurface (DOE 1997a).

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

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

2.4 GROUNDWATER CONTAMINATION

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

2.4.1 Bear Creek Regime

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

2.4.1.1 S-3 Site

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

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

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

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

2.4.1.2 Oil Landfarm WMA

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

The Boneyard was used for the disposal of magnesium chips and construction debris (e.g., concrete) in unlined shallow trenches. Filled trenches were covered with topsoil and seeded with grass. The Burnyard consisted of two unlined trenches, each about 300 ft long by 40 ft wide, in which various types of refuse (including pesticide containers, metal shavings, solvents, oils, and laboratory chemicals) were burned. 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 (yd^3) 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 yd^3 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 downdip 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 Secion. 2.4.1.2), waste materials containing high concentrations of uranium were within the saturated zone during seasonally high groundwater levels. Uranium isotopes that were leached from the wastes were transported with the shallow groundwater that discharges into NT-3 and recharges directly into the Maynardville Limestone. Prior to the removal of the wastes, gross alpha and gross beta activity exceeded 1,000 pCi/L in the shallow groundwater along NT-3 from the northwest corner of the site to the confluence of NT-3 and Bear Creek (Figure A.9 and Figure A.10).

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 xylenes) occur in shallow groundwater near former petroleum fuel USTs. In the aquitard, concentrations of individual plume constituents exceed 1,000 µg/L in the shallow groundwater near the Waste Coolant Processing Area (WCPA), Building 9201-5, and Tank 0134-U and indicate the presence of DNAPL in the subsurface. At shallow depths (<100 ft bgs) in the Maynardville Limestone, a relatively continuous plume of dissolved VOCs begins near the Fire Training Facility in the western Y-12 area, intermingles with VOC plumes from several sources in the central Y-12 area, and extends underneath NHP in the eastern Y-12 area (Figure A.8). The extent of the plume at intermediate (>200 ft bgs) and deep (>400 ft bgs) intervals in the Maynardville Limestone is not well defined in the western and central Y-12 areas because of very limited well coverage. However, data from the network of wells in the eastern Y-12 area show that a plume of dissolved chloromethanes (primarily CTET), which is believed to originate from several sources, including suspected DNAPL in the Maynardville Limestone west of NHP near Building 9720-6, extends vertically more than 400 ft bgs and laterally (parallel with geologic strike) into Union Valley up to 2,000 ft east of the ORR boundary. Operation of the VOC plume capture system since CY 2000 (see Sect. 2.3.1.1) has effectively reduced VOC concentrations in groundwater downgradient of the pumping well (DOE 2010).

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 µg/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 µg/L). The repeated detection of these compounds in the groundwater at both wells probably reflects southward transport from the CRSP because this site is the only known source of VOCs that is hydraulically upgradient of either well.

The ILF IV, which is located on the crest of Chestnut Ridge directly south of the west end of Y-12, has received non-hazardous solid waste since October 1989 and is a suspected source of 111TCA, 11DCA, 11DCE in groundwater downgradient of the site. These VOCs have been repeatedly detected in a well located south of the eastern portion of the site (GW-305). 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. In response to sampling results confirming 11DCE concentrations above the MCL, the Tennessee Department of Environment and Conservation (TDEC) issued a Notice of Violation (NOV) in a letter to BJC dated November 2, 2009 (TDEC 2009). The NOV letter requested implementation of Assessment Monitoring Phase 3 at Industrial Landfill IV in accordance with an approved Groundwater Quality Assessment Plan (GWQAP). The TDEC approved the GWQAP (BJC 2009a) for Industrial Landfill IV in December 2009 and Assessment Monitoring Phase 3 subsequently began with groundwater sampling of well GW-305 for VOC analysis per the quarterly frequency specified in the plan.

Kerr Hollow Quarry is on the broad southern flank of Chestnut Ridge about 1,000 ft north of Bethel Valley Road and served as a source of stone construction material until it filled with water and was abandoned in the late 1940's. From the early 1950s until November 1988, the quarry was used for the disposal of reactive materials from Y-12 and ORNL. Wastes were removed from the quarry between mid-1990 and late 1993 to obtain certified clean-closure status from the TDEC, but the site was finally closed with some wastes remaining in place. Low levels (<5 µg/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 2009 MONITORING PROGRAMS

The groundwater and surface water monitoring data included in this report were obtained during CY 2009 from implementation of monitoring programs directed by the Y-12 GWPP and BJC. The Y-12 GWPP implemented surveillance and exit-pathway/perimeter monitoring (hereafter referenced collectively as DOE Order monitoring) specifically to meet requirements of DOE Order 450.1A. 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 2009 (B&W Y-12 2008), 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 2009: (1) RCRA post-closure detection monitoring and RCRA post-closure corrective action monitoring (collectively referenced as RCRA monitoring); (2) CERCLA monitoring in accordance with applicable RODs or related decision documents (hereafter referenced as CERCLA ROD monitoring); (3) CERCLA baseline monitoring to evaluate pre-remediation water quality; (4) CERCLA detection monitoring at the EMWMF, an operating facility located in the Bear Creek Regime for CERCLA remediation wastes generated on the ORR; and (5) detection or assessment monitoring for several nonhazardous solid waste disposal facilities (SWDFs) located in the Chestnut Ridge Regime (referenced as SWDF monitoring). Groundwater and surface water sampling and analysis activities associated with these programs were performed in general accordance with the requirements specified in the ORR Water Resources Restoration Program (WRRP) SAP for fiscal year 2009 (BJC 2009b); the WRRP quality assurance project plan (BJC 2009c); the environmental monitoring plan for the EMWMF (BJC 2007a); and a SWDF monitoring SAP issued by the subcontractor responsible for the operations of the landfills on Chestnut Ridge (EnergySolutions 2007). The following subsections provide general information regarding the monitoring programs implemented by BJC (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 2009 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 2009 from 235 sampling locations at Y-12, including 190 monitoring wells (complete construction details for each well are provided in Appendix C), 14 springs, and 31 surface water stations. The following subsections provide details regarding the sampling locations in each hydrogeologic regime and the corresponding sampling frequency for each applicable well, spring, and surface water station.

3.1.1 Bear Creek Regime

As shown below in Table 1, a total of 66 monitoring wells, six springs, and 19 surface water stations in the Bear Creek Regime were sampled during CY 2009 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 2009 sampling locations in the Bear Creek Regime

Monitoring Driver	Monitoring Wells	Springs	Surface Water Stations
DOE Order	38	2	4
RCRA	6	1	0
CERCLA	22	5	17
Totals:	**66**	**6***	**19***

Note: * = Separate samples were collected for DOE Order and CERCLA monitoring purposes at springs SS-4 and SS-5 and surface water stations BCK-04.45 and NT-01 (see Table B.2).

Samples were collected either annually or semiannually from most of the monitoring locations during CY 2009. Of the monitoring wells, 35 were sampled annually and 19 were sampled semiannually (Table B.2). Spring and surface water samples were collected annually (13 locations), semiannually (five locations), during three quarters (two locations), or quarterly (five locations).

Thirty-three of the wells that were sampled specifically for DOE Order monitoring during CY 2009 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). One of these wells is equipped with Westbay™ multi-port sampling equipment (Westbay well GW-726), with groundwater samples collected in May 2009 from seven discrete depths intervals in the well (Figure A.12). The remaining five wells are components of two Exit Pathway Pickets in the regime: Picket B (GW-703) is located about 2,000 ft west of the Oil Landfarm and Picket C (GW-724, GW-725, GW-738, and GW-740) is located about 3,000 ft west of the S-3 Site (Figure A.13). 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 2009 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 2009 (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.13). Spring SS-6 also serves as a plume boundary monitoring location (Figure A.11).

A total of 44 monitoring locations in the Bear Creek Regime were sampled to meet CERCLA monitoring requirements during CY 2009 (Table B.2 and Figure A.11). Eight wells, five springs, and 13 surface water stations were sampled to support CERCLA ROD monitoring requirements. Fourteen wells and five surface water stations were sampled for CERCLA detection monitoring purposes at the EMWMF. Two surface water stations located near the BCBG WMA (NT-07 and NT-08) were sampled for CERCLA baseline monitoring purposes (Figure A.11).

3.1.2 East Fork Regime

As shown below in Table 2, a total of 83 monitoring wells, three springs, and five surface water stations in the East Fork Regime (and surrounding areas) were sampled during CY 2009 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 2009 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	61	1	3
RCRA	5	0	0
CERCLA	18	2	2
Totals:	**83 ***	**3**	**5**

Note: * = The total number is less than the sum because separate samples were collected from well GW-722 for DOE Order (September) and CERCLA (February) monitoring purposes (see Table B.3).

Most of the CY 2009 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.14), and three surface water stations are located in drainage features along the ORR boundary on the north side of Pine Ridge (Figure A.15). Samples were collected from the locations either annually (59 wells, three springs, three surface water stations) or semiannually (24 wells and three surface water stations).

Fifty-four monitoring wells in East Fork Regime, most of which are located within the western and central areas of Y-12 (Figure A.14), were sampled during CY 2009 specifically to meet DOE Order surveillance monitoring requirements (Table B.3). Seven monitoring wells, a spring (SP-17), 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 (GW-816) that is located next to UEFPC in the gap through Pine Ridge northeast of Y-12 (Figure A.14). One well is equipped with Westbay™ multi-port sampling equipment (Westbay well GW-722), with groundwater samples collected in July 2009 from five discrete depths intervals in the well (Figure A.16). The surface water stations are located north of Pine Ridge (Figure A.15), and samples were collected in January 2009 (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 2009. 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.14).

Eighteen monitoring wells, two springs, and two surface water stations were sampled during CY 2009 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.14). The surface water stations (200A6 and Station 8) are located in the central Y-12 area (Figure A.14). The other five monitoring wells and the springs are located in Union Valley east of the ORR boundary along Scarboro Road (Figure A.14).

3.1.3 Chestnut Ridge Regime

As shown below in Table 3, a total of 41 monitoring wells, five springs, and seven surface water stations in the Chestnut Ridge Regime were sampled during CY 2009 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.17.

Table 3. CY 2009 sampling locations in the Chestnut Ridge Regime

Monitoring Driver	Monitoring Wells	Springs	Surface Water Stations
DOE Order	5	2	3
SWDF	17	1	0
RCRA	15	0	0
CERCLA	4	2	4
Totals:	**41**	**5**	**7**

Groundwater samples were collected semiannually from most (36) of the monitoring wells, 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).

Five monitoring wells located near the CRSP (GW-174, GW-175, GW-176, GW-180, and GW-322) were sampled specifically for DOE Order surveillance monitoring purposes during CY 2009 (Figure A.17 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 stations SCR1.5SW, SCR3.5SW, and S17) where surface water exits the Chestnut Ridge Regime (Figure A.17).

Seventeen monitoring wells and one spring were sampled during CY 2009 to meet SWDF monitoring requirements (Table B.4). The monitoring wells are located at four SWDFs: three wells at ILF II; five wells at ILF IV; five wells at ILF V; and four wells at CDL VII (Figure A.17). Well GW-205 at the United Nuclear Corporation Site was selected to serve as the plume delineation well for SWDF assessment monitoring at ILF IV. Spring SCR4.3SP, sampled for SWDF detection monitoring at ILF V, is located about 2,400 ft southeast of the site (Figure A.17).

Groundwater samples were collected from 15 monitoring wells to meet RCRA monitoring requirements during CY 2009 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.17). 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.17). The spring sampling location (SCR4.3SP) is located south of CDL VII (Figure A.17). During CY 2009, 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.17). 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.17). The RCRA monitoring network for CY 2009 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.17).

Samples were collected from four monitoring wells, two springs, and four surface water stations to meet CERCLA monitoring requirements in the Chestnut Ridge Regime during CY 2009 (Table B.4). The wells and one surface water station are located at the United Nuclear Corporation Site (Figure A.17). One spring (SCR1.25SP) is located along Dunaway Branch in the southwestern portion of the regime, and a spring (SCR3.5SP) and three surface water stations (MCK 1.4, MCK 2.0, and MCK 2.05) are located along McCoy Branch (Figure A.17).

3.2 QUALITY ASSURANCE/QUALITY CONTROL SAMPLING

Quality assurance/quality control sampling activities managed by the Y-12 GWPP during CY 2009 were performed to ensure that the highest level of quality in sampling provided representative groundwater results. Comparable QA/QC sampling protocols also were performed under monitoring programs managed by BJC (BJC 2009c 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 2009 included 57 trip blanks, 38 method (laboratory) blanks, two field blanks, two equipment rinsate samples, and 15 duplicate groundwater and surface water samples.

Table 4. QA/QC samples analyzed in CY 2009 for the Y-12 GWPP

Sample Type	Total Number of Samples per Quarter of CY 2009				Annual Total
	First	Second	Third	Fourth	
Trip Blank Samples	16	15	13	13	**57**
Method Blank Samples	8	10	10	10	**38**
Field Blank Samples	1	0	1	0	**2**
Equipment Rinsate Samples	0	1	1	0	**2**
Duplicate Samples	4	4	4	3	**15**

The blanks and equipment rinsate samples were prepared and analyzed as specified in the *Field Quality Control Samples* operating procedure (B&W Y-12 2009a). Analytical results for the blank samples help assess the environmental conditions in the field and laboratory under which associated groundwater and surface water samples were collected, transported, stored, and analyzed. Trip blanks were samples of analyte-free water prepared in the laboratory and transported to the field and then to the laboratory in coolers containing groundwater and surface water samples. Field blanks were samples of analyte-free water that were transported to the field in a sealed glass container and transferred to sample bottles at monitoring wells GW-623 (first quarter) and 56-3C (third quarter) and then transported to the laboratory in a cooler containing the other samples from the well. Method blanks were samples of analyte-free water that were prepared in the laboratory and analyzed along with one or more associated groundwater or surface water samples. The equipment rinsates are samples of the analyte-free water from the final rinse of the decontaminated portable sampling equipment after sampling was completed at Westbay wells GW-726 (second quarter) and GW-722 (third quarter).

Method blanks, trip blanks, field blanks, and equipment rinsate samples were analyzed for VOCs. Appendix G provides summaries of detected results for the QA/QC blanks and equipment rinsate samples and shows the method blank and trip blank samples associated with each groundwater and surface water sample collected under management of the GWPP during CY 2009.

A total of 15 field duplicate samples were collected during CY 2009 from five wells and one surface water station in the Bear Creek Regime (Table B.2), seven wells and a spring in the East Fork Regime (Table B.3), and one well in the Chestnut Ridge Regime (Table B.4). The duplicate samples were analyzed for the same constituents and parameters specified for the sampling location from which they were collected. Analytical results for the duplicates are presented with the regular sample results in Appendices D, E, and F.

3.3 SAMPLE COLLECTION AND HANDLING

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

Unfiltered samples were collected from the monitoring wells, springs, and surface water stations in each hydrogeologic regime during CY 2009. Groundwater samples were collected from most monitoring wells with dedicated bladder pumps (Well Wizard™). However, samples were obtained from two wells equipped with a dedicated Westbay ™ multi-port sampling apparatus (wells GW-722 and GW-726).

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

Groundwater samples were collected from Westbay wells GW-722 and GW-726 in accordance with the most recent and approved version of the operating procedures for the multi-port sampling equipment (BWXT 2007a and BWXT 2007b). Four 250-milliliter non-vented stainless steel sample collection bottles are used to obtain groundwater samples from the sampling ports. The sample collection bottles are lowered to the designated sampling port, the sampling port valve is opened remotely, and the bottles are allowed to fill with groundwater. The filled bottles are retrieved to the surface and the contents are poured into the appropriate laboratory sample bottle(s). The sample collection bottles are lowered, filled, and retrieved as many times as needed to completely fill the laboratory sample bottles. Groundwater in the first sample collection bottle retrieved from each sampling port is used as a “formation rinse” to obtain field measurements and to condition the sample collection bottles.

Passive (no purge) sampling methods were used to evaluate groundwater quality at 34 wells during CY 2009. A passive diffusion bag (PDB) was used to evaluate VOC concentrations in groundwater in 31 of these wells, including nine wells in the Bear Creek Regime (Appendix D), 17 wells in the East Fork Regime (Appendix E), and five wells in the Chestnut Ridge Regime (Appendix F). The PDB sampling method is suitable only for monitoring for the presence and concentration of selected VOCs in groundwater. This method involves suspending a polyethylene bag (semipermeable membrane) filled with analyte-free water at a selected depth within the monitored interval of the well and leaving the PDB in place for a prescribed period (at least two weeks). The chemical concentration gradient between the uncontaminated analyte-free water in the PDB and the surrounding contaminated groundwater induces VOCs in the groundwater to diffuse through the bag into the analyte-free water until equilibrium conditions are achieved. When retrieved, the water in the PDB is decanted into VOC sample bottles (U.S. Geological Survey 2001).

A “no-purge method” was used for wells that have demonstrated a very low pumping rate (<50 ml/min) to meet the minimal drawdown requirement during purging and sample collection. During CY 2009, the no-purge method was used to collect groundwater samples from two wells (GW-065 and GW-623) in the Bear Creek Regime and one well (56-4A) in the East Fork Regime. For this method, field measurements were obtained and groundwater samples were collected after pumping the stagnant water (calculated volume) from the tubing.

3.4 FIELD MEASUREMENTS AND LABORATORY ANALYTES

The following discussion pertains to the field measurements and laboratory analytes associated with the CY 2009 groundwater and surface water sampling activities directed by the Y-12 GWPP. Identical or functionally equivalent field measurements and laboratory analyses were performed under monitoring programs managed by BJC during CY 2009 (BJC 2007a, BJC 2009b, BJC 2009c, and EnergySolutions 2007).

Field personnel measured the depth to the static water surface before sampling groundwater in each monitoring well (except wells GW-722 and GW-726, and all wells sampled using PDBS.) 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 wells GW-722 and GW-726. Additionally, REDOX and dissolved oxygen were not recorded for wells GW-722 and GW-726 (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 2009 SAP for the Y-12 GWPP (B&W Y-12 2008). The field measurements recorded for the sampling locations in each regime are presented in Appendix D (Bear Creek Regime), Appendix E (East Fork Regime), and Appendix F (Chestnut Ridge Regime).

Most of the CY 2009 groundwater samples and surface water samples were analyzed for: (1) miscellaneous laboratory analytes—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). The Y-12 GWPP implemented selective parameter monitoring during CY 2009 on samples from monitoring wells with analytical results for at least eight groundwater samples obtained since January 1991 (B&W Y-12 2008). Historical data clearly demonstrate that the selected parameters are the contaminants of concern and provide sufficient data for the other parameters. For example, samples from 35 monitoring wells were analyzed only for VOCs, and historical data for these locations show consistently low results for inorganic and radiochemical analytes. The CY 2009 results provide the data necessary to meet requirements of the Y-12 GWPP monitoring program.

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

The analytical method used for mercury concentrations in groundwater and surface water samples was modified during CY 2009 to achieve a significantly lower reporting limit (0.00005 mg/L). 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 2009 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 2009 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 2007b and BJC 2009c) 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 2009 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 2007b and BJC 2009c). 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 2009 from BJC that are presented in this report may not meet the GWPP DQOs.

3.6 GROUNDWATER ELEVATION MONITORING

As shown in Table 5, selected monitoring wells in the Bear Creek, East Fork, and Chestnut Ridge hydrogeologic regimes were used to monitor groundwater elevations during seasonally high flow conditions in CY 2009.

Table 5. Summary of CY 2009 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	76	April 8-9, 2009	Table B.6	Figure A.4
East Fork	62	April 7-9, 2009	Table B.7	Figure A.5
Chestnut Ridge	77	April 7-8, 2009	Table B.8	Figure A.6

Field personnel with the Environmental Sampling Section of the Y-12 Environmental Compliance Department measured the depth to the static water surface in each well in accordance with the operating procedure (BWXT 2004).

4.0 CY 2009 MONITORING DATA

The monitoring data obtained in CY 2009 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 2009c), 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 2009 monitoring results for the applicable RCRA, CERCLA, and SWDF sampling locations in the Bear Creek Regime, East Fork Regime, and Chestnut Ridge Regime: the *2010 Remediation Effectiveness Report* (DOE 2010), the *Calendar Year 2009 Resource Conservation and Recovery Act Annual Monitoring Report* (BJC 2010a), the *Annual Report for 2008 - 2009 Detection Monitoring at the Environmental Management Waste Management Facility* (BJC 2010b) and each semiannual *Groundwater Monitoring Report for the Oak Ridge Reservation Landfills* (BJC 2009d and BJC 2009e).

4.1 SURVEILLANCE MONITORING

Groundwater quality monitoring data collected during CY 2009 were evaluated to determine if any changes have occurred in areas that are, or could be, affected by Y-12 operations. Due to inherent differences in their characteristics, these evaluations were done for each hydrogeologic unit (aquitard and aquifer) within each hydrogeologic regime (Bear Creek, East Fork, and Chestnut Ridge).

4.1.1 Bear Creek Regime

In CY 2009, groundwater samples were collected from 63 surveillance monitoring wells in the Bear Creek Regime (Table B.2). Forty-one of these wells are completed in the geologic formations comprising the aquitard in BCV (Nolichucky Shale, Maryville Limestone, Rogersville Shale, Pumpkin Valley Shale, and

Rome Formation). Twenty-two wells are completed in the geologic formations that comprise the aquifer in BCV (Copper Ridge Dolomite and Maynardville Limestone).

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 2009 from 23 aquitard wells in the Bear Creek Regime (Table B.9). The presence of contaminants in the groundwater at these wells is attributable to the transport/migration of the mobile components of 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 2009 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 2009 from nine 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 2009: 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-Feb 2009	Jul-Aug 2009	Jan-Feb 2009	Jul-Aug 2009
GW-615	South	50 ft	245	10,400	NS	1.33	NS
GW-246		50 ft	76	NS	2,829	NS	0.436
GW-276	Southeast	200 ft	18.5	12.2	11	0.39	0.35
GW-127	Southwest	300 ft	24	<	NS	0.0534	NS
GW-616		400 ft	269	NS	255	NS	NA
GW-101	West	160 ft	17.5	20.1	NS	<	NS
GW-526		1,300 ft	114.6	1,560	NS	NA	NS
GW-537		2,500 ft	23.3	NS	397	NS	NA
GW-085		3,000 ft	58.8	97.4	NS	NA	NS
MCL				10		0.03	

Note: NA = Not analyzed; NS = Not sampled; "<"= Less than MCL.

These sampling results show that the highest concentrations of nitrate occur in the groundwater from wells located directly south (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. The very high nitrate levels in the groundwater samples from well GW-526 confirm the substantial westward transport of nitrate via strike-parallel flowpaths (e.g., bedding plane fractures) at depth (>100 ft bgs) in the Nolichucky Shale. The high nitrate concentration in the shallow groundwater from well GW-537 (Figure A.7) is believed to reflect upwelling of nitrate-contaminated groundwater from deeper flowpaths toward discharge features along NT-2. The elevated nitrate levels in the groundwater from well GW-085 indicate continued westward transport of nitrate in the shallow flow system west of NT-2, at least 3,000 ft from the S-3 Site.

As with nitrate, the CY 2009 groundwater sampling results show that the highest concentrations of total uranium occur geologically down-dip to the south of the S-3 Site. Elevated uranium concentrations in the Nolichucky Shale occur only in the low-pH groundwater within approximately 500 ft of the S-3 Site.

The CY 2009 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-101 (nitrate), GW-127 (uranium), GW-276 (nitrate and uranium), and GW-537 (nitrate), as illustrated by the nitrate data for wells GW-276 and GW-537 (Figure A.18). 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-615, and GW-616 and for uranium concentrations at well GW-246. For example, data for well GW-246 (Figure A.18) show little if any change in the uranium concentrations evident in March 1987 (0.464 mg/L) and August 2009 (0.436 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 trends for nitrate concentrations at well GW-526 and for uranium concentrations at well GW-615 (Figure A.18). 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 2009 from 16 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 (three wells), OLF (two wells), and various waste disposal areas within the BCBG WMA (11 wells).

Table 7. Bear Creek Regime CY 2009: maximum VOC concentrations in surveillance monitoring aquitard wells

Location/ Well Number (Figure A.8)	Concentration (µg/L)										
	PCE	**TCE**	**c12 DCE**	**11DCE**	**VC**	**111 TCA**	**112 TCA**	**12 DCA**	**11DCA**	**MC**	**Benzene**
S-3 Site											
GW-246	97	<	.	<	.	.	.	.	.	15	.
GW-276	6.43	.	.	.	.	.	.	.	.	.	.
GW-615	.	.	.	.	.	.	.	.	.	5	.
OLF											
GW-008	51	11.3	<	<	.	.	.	.	13	.	<
GW-098	.	7	<	<	.	.	.	.	.	.	.
BCBG											
GW-014	28	160	710	34	120	.	.	.	180	.	<
GW-046	1,300	783	2,730	98	320	85	.	.	360	.	180
GW-068	<	93	1,900	180	320	.	.	.	850	.	110
GW-071	610	63	<	78	3	200	.	.	2,900	.	1,500
GW-082	.	<	150	<	92	.	.	.	77	.	<
GW-242	5	<	<	.	18	.	.	.	4	.	.
GW-289	260	12	2	.	.	.	.	.	.	.	.
GW-623	25,000	19,000	640	290	150	.	.	.	3,300	29	10
GW-627	870	330	45	49	78	.	.	.	130	.	.
GW-629	180,000	24,000	.	2,700	.	1,200	43	24	11,000	.	.
GW-653	13	24	190	5	.	.	.	.	11	.	.
MCL	5	5	70	7	2	200	5	5	NA	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 2009 sampling results for the wells listed in Table 7 support long-term summed VOC (e.g., chloroethenes) concentration trends (Table B.9), with time-series plots of the VOC data for each well generally showing:

- Decreasing concentration trends for VOCs in groundwater from wells GW-014, GW-071, GW-098, and GW-276, as illustrated by the PCE results for wells GW-014 and GW-276 (Figure A.19). 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 summed VOC groups in groundwater from five wells located hydraulically downgradient of the BCBG WMA (GW-046, GW-068, GW-082, GW-242, GW-289, GW-623, and GW-629), as illustrated by the PCE results for wells GW-046 and GW-289 (Figure A.19). For example, PCE concentrations at well GW-046 show wide (seasonal, with peak concentrations in July) fluctuations, but similar results were reported for the groundwater samples collected from the well in 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-068, GW-627, GW-629, and GW-653 at the BCBG WMA. The increasing concentration trend indicated by the PCE data for well GW-246 (Figure A.19) 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-627 (Figure A.19) and GW-653 potentially reflect an increase in the relative flux of VOCs via the strike-parallel flowpaths in the Nolichucky Shale west of BG-A South, following down-dip migration of dissolved VOCs in the groundwater and DNAPL in the nearby subsurface.

Divergent concentration trends for individual chloroethenes in groundwater from well GW-068 at the BCBG WMA indicate biodegradation. The CY 2009 results show that c12DCE, 11DCE, and VC are the chloroethenes with the highest concentrations (Table 7). Historic data for the well show clearly decreasing trends for concentrations of PCE and TCE (parent compounds), with clearly increasing trends for concentrations of c12DCE and VC (degradation products). For example, between March 1987 and March 2009, PCE concentrations decreased from 220 µg/L to 2 µg/L and total 12DCE concentrations increased from 420 µg/L to 1903 µg/L.

Gross Alpha and Gross Beta Activity

Groundwater samples collected during CY 2009 from 11 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 seven of these wells. However, the elevated gross alpha activity for well GW-726-06 in May 2009 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, shown with a “Q” qualifier, is a suspected outlier (possible sampling or analytical artifact) that is excluded from further evaluation in this report. Future monitoring results will confirm or negate the elevated activity.

Table 8. Bear Creek Regime CY 2009: 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	02/23/09	2.9		<MDA		5.4	53	±	5.1
GW-127	02/17/09	2.5	27	±	4.6	4.7		<	
GW-246	08/05/09	76	380	±	100	140	11,000	±	360
GW-276	01/07/09	2.55	136	±	23.2	4.65	144	±	23.6
GW-276	07/06/09	2.42	107	±	18.4	5.01	148	±	24.4
GW-537	08/05/09	5.9		<MDA		15	130	±	14
GW-615	02/18/09	93	400	±	250	170	57	±	190
GW-726-06	05/04/09	18	41 Q	±	21	30		<MDA	
Screening Level		15				50			
Note: "<" = Less than or equal to screening level; "Q" = inconsistent with historical measurements.									

The elevated levels of gross alpha activity and gross beta activity reflect transport/migration of uranium isotopes and Tc-99, respectively, from the groundwater contaminants (acidified wastes) emplaced at the source during historical operation of the former S-3 Ponds. As with total uranium, the relatively limited extent of elevated gross alpha activity indicated by the CY 2009 sampling results reflects the limited mobility of uranium isotopes beyond the acidic groundwater in the Nolichucky Shale within approximately 500 ft of the site.

As shown by the CY 2009 sampling results summarized in Table 8 and shown on Figure A.10, gross beta activity remains extremely high (>10,000 pCi/L) in groundwater from the Nolichucky Shale nearest to the S-3 Site (well GW-246), and exceeds 100 pCi/L in the shallow groundwater 2,500 ft west of the site (well GW-537). Moreover, as with nitrate, the CY 2009 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 (TcO_4) that, like nitrate, is not readily attenuated in the subsurface and is highly mobile in the groundwater. This largely explains the similar distribution of nitrate and elevated gross beta activity in the aquitard near the site.

The gross alpha and gross beta activity reported for the groundwater samples collected during CY 2009 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 wells GW-127 (gross alpha activity) and GW-276 (gross alpha and gross beta activity), which are located southwest and southeast, respectively, of the S-3 Site (Figure A.11). As shown by data for well GW-276, the decreasing trends for gross alpha and gross beta activity mirror the concurrently decreasing trends evident for nitrate and uranium (Figure A.18) and PCE (Figure A.20). As with the other contaminants in the groundwater from this well, the decreasing levels of gross alpha and gross beta activity likewise primarily reflect the substantially reduced flux of uranium isotopes and Tc-99 that occurred after the former S-3 Ponds were closed and capped.

- Indeterminate gross alpha and/or gross beta activity trends for wells GW-085, GW-246, GW-537, and GW-615, which together 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. 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. The data for well GW-085 (Figure A.20) 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. As noted previously, the nitrate concentrations at well GW-537 show a generally decreasing trend (Figure A.18), and the indeterminate gross beta trend appears to be generally decreasing in the groundwater samples collected from the well since August 2003.

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 2009 from 16 aquifer wells in the Bear Creek Regime (Table B.9). Six of these wells are components of two Exit Pathway Pickets in the Bear Creek Regime (Figure A.13): Picket B (GW-703, GW-704, and GW-706) and Picket C (GW-724, GW-738, and GW-740). The remaining wells are located near the eastern end of the regime near the S-3 Site (GW-100, GW-122, GW-236), and Rust Spoil Area (GW-307); near Bear Creek south of the OLF WMA (GW-225, GW-229, GW-365, and GW-601); and near Bear Creek south of the BCBG WMA (GW-053 and GW-058).

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 2009 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 2009 from 10 of the aquifer wells used for surveillance monitoring in the Bear Creek Regime, listed below in Table 9 in sequence from closest to farthest from the S-3 Site.

Table 9. Bear Creek Regime CY 2009: 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-Feb 2009	July-Aug 2009	Jan-Feb 2009	July-Aug 2009
S-3 Site	GW-122	375 ft Southwest	206	NS	<	NS
	GW-100	1,150 ft Southwest	25.4	NS	<	NS
	GW-236	1,650 ft Southwest	35.9	NS	<	NS
Exit Pathway Picket C	GW-738	3,000 ft West	12.7	NS	<	NS
	GW-724		12.9	NS	NA	NS
OLF WMA	GW-601	4,500 ft West	16.6	NS	NA	NS
	GW-229	5,000 ft West	.	NS	0.143	NS
Exit Pathway Picket B	GW-706	7,000 ft West	21.4	8.1	0.066	0.058
	GW-704		12.6	NS	<	NS
BCBG	GW-058	9,000 ft West	11.4	NS	<	NS
MCL			10		0.03	

Note: “.” = Not detected; “<” = Less than MCL; NS = Not sampled; NA = Not analyzed

These sampling results show that the highest nitrate concentrations in the aquifer occur within approximately 500 ft of the S-3 Site (e.g., GW-122). Elevated concentrations of total uranium were reported only for groundwater samples from wells GW-229 and GW-706, which are located hydraulically downgradient to the west of the BYBY (Figure A.9). Uranium-bearing wastes were buried at depths below the seasonally high water table at the BYBY. Carbonate dissolved from the limestone bedrock combined with uranyl cations leached from the wastes, which greatly increased the otherwise limited mobility of uranium in the neutral pH groundwater typical of the Maynardville Limestone (DOE 1997a). The bulk of these wastes 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 2009 from the aquifer wells in the Bear Creek Regime support the respective long-term concentration trends indicated by historical data (Table B.9), except for the unusually low nitrate results reported for wells GW-225 and GW-725. These nitrate results are inconsistent with respect to available historical data for the locations and are flagged with a “Q” qualifier in Appendix D. The CY 2009 data for the other wells have 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 eight wells (GW-100, GW-122, GW-236, GW-601, GW-704, GW-706, GW-724, and GW-738) and for uranium at well GW-706, as illustrated by nitrate and uranium data for well GW-706 (Figure A.21). 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. The sharp decrease in uranium concentrations at well GW-706 between January and July 2003 may be attributable to the CERCLA remedial actions at the BYBY that were completed in May 2003.

- Increasing concentration trends for nitrate in well GW-058 and uranium in well GW-229 (Figure A.21). Only the two most recent samples from well GW-058 have elevated nitrate concentrations, and the significance of this trend is questionable. 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 February 2009 (0.143 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 2009 from 13 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 TCE, c12DCE, 11DCE, VC, and benzene reported for at least one groundwater sample from one or more wells exceed the respective drinking water MCLs.

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 2009 sampling results show the continued persistence of TCE in the groundwater from a few 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 2009: maximum VOC concentrations in surveillance monitoring aquifer wells

Well Number	Concentration (µg/L)				
	TCE	**c12DCE**	**11DCE**	**VC**	**Benzene**
GW-053	<	<	.	.	.
GW-225	280	<	<	.	.
GW-229	6	340	42	43	13
GW-307	12	<	.	.	.
GW-365	14	<	14	.	.
GW-601	83	.	.	.	.
GW-703	10	<	.	.	.
GW-704	40	<	<	.	.
GW-706	15.5	<	<	.	.
GW-724	90	<	.	.	.
GW-725	10	.	.	.	.
GW-738	20	.	.	.	.
GW-740	27	<	.	.	.
MCL	5	70	7	2	5

Note: "." = Not detected; "<" = Less than MCL

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

- Variable, but generally decreasing, concentration trends for VOCs (primarily TCE) in groundwater from eight wells (GW-053, GW-307, GW-365, GW-601, GW-703, GW-704, GW-738, and GW-740), as illustrated by TCE data for wells GW-704 and GW-738 (Figure A.22). 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 four wells GW-225, GW-706, GW-724, and GW-725, as illustrated by the TCE data for wells GW-225 and GW-706 (Figure A.22). The relatively unchanged levels of VOCs in the groundwater from these wells suggest there is minimal change in the advective flux of VOCs in the hydrostratigraphic zone monitored by each well.

- Generally increasing concentration trends for summed VOC groups in groundwater from well GW-229. The data for this well are clearly distinguishable from the other wells listed in Table 10 by the dominant concentrations of TCE degradation products (c12DCE, 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.22). The increasing concentrations do not reflect any clear response to the CERCLA remedial actions at the BYBY. This suggests that the site is not a significant source of the VOCs in the groundwater from the well. However, Sanitary Landfill I is located upgradient and along geologic strike to the east of well GW-229, and may be the source of VOCs in groundwater at the well.

Divergent concentration trends observed for individual chloroethenes that indicate ongoing biodegradation near wells GW-229 and GW-365. For example, the low flow sampling results from March 2001 to March 2009 reported for well GW-365 show that TCE (parent compound) concentrations decreased from 54 µg/L to 14 µg/L while c12DCE (degradation product) concentrations concurrently increased from 17 µg/L to 40 µg/L.

Gross Alpha and Gross Beta Activity

Groundwater samples collected during CY 2009 from 13 aquifer surveillance monitoring wells contained gross alpha and/or gross beta activity above the associated MDA and the corresponding TPU. However, as shown in Table 11, only samples from three of these wells had elevated levels of gross alpha activity (>15 pCi/L) and/or gross beta activity (>50 pCi/L).

Table 11. Bear Creek Regime CY 2009: 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	02/10/09	3.1	34	±	4.6	5.4	54	±	5.3
GW-229	02/26/09	3.4	53	±	6.7	5.8		<	
GW-706	03/03/09	3.83	18.1	±	5.24	5.07		<	
GW-706	07/22/09	2.29	17.9	±	4.33	4.15	51	±	9.24
Screening Level		15				50			

Note: "<" = Less than or equal to screening level.

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

The CY 2009 monitoring results show that the highest level of gross alpha activity occurs in the groundwater from aquifer well GW-229, located downgradient (west-southwest) of the former BYBY (Figure A.9 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. Gross beta activity is higher in the other two wells, which probably reflects a combination of the uranium decay products from the BYBY and Tc-99 from the S-3 Site.

The elevated gross alpha and gross beta activity in samples collected from aquifer wells during CY 2009 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 and gross beta activity trend for well GW-706 (Figure A.23). The long-term trends for conventional sampling were highly variable and indeterminate. However, the trend for low flow sampling results show a generally decreasing trend with a drop in alpha activity in July 2003 that is a possible response to the CERCLA actions completed in May 2003.

- Increasing long-term trends for gross alpha and beta activity in well GW-058 and gross alpha activity in well GW-229. The monitoring history for well GW-058 spans a 14-yr sampling gap (September 1992 - June 2006) and only the recent samples have elevated radioactivity, as shown by the gross alpha activity reported for the well (Figure A.23). The trend for gross alpha activity at well GW-229 (Figure A.23) is similar to the long-term trend for total uranium (Figure A.21) which shows a significant concentration increase between September 1995 and March 2002, followed by a generally decreasing trend through February 2009. The most recent data for gross alpha activity likewise show decreasing levels between February 2003 (150 pCi/L) and February 2009 (53 pCi/L). 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 2009, groundwater samples were collected from 73 surveillance monitoring wells in the East Fork Regime (Table B.3). Forty-five 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 28 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 2009 from 34 aquitard monitoring wells in the East Fork

Regime (Table B.10). The presence of principal contaminants in the groundwater at these wells is attributable to the transport/migration of the mobile components of the groundwater contaminant plumes originating from multiple sources, including the S-3 Site (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 2009 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-274, and GW-633) and the shallow bedrock (<70 ft bgs) interval (wells 55-2C, GW-108, and GW-275) in the Nolichucky Shale east and southeast of the site.

Table 12. East Fork Regime CY 2009: 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-May 2009	Oct 2009	Jan-May 2009	Oct 2009
Western Y-12 Area	GW-505	600 E	NA	NS	0.0629 Q	NS
	GW-270	700 E	107	NS	<	NS
	GW-272	1,350 E	682	NS	<	NS
	GW-633	720 SE	823	NS	.	NS
	GW-108	800 SE	8,030	NS	<	NS
	GW-275	1,300 SE	8,960	NS	.	NS
	GW-274	1,300 SE	1,739	NS	<	NS
Central Y-12 Area	55-2A	3,000 SE	NS	212	NS	NS
	55-2B	3,000 SE	NS	292	NS	.
	55-2C	3,000 SE	NS	261	NS	NS
	GW-204	5,100 SE	NA	NS	0.0421	NS
		MCL	10		0.03	

Note: “NA” = Not analyzed; “NS“ = Not sampled; “<“ = Concentration less than MCL; “.“ = Not detected; “Q”=inconsistent with other results for the location.

For the wells with elevated nitrate concentrations, the CY 2009 sampling results are consistent with historical nitrate concentration trends (Table B.10), with time-series plots for each well generally showing:

- Decreasing nitrate concentration trends for wells GW-108, GW-270, GW-274, and GW-633, as illustrated by the nitrate data for wells GW-108 and GW-274 (Figure A.24). 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 and GW-275 (Figure A.24). The relatively unchanged nitrate levels 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 the 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 wells 55-2B, 55-2C, and GW-272, as illustrated by the nitrate data for wells 55-2B and GW-272 (Figure A.24). The increasing nitrate concentrations at wells 55-2B and 55-2C 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 only for wells GW-204 and GW-505. The elevated uranium result reported for GW-505 in April 2009 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, shown with a “Q” qualifier, is a suspected outlier (possible sampling or analytical artifact) that is excluded from further evaluation in this report. Well GW-204, located in the central Y-12 area on the east side of Bldg. 9204-2 (Figure A.14), 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, with results since June 2000 ranging from 0.0316 mg/L to 0.127 mg/L.

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 2009 from 29 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 toluene 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 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 2009 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 2009: 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	12 DCA	Ben-zene	ETB	Tol-uene
Western											
GW-108	10.7	5.7	.	<	.	.	48.8	.	<	.	.
GW-269	13	5	<	160	.	.	.	.	.	.	.
GW-274	1,600	11	<	.	3	.	29	.	200	.	.
GW-332	560	170	740	20	11	.	.	.	.	.	.
GW-337	380	450	1,500	55	13	.	.	.	.	.	.
GW-508	.	.	.	.	.	.	.	.	280	310	890
GW-633	190	7	<	<	.	.	18	.	2,100	.	.
Central											
55-2A	200	100	280	7	7	.	.	.	.	.	.
55-2B	390	170	430	13	14	.	.	.	.	.	.
55-2C	260	140	450	15	13	.	.	.	.	.	.
55-3A	17,000	1,700	1,300	50	110	.	.	.	.	.	.
55-3B	51,000	6,400	1,500	210	530	.	.	.	<	.	<
55-3C	8,300	1,500	1,400	37	160	.	.	.	.	.	.
56-2A	12	<	<	.	.	.	.	.	.	.	.
56-2B	1,000	75	98	<	.	.	.	.	.	.	.
56-2C	40	170	920	13	59	.	.	.	.	.	.
56-3A	14	5	<	.	.	.	.	.	.	.	.
56-3B	150	15	<	.	.	.	.	.	.	.	.
56-3C	520	38	<	<	.	.	.	.	.	.	.
GW-656	32	2,700	150	150	.	.	.	.	.	.	.
GW-769	22	7	<	<	.	160	.	.	.	.	.
GW-770	.	.	.	.	.	12	.	.	.	.	.
GW-782	36	16	<	9	.	<	.	.	.	.	.
GW-783	<	<	<	.	.	.	.	.	.	.	.
GW-791	22	.	.	.	.	.	.	.	.	.	.
Eastern											
GW-383	120	150	210	<	5	.	.	.	.	.	.
GW-658	.	.	.	.	.	.	.	373	8,110	837	2,110
GW-762	2,460	172	<	54.2	4.72	.	.	.	.	.	.
GW-763	.	.	<	.	4	.	.	.	.	.	.
MCL	5	5	70	7	2	5	5	5	5	700	1,000

Note: "." = Not detected; "<" = Less than MCL

The CY 2009 sampling results for these wells support the long-term summed VOC (e.g., chloroethenes) concentration trends (Table B.10), with time-series plots of the VOC results generally showing:

- Decreasing concentration trends for VOCs at 12 wells, including three wells in the western Y-12 area (GW-332, GW-337, and GW-508) and nine wells in the central Y-12 area (55-2A, 55-2B, 55-2C, 56-2A, 56-2C, 56-3A, GW-656, GW-783, and GW-791). Decreasing trends are illustrated by the summed chloroethene concentrations detected in the samples from wells GW-337 and GW-656 (Figure A.25). The decreasing concentration trends reflect several factors, such the cumulative effectiveness of natural attenuation processes, including biologically mediated degradation. Decreasing VOC concentrations in samples from well 55-2B are concurrent with clearly increasing nitrate concentrations (Figure A.24), which suggest separate sources of VOCs and nitrate.

- Indeterminate concentration trends for VOCs in groundwater from eight wells, including six wells in the central Y-12 area (55-3A, 55-3B, 55-3C, 56-2B, 56-3B, and 56-3C); and two wells (GW-658 and GW-763) in the eastern Y-12 area. These trends are illustrated (Figure A.25) by concentrations of the principal VOC detected in shallow wells 55-2A (PCE) and GW-658 (benzene). Widely variable, but essentially unchanged, levels of VOCs 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 wells GW-769 and GW-770 in the central Y-12 area and well GW-383 in the eastern Y-12 area, as illustrated by the concentrations of 12DCE in well GW-383 and CTET in well GW-769 (Figure A.25). 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 summed VOC concentration trends (Table B.10) in groundwater from six wells, including four wells in the western Y-12 area (GW-108, GW-269, GW-274, and GW-633), well GW-782 in the central Y-12 area , and well GW-762 in the eastern Y-12 area. Historical data for all of the wells except for well GW-782 show an increasing trend for summed chloroethenes with a concurrent indeterminate trend for summed chloroethanes or chloromethanes. The long term trends for well GW-782 show decreasing summed chloroethene concentrations with indeterminate summed chloroethane concentrations.

Divergent concentration trends observed for individual chloroethenes in wells 55-3A, 56-2C, and GW-383 are likely attributable to the effects of biotic and/or chemical degradation processes. Historic data for the wells show decreasing and/or indeterminate trends for concentrations of parent compounds (PCE and/or TCE), with increasing trends for concentrations of degradation products (c12DCE, 11DCE, and/or VC). For example, the 12DCE (total) concentrations reported for well GW-383 increased significantly between January 1991 (41 µg/L) and October 2009 (213 µg/L), while initial and most recent concentrations of PCE (390 µg/L – 120 µg/L) and TCE (150 µg/L – 150 µg/L) show decreasing and indeterminate trends, respectively.

Gross Alpha and Gross Beta Activity

Groundwater samples collected during CY 2009 from 19 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 three of these wells had elevated gross alpha activity (>15 pCi/L) and/or gross beta activity (>50 pCi/L). The elevated alpha activity reported for well GW-505 in April 2009 (as with the total uranium result) 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, shown with a “Q” qualifier, is a suspected outlier (possible sampling or analytical artifact) that is excluded from further evaluation in this report. Future monitoring results will confirm or negate the elevated activity. Conversely, very low gross beta results (<5 pCi/L) reported for groundwater samples collected in April 2009 from wells GW-274 and GW-633 in the western Y-12 area also are flagged with a “Q” qualifier (see Appendix E) because gross beta activity for both of these wells typically exceeds 1,000 pCi/L.

Table 14. East Fork Regime CY 2009: 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	01/12/09	101	186	±	75	101	16,200	±	2,600
GW-108	07/08/09	61.2		<MDA		108	13,400	±	2,140
GW-505	04/20/09	2.3	67Q	±	5.6	5.8		<	
Central Y-12 Area									
GW-204	05/12/09	3	35	±	4.7	6.4		<	
Screening Level		15				50			

Note: “<”= Less than the screening level; “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 well GW-108. 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 well GW-204 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 2009 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:

- Indeterminate trends for gross alpha activity in groundwater from wells GW-108 and GW-204 (Figure A.26). Widely variable and not clearly increasing or decreasing levels of gross alpha activity in the groundwater from these wells suggest minimal change in the flux of alpha-emitting radionuclides (primarily uranium isotopes) in the groundwater.

- An increasing trend for gross beta activity in groundwater from well GW-108 (Figure A.26). 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 2009 from 21 surveillance monitoring aquifer wells in the East Fork Regime (Table B.10), including three wells located in the western Y-12 area; nine wells located in the central Y-12 area; eight wells in the eastern Y-12 area; and one well in Union Valley east of the ORR boundary.

Nitrate and Uranium
As shown in Table 15, elevated concentrations of nitrate (>10 mg/L) or total uranium (>0.03 mg/L) were detected in the groundwater samples collected during CY 2009 from nine 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 2009 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 upgradient of well GW-605, and from the Oil Skimmer Basin (GW-154 and GW-223). As shown below, the highest concentrations of uranium were reported for well GW-154, located near the former Oil Skimmer Basin.

Table 15. East Fork Regime CY 2009: elevated nitrate and uranium concentrations in surveillance monitoring aquifer wells

Well Location/Number		Nitrate (mg/L)		Uranium (mg/L)	
		Jan-May 2009	July-Oct 2009	Jan-May 2009	July-Oct 2009
Western Y-12 Area	GW-253	744	NS	<	NS
	GW-251	38.7	NS	<	NS
Central Y-12 Area	GW-219	NA	NA	0.555	NS
	GW-698	90.1	12.1	NA	NA
Eastern Y-12 Area	GW-154	NA	NA	0.6	0.56
	GW-222	<	<	0.228	0.228
	GW-223	.	.	0.04	0.046
	GW-605	<	<	0.13	0.1
	GW-606	12.8	16	<	<
	MCL	10		0.03	

Note: "." = Not detected; "<" = Less than MCL; NS = Not sampled; NA = Not analyzed

The CY 2009 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.27), 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, GW-219, GW-222, and GW-605. These trends are illustrated by the historical data for wells GW-253 and GW-154 (Figure A.27). 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.27) 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.27). 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 2009 from 19 aquifer wells in the East Fork Regime contained one or more dissolved VOCs at individual or summed concentrations of 5 µg/L or more (Table B.10). As shown in Table 16, the maximum concentrations of PCE, TCE, c12DCE, VC, CTET, and/or chloroform exceed drinking water MCLs. The presence of VOCs reflects transport/migration of the intermingled plume(s) of dissolved VOCs in the Maynardville Limestone (Figure A.8). The summed concentration of chloroethenes (c12DCE and VC) in the CY 2009 groundwater sample from aquifer well GW-230 (10.72 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 2009 sampling results for the wells in Union Valley exceeds the applicable drinking water MCLs.

Table 16. East Fork Regime CY 2009: maximum VOC concentrations in surveillance monitoring aquifer wells

Location and Well	Maximum Concentration (µg/L)					
	PCE	TCE	c12DCE	VC	CTET	Chloroform
Western Y-12 Area						
GW-251	230	110	<	.	<	<
GW-253	766	812	257	75.6	42.4 J	<
GW-618	<	7.81	<	.	.	.
Central Y-12 Area						
GW-686	6	<	<	.	.	.
GW-690	65	<	<	.	.	.
GW-691	14 Q	.	.	.	.	<
GW-692	7	<	<	.	.	<
GW-698	100	280	<	.	<	<
GW-700	17	10	<	.	.	.
GW-820	870	350	490	.	.	.
GW-959	.	.	<	.	.	.
Eastern Y-12 Area						
GW-153	.	.	.	.	68	<
GW-222	13	<	<	.	.	.
GW-223	21.8	13.4	80.2	5.04	.	.
GW-381	<	.	<	.	340	<
GW-382	25.5	.	<	.	439	120
GW-605	110	110	160	<	81	<
GW-606	6	<	.	.	61	<
Union Valley						
GW-230	.	.	<	<	.	.
MCL	5	5	70	2	5	80*

Note: “. “ = Not detected; “<”= Less than the MCL; J = Estimated value; Q = inconsistent with other measurements (lower) for the location; * = MCL for total trihalomethanes (byproducts of drinking water disinfection with chlorine)

The CY 2009 VOC results for the aquifer wells support the long-term summed VOC (e.g., chloroethenes) concentration trends (Table B.10), and time-series plots of the VOC data generally show:

- Variable but generally decreasing trends for chloroethene and/or chloromethane concentrations for eight wells (GW-153, GW-223, GW-230, GW-382, GW-618, GW-690, GW-700, and GW-959), as illustrated by the summed concentration of chloromethanes detected in well GW-382 and chloroethenes in well GW-618 (Figure A.28). The decreasing concentration trends reflect reduced flux of VOCs from the applicable source areas and the long-term effects of natural attenuation processes. The decrease in VOC concentrations at well GW-382 between May 1995 and September 1999 may reflect a sampling method bias with higher concentrations in samples obtained with the conventional method.

- Indeterminate concentration trends for chloroethenes and/or chloromethanes (Table B.10) in groundwater from seven wells (GW-222, GW-251, GW-253, GW-686, GW-691, GW-698, and GW-820). These trends are illustrated by the summed chloroethene concentrations detected in the groundwater samples from wells GW-251 and GW-698 (Figure A.28). 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. The VOC concentrations at well GW-698 generally show seasonal fluctuations that are opposite of the relationship shown at well GW-251. Higher VOC concentrations evident during seasonally low flow conditions (October/November) suggest recharge of less contaminated groundwater that dilute the VOC concentrations during high flow conditions.

- An increasing concentration trend for summed chloroethenes and chloromethanes in the groundwater samples collected with low flow sampling from well GW-605 (Figure A.28). The VOC concentrations show seasonal fluctuations, with high concentrations typically evident in samples collected during seasonally low flow conditions (July). This relationship suggests seasonal inflow of uncontaminated recharge via the groundwater flowpaths intercepted by the monitored interval in the well. The increasing VOC concentration trends probably reflect increased flux in the groundwater flowpaths monitored by the well.

- A combination of indeterminate trends for summed chloroethenes and decreasing trends for summed chloromethanes in groundwater from wells GW-381, GW-606, and GW-692 (Table B.10). The divergent trends suggest different source areas and/or flowpaths for the different types of VOCs detected at these wells.

Divergent concentration trends for individual chloroethenes may reflect biologically mediated degradation at wells GW-223 and GW-253. For instance, while the 12DCE concentrations reported for well GW-223 (located near NHP, Figure A.14) increased between February 1991 (30 µg/L) and March 2009 (80.2 µg/L), significant concentration decreases were reported for this same time period for concentrations of PCE (190 µg/L – 21.8 µg/L) and TCE (42 µg/L – 13.4 µg/L). Similarly at well GW-253, the concentrations of PCE and TCE have remained fairly stable (indeterminate trend) while concentrations of VC have increased from not detected in CY 1991 to 75.6 µg/L in March 2009.

Gross Alpha and Gross Beta

Groundwater samples collected during CY 2009 from 12 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 five 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 upgradient of well GW-605, and the Oil Skimmer Basin (GW-154).

Table 17. East Fork Regime CY 2009: elevated gross alpha activity and gross beta activity in surveillance monitoring aquifer wells

Well	Date Sampled	Gross Alpha (pCi/L)				Gross Beta (pCi/L)			
		MDA	Activity ± TPU			MDA	Activity ± TPU		
Western Y-12 Area									
GW-253	03/04/09	4.65	23.7	±	5.6	7.0		<	
Central Y-12 Area									
GW-219	05/11/09	2.9	140	±	9.4	7	82	±	8.1
Eastern Y-12 Area									
GW-154	03/03/09	3.17	433	±	70.7	7.34	133	±	22.2
GW-154	07/23/09	3.55	354	±	59.5	8.9	67.6	±	12.8
GW-222	04/30/09	3.1	70	±	6.7	7.5		<	
GW-605	01/08/09	2.47	71	±	12.8	4.76		<	
GW-605	07/07/09	2.34	51.8		9.74	4.65		<	
Screening Level		15				50			

Note: "<" = Less than the screening level

The gross alpha and gross beta activity reported for the samples collected during CY 2009 support the long-term trends indicated by historical data (Table B.10). Time-series plots of the gross alpha and/or gross beta activity reported for each applicable well generally show:

- Widely variable, indeterminate long-term trends for gross alpha activity in groundwater from wells GW-154, GW-219, GW-222, GW-253, and GW-605 and for gross beta activity at wells GW-154 and GW-219. These trends, illustrated by the data for wells GW-154, GW-219, and GW-605 (Figure A.29), 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 2009 groundwater sampling results for 41 wells on Chestnut Ridge meet the requirements of surveillance monitoring in the Chestnut Ridge Regime. Most of these wells continue to yield uncontaminated groundwater. Data for a few wells suggest 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 2009, with at least one principal compound detected (>1 µg/L) in samples from nine wells (Table 18). The TCE and c12DCE results for well GW-217 are inconsistent with historic and subsequent results (see Appendix F) from the well, are considered to be analytical artifacts, and are excluded from further discussion in this report.

Table 18. Chestnut Ridge Regime CY 2009: maximum VOC concentrations in surveillance monitoring wells

Well	Maximum Concentration (µg/L)							
	PCE	**TCE**	**c12DCE**	**11DCE**	**111TCA**	**11DCA**	**TCFM**	**F113**
Near CRSP:								
GW-174	.	.	.	.	.	.	10	3 J
GW-175	4 J	.	.	.	.	.	3 J	.
GW-176	.	.	.	23	20	46	2 J	.
GW-177	.	.	.	8.09	7.75	39	NR	NR
GW-180	4 J	.	1 J	.	.	.	5 J	2 J
GW-322	4 J	.	.	53	16	75	32	3 J
GW-798	15	1.3 J	13	8.7	2.9 J	4.7 J	22	.
IL IV:								
GW-217	.	6.8Q	2.6Q	.	.	.	.	NR
GW-305	.	.	.	9.1	18	40	.	NR
MCL	5	5	70	7	200	NA	NA	NA

Note: ". " = Not detected; J = Estimated value; NR = Not reported; NA = Not applicable;
"Q" = inconsistent with other measurement for the location.

The CRSP are the source of the VOCs in the groundwater at seven of these wells (GW-174, GW-175, GW-176, GW-177, GW-180, GW-322, 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). 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-176, GW-177, GW-322, and GW-798 exceed respective drinking water MCLs.

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.

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

The CY 2009 sampling results generally continue the long-term concentration trends indicated by historical VOC data (Table B.11), as illustrated the VOC data for wells GW-322 and GW-798 (Figure A.30). The 111TCA concentrations at well GW-322 show a steadily decreasing trend, with the summed concentration of degradation products (11DCA and 11DCE) increasing from March 1988 through January 1998 then decreasing concurrently with 111TCA (Figure A.30). The VOC data for well GW-798 shows an overall indeterminate trend characterized by peak concentrations in January 2003, January 2007, and February 2009 (Figure A.30).

The groundwater samples collected from well GW-305 during CY 2009 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 2009 monitoring results continue the concentration trends evident after the sequential detection of 111TCA, 11DCA, and 11DCE beginning in January 1992 (Figure A.30). The data show the arrival of the parent compound (111TCA) followed four years later by the related degradation products (11DCA and 11DCE). From January 2001 to December 2009, 111TCA concentrations have decreased (20 µg/L–14 µg/L), 11DCE concentrations have remained fairly stable (4.1 µg/L–7.9 µg/L), and 11DCA concentrations have increased (12 µg/L–35.7 µg/L).

4.2 EXIT PATHWAY/PERIMETER MONITORING

This section describes results of groundwater and surface water quality monitoring performed during CY 2009 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 2009 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.13), (2) six springs that represent natural groundwater discharge locations, and (3) 19 surface water stations that measure water quality in strategic locations along Bear Creek. For this report, these sampling locations are assigned to three areas: Upper, Middle, and Lower Bear Creek. Upper Bear Creek encompasses the surface water sampling locations upstream (east) of the confluence of NT-2 with Bear Creek (Figure A.11), including two sampling locations in Bear Creek (BCK-11.97 and BCK-12.34) and sampling locations in NT-1 (NT-01) and NT-2 (S07). 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), four sampling location in Bear Creek (BCK-09.20, BCK-09.40, BCK-11.54, and BCK-11.84), and sampling locations in NT-3 (EMWNT-03A and NT-03), NT-4 (NT-04 and EMW-VWUNDER), NT-5 (EMWNT-05 and EMW-VWEIR), NT-7 (NT-07), and NT-8 (NT-08). The lower Bear Creek sampling locations (downstream of NT-9) include the monitoring wells listed in Table 19, four springs (SS-6, SS-6.6, SS-7, and SS-8), and three surface water stations in Bear Creek (BCK.03.30, BCK-04.55, and BCK-07.87) (Figure A.11).

Table 19. Bear Creek Regime CY 2009: sampling locations used for exit pathway/perimeter monitoring

Bear Creek Area	Monitoring Wells		Springs	Surface Water Stations	
	Well Number	Monitored Interval Depth (ft bgs)		Bear Creek Main Channel	Bear Creek Tributaries
Upper	-		-	BCK-12.34 BCK-11.97	NT-01 NT-02 (S07)
Middle	-		SS-4 SS-5	BCK-11.84 BCK.11.54 BCK-09.40 BCK-09.20	EMWNT-03A NT-03 NT-04 EMW-VWUNDER (NT-4) EMWNT-05 EMW-VWEIR (NT-5) NT-07 NT-08
Lower	GW-712 GW-713 GW-714	441.5 - 457.5 305.0 - 315.2 115.1 - 145.0	SS-6 SS-6.6 SS-7 SS-8	BCK-07.87 BCK-04.55 BCK-03.30	-

4.2.1.1 Upper Bear Creek

The chemical quality of surface water in Upper Bear Creek is primarily controlled by inflow of groundwater containing the principal components of the contaminant plume emplaced during historical operations of the S-3 Ponds. To the west of this site, contaminated groundwater discharges from the aquitard (Nolichucky Shale) as base flow into NT-1, 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 2009 show that nitrate, uranium, and PCE concentrations in Upper Bear Creek remain above respective screening levels, with the highest levels of nitrate and gross beta activity in NT-01 and highest uranium and gross alpha activity in the main channel of Bear Creek.

Table 20. Upper Bear Creek CY 2009: maximum contaminant concentrations

Sampling Point	Nitrate (mg/L)	Uranium (mg/L)	PCE (µg/L)	Radioactivity (pCi/)	
				Alpha	**Beta**
NT-01	**122**	0.0213	26	5.8	**310**
S07	NA	.	.	NA	NA
BCK-12.34	.	**0.11**	7.5	NA	NA
BCK-11.97	**28.5**	**0.158**	.	**64**	**84**
Screening Level	10	0.03	5	15	50
Note: "." = Not detected; **BOLD** = Exceeds screening level; NA = not analyzed.					

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

4.2.1.2 Middle Bear Creek

Surface water quality in Middle Bear Creek is impacted by contaminants from the S-3 Site (nitrate, uranium, and radioactivity), the 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 surface water stations located in the main Channel of Bear Creek nearest to the S-3 Site (BCK-11.84 and BCK-11.54). The highest uranium levels were reported for the sampling location in NT-8, west of the BCBG WMA (Figure A.11). The uranium concentration reported for station BCK-09.40 is similar to the uranium concentration at station BCK-11.84, which reflects contributions of uranium to Bear Creek from spring SS-4 and NT-08. The highest VOC concentrations were reported for surface water stations at the BCBG (NT-07 and NT-08).

Table 21. Middle Bear Creek CY 2009: maximum contaminant concentrations

Sampling Point	Nitrate (mg/L)	Uranium (mg/L)	Chloroethenes (µg/L)					Radioactivity (pCi/L)	
			PCE	TCE	c12DCE	11DCE	VC	Alpha	Beta
BCK-11.84	**31**	**0.0816**	.	.	.	.	.	NA	NA
EMWNT-03	NA	.	.	.	.	.	.	NA	NA
NT-03	0.017	**0.0303**	.	.	.	.	.	NA	NA
BCK-11.54	**19**	**0.0545**	.	.	.	.	.	NA	NA
EMW-VWUNDER	NA	.	.	.	.	.	.	NA	NA
NT-04	NA	.	.	.	5.83	.	.	NA	NA
EMWNT-05	NA	.	.	.	.	.	.	NA	NA
EMW-VWWEIR	NA	0.0084	.	.	.	.	.	NA	NA
SS-4	**15.3**	**0.0801**	.	3 J	3 J	.	.	**42**	33
NT-07	0.61	**0.031**	**36.5**	**34.1**	**186**	**7.33**	**3.41**	NA	NA
NT-08	0.04	**0.42**	**24**	**28**	**150**	4.7	**4.8**	NA	NA
BCK-09.40	5.86	**0.0812**	.	3 J	.	.	.	**36**	22
SS-5	2.78	0.0242	.	.	.	.	.	17	13
BCK-09.20	.	**0.044**	1.3	1.5	7	.	.	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. Recent data suggest a possible increase in VOC and uranium concentration in samples from stations NT-07 and NT-08 at the BCBG, although results are still within the historical range of contaminants at each location.

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 2009 monitoring results summarized in Table 22, the concentrations of all principal contaminants were below applicable screening levels at BCK-04.55. The only result reported above a respective screening level was the uranium concentration at surface water station BCK-07.87.

Table 22. Lower Bear Creek CY 2009: maximum contaminant concentrations

Sampling Point	Nitrate (mg/L)	Uranium (mg/L)	Summed VOCs (µg/L)	Radioactivity (pCi/L)	
				Gross Alpha	Gross Beta
Monitoring Wells					
GW-712	0.052	.	.	.	.
GW-713	0.028	.	.	.	.
GW-714	0.34	.	.	.	.
Springs					
SS-6	0.68	0.0065	.	3.19	4.2
SS-6.6	0.1	.	.	NA	NA
SS-7	0.064	.	.	NA	NA
SS-8	0.19	.	.	NA	NA
Surface Water					
BCK-07.87	4.2	**0.0396**	1.2	NA	NA
BCK-04.55	1.56	0.0283	2 J	12	14
BCK-03.30	0.81	0.0127	.	NA	NA
Screening Level	10	0.03	MCL or >5 µg/L	15	50
Note: "**.**" = Not detected; J = estimated value; **BOLD** = Exceeds screening level.					

The CY 2009 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 2009 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.14). Spring SP-17 is located on the south side of UEFPC about 1,700 ft upstream of NHP, and the two surface water stations located in the East Fork (200A6 and Station 8) are in the south-central part of Y-12 (Figure A.14).

Table 23. East Fork Regime CY 2009: sampling locations for exit pathway/perimeter monitoring

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

In addition to the surface water and spring sampling locations within the East Fork Regime, two springs located along South Illinois Avenue east of Y-12 (Figure A.14) 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.15) also serve as exit pathway/perimeter monitoring locations. Sampling results for these locations showed principal contaminant concentrations below screening levels.

4.2.2.1 Groundwater

At least one of the groundwater samples collected during CY 2009 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.14). 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 2009: maximum VOC concentrations in exit pathway/perimeter monitoring wells

Well	Maximum Concentration (µg/L)				
	PCE	TCE	c12DCE	CTET	Chloroform
GW-151	**731**	**115 J**	61.4 J	**1,340**	74.5 J
GW-220	**210**	**100**	65	**690**	71
GW-722-22	3	1.26 J	.	**21.8**	2.06 J
GW-722-20	**8**	1.72 J	.	**51.2**	7.19
GW-722-17	4	.	.	**23**	4.96 J
GW-722-14	4 J	1.04 J	.	**26**	2.16 J
GW-733	.	.	.	**7.3**	1 J
GW-832	**7**	1 J	0.8 J	**6.77**	1.49 J
MCL	5	5	70	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 2009 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.31). 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.32).

The CY 2009 monitoring results for spring SP-17 show that the nitrate concentration (9.08 mg/L) at this location is just below the drinking water MCL for nitrate (10 mg/L). The S-2 Site is the suspected source of nitrate in the groundwater at this spring (Figure A.7). Samples from springs SCR7.1SP and SCR7.8SP in Union Valley were analyzed for VOCs and none were detected.

4.2.2.2 Surface Water

Maximum concentrations reported for CY 2009 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 2009: 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	**0.088**	NA	NA	NA
Station 8	NA	**0.036**	NA	12.9	8.99
North of Pine Ridge					
GHK2.51WSW	0.21	.	.	.	.
NPR12.0SW	0.172	.	.	.	5.8
NPR23.0SW	0.177	.	.	.	.
Screening Level	10	0.03	5	15	50
Note: "." = not detected (or below MDA); NA = not analyzed; **BOLD** = Exceeds screening level.					

The CY 2009 uranium concentrations for surface water stations 200A6 and Station 8 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 2009 reflect the continued impact of legacy Y-12 operations on the quality of surface water in UEFPC upstream of the ORR boundary.

Although not a principal groundwater contaminant because of very low solubility, mercury is a primary contaminant of soils and surface water in the East Fork Regime as a legacy of historical operations at Y-12. Extensive surface water sampling (flow proportionate and grab samples) is performed by other monitoring programs (e.g., NPDES and CERCLA) and the annual monitoring results are not addressed in this document. However for information purposes, the mercury concentration reported for over 200 surface water samples collected during CY 2009 from Station 17 ranged from 0.000021 mg/L (August 2009) to 0.005511 mg/L (January 2009), which exceeds the drinking water MCL (0.002 mg/L). Station 17 is located in UEFPC on the south side of Bear Creek Road (Figure A.13) downstream (north) of Lake Reality. As noted in the explanation notes for Appendix E (page iii), total and dissolved mercury concentrations were analyzed in samples collected by BJC in June and December 2009. The total (unfiltered) mercury concentrations in both samples (0.0002895 mg/L and 0.0002849 mg/L, respectively) were an order of magnitude below the MCL for mercury.

4.2.3 Chestnut Ridge Regime

The CY 2009 monitoring results reported for the springs and surface water sampling stations listed in Table 26 serve as the exit pathway/perimeter monitoring locations in the Chestnut Ridge Regime.

Table 26. Chestnut Ridge Regime CY 2009: sampling locations used for exit pathway/perimeter monitoring

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

4.2.3.1 Groundwater

The springs used for exit pathway/perimeter monitoring in the Chestnut Ridge Regime are located in 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.17). The CY 2009 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 (1 µg/L) of chloromethane detected at SCR-4.3SP (suspected analytical artifact), 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 semiannual sample from two of the springs, and these gross beta results (3.18 pCi/L at spring SCR3.5SP and 4.55 pCi/L at spring SCR4.3SP) indicate 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 2009 are located in Dunaway Branch (SCR1.5SW) at the western boundary of the regime; near the headwaters of SCR2 (UNC SW-1); in McCoy Branch downstream of the FCAP (MCK 2.05 and MCK 2.0), upstream of Rogers Quarry (SCR3.5SW), and near the confluence with the Clinch River (MCK 1.4); and in tributary SCR5 downstream of KHQ (S17) near the southeastern boundary of the regime (Figure A.17).

Analytical results for the surface water samples collected from McCoy Branch during CY 2009 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 2010). Historical data show that the surface water samples from both locations are distinguished by elevated concentrations of sulfate and arsenic. The sulfate concentrations in the samples collected in March and September 2009 from MCK 2.05 (27.7mg/L and 41.5 mg/L, respectively) and MCK 2.0 (31.2 mg/L and 29.7 mg/L, respectively) exceed background levels. The monitoring results obtained during CY 2009 show that the maximum arsenic concentrations at MCK 2.05 (0.101 mg/L) and MCK 2.0 (0.0159 mg/L) are above the drinking water MCL (0.01 mg/L). At station MCK 1.4, located about 4,000 ft downstream from MCK 2.0, much lower arsenic concentrations were reported in the CY 2009 samples collected in March (0.005 mg/L) and September (0.00604 mg/L). 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 2009 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, except for nitrate concentration (6.94 mg/L) in the October 2009 sample from station S17. The CY 2009 nitrate result is higher than previous measurements (e.g., 2.17 mg/L in April 2008). Future monitoring results will determine if the result is an outlier or indicates an increasing trend. Uranium and 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 one surface water sample: gross alpha (5 pCi/L) in the October 2009 sample from station SCR3.5SW. Alpha activity was not detected in the April 2009 sample and the low activity level is indicative of natural background radiation and/or analytical variability. Historical and current waste management operations do not appear to have significantly affected surface-water quality in these drainage features.

5.0 CONCLUSIONS AND RECOMMENDATIONS

The groundwater and surface water quality data obtained during CY 2009 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 2009 monitoring results reported for 66 wells (38 aquitard wells and 28 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. Chloroethenes (PCE, TCE, 12DCE, 11DCE, and VC) are the most widespread groundwater contaminants, with elevated concentrations of one or more of these VOCs reported for 28 wells.

The CY 2009 exit pathway/perimeter monitoring in the Bear Creek Regime is reported for 19 surface water stations along Bear Creek (including six northern tributaries), six springs that discharge into Bear Creek, and three aquifer wells at the westernmost Exit Pathway Picket (Picket W). None of the groundwater samples from the Picket W wells had elevated concentrations of the principal groundwater contaminants at Y-12, but elevated concentrations of one or more of the contaminants were detected in surface water samples from seven sampling stations in Bear Creek (BCK-12.34, BCK-11.97, BCK-11.84, BCK-11.54, BCK-09.40, BCK-09.20, and BCK-07.87), five tributaries (NT-1, NT-2, NT-3, 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 2009 concentrations of all principal contaminants were below applicable screening levels.

The CY 2009 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 ten monitoring wells (eight aquitard wells and two aquifer wells). These monitoring locations are near the S-3 Site (three wells), the OLF WMA (two wells), and the BCBG WMA (five wells). Decreasing or indeterminate (not increasing or decreasing) trends are evident for at least one contaminant detected in samples from 33 wells, 12 surface water stations, and two springs. Monitoring wells with elevated concentrations of more than one principal contaminant that have different trends for each contaminant (e.g., increasing nitrate trend and decreasing or indeterminate VOC trend), reflect different sources and/or transport flowpaths for the different contaminants. Divergent concentration trends for individual chloroethenes at wells GW-068, GW-229, and GW-365 are likely attributable to the effects of biotic and/or chemical degradation processes.

The CY 2009 monitoring results reported for 45 aquitard wells and 28 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 33 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 (>20,000 µg/L) VOC concentrations were reported for the groundwater near Building 9201-5 and very high (>1,000 µg/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 2009 monitoring results reported for 18 sampling locations, including ten monitoring wells, three springs and five surface water stations meet the requirements of exit-pathway/perimeter monitoring for the East Fork Regime. Elevated concentrations of one or more of the principal groundwater contaminants at Y-12 were reported for at least one of the samples from five of the wells (VOCs) and two of the surface water sampling stations (uranium). Sampling results for some of the wells exhibit a direct response (i.e., lower VOC concentrations) to the operation of the groundwater extraction well used to help capture the plume and deter continued migration of VOCs into Union Valley. Uranium concentrations reported for the surface water sampling stations suggest the continued impact of legacy Y-12 operations on the quality of surface water in UEFPC upstream of the ORR boundary. 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 directly addressed in this report. Because of low solubility, mercury is consistently detected only in groundwater samples very near source areas, and is not considered to be a principal groundwater contaminant.

The CY 2009 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 16 wells, and decreasing or indeterminate (not increasing or decreasing) concentration trends are evident for at least one contaminant detected in samples from 53 wells and two 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, transport flowpaths, and/or geochemical attenuation characteristics for the different contaminants. The effects of biotic and/or chemical degradation processes are the likely cause of divergent concentration trends for individual chloroethenes at wells 55-3A, 56-2C, GW-223, GW-253, and GW-383. Historic data for the wells show decreasing and/or indeterminate trends for concentrations of parent compounds (PCE and/or TCE), with increasing trends for concentrations of degradation products (c12DCE, 11DCE, and/or VC).

The CY 2009 sampling results for 41 wells located on Chestnut Ridge meet the requirements of surveillance monitoring in the Chestnut Ridge Regime, and results for eight wells indicate former operations at Y-12 have impacted groundwater quality. One or more VOCs were detected in groundwater samples from well GW-305 at Industrial Landfill IV and seven wells near the CRSP. Concentrations above applicable drinking water MCLs were reported for 11DCE (GW-305, GW-176, GW-177, GW-322, and GW-798) and PCE (GW-798). 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 2009 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 2009 monitoring results reported for five natural springs and seven 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 2009 sampling results for sampling stations in McCoy Branch show elevated concentrations of arsenic (>0.01 mg/L) and sulfate (>20 mg/L) immediately downstream of the FCAP, but not farther downstream where this drainage feature exits the ORR.

Based on groundwater and surface water monitoring data obtained during CY 2009, the following observations were noted and/or actions are recommended:

- Results of mercury analyses for samples collected during CY 2009 using the revised analytical method with a lower reporting limit are generally consistent with historic results. Mercury was detected in samples from six locations, including one well in the Bear Creek Regime (GW-246), and five wells in the East Fork Regime (56-1A, 56-3B, GW-274, GW-692, and GW-698). All but two of these results are greater than the historic reporting limit (0.0002 mg/L), and all results are below the drinking water MCL for mercury (0.002 mg/L). There were no locations where mercury was detected for the first time. The lowest results were reported for wells 56-1A (0.0000835 mg/L) and 56-3B (0.0000517 mg/L) located in the central Y-12 Area, and mercury was detected at each of these locations in CY 2006.

- Some VOC results obtained using PDB samplers were lower than results obtained using the low-flow method. For example, PCE results were much lower than expected at wells GW-289 and GW-315 in the Bear Creek Regime, wells GW-174 and GW-180 in the Chestnut Ridge Regime, and wells 56-2C, GW-220, GW-337, GW-383, GW-700, and GW-820 in the East Fork Regime. Studies have indicated that the PDB sampling method is appropriate for analysis for PCE concentrations. However, these results indicate that low-flow sampling may be the more conservative method for VOC analyses at these wells. The current procedure for PDB sampling is to install and leave the PDB for at least two weeks before collecting samples. It is recommended to install the PDB at least four weeks before collecting samples to allow twice the amount of time for VOCs to diffuse into the PDB sampler.

- 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.

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APPENDIX A

FIGURES

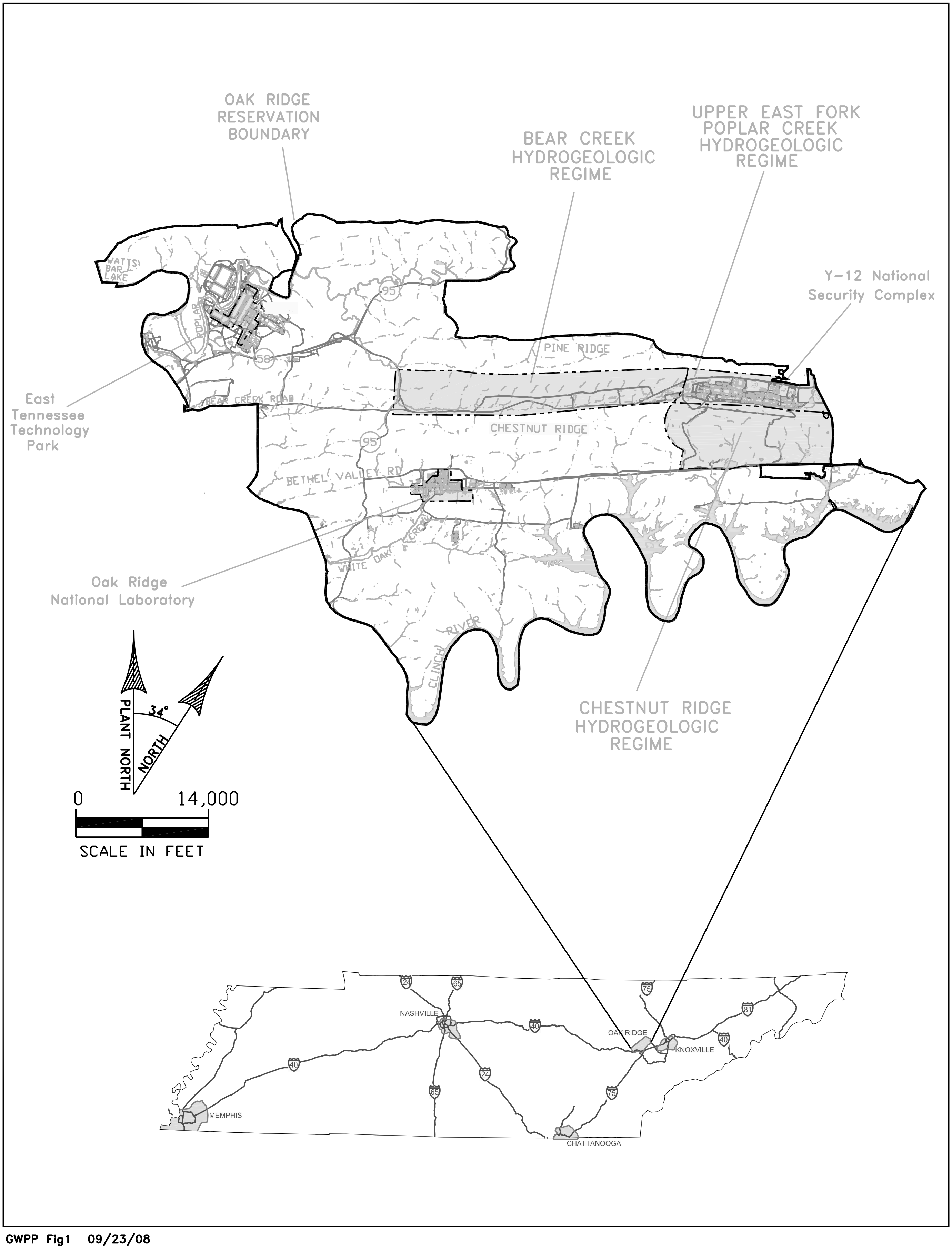
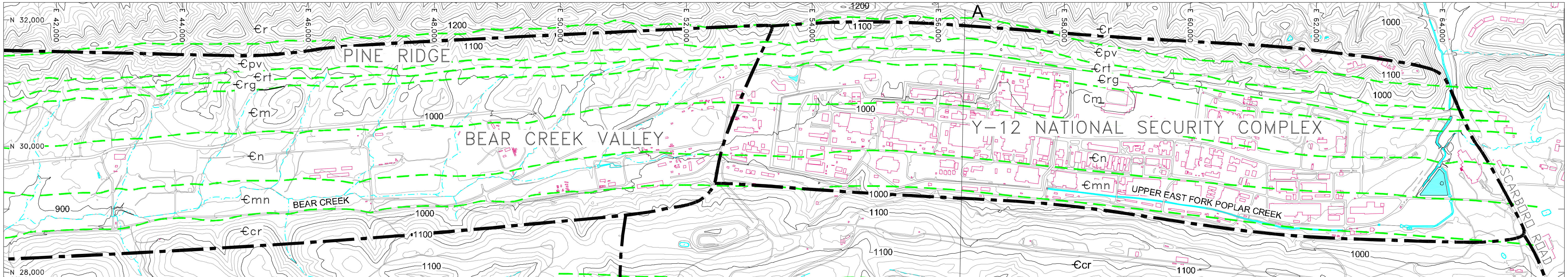
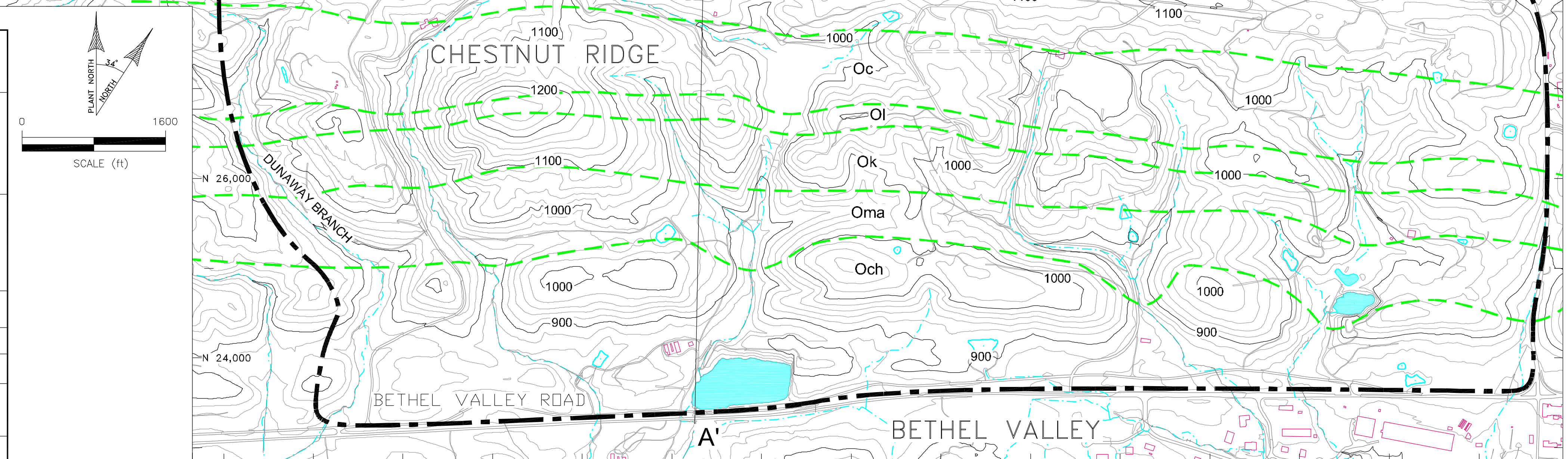


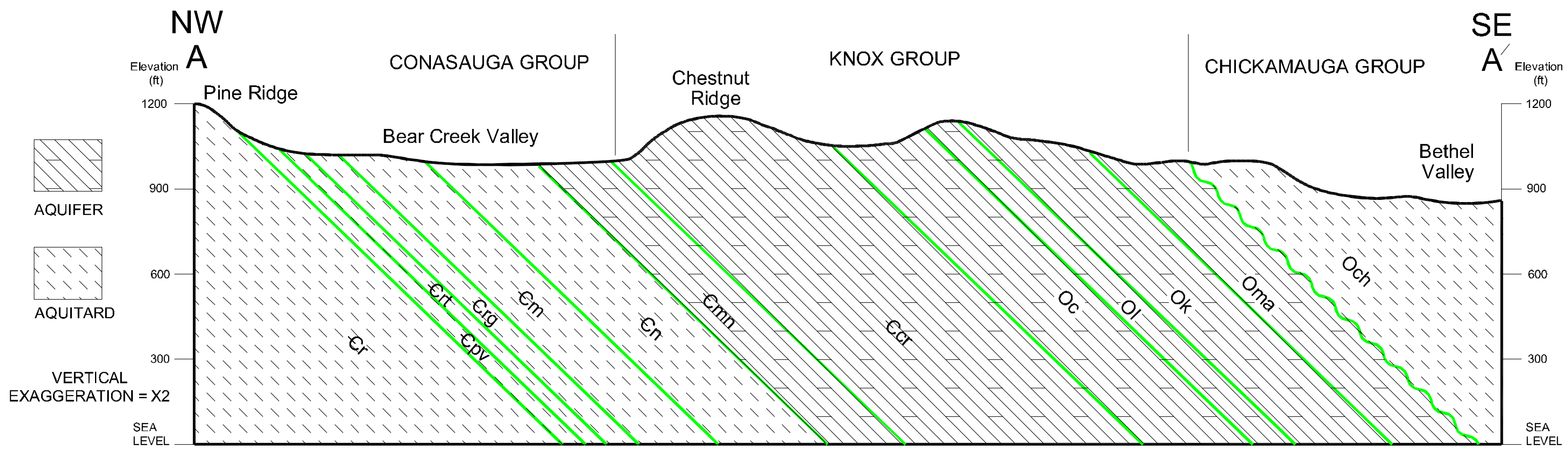
Fig. A.1. Hydrogeologic regimes at the Y-12 National Security Complex.





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

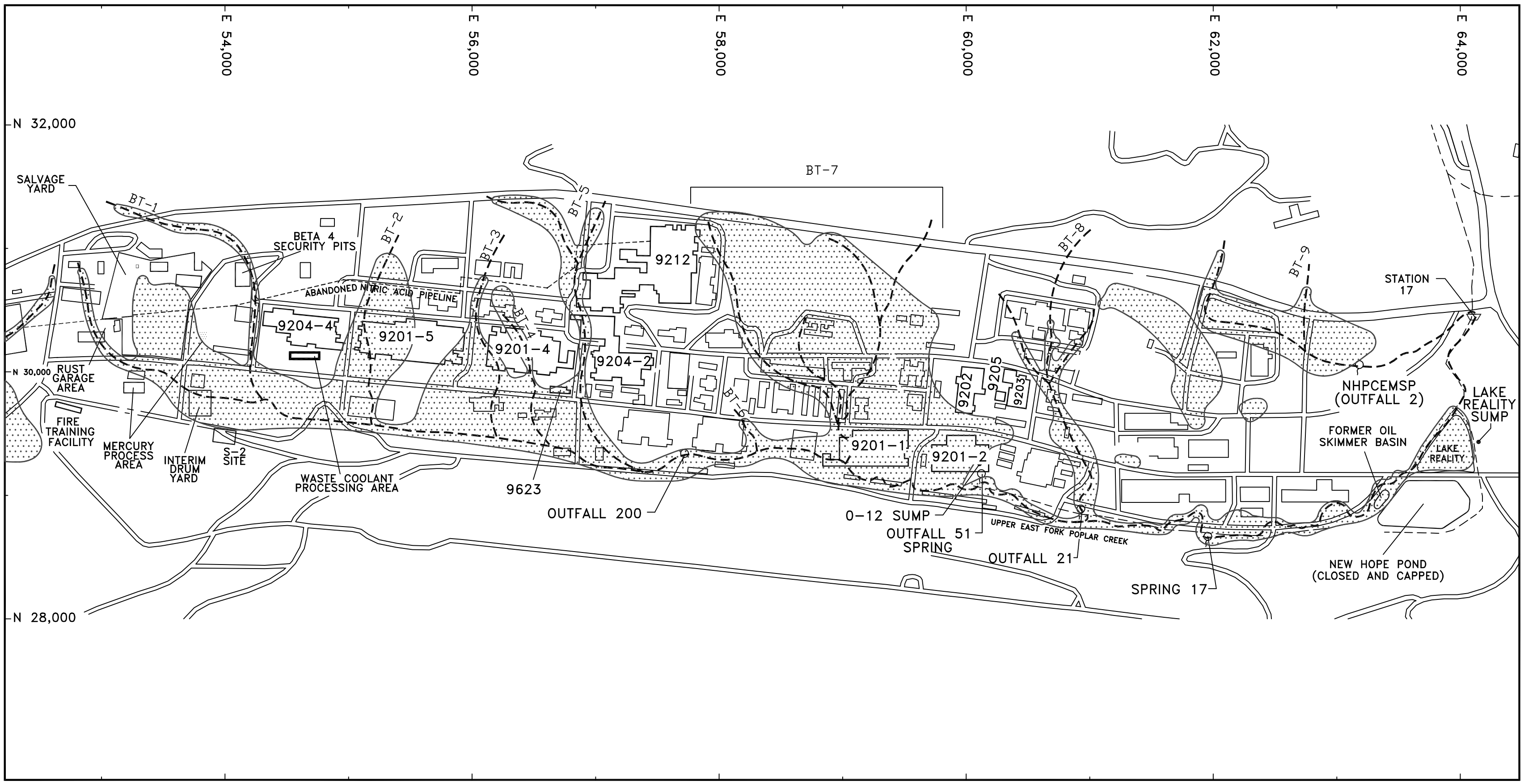
SOURCES: King and Haas 1987
Hatcher et al. 1992



GENERALIZED GEOLOGIC CROSS SECTION

GWMR_02

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

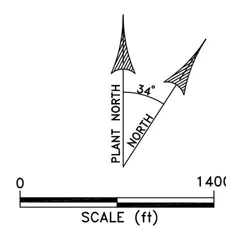
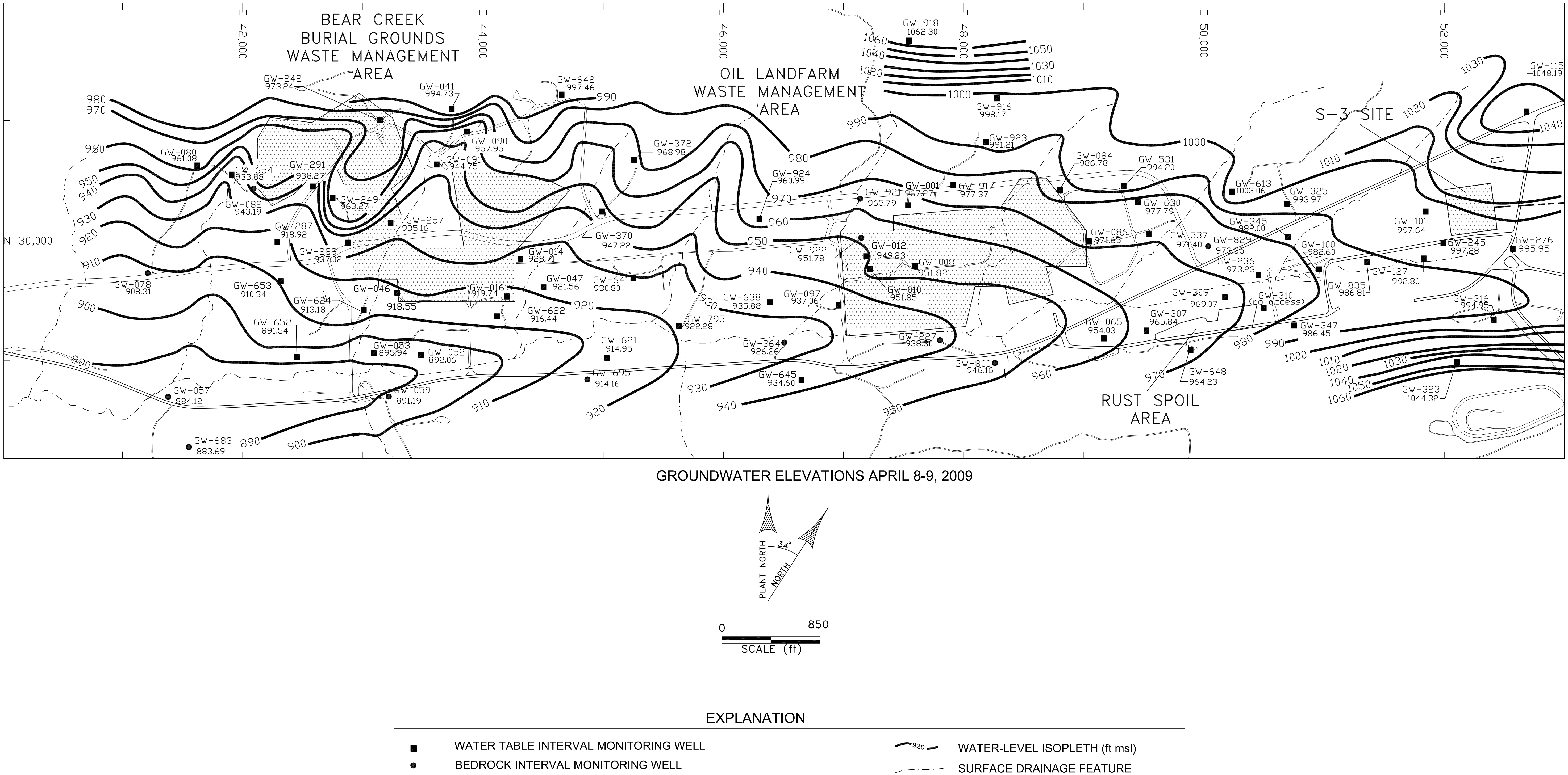
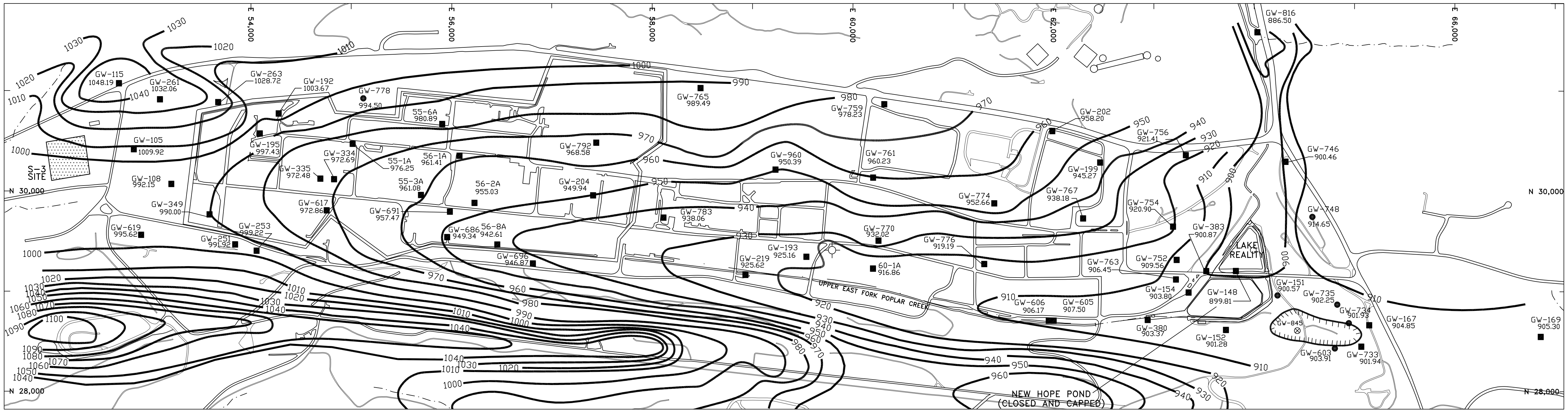


Fig. A.3. Fill areas and pre-construction drainage features in the Upper East Fork Poplar Creek Hydrogeologic Regime.

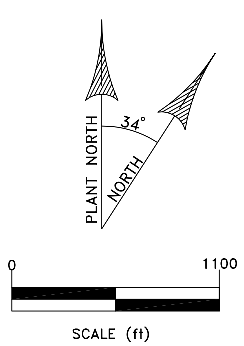


Elvado: GWMR09_04

Fig. A.4. Groundwater elevations in the Bear Creek Hydrogeologic Regime, April 2009.



GROUNDWATER ELEVATIONS APRIL 7-9, 2009

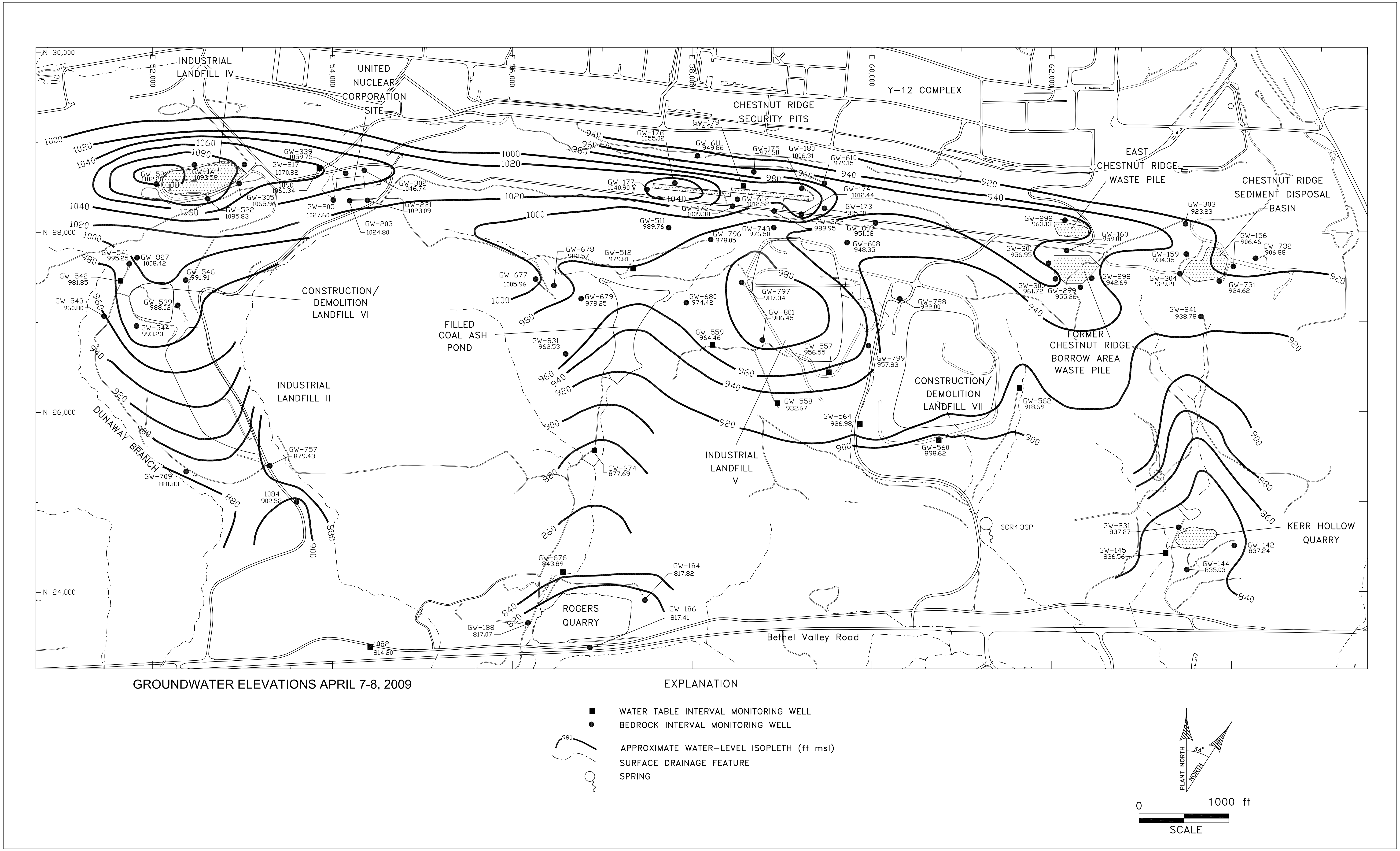


EXPLANATION

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

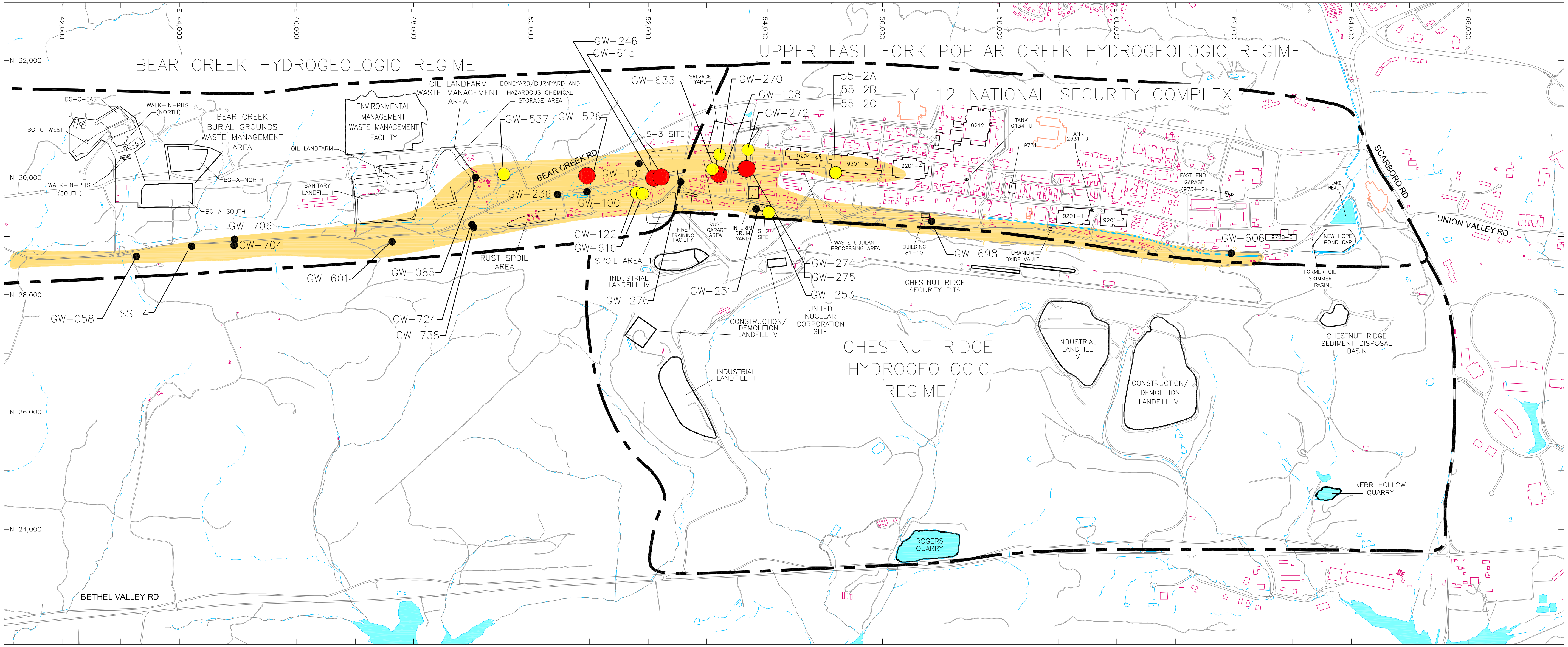
Elvado: GWMR_05

Fig. A.5. Groundwater elevations in the Upper East Fork Poplar Creek Hydrogeologic Regime, April 2009.



Elvado: GWMR_06

Fig. A.6. Groundwater elevations in the Chestnut Ridge Hydrogeologic Regime, April 2009.



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

EXPLANATION

- SURFACE DRAINAGE FEATURE
- BOUNDARY OF SITE
- BOUNDARY OF REGIME
- BUILDINGS
- NITRATE > 10 mg/L (NITRATE AS "N")

MAXIMUM CY2009 NITRATE

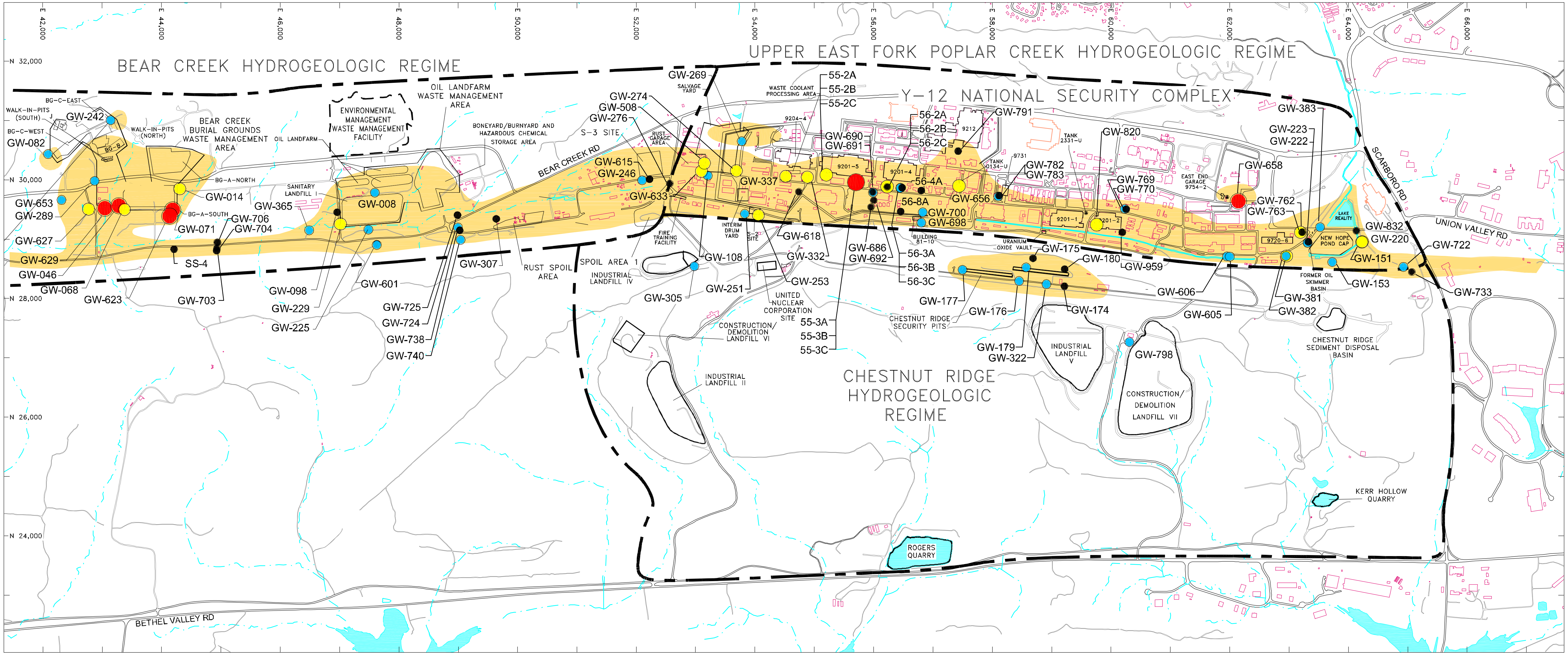
- 10-100 mg/L
- 100-1,000 mg/L
- >1,000 mg/L

PLANT NORTH
NORTH
34°

0 1800
SCALE (ft)

Elvado: GWMR09_07

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



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

EXPLANATION

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

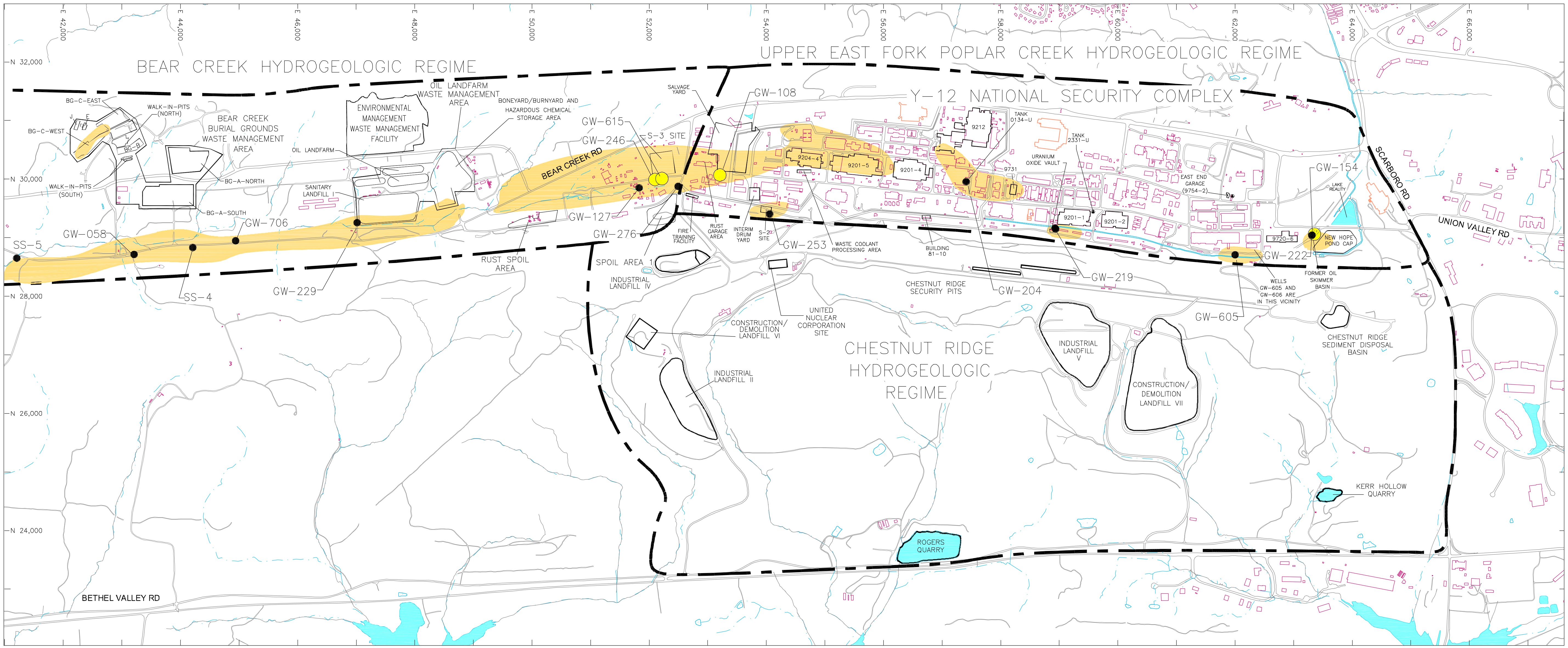
MAXIMUM CY2009 SUMMED VOCs

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

PLANT NORTH
NORTH
34°
0 1800
SCALE (ft)

Elvado: GWMR09_08

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

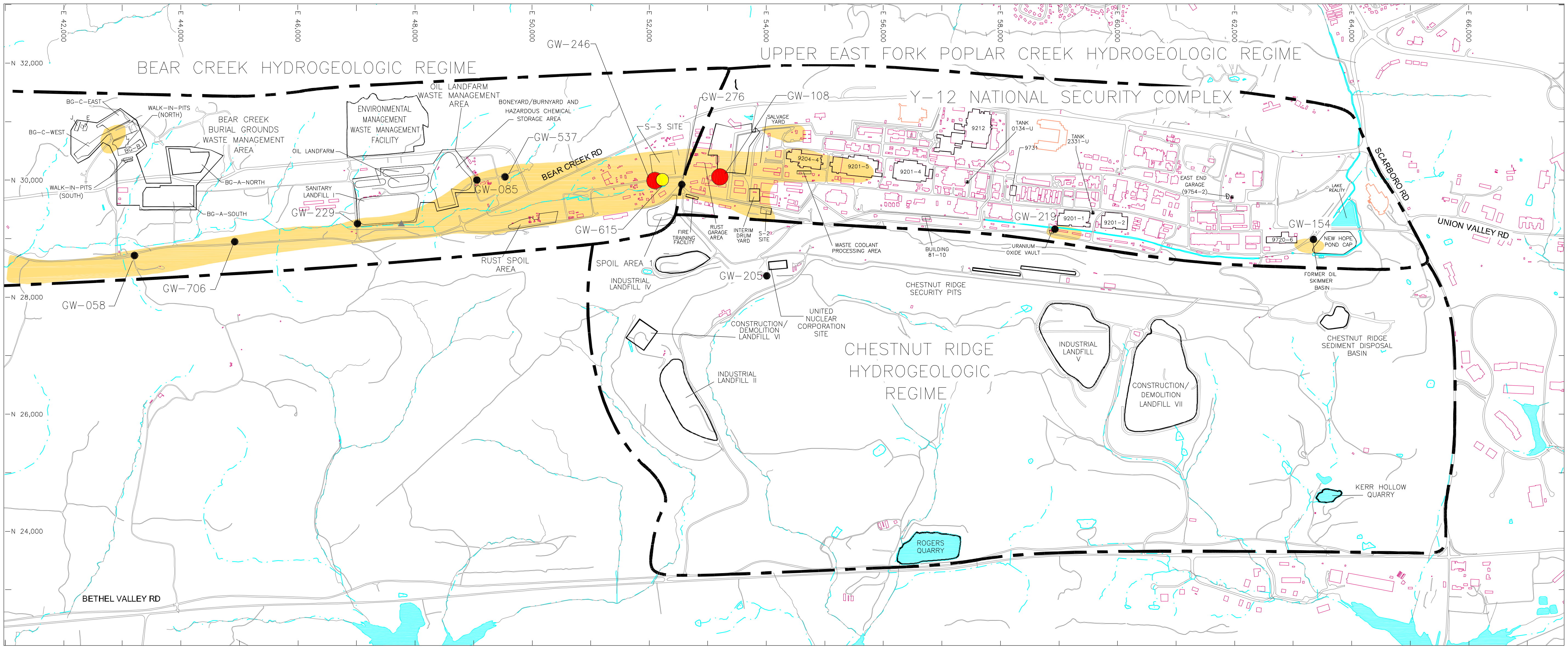
— SURFACE DRAINAGE FEATURE
— BOUNDARY OF SITE
— BOUNDARY OF REGIME
— BUILDINGS
— GROSS ALPHA > 15 pCi/L

MAXIMUM CY2009 GROSS ALPHA

— 15-150 pCi/L
— 150-1,500 pCi/L

Elvado: GWMR09_09

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



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

EXPLANATION

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

MAXIMUM CY2008 GROSS BETA

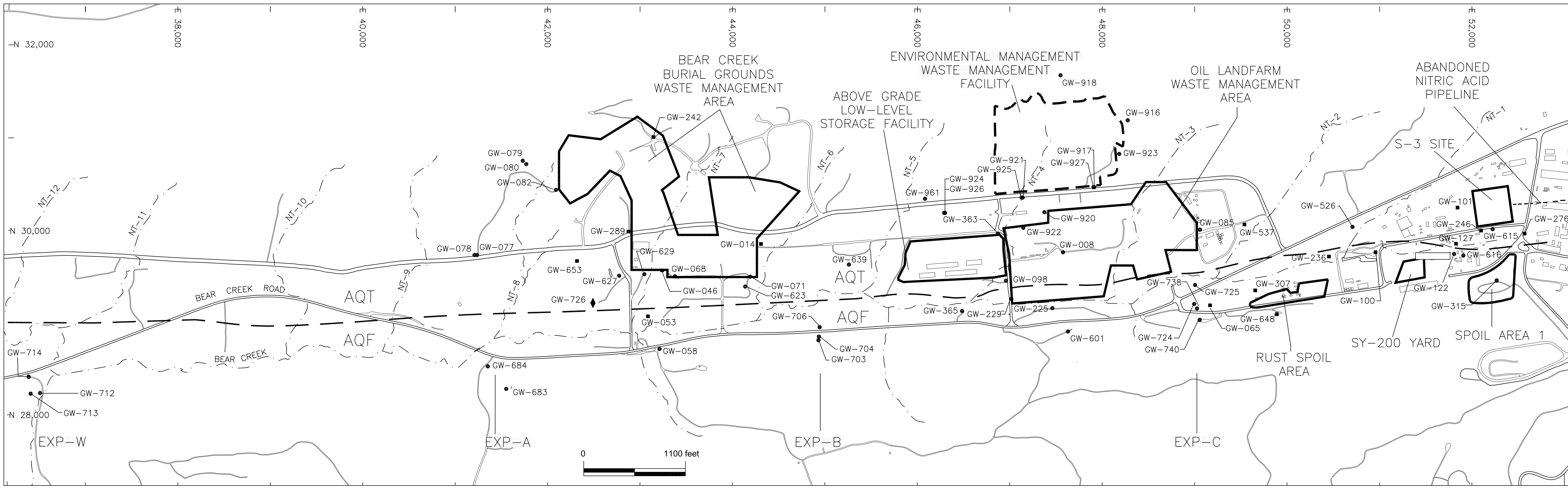
- 50-500 pCi/L
- 500-5,000 pCi/L
- >5,000 pCi/L

PLANT NORTH
NORTH
34°

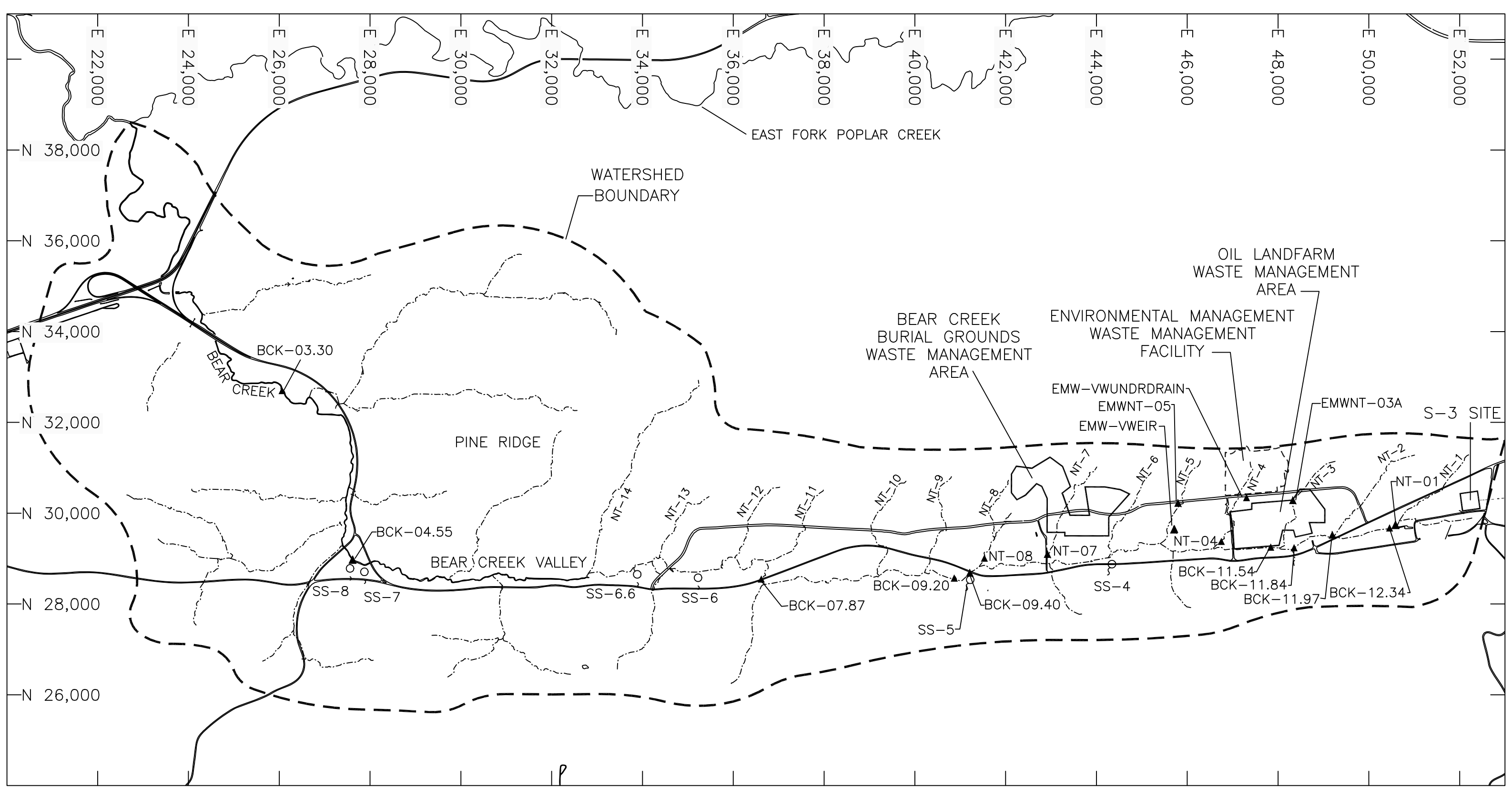
0 1800
SCALE (ft)

Elvado: GWMR09_10

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

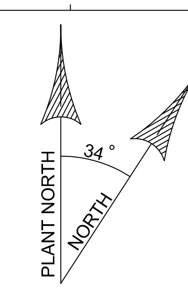


MONITORING WELL LOCATIONS



0 4000 feet

SPRING AND SURFACE WATER SAMPLING LOCATIONS

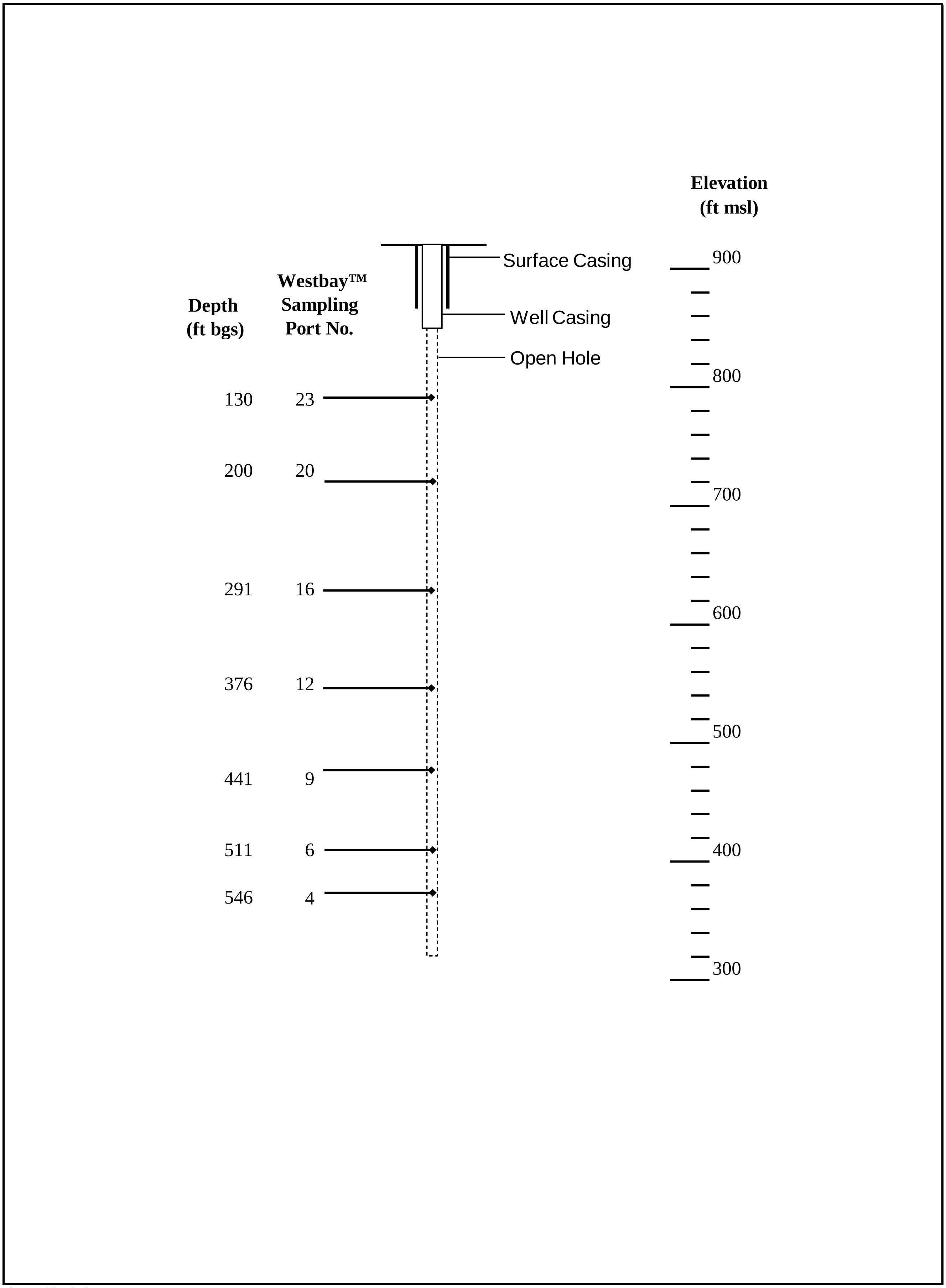


EXPLANATION

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

GWMR09_11 03/16/10

Fig. A.11. CY 2009 sampling locations in the Bear Creek Hydrogeologic Regime.



GWMR09_12.xls

Fig. A.12. Westbay™ monitoring system sampling port depths in well GW-726.

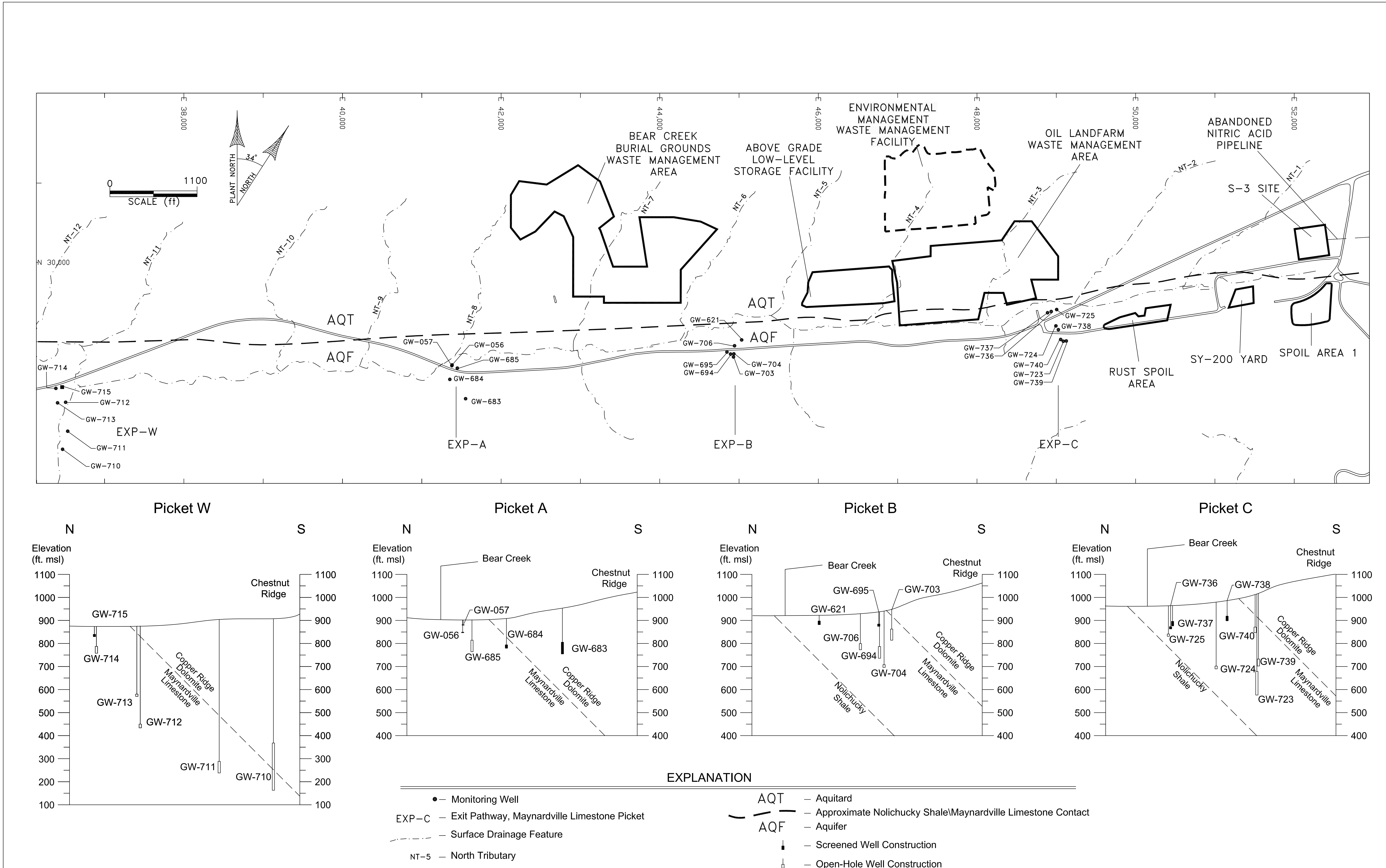
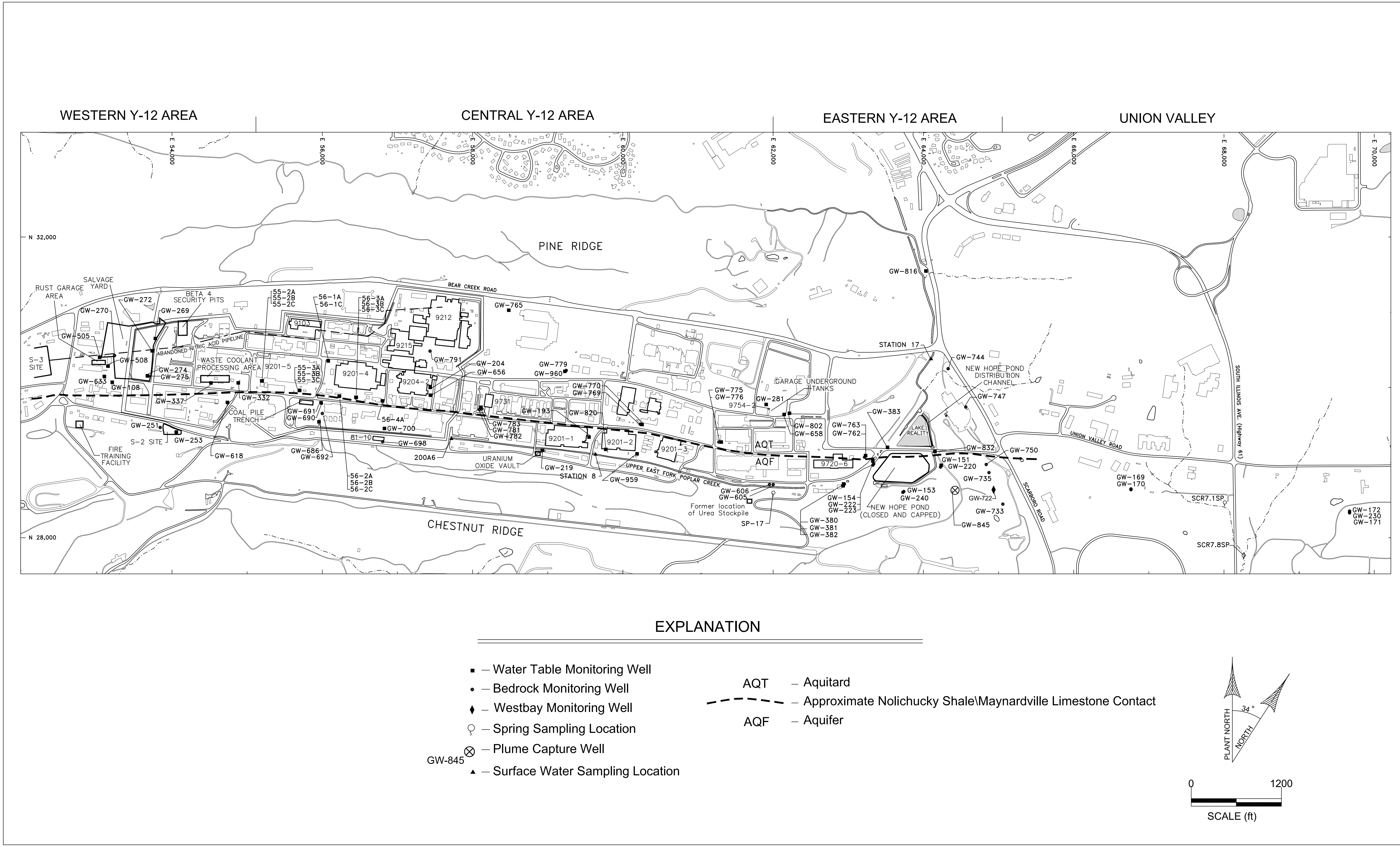
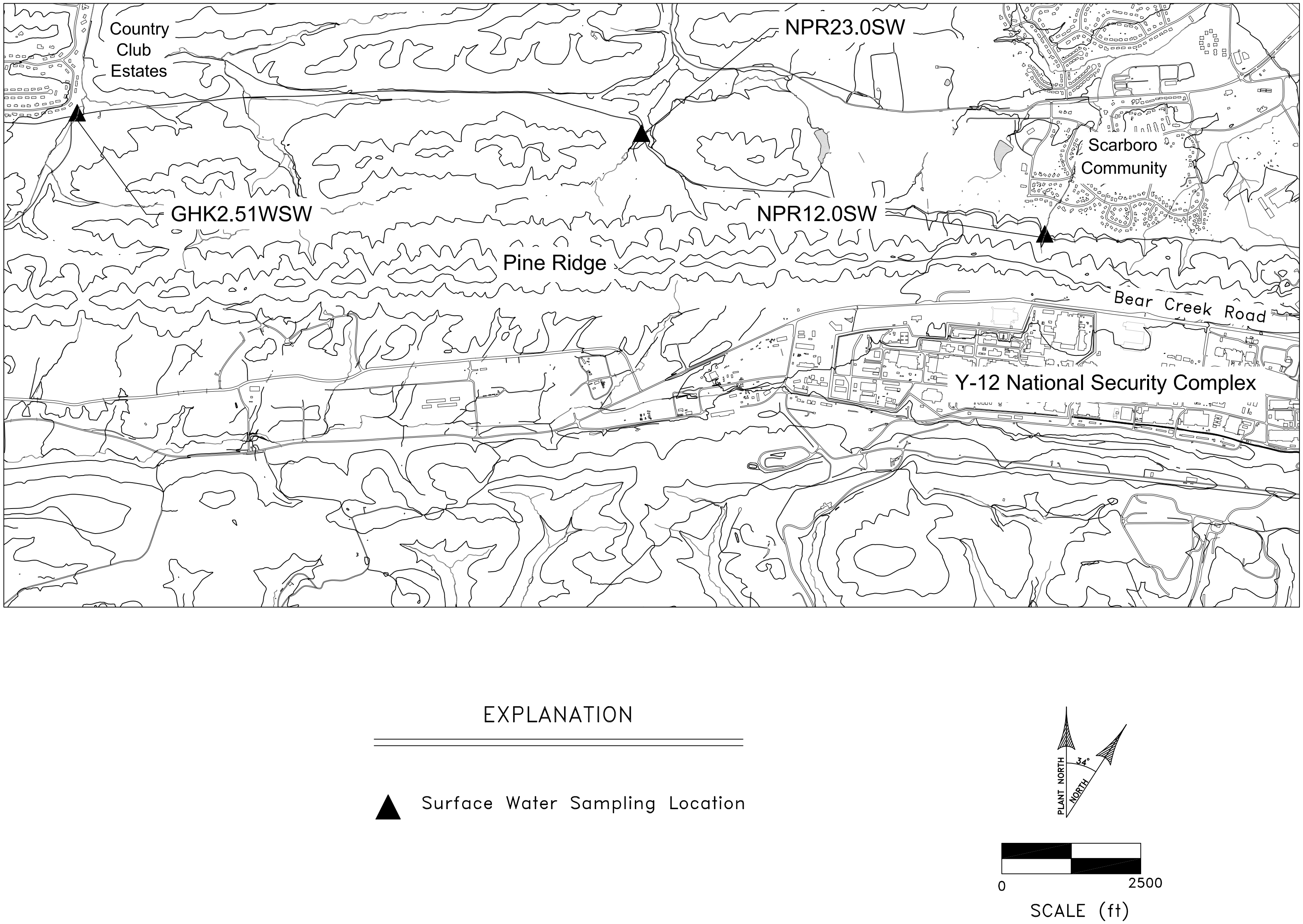


Fig. A.13. Components of Maynardville Limestone exit pathway pickets A, B, C, and W.



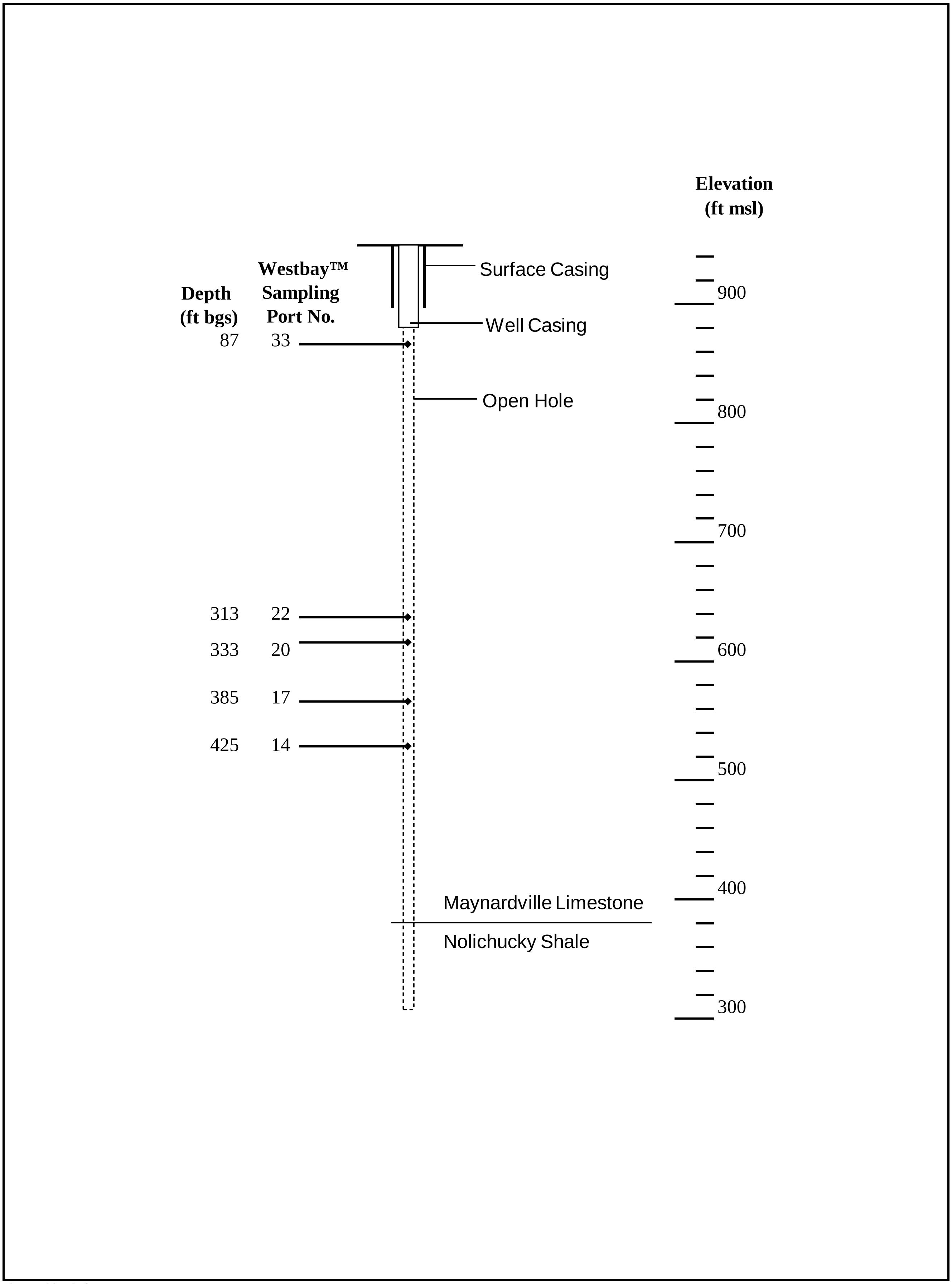
Elvado: GWMR_14

Fig. A.14. CY 2009 sampling locations in the Upper East Fork Poplar Creek Hydrogeologic Regime and in Union Valley.



Elvado: GWMR09_15

Fig. A.15. CY 2009 surface water sampling locations north of Pine Ridge.



GWMR09_16.xls

Fig. A.16. Westbay™ monitoring system sampling port depths in well GW-722.

GWMR09_17 03/16/10

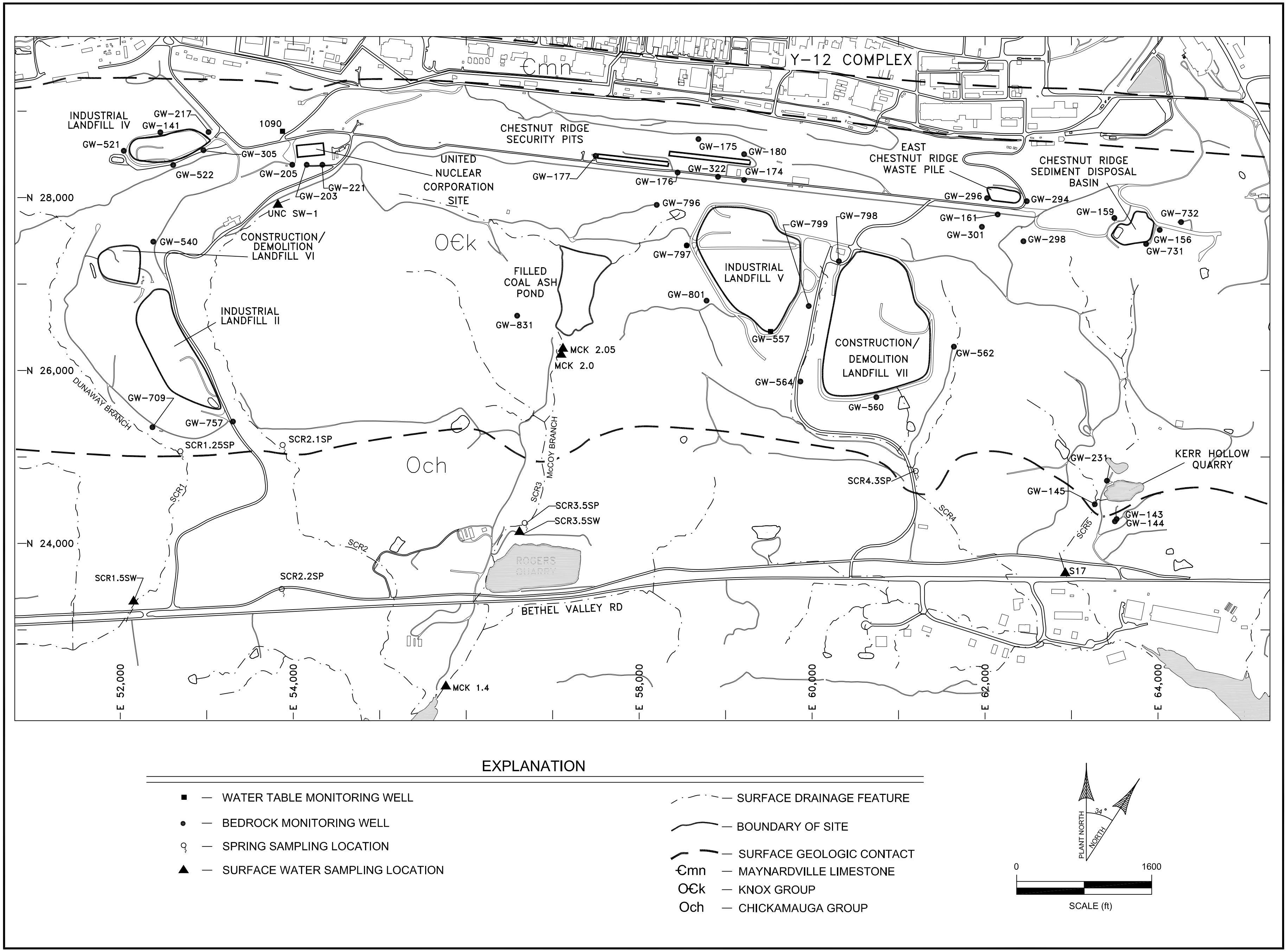
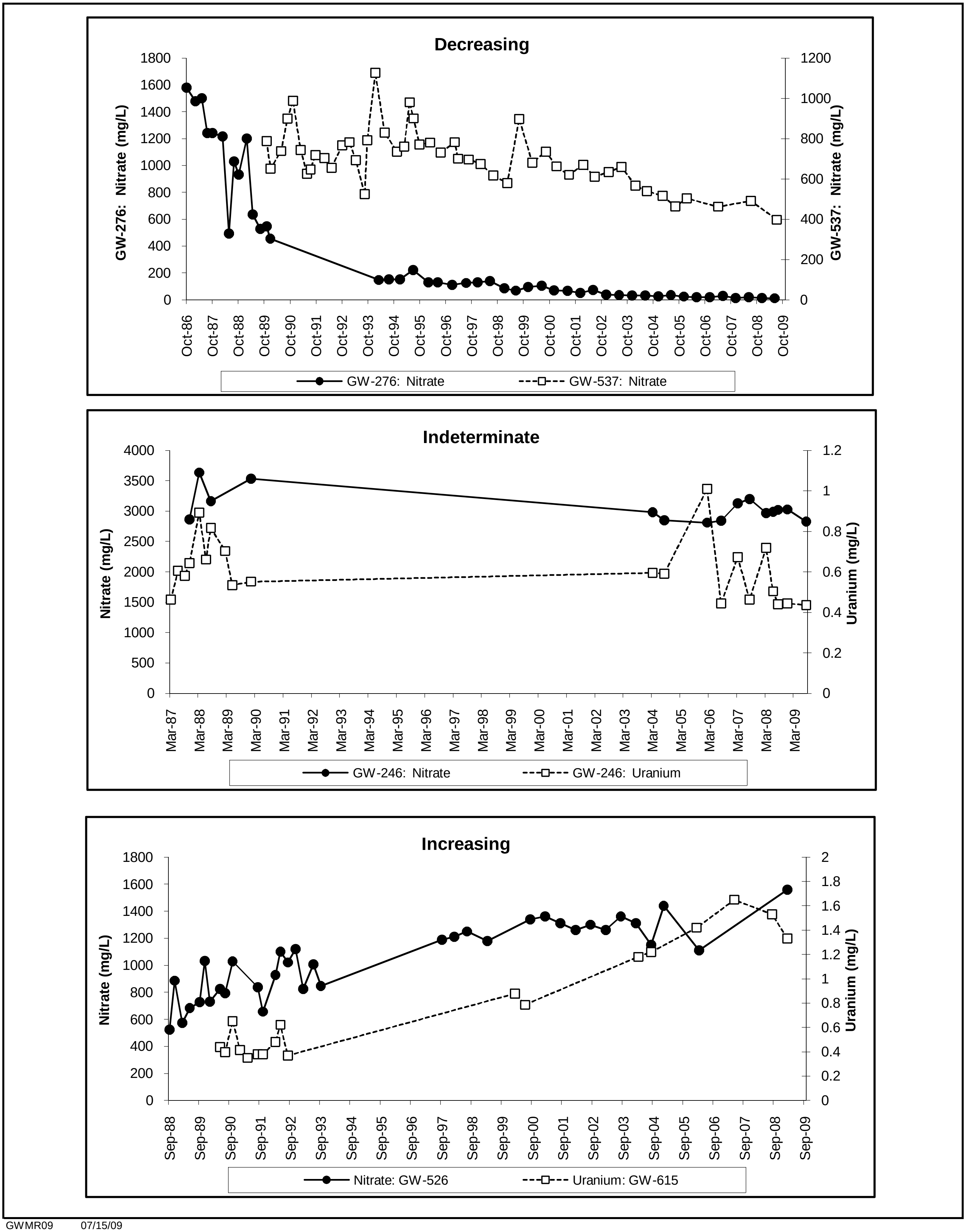
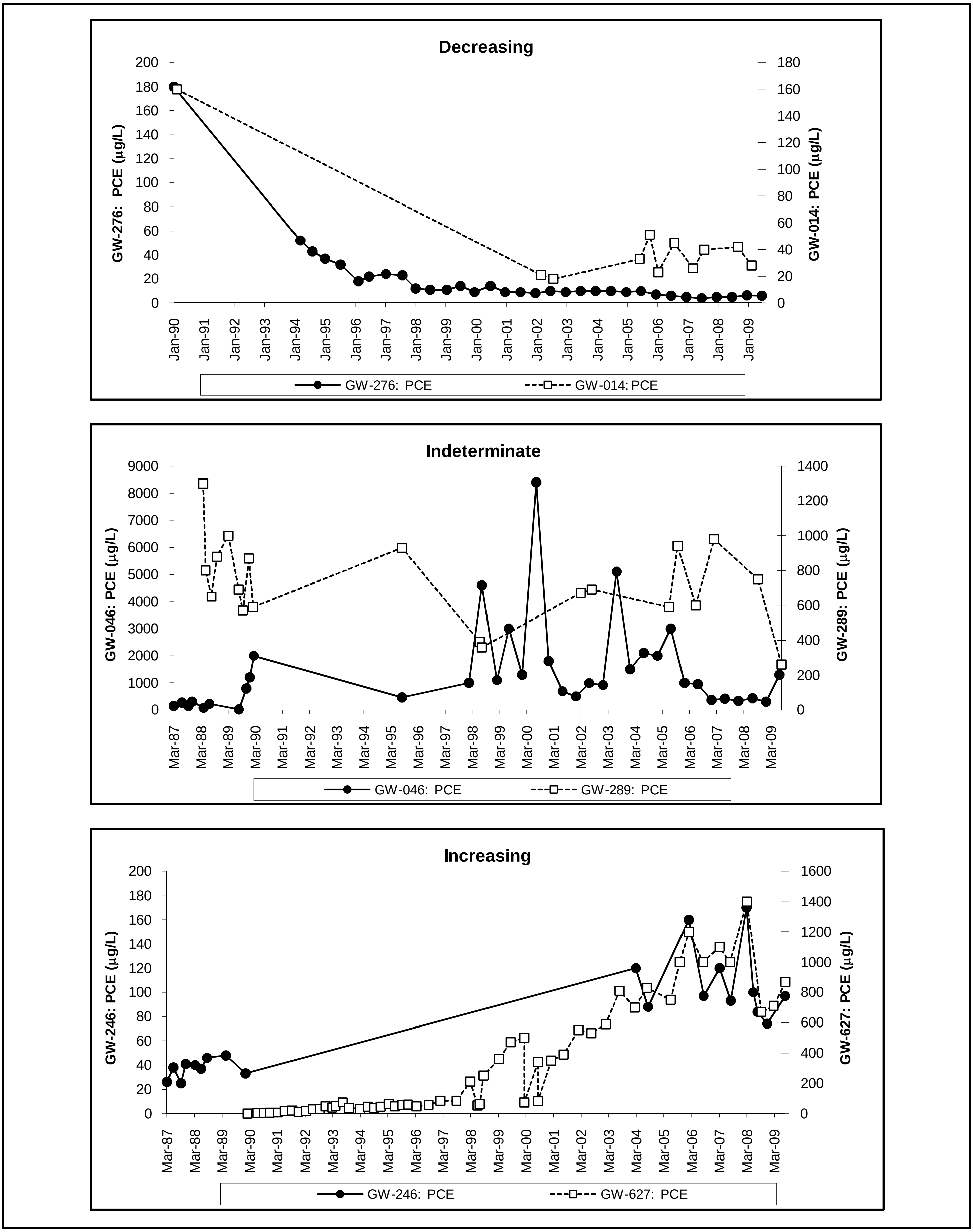


Fig. A.17. CY 2009 sampling locations in the Chestnut Ridge Hydrogeologic Regime.



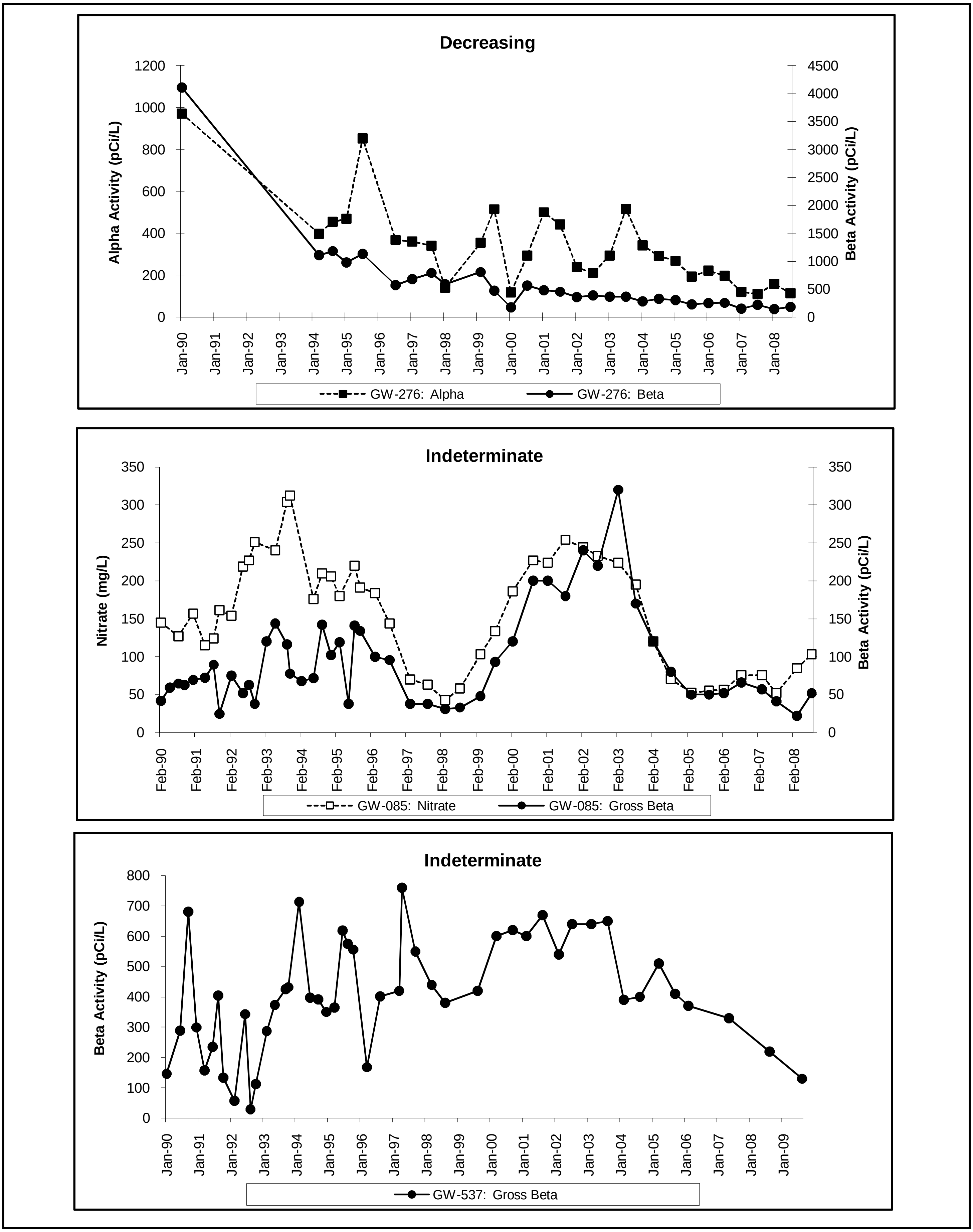
GWMR09 07/15/09

Fig. A.18. Bear Creek Regime CY 2009: nitrate and/or uranium concentration trends in surveillance monitoring aquitard wells GW-246, GW-276, GW-526, GW-537, and GW-615.



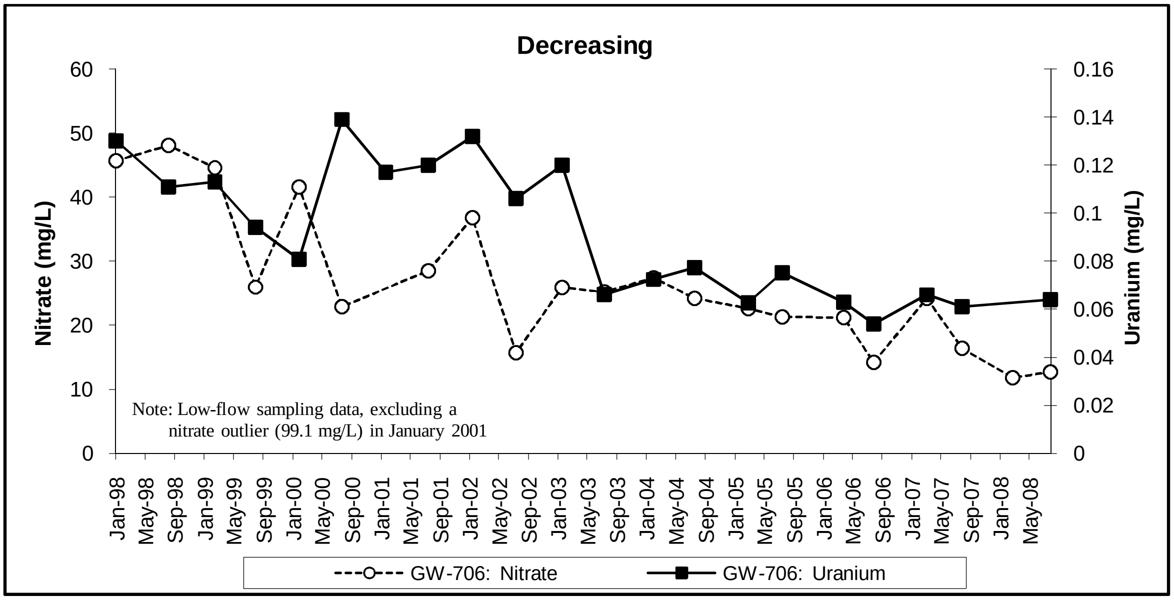
GWMR09 06/16/10

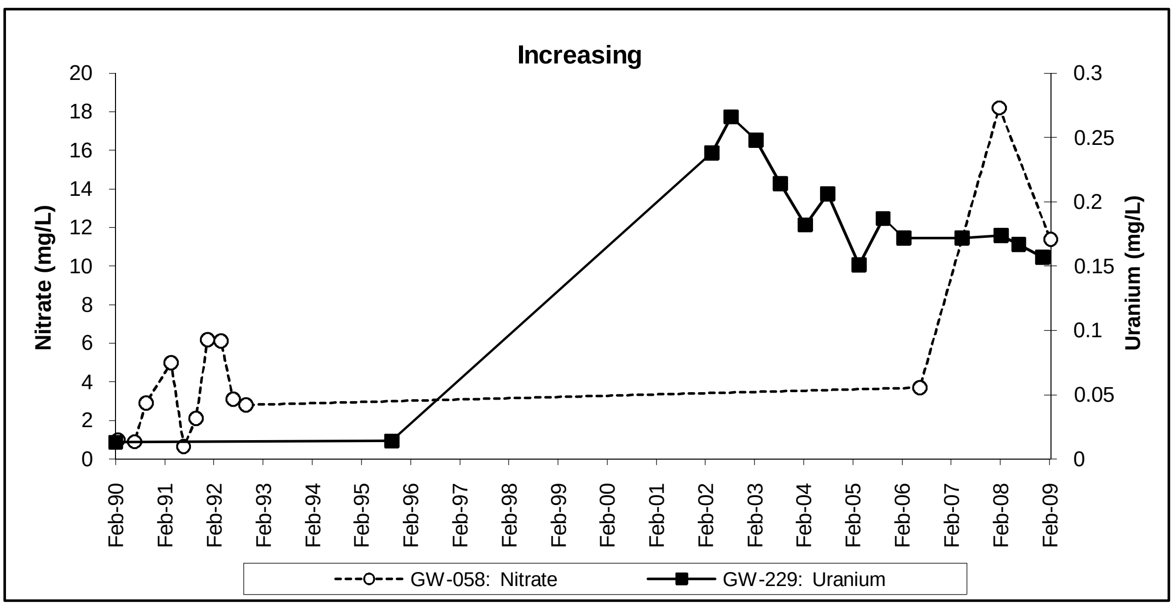
Fig. A.19. Bear Creek Regime CY 2009: PCE concentration trends in surveillance monitoring aquitard wells GW-014, GW-046, GW-246, GW-276, GW-289, and GW-627.



GWMR09 06/15/10

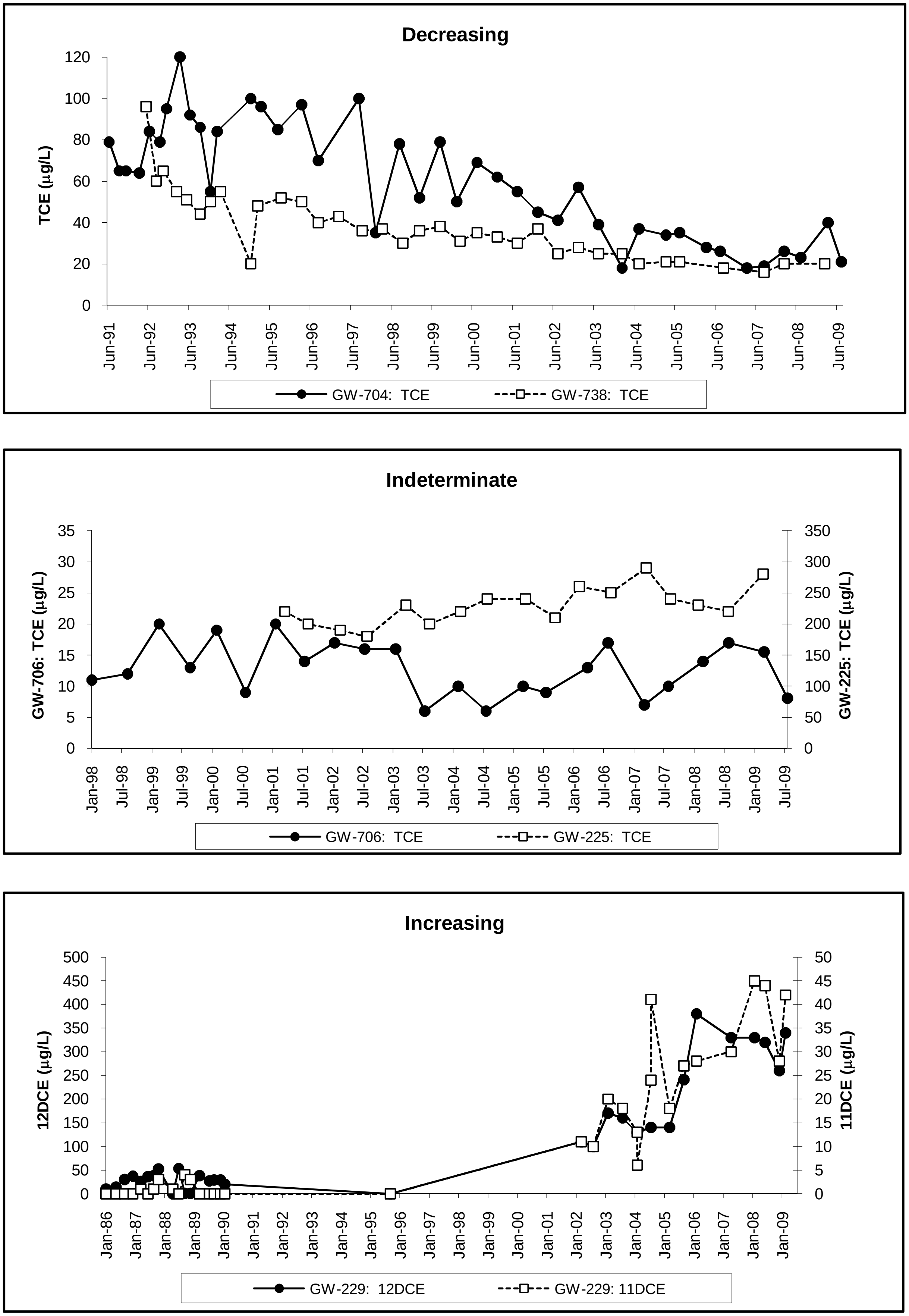
Fig. A.20. Bear Creek Regime CY 2009: gross alpha and/or gross beta activity trends in surveillance monitoring aquitard wells GW-085, GW-276, and GW-537.





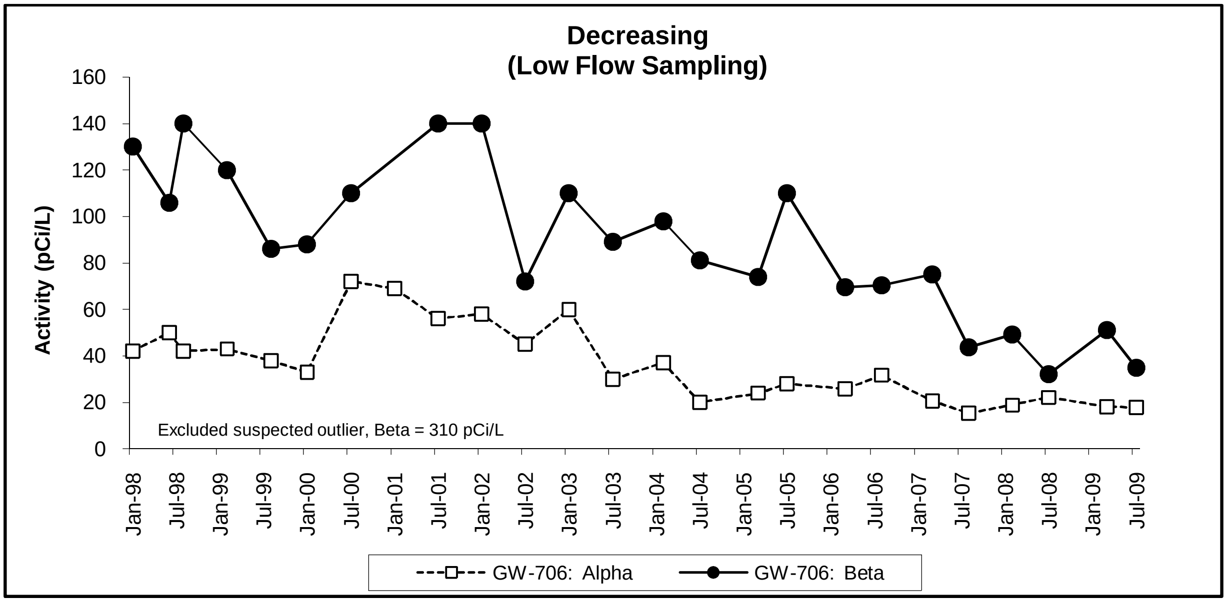
GWMR09 08/03/10

Fig. A.21. Bear Creek Regime CY 2009: nitrate and/or uranium concentration trends in surveillance monitoring aquifer wells GW-058, GW-229, and GW-706.



GWMR09 08/03/10

Fig. A.22. Bear Creek Regime CY 2009: selected VOC concentration trends in surveillance monitoring aquifer wells GW-225, GW-229, GW-704, GW-706, and GW-738.



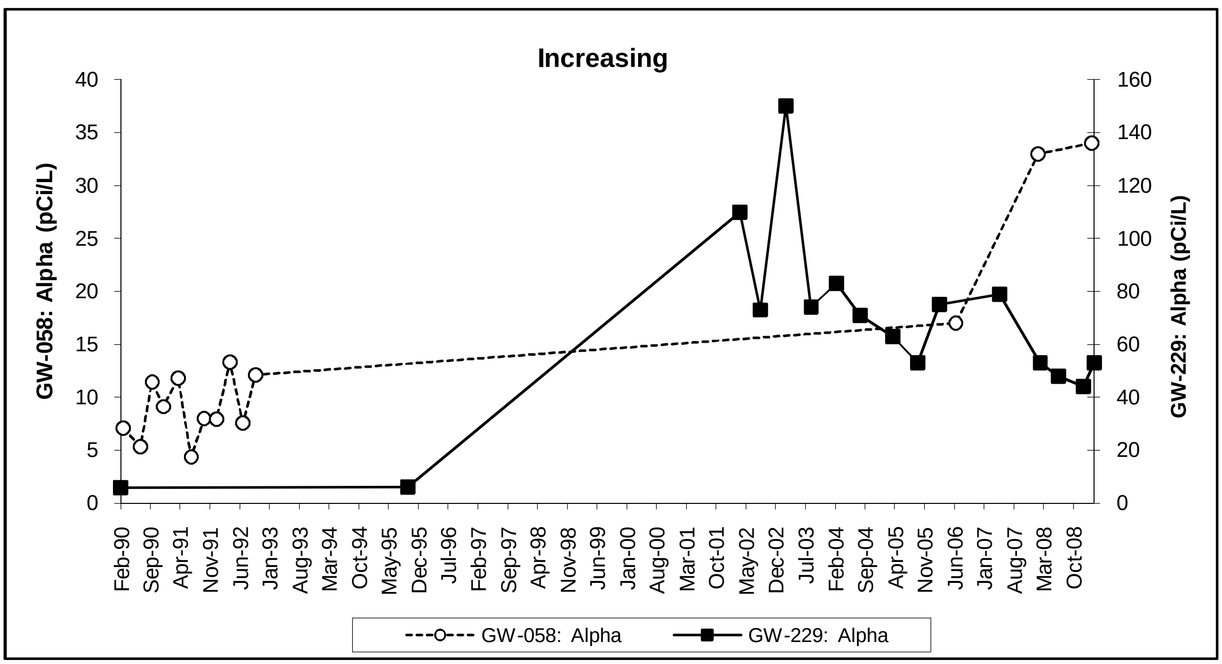
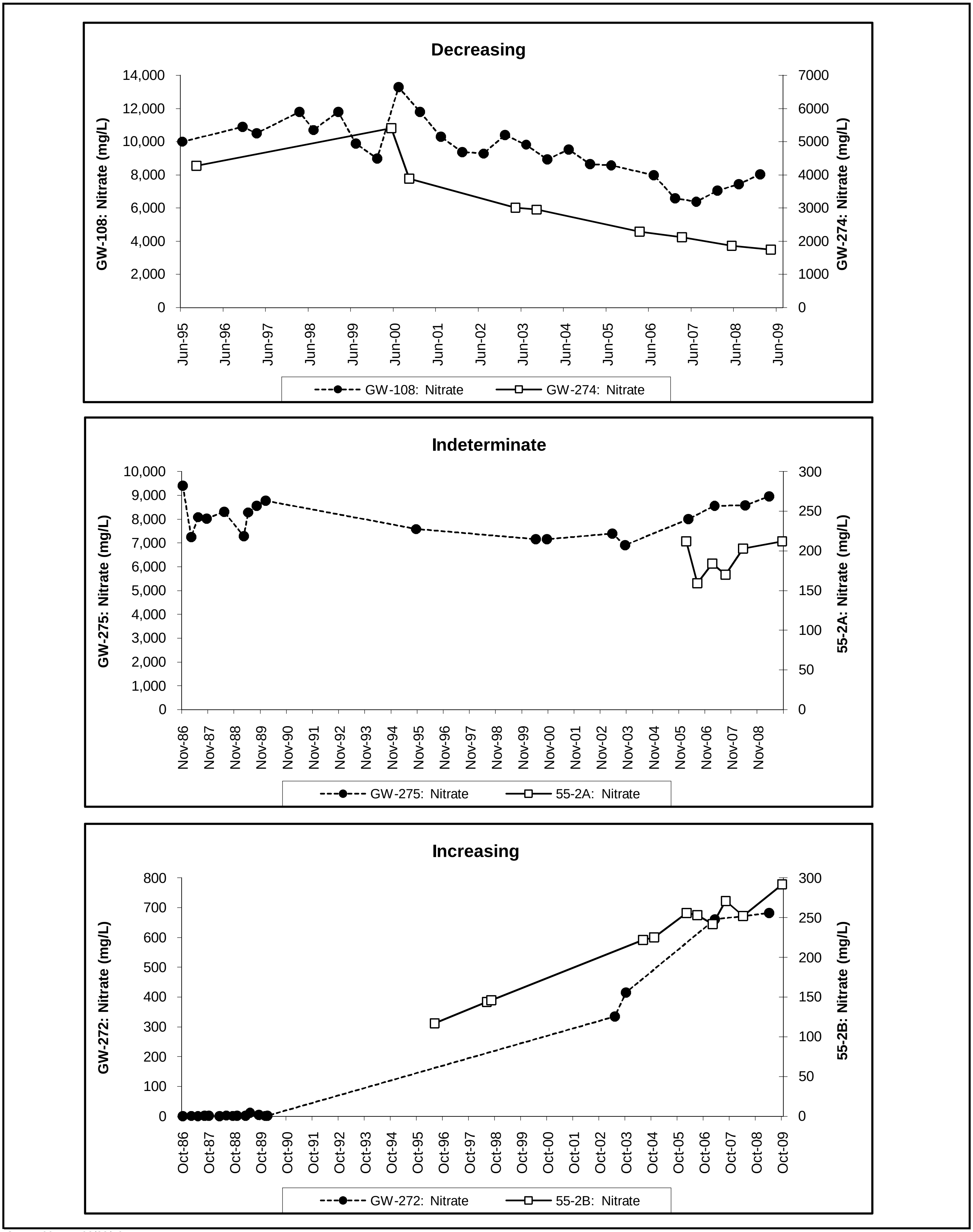
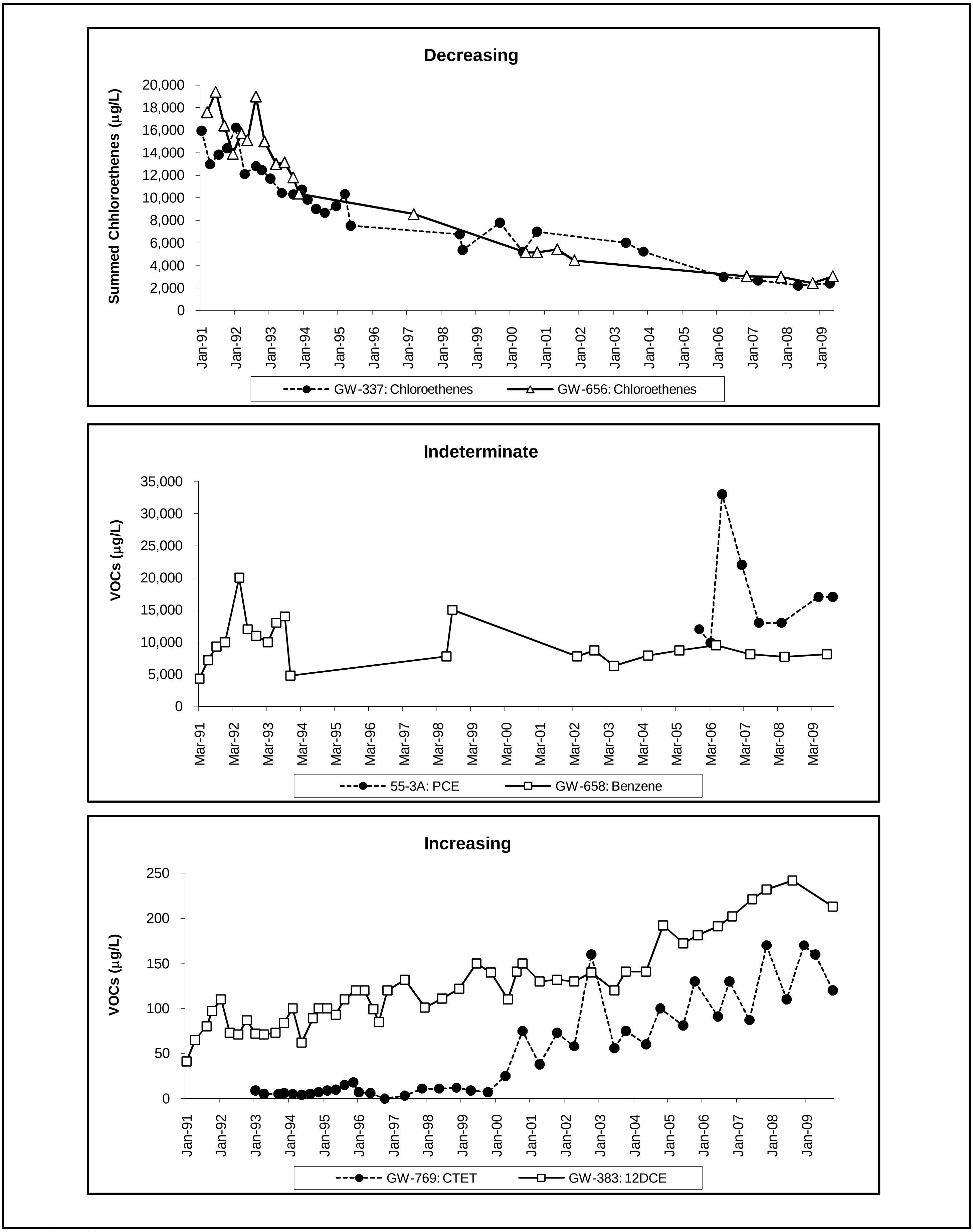


Fig. A.23. Bear Creek Regime CY 2009: gross alpha and/or gross beta activity trends in surveillance monitoring aquifer wells GW-058, GW-229, and GW-706.



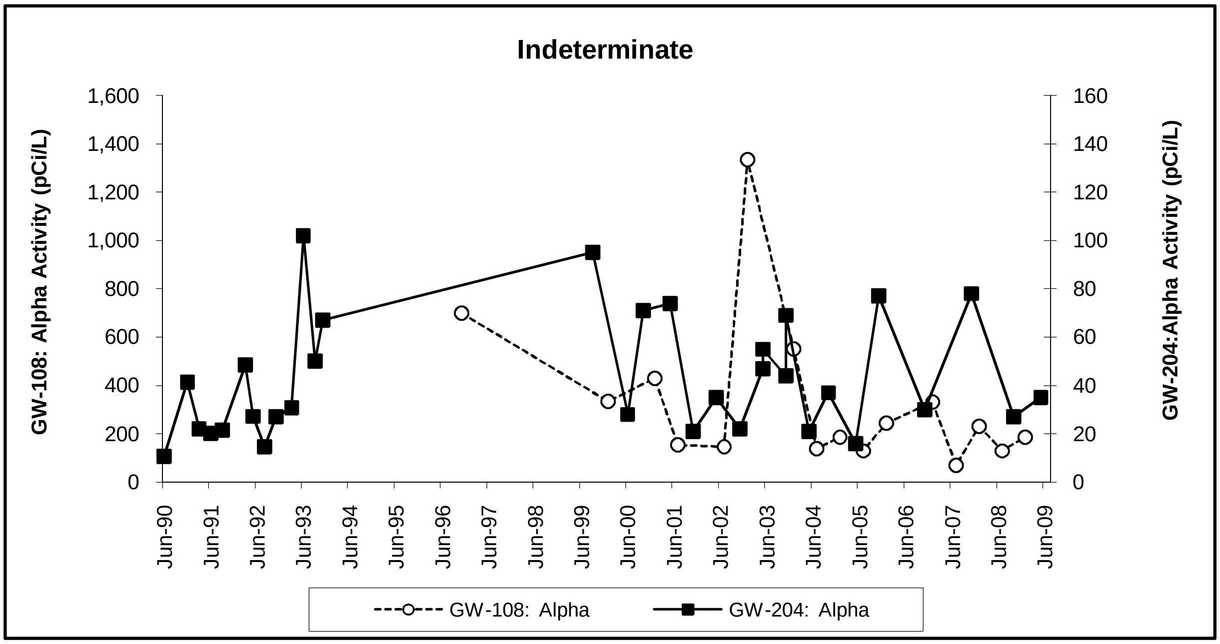
GWMR09 08/23/10

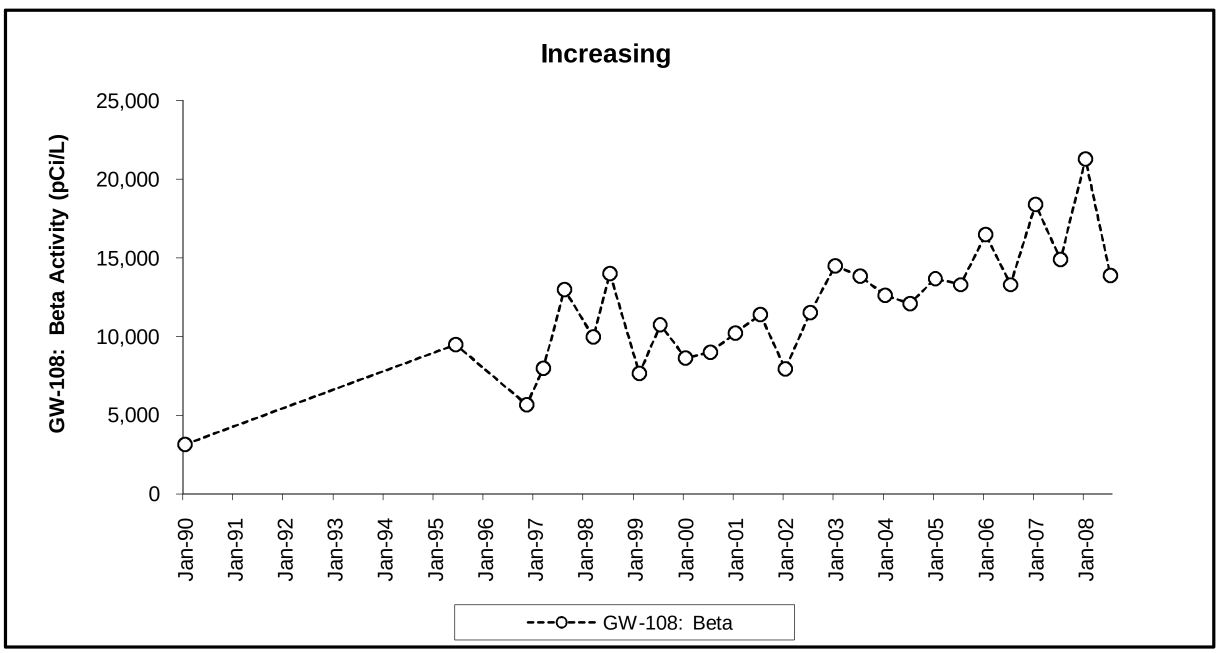
Fig. A.24. East Fork Regime CY 2009: nitrate concentration trends in surveillance monitoring aquitard wells 55-2A, 55-2B, GW-108, GW-272, GW-274, and GW-275.



GWMR09 08/24/10

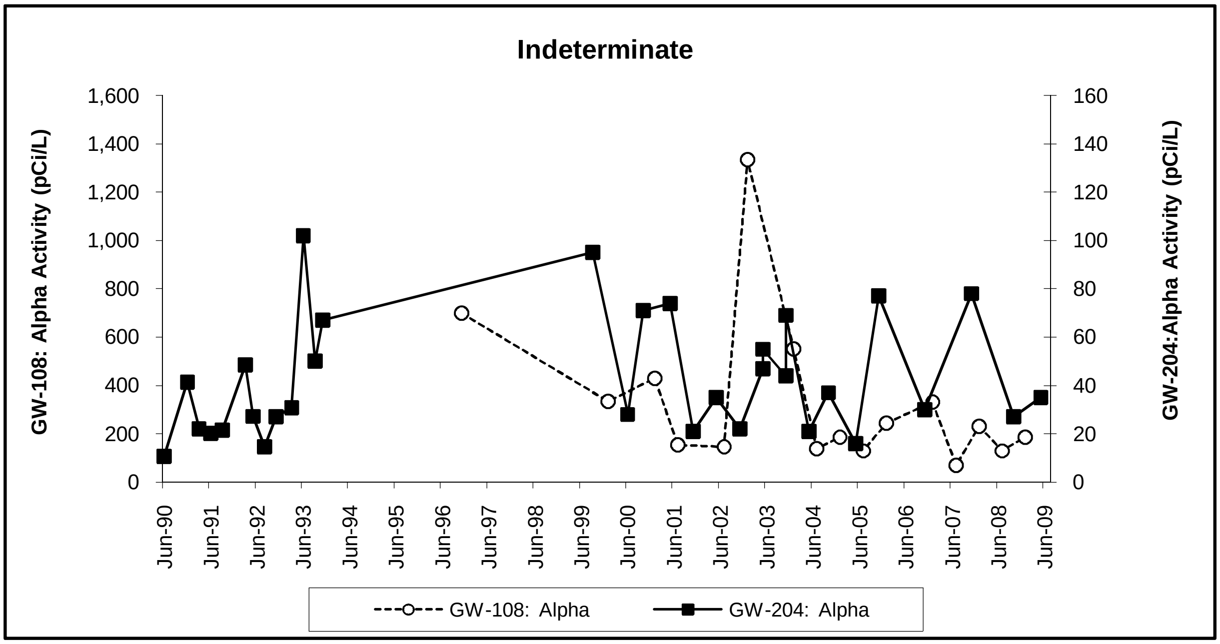
Fig. A.25. East Fork Regime CY 2009: summed VOC concentration trends in surveillance monitoring aquitard wells 55-3A, GW-337, GW-383, GW-656, GW-658, and GW-769.

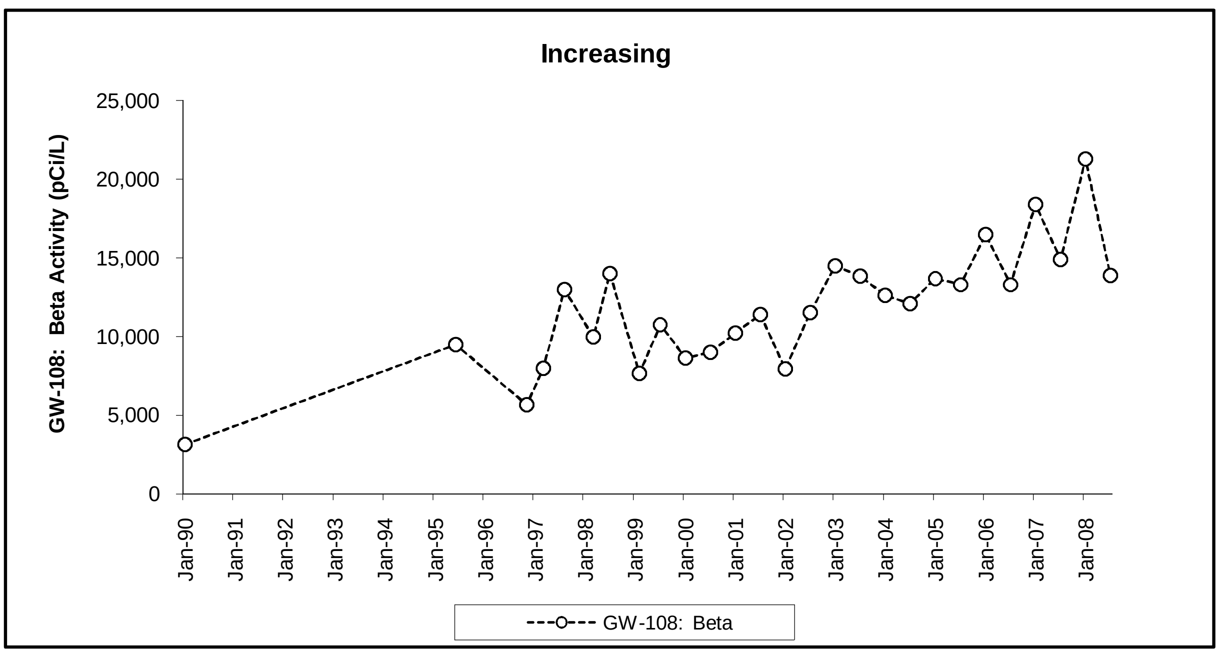




GWMR09 06/15/10

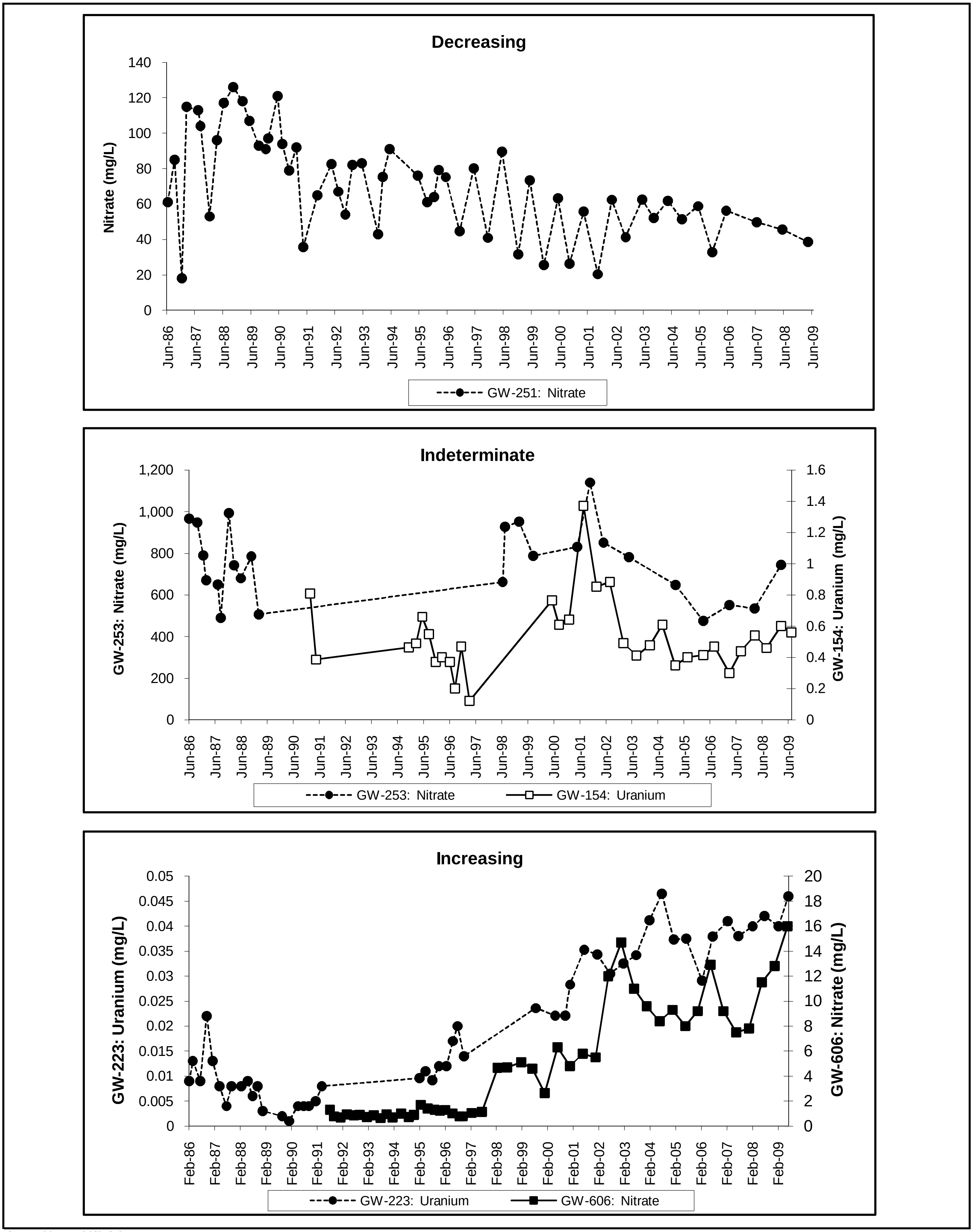
Fig. A.26. East Fork Regime CY 2009: gross alpha and/or gross beta activity trends in surveillance monitoring aquitard wells GW-108 and GW-204.





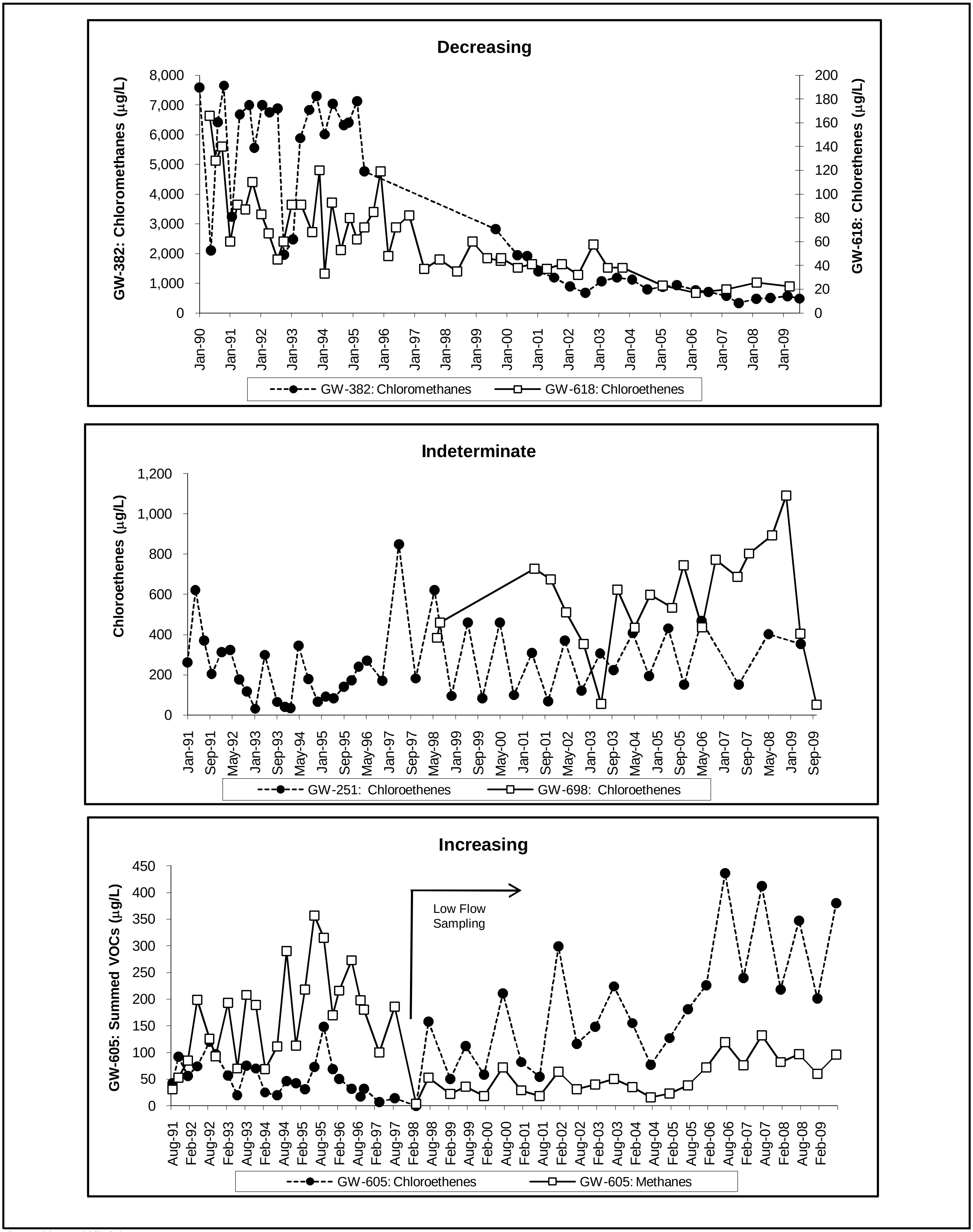
GWMR09 06/15/10

Fig. A.26. East Fork Regime CY 2009: gross alpha and/or gross beta activity trends in surveillance monitoring aquitard wells GW-108 and GW-204.



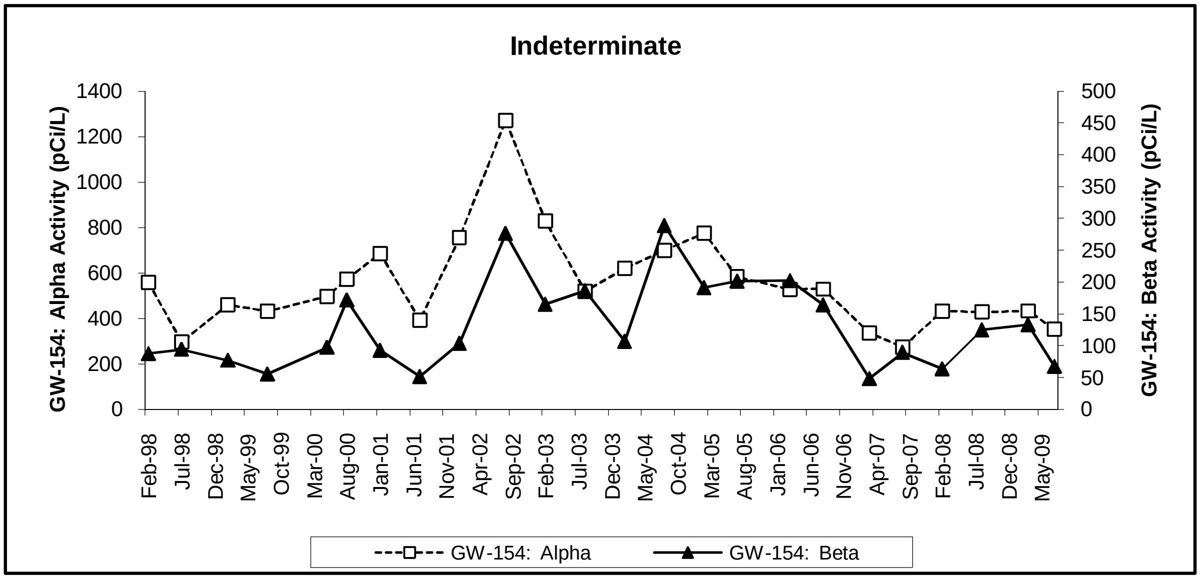
GWMR09 09/07/10

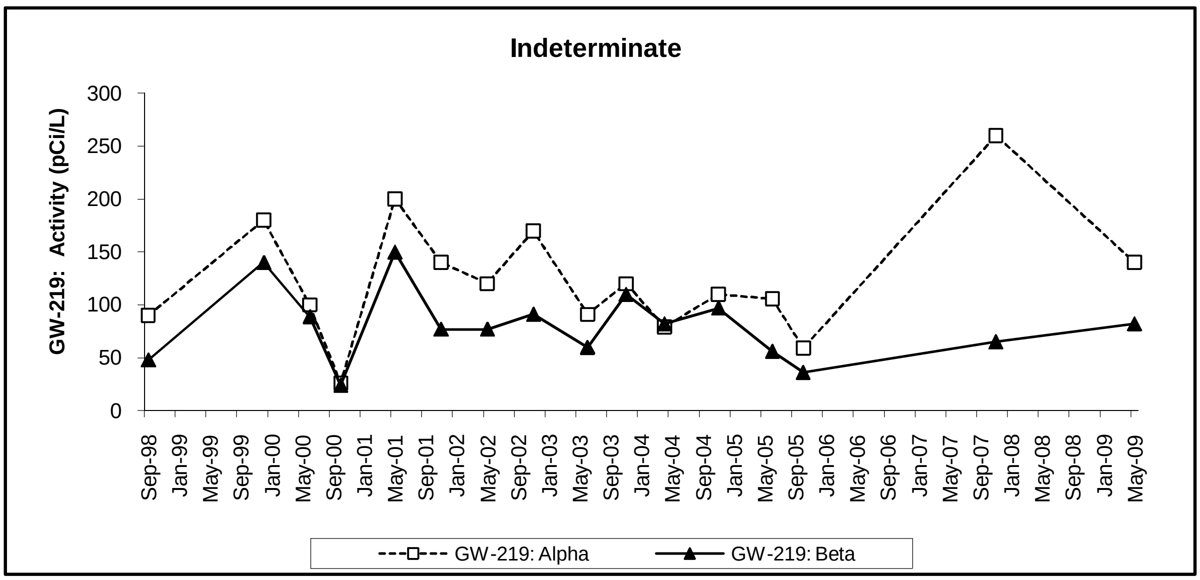
Fig. A.27. East Fork Regime CY 2009: nitrate and/or uranium concentration trends in surveillance monitoring aquifer wells GW-154, GW-223, GW-251, GW-253, and GW-606.

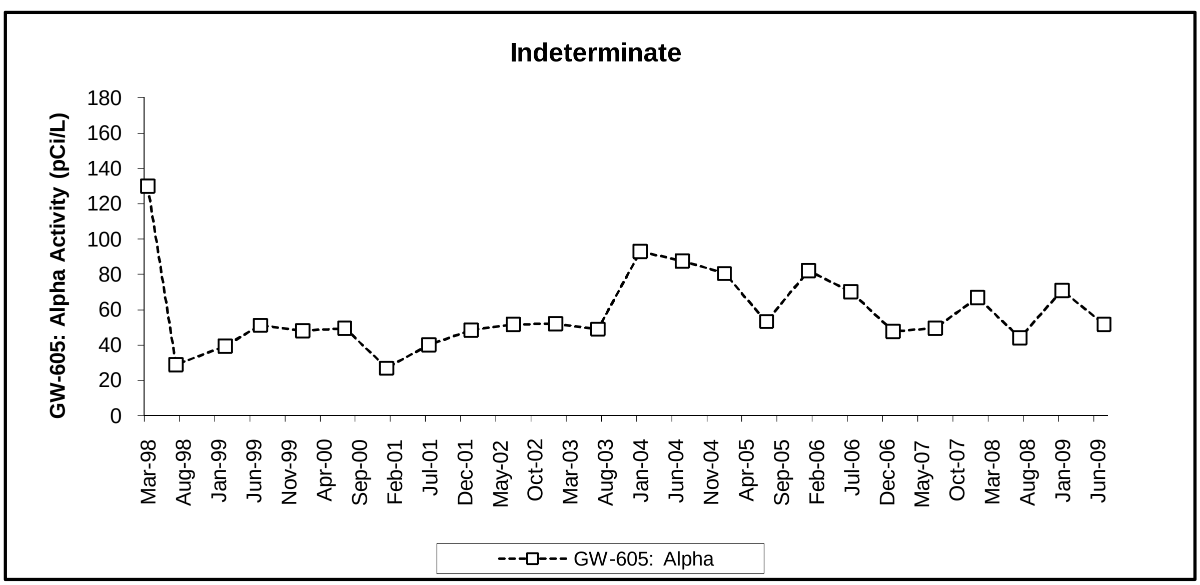


GWMR09 09/07/10

Fig. A.28. East Fork Regime CY 2009: selected VOC concentration trends in surveillance monitoring aquifer wells GW-251, GW-382, GW-605, GW-618, and GW-698.

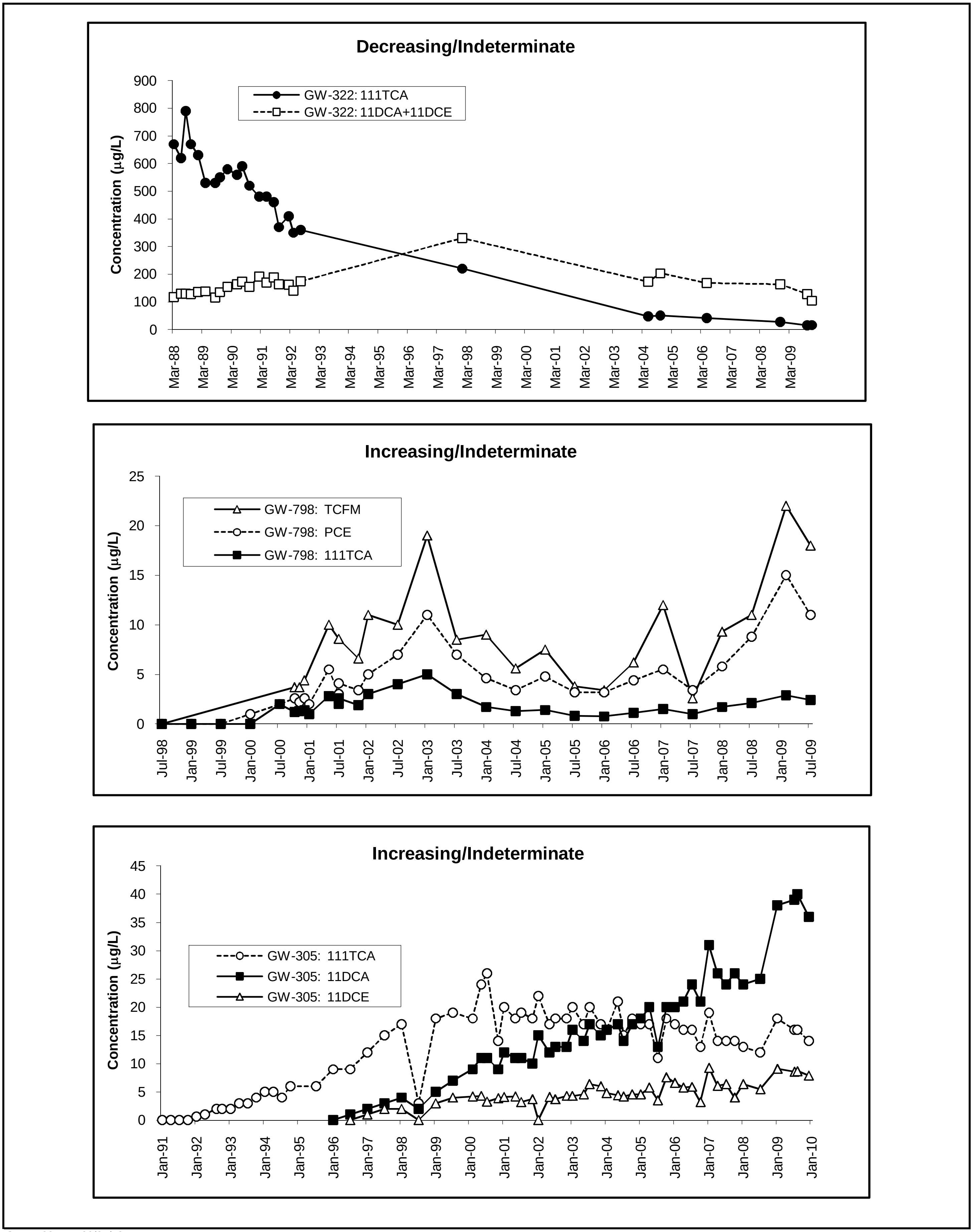






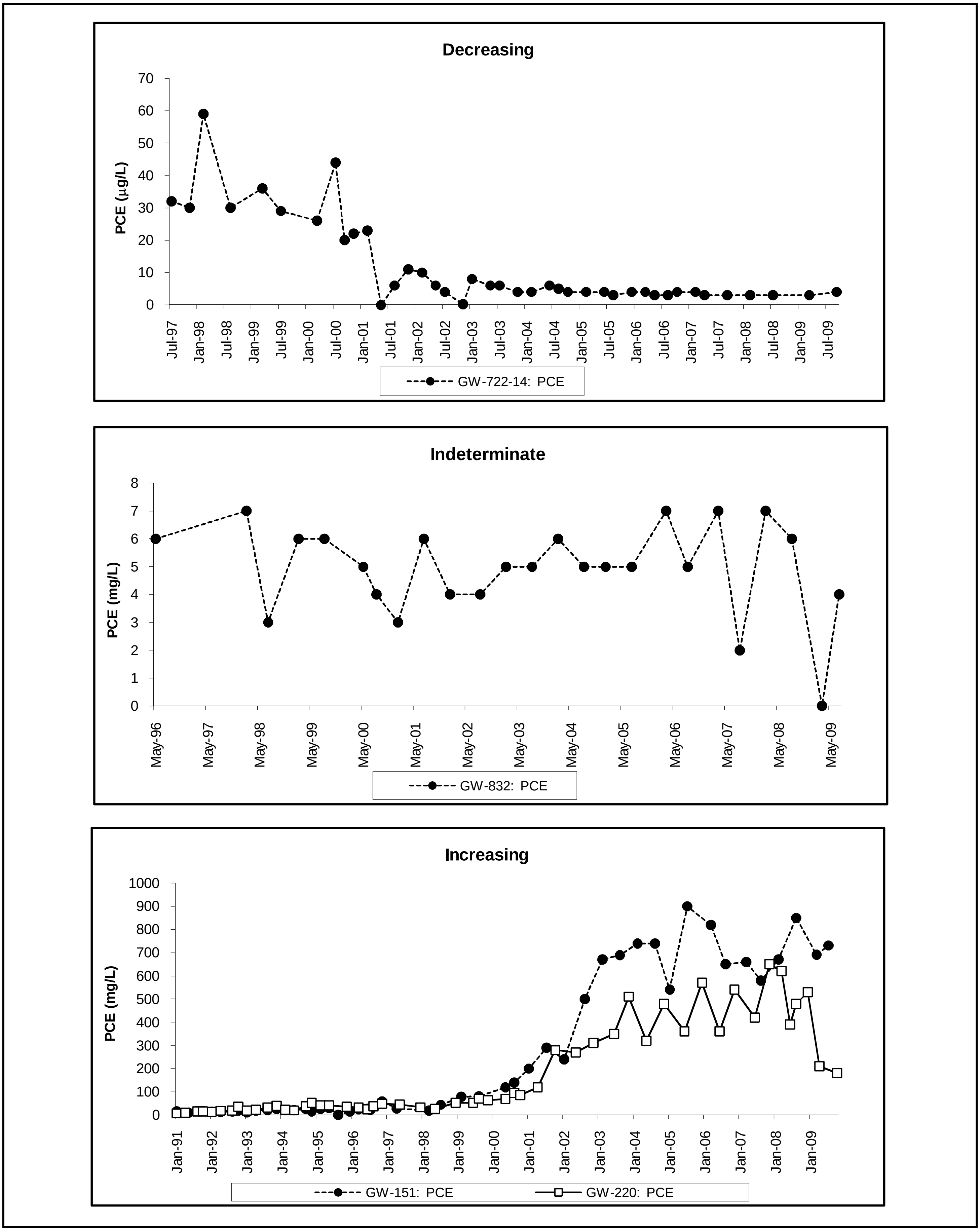
GWMR09 09/10/10

Fig. A.29. East Fork Regime CY 2009: gross alpha and/or gross beta activity trends in surveillance monitoring aquifer wells GW-154, GW-219, and GW-605.



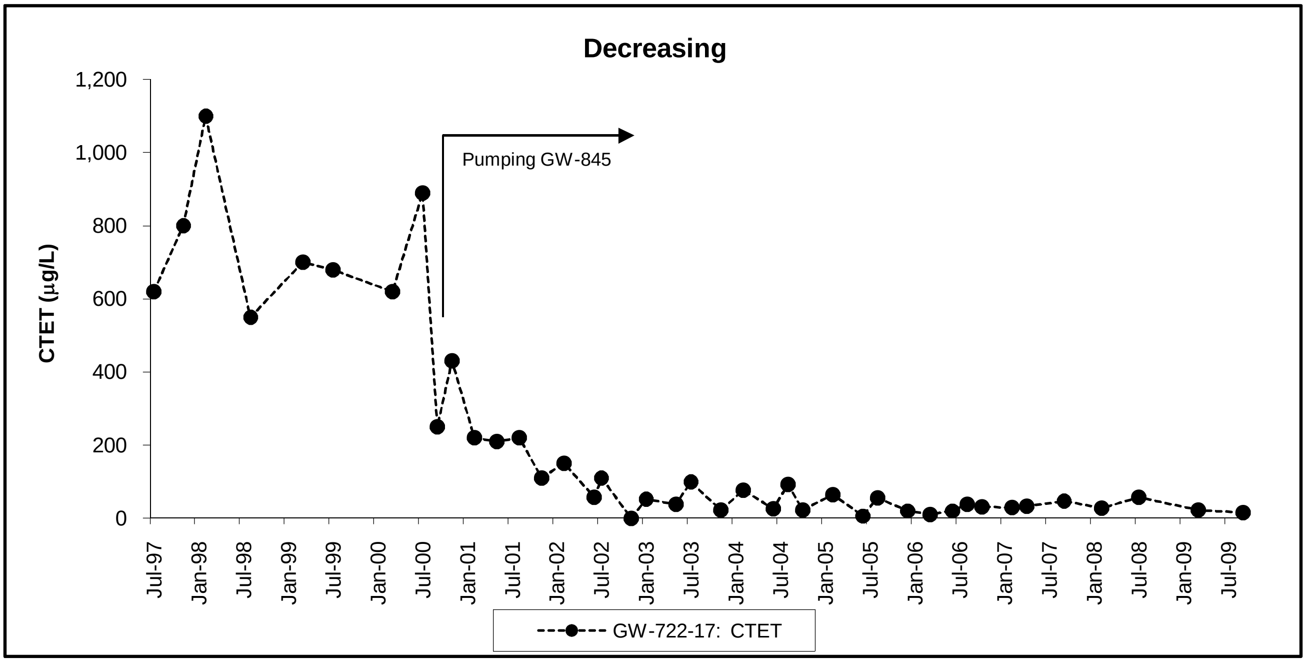
GWMR09 09/21/10

Fig. A.30. Chestnut Ridge Regime CY 2009: VOC trends in surveillance monitoring wells GW-305, GW-322, and GW-798.



GWMR09 09/21/10

Fig. A.31. East Fork Regime CY 2009: PCE concentration trends in exit pathway monitoring wells GW-151, GW-220, GW-722-14, and GW-832.



GWMR09 09/07/10

Fig. A.32. East Fork Regime CY 2009: CTET concentration trend in exit pathway monitoring well GW-722-17.

APPENDIX B

TABLES

Table B.1. Summary of CY 2009 sampling and analysis plan addenda

Addendum No.	Effective Date	Modification to the CY 2009 Sampling and Analysis Plan [1]
2009-01	09/09/09	Add collection of a groundwater sample, using a bailer, from well GW-629 to evaluate the the composition of the oil observed on the passive diffusion bag when retrieved from the well on August 6, 2009.
2009-02	12-16-09	Add collection of groundwater samples using the low-flow method at wells GW-175 and GW-305 (YGW112-CR) during the fourth quarter. Samples were collected using passive diffusion bags and analytical results were significantly lower than expected.
2009-03	07/29/09	Documents the sample results by the SW846-6020 method (ICPMS) for the third and fourth quarter sampling events have elevated detection limits caused by dilution used during analyses to accommodate interference issues.
2009-04	01/08/09	Changes the lab test code used on the bottle list for volatile organic analysis of samples collected using a passive diffusion bag sampler.

Note:

1 Modification to the *Y-12 Groundwater Protection Program Groundwater and Surface Water Sampling and Analysis Plan for Calendar Year 2009* (B&W Y-12 2008).

Table B.2. CY 2009 groundwater and surface water sampling dates
in the Bear Creek Hydrogeologic Regime

Sampling Point[3]	Functional Area[4]	CY 2009 Sampling Date[5]				DOE Order Surveillance Monitoring (GWPP[2])	DOE Order Exit Pathway/Perimeter Monitoring (GWPP[2])	RCRA Post-Closure Corrective Action Monitoring (BJC[1])	CERCLA ROD (●), Detection (□), and Baseline (○) Monitoring (BJC[1])
		1st Quarter	2nd Quarter	3rd Quarter	4th Quarter				
GW-008	OLF	01/06/09	.	07/06/09	.	x		●	
GW-014	BG	03/04/09	.	.	.	●			
GW-046	BG	01/07/09	.	07/06/09	.	x		●	
GW-053	BG	**03/03/09 D**	.	.	.	●			
GW-058	BG	02/10/09	.	.	.	●			
GW-065	OLF	02/25/09	.	08/06/09	.	●			
GW-068	BG	03/03/09	.	.	.	●			
GW-071	BG	03/04/09	.	08/10/09	.	●			
GW-077	BG	03/02/09	.	07/21/09	.	x			●
GW-078	BG	03/02/09	.	07/21/09	.	x			●
GW-079	BG	03/02/09	.	07/22/09	.	x			●
GW-080	BG	**03/02/09 D**	.	**07/22/09 D**	.	x			●
GW-082	BG	.	.	08/10/09	.	●			
GW-085	OLF	**02/23/09 D**	.	.	.	●			
GW-098	OLF	02/25/09	.	.	.	●			
GW-100	S3	02/19/09	.	.	.	●			
GW-101	S3	02/19/09	.	.	.	●			
GW-122	S3	02/17/09	.	.	.	●			
GW-127	S3	02/17/09	.	.	.	●			
GW-225	OLF	02/26/09	.	.	.	●			
GW-229	OLF	02/26/09	.	.	.	●			
GW-236	S3	02/23/09	.	.	.	●			
GW-242	BG	03/05/09	.	.	.	●			
GW-246	S3	.	.	08/05/09	.	●			
GW-276	S3	01/07/09	.	07/06/09	.	x		●	
GW-289	BG	.	.	**08/06/09 D**	.	●			
GW-307	RS	**02/10/09 D**	.	.	.	●			
GW-315	SPI	02/17/09	.	.	.	●			
GW-363*	EMWMF	02/17/09	04/22/09	08/19/09	11/19/09	x			□
GW-363	EMWMF	02/18/09	04/23/09	08/20/09		x			□
GW-365	OLF	03/02/09	.	.	.	●			
GW-526	S3	02/24/09	.	.	.	●			
GW-537	OLF	.	.	08/05/09	.	●			
GW-601	OLF	03/02/09	.	.	.	●			

Table B.2 (continued)

BJC [1] / GWPP [2]						DOE Order Surveillance Monitoring	DOE Order Exit Pathway/Perimeter Monitoring	RCRA Post-Closure Corrective Action Monitoring	CERCLA ROD (●), Detection (□), and Baseline (○) Monitoring
Sampling Point [3]	Functional Area [4]	CY 2009 Sampling Date [5] 1st Quarter	2nd Quarter	3rd Quarter	4th Quarter				
GW-615	S3	02/18/09	.	.	.	●			
GW-616	S3	.	.	08/05/09	.	●			
GW-623	BG	03/03/09	.	.	.	●			
GW-627	BG	03/05/09	.	08/06/09	.	●			
GW-629	BG	03/05/09	.	08/06/09	.	●			
GW-629	BG	.	.	09/09/09 **B**	.	●			
GW-639*	EMWMF	02/17/09	04/22/09	08/18/09	11/18/09	x			□
GW-639	EMWMF	02/18/09	04/23/09	08/19/09		x			□
GW-648	RS	**02/09/09 D**	.	08/05/09	.	●			
GW-653	BG	03/05/09	.	.	.	●			
GW-683	EXP-A	03/04/09	.	07/21/09	.	x			●
GW-684	EXP-A	03/03/09	.	07/20/09	.	x			●
GW-703	EXP-B	02/26/09	.	.	.	●			
GW-704	EXP-B	03/03/09	.	07/21/09	.	x			●
GW-706	EXP-B	03/03/09	.	07/22/09	.	x			●
GW-712	EXP-W	01/07/09	.	07/06/09	.		x	●	
GW-713	EXP-W	**01/07/09 D**	.	**07/07/09 D**	.		x	●	
GW-714	EXP-W	01/06/09	.	07/06/09	.		x	●	
GW-724	EXP-C	02/25/09	.	.	.	●			
GW-725	EXP-C	02/25/09	.	.	.	●			
GW-726-04	BG	.	05/04/09	.	.	●			
GW-726-06	BG	.	05/04/09	.	.	●			
GW-726-09	BG	.	05/05/09	.	.	●			
GW-726-12	BG	.	05/05/09	.	.	●			
GW-726-16	BG	.	05/06/09	.	.	●			
GW-726-20	BG	.	05/06/09	.	.	●			
GW-726-23	BG	.	05/06/09	.	.	●			
GW-738	EXP-C	02/25/09	.	.	.	●			
GW-740	EXP-C	02/24/09	.	.	.	●			
GW-916	EMWMF	02/12/09	04/15/09	08/11/09	11/11/09	x			□
GW-917	EMWMF	02/09/09	04/14/09	08/12/09	11/09/09	x			□
GW-918	EMWMF	02/10/09	04/15/09	08/12/09	11/12/09	x			□
GW-920	EMWMF	02/10/09	04/16/09	08/11/09	11/12/09	x			□
GW-921	EMWMF	02/11/09	04/14/09	08/13/09	11/10/09	x			□
GW-922	EMWMF	02/10/09	04/16/09	08/10/09	11/11/09	x			□

Table B.2 (continued)

Sampling Point [3]	Functional Area [4]	CY 2009 Sampling Date [5]: 1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	DOE Order Surveillance Monitoring (GWPP [2])	DOE Order Exit Pathway/Perimeter Monitoring (GWPP [2])	RCRA Post-Closure Corrective Action Monitoring (BJC [1])	CERCLA ROD (●), Detection (□), and Baseline (○) Monitoring (BJC [1])
GW-923*	EMWMF	02/17/09	04/20/09	08/11/09	11/11/09	x			□
GW-923	EMWMF	02/18/09	04/21/09	08/12/09	.	x			□
GW-923	EMWMF	.	04/22/09	08/13/09	.	x			□
GW-924	EMWMF	**02/11/09 D**	**04/20/09 D**	**08/17/09 D**	11/16/09	x			□
GW-925*	EMWMF	02/11/09	04/14/09	08/17/09	11/11/09	x			□
GW-925	EMWMF	02/12/09	04/15/09	08/18/09	.	x			□
GW-926	EMWMF	02/10/09	04/20/09	08/17/09	11/17/09	x			□
GW-927	EMWMF	02/09/09	04/14/09	08/12/09	11/10/09	x			□
GW-961	EMWMF	.	.	.	11/23/09	x			□
BCK-03.30	EXP-SW	.	.	.	12/07/09		x		●
BCK-04.55	EXP-SW	.	.	.	12/07/09		x		●
BCK-04.55	EXP-SW	.	.	08/03/09	.		●		
BCK-07.87	EXP-SW	.	.	.	12/07/09		x		●
BCK-09.20	EXP-SW	.	.	.	12/07/09		x		●
BCK-09.40	EXP-SW	.	.	**08/03/09 D**	.		●		
BCK-11.54	EXP-SW	.	.	.	12/07/09		x		●
BCK-11.84	EXP-SW	.	.	.	12/07/09		x		●
BCK-11.97	EXP-SW	.	.	08/03/09	.		●		
BCK-12.34	EXP-SW	.	.	.	12/07/09		x		●
EMWNT-03A	EXP-SW	02/09/09	04/13/09	08/10/09	11/09/09		x		□
EMWNT-05	EXP-SW	02/09/09	04/13/09	08/10/09	11/09/09		x		□
EMW-VWEIR	EXP-SW	**02/09/09 D**	04/13/09	08/10/09	**11/09/09 D**		x		□
EMW-VWUND	EXP-SW	02/12/09	04/16/09	08/11/09	**11/12/09 D**		x		□
NT-01	EXP-SW	.	.	08/03/09	.		●		
NT-01	EXP-SW	.	**06/25/09 D**	**07/20/09 D**	**11/17/09 D**		x		●
NT-01	EXP-SW	.	.	.	12/07/09		x		●
NT-03	EXP-SW	.	.	.	12/07/09		x		●
NT-04	EXP-SW	02/09/09	04/13/09	08/10/09	11/09/09		x		□
NT-07	EXP-SW	02/10/09	.	08/04/09	.		x		○
NT-08	EXP-SW	02/10/09	.	08/04/09	.		x		○
NT-08	EXP-SW	.	.	.	**12/07/09 D**		x		●
S07 (NT-02)	EXP-SW	.	.	.	12/07/09		x		●
SS-4	EXP-SW	.	.	08/03/09	.		●		
SS-4	EXP-SW	02/23/09	.	07/20/09	.		x		●
SS-5	EXP-SW	.	.	08/03/09	.		●		

Table B.2 (continued)

BJC[1]										
GWPP[2]										
Sampling Point[3]	Functional Area[4]	CY 2009 Sampling Date[5] 1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	DOE Order Surveillance Monitoring	DOE Order Exit Pathway/Perimeter Monitoring	RCRA Post-Closure Corrective Action Monitoring	CERCLA ROD (●), Detection (□), and Baseline (○) Monitoring
SS-5	EXP-SW	.	.	.	12/07/09		x		●
SS-6	EXP-SW	01/05/09	.	07/06/09	.		x	●	
SS-6.6	EXP-SW	.	.	.	12/07/09		x		●
SS-7	EXP-SW	.	.	.	12/07/09		x		●
SS-8	EXP-SW	.	.	.	**12/07/09 D**		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 2009 samples were collected for various monitoring purposes, all of the data meet DOE Order monitoring requirements. Surveillance and exit pathway/perimeter monitoring data evaluations are provided in Section 4.

3 BCK - Bear Creek Kilometer
EMW-VWUND - EMW-VWUNDRDRAIN; outfall for an underdrain installed to lower the water table and relieve hydrostatic pressure beneath the EMWMF liners.
GW - Groundwater Monitoring Well
NT - Northern Tributary (to Bear Creek)
SS - Spring sampling location (south side of Bear Creek)

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

5 **.** - Not sampled
B - Sample collected with a bailer to evaluate free product in well (GW-629)
D - Duplicate sample collected on specified date
* - Field measurements obtained on the initial date shown, with laboratory samples collected on subsequent days; dependent upon groundwater volume in well after purging.

Table B.3. CY 2009 groundwater and surface water sampling dates in the Upper East Fork Poplar Creek Hydrogeologic Regime

BJC [1]									
GWPP [2]									
Sampling Point [3]	Functional Area [4]	CY 2009 Sampling Date [5]				DOE Order Surveillance Monitoring	DOE Order Exit Pathway/Perimeter Monitoring	RCRA Post-Closure Corrective Action Monitoring	CERCLA ROD Monitoring
		1st Quarter	2nd Quarter	3rd Quarter	4th Quarter				
55-2A	GRID B3	.	.	.	10/27/09	•			
55-2B	GRID B3	.	.	.	10/26/09	•			
55-2C	GRID B3	.	.	.	10/26/09	•			
55-3A	B9201-5	.	05/14/09	.	10/20/09	•			
55-3B	B9201-5	.	05/14/09	.	10/21/09	•			
55-3C	B9201-5	.	05/13/09	.	10/21/09	•			
56-1A	Y12	.	.	07/28/09	.	•			
56-1C	Y12	.	.	**07/28/09 D**	.	•			
56-2A	GRID C3	.	.	07/29/09	.	•			
56-2B	GRID C3	.	.	07/29/09	.	•			
56-2C	GRID C3	.	.	07/28/09	.	•			
56-3A	Y12	.	.	07/30/09	.	•			
56-3B	Y12	.	.	07/29/09	.	•			
56-3C	Y12	.	.	07/30/09	.	•			
56-4A	Y12	.	05/12/09	.	.	•			
GW-108	S3	01/12/09	.	07/08/09	.	x		•	
GW-151	NHP	03/03/09	.	07/23/09	.		x		•
GW-153	NHP	.	.	.	**10/14/09 D**	•			
GW-154	NHP	03/03/09	.	07/23/09	.	x			•
GW-169	EXP-UV	03/04/09	.	07/23/09	.	x			•
GW-170	EXP-UV	**03/04/09 D**	.	**07/23/09 D**	.	x			•
GW-171	EXP-UV	03/05/09	.	.	.	x			•
GW-172	EXP-UV	03/05/09	.	.	.	x			•
GW-193	T2331	01/13/09	.	07/07/09	.	x		•	
GW-204	T0134	.	05/12/09	.	.	•			
GW-219	UOV	.	05/11/09	.	.	•			
GW-220	NHP	.	04/29/09	.	10/14/09		•		
GW-222	NHP	.	**04/30/09 D**	.	.	•			
GW-223	NHP	03/03/09	.	07/22/09	.	x			•
GW-230	EXP-UV	03/05/09	.	.	.	x			•
GW-240	NHP	.	.	.	10/14/09	•			
GW-251	S2	.	04/30/09	.	.	•			
GW-253	S2	03/04/09	.	.	.	x			•
GW-269	SY	.	04/21/09	.	.	•			
GW-270	SY	.	04/28/09	.	.	•			
GW-272	SY	.	04/21/09	.	.	•			
GW-274	SY	.	**04/21/09**	.	.	•			

Table B.3 (continued)

BJC [1]									
GWPP [2]									
Sampling Point [3]	Functional Area [4]	CY 2009 Sampling Date [5] 1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	DOE Order Surveillance Monitoring	DOE Order Exit Pathway/Perimeter Monitoring	RCRA Post-Closure Corrective Action Monitoring	CERCLA ROD Monitoring
GW-275	SY	.	04/27/09	.	.	●			
GW-281	FF	.	.	08/13/09	.	x			●
GW-332	WCPA	.	04/28/09	.	.	●			
GW-337	WCPA	.	04/28/09	.	.	●			
GW-380	NHP	03/04/09	.	07/23/09	.	x			●
GW-381	NHP	.	.	.	10/19/09	●			
GW-382	NHP	03/04/09	.	07/23/09	.	x			●
GW-383	NHP	.	.	.	10/14/09	●			
GW-505	RG	.	**04/20/09 D**	.	.	●			
GW-508	RG	.	04/20/09	.	.	●			
GW-605	EXP-I	**01/08/09 D**	.	**07/07/09 D**	.	x		●	
GW-606	EXP-I	01/08/09	.	07/07/09	.	x		●	
GW-618	EXP-E	03/30/09	.	.	.	x			●
GW-633	RG	.	04/28/09	.	.	●			
GW-656	T0134	.	05/12/09	.	.	●			
GW-658	FF	.	.	08/13/09	.	x			●
GW-686	CPT	.	05/13/09	.	.	●			
GW-690	CPT	.	05/13/09	.	.	●			
GW-691	CPT	.	05/12/09	.	**10/20/09 D**	●			
GW-692	CPT	.	05/12/09	.	.	●			
GW-698	B8110	.	**04/29/09 D**	.	10/21/09	●			
GW-700	B8110	.	.	07/28/09	.	●			
GW-722-14	EXP-J	03/02/09	.	.	.		x		●
GW-722-14	EXP-J	.	.	09/02/09	.		●		
GW-722-17	EXP-J	03/02/09	.	.	.		x		●
GW-722-17	EXP-J	.	.	09/02/09	.		●		
GW-722-20	EXP-J	03/02/09	.	.	.		x		●
GW-722-20	EXP-J	.	.	09/02/09	.		●		
GW-722-22	EXP-J	03/02/09	.	.	.		x		●
GW-722-22	EXP-J	.	.	09/02/09	.		●		
GW-722-33	EXP-J	03/02/09	.	.	.		x		●
GW-722-33	EXP-J	.	.	09/03/09	.		●		
GW-733	EXP-J	01/12/09	.	07/07/09	.		x	●	
GW-735	EXP-J	.	.	08/26/09	.		●		
GW-744	GRID K1	.	.	08/26/09	.		●		

Table B.3 (continued)

BJC [1]									CERCLA ROD Monitoring
								RCRA Post-Closure Corrective Action Monitoring	
GWPP [2]							DOE Order Exit Pathway/Perimeter Monitoring		
						DOE Order Surveillance Monitoring			
Sampling Point [3]	Functional Area [4]	CY 2009 Sampling Date [5]							
		1st Quarter	2nd Quarter	3rd Quarter	4th Quarter				
GW-747	GRID K2	.	.	08/31/09	.		●		
GW-750	EXP-J	.	04/29/09	.	.		●		
GW-762	GRID J3	**03/04/09 D**	.	**07/23/09 D**	.	x			●
GW-763	GRID J3	.	.	.	10/14/09	●			
GW-765	GRID E1	.	05/07/09	.	.	●			
GW-769	GRID G3	.	04/29/09	.	10/13/09	●			
GW-770	GRID G3	.	.	.	10/13/09	●			
GW-775	GRID H3	.	.	08/27/09	.	●			
GW-776	GRID H3	.	.	09/01/09	.	●			
GW-779	GRID F2	.	.	08/31/09	.	●			
GW-781	GRID E3	.	.	08/27/09	.	●			
GW-782	GRID E3	.	.	08/27/09	.	●			
GW-783	GRID E3	.	.	08/27/09	.	●			
GW-791	GRID D2	.	.	08/27/09	.	●			
GW-802	FF	.	.	08/13/09	.	x			●
GW-816	EXP-SR	.	.	08/26/09	.		●		
GW-820	B9201-2	.	04/29/09	.	.	●			
GW-832	NHP	03/03/09	.	07/23/09	.		x		●
GW-959	B9201-2	.	05/06/09	.	.	●			
GW-960	GRID F2	.	05/07/09	.	.	●			
GHK2.51WSW	EXP-SW	01/29/09	.	.	.		●		
NPR12.0SW	EXP-SW	01/29/09	.	.	.		●		
NPR23.0SW	EXP-SW	01/29/09	.	.	.		●		
SCR7.1SP	EXP-SW	02/05/09	.	.	.		x		●
SCR7.8SP	EXP-SW	02/05/09	.	.	.		x		●
SP-17	EXP-SW	.	.	**08/03/09 D**	.		●		
200A6*	EXP-SW	01/06/09	.	08/19/09	.		x		●
200A6	EXP-SW	01/22/09	.	09/10/09	.		x		●
STATION 8*	EXP-SW	01/06/09	.	08/19/09	.		x		●
STATION 8	EXP-SW	01/22/09	.	09/10/09	.		x		●

Notes:

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

Table B.3 (continued)

Notes: (continued)

2	Groundwater and surface water sampling performed for the Y-12 Groundwater Protection Program (GWPP), managed by Babcock & Wilcox Technical Services Y-12, LLC.		
	x	-	Denotes the DOE Order monitoring category (surveillance or exit pathway/perimeter) fulfilled by samples collected under programs managed by BJC. Although the CY 2009 samples were collected for various monitoring purposes, all of the data meet DOE Order monitoring requirements. Surveillance and exit pathway/perimeter monitoring data evaluations are provided in Section 4.
3	GHK	-	Gum Hollow Branch Kilometer (surface water sampling station)
	GW	-	Groundwater Monitoring Well (also locations beginning with number 5 or 6)
	NPR	-	North of Pine Ridge near the Scarboro Community (surface water sampling station)
	200A6	-	Storm drain outfall (surface water sampling station)
	SCR	-	Spring sampling location in Union Valley (prefix)
	SP	-	Spring sampling location (prefix or suffix)
	STATION 8	-	Surface water sampling location in Upper East Fork Poplar Creek, central Y-12
	STATION 17	-	Surface water sampling location in Upper East Fork Poplar Creek, eastern Y-12
	SW	-	Surface water sampling location (suffix)
4	B8110	-	Building 81-10
	B9201-2	-	Building 9201-2
	B9201-5	-	Building 9201-5
	CPT	-	Coal Pile Trench
	EXP-E	-	Exit Pathway Picket E
	EXP-I	-	Exit Pathway Picket I
	EXP-J	-	Exit Pathway Picket J
	EXP-SR	-	Along Scarboro Road in the gap through Pine Ridge
	EXP-SW	-	Surface water or spring sampling station
	EXP-UV	-	East of the Oak Ridge Reservation boundary in Union Valley
	FF	-	Fuel Facility (Building 9754-2)
	GRID	-	Comprehensive Groundwater Monitoring Plan Grid Location
	NHP	-	New Hope Pond
	RG	-	Rust Garage Area
	S2	-	S-2 Site
	S3	-	S-3 Site
	SY	-	Y-12 Salvage Yard
	T0134	-	Tank 0134-U
	T2331	-	Tank 2331-U
	UOV	-	Uranium Oxide Vault
	WCPA	-	Waste Coolant Processing Area
	Y12	-	Y-12 Complex
5	**.**	-	Not sampled.
	D	-	Duplicate sample collected on specified date (shown in bold typeface).
	*	-	Two sets of surface water samples collected; a stormflow sample on the first date shown and a base flow sample collected later during the first and third quarters.

Table B.4. CY 2009 groundwater and surface water sampling dates in the Chestnut Ridge Hydrogeologic Regime

GWPP[2] / BJC[1]		CY 2009 Sampling Date[5]				DOE Order Surveillance Monitoring	DOE Order Exit Pathway/Perimeter Monitoring	CERCLA ROD (●) and Baseline (○) Monitoring	RCRA Post-Closure Detection (●) and Corrective Action (○) Monitoring	Solid Waste Disposal Facility Detection (●) and Assessment (○) Monitoring
Sampling Point[3]	Functional Area[4]	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter					
1090	UNCS	03/05/09	.	07/27/09	.	x		●		
GW-141	LIV	01/29/09	.	07/16/09	.	x				●
GW-143	KHQ	01/08/09	.	.	.	x			●	
GW-144	KHQ	01/06/09	.	.	.	x			●	
GW-145	KHQ	01/08/09	.	.	.	x			●	
GW-156	CRSDB	**01/13/09 D**	.	.	.	x			●	
GW-159	CRSDB	01/13/09	.	.	.	x			●	
GW-161	ECRWP	01/14/09	.	07/08/09	.	x			●	
GW-174	CRSP	.	.	.	10/13/09	●				
GW-175	CRSP	.	.	.	10/13/09	●				
GW-175	CRSP	.	.	.	12/15/09 **R**	●				
GW-176	CRSP	.	.	.	**10/13/09 D**	●				
GW-177	CRSP	01/14/09	.	07/09/09	.	x			○	
GW-180	CRSP	.	.	.	10/13/09	●				
GW-203	UNCS	03/05/09	.	07/27/09	.	x		●		
GW-205	UNCS	03/05/09	.	7/27/09	.	x		●		
GW-205	UNCS	.	.	.	10/15/09	x				○
GW-217	LIV	01/28/09	.	07/13/09	.	x				○
GW-221	UNCS	03/05/09	.	07/27/09	.	x		●		
GW-231	KHQ	**01/12/09 D**	.	.	.	x			●	
GW-294	ECRWP	**01/14/09 D**	.	**07/08/09 D**	.	x			●	
GW-296	ECRWP	01/14/09	.	07/08/09	.	x			●	
GW-298	ECRWP	01/13/09	.	07/08/09	.	x			●	
GW-301	CRBAWP	**01/14/09 D**	.	**07/08/09 D**	.	x			○	
GW-305	LIV	01/28/09	.	07/09/09	12/14/09	x				○
GW-305	LIV	.	.	08/27/09 **R**	.	x				○
GW-322	CRSP	.	.	.	10/13/09	●				
GW-322	CRSP	.	.	.	12/16/09 **R**	●				
GW-521	LIV	01/28/09	.	07/09/09	.	x				○
GW-522	LIV	**01/28/09 D**	.	**07/09/09 D**	.	x				○
GW-540	CDLVI	02/02/09	.	07/13/09	.	x				●
GW-557	LV	02/02/09	.	07/14/09	.	x				●

Table B.4 (continued)

Sampling Point[3]	Functional Area[4]	CY 2009 Sampling Date[5] 1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	GWPP[2]: DOE Order Surveillance Monitoring	GWPP[2]: DOE Order Exit Pathway/Perimeter Monitoring	BJC[1]: CERCLA ROD (●) and Baseline (○) Monitoring	BJC[1]: RCRA Post-Closure Detection (●) and Corrective Action (○) Monitoring	BJC[1]: Solid Waste Disposal Facility Detection (●) and Assessment (○) Monitoring
GW-560	CDLVII	02/02/09	.	07/15/09	.	x				●
GW-562	CDLVII	02/02/09	.	07/15/09	.	x				●
GW-564	CDLVII	**02/02/09 D**	.	**07/15/09 D**	.	x				●
GW-709	LII	02/03/09	.	07/13/09	10/15/09	x				●
GW-731	CRSDB	01/13/09	.	.	.	x			●	
GW-732	CRSDB	01/13/09	.	.	.	x			●	
GW-757	LII	02/03/09	.	07/13/09	.	x				●
GW-796	LV/CDLVII	01/29/09	.	07/14/09	.	x				●
GW-797	LV	01/29/09	.	07/14/09	.	x				●
GW-798	CDLVII	02/02/09	.	07/14/09	.	x				●
GW-799	LV	01/29/09	.	07/14/09	.	x				●
GW-801	LV	01/29/09	.	07/13/09	.	x				●
GW-831	FCAP	01/14/09	.	07/08/09	.	x			○	
MCK 1.4	FCAP	03/18/09	.	09/03/09	.		x	●		
MCK 2.0	FCAP	03/18/09	.	09/03/09	.		x	●		
MCK 2.05	FCAP	**03/18/09 D**	.	**09/03/09 D**	.		x	●		
S17	EXP-SW	.	.	.	10/12/09		●			
SCR1.25SP	EXP-SW	03/11/09	.	09/03/09	.		x	○		
SCR1.5SW	EXP-SW	.	.	.	10/12/09		●			
SCR2.1SP	EXP-SW	.	05/04/09	.	10/12/09		●			
SCR2.2SP	EXP-SW	.	.	.	10/12/09		●			
SCR3.5SP	EXP-SW	03/11/09	.	09/03/09	.		x	○		
SCR3.5SW	EXP-SW	.	.	.	10/12/09		●			
SCR4.3SP	EXP-SW	01/29/09	.	07/14/09	.		x			●
UNC SW-1	EXP-SW	03/11/09	.	08/19/09	.		x			●

<u>Notes</u>:

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 2009 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	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).
	R	-	Resample collected during the same quarterly event.

Table B.5. Field measurements and laboratory analytes for CY 2009 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
Anions			
Carbonate	SM 2320B 18	1	mg/L
Bicarbonate	SM 2320B 18	1	mg/L
Chloride	EPA-300.0	0.2	mg/L
Fluoride	SM 4500F 18	0.1	mg/L
Nitrate (as Nitrogen)	EPA-300.0	0.05	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	0.00005	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)

2 The lowest concentration reported.

NA - not applicable

Table B.5 (continued)

Notes: (continued)

3	ft	-	feet
	μg/L	-	micrograms per liter
	μmho/cm	-	micromhos per centimeter
	mg/L	-	milligrams per liter
	mV	-	millivolts
	NTU	-	nephelometric turbidity units
	ppm	-	parts per million
	pCi/L	-	picoCuries per liter
4	CRQL	-	contract-required quantitation limit; estimated values are reported below this level and above the instrument detection limit. Results below the instrument detection limit are reported as not detected at the CRQL.
5	MDA	-	minimum detectable activity. The target MDA may be obtained under optimal analytical conditions; actual MDAs are sample-specific and, in some cases, may vary significantly from the target value.

Table B.6. Depth-to-water measurements and groundwater elevations for selected wells in the Bear Creek Hydrogeologic Regime, April 2009

Well Number	Location [1]	Hydrogeologic Unit		Measuring Point [2]	Date Measured	Depth to Water [3]	Groundwater Elevation [4]
		Aquifer	Aquitard				
GW-001	OLF		●	981.00	04/09/09	13.73	967.27
GW-008	OLF		●	965.39	04/09/09	13.57	951.82
GW-010	OLF		●	952.70	04/09/09	0.85	951.85
GW-012	OLF		●	955.57	04/09/09	6.34	949.23
GW-014	BG		●	934.50	04/08/09	5.79	928.71
GW-016	BG		●	928.81	04/08/09	9.07	919.74
GW-041	BG		●	1008.10	04/09/09	13.37	994.73
GW-046	BG		●	921.17	04/08/09	2.62	918.55
GW-047	BG		●	929.00	04/08/09	7.44	921.56
GW-052	BG	●		905.70	04/08/09	13.64	892.06
GW-053	BG	●		903.42	04/08/09	7.48	895.94
GW-057	EXP-A	●		890.20	04/08/09	6.08	884.12
GW-059	BG	●		912.70	04/08/09	21.51	891.19
GW-065	OLF	●		982.50	04/08/09	28.47	954.03
GW-078	BG		●	918.10	04/09/09	9.79	908.31
GW-080	BG		●	981.00	04/09/09	19.92	961.08
GW-082	BG		●	964.00	04/09/09	20.81	943.19
GW-084	OLF		●	997.18	04/08/09	10.40	986.78
GW-086	OLF		●	982.80	04/08/09	11.15	971.65
GW-090	BG		●	961.88	04/09/09	3.93	957.95
GW-091	BG		●	952.62	04/09/09	7.87	944.75
GW-097	OLF		●	945.41	04/09/09	8.35	937.06
GW-100	S3	●		987.40	04/09/09	4.80	982.60
GW-101	S3		●	1007.40	04/09/09	9.76	997.64
GW-115	S3		●	1055.01	04/09/09	6.82	1048.19
GW-127	S3		●	1005.90	04/09/09	13.10	992.80
GW-227	OLF	●		946.46	04/09/09	8.16	938.30
GW-236	S3	●		983.21	04/08/09	9.98	973.23
GW-242	BG		●	978.69	04/09/09	5.45	973.24
GW-245	S3		●	1009.08	04/09/09	11.80	997.28
GW-249	BG		●	991.15	04/09/09	27.88	963.27
GW-257	BG		●	961.68	04/09/09	26.52	935.16
GW-276	S3		●	1001.57	04/08/09	5.62	995.95
GW-287	BG		●	927.04	04/09/09	8.12	918.92
GW-289	BG		●	948.73	04/09/09	11.71	937.02
GW-291	BG		●	948.66	04/09/09	10.39	938.27
GW-307	RS	●		993.14	04/09/09	27.30	965.84
GW-309	RS	●		988.17	04/09/09	19.10	969.07
GW-316	SPI	●		1047.17	04/08/09	52.22	994.95

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-323	SPI	●		1130.11	04/08/09	85.79	1044.32
GW-325	S3		●	1003.00	04/08/09	9.03	993.97
GW-345	S3		●	999.63	04/08/09	17.63	982.00
GW-347	S3	●		1001.05	04/09/09	14.60	986.45
GW-364	OLF	●		936.16	04/09/09	9.90	926.26
GW-370	BG		●	960.81	04/09/09	13.59	947.22
GW-372	BG		●	983.16	04/09/09	14.18	968.98
GW-531	LD		●	1004.61	04/08/09	10.41	994.20
GW-537	OLF		●	976.65	04/08/09	5.25	971.40
GW-613	S3		●	1013.58	04/08/09	10.52	1003.06
GW-621	EXP-B	●		925.45	04/09/09	10.50	914.95
GW-622	BG		●	924.16	04/09/09	7.72	916.44
GW-624	BG		●	922.15	04/08/09	8.97	913.18
GW-630	LD		●	986.65	04/08/09	8.86	977.79
GW-638	OLF		●	941.77	04/09/09	5.89	935.88
GW-641	BG		●	946.66	04/09/09	15.86	930.80
GW-642	BG		●	1014.95	04/09/09	17.49	997.46
GW-645	OLF	●		1006.40	04/09/09	71.80	934.60
GW-648	RS	●		1029.20	04/09/09	64.97	964.23
GW-652	BG	●		900.83	04/08/09	9.29	891.54
GW-653	BG		●	931.84	04/09/09	21.50	910.34
GW-654	BG		●	940.79	04/09/09	6.91	933.88
GW-683	EXP-A	●		972.23	04/08/09	88.54	883.69
GW-695	EXP-B	●		939.54	04/09/09	25.38	914.16
GW-795	AGLLSF		●	926.18	04/09/09	3.90	922.28
GW-800	OLF	●		964.36	04/09/09	18.20	946.16
GW-829	OLF		●	985.95	04/08/09	12.60	973.35
GW-835	S3	●		1000.91	04/09/09	14.10	986.81
GW-916	EMWMF		●	1002.85	04/09/09	4.68	998.17
GW-917	EMWMF		●	997.10	04/09/09	19.73	977.37
GW-918	EMWMF		●	1067.96	04/09/09	5.66	1062.30
GW-921	EMWMF		●	971.29	04/09/09	5.50	965.79
GW-922	EMWMF		●	956.91	04/09/09	5.13	951.78
GW-923	EMWMF		●	1016.73	04/09/09	25.52	991.21
GW-924	EMWMF		●	968.90	04/09/09	7.91	960.99

Table B.6 (continued)

Notes:

1

AGLLSF	-	Above Grade Low-Level Storage Facility
BG	-	Bear Creek Burial Grounds Waste Management Area
EMWMF	-	Environmental Management Waste Management Facility
EXP-A	-	Exit Pathway (Maynardville Limestone) Picket A
EXP-B	-	Exit Pathway (Maynardville Limestone) Picket B
LD	-	Lysimeter Demonstration Site
OLF	-	Oil Landfarm Waste Management Area
RS	-	Rust Spoil Area
S3	-	S-3 Site
SPI	-	Spoil Area I

2 The measuring point is the surveyed elevation of a mark on either the top of the innermost well casing or the top of dedicated sampling equipment, in feet above mean sea level.

3 The depth to water is in feet below the measuring point.

4 The groundwater elevation (measuring point depth to water) is in feet above mean sea level.

Table B.7. Depth-to-water measurements and groundwater elevations for selected wells in the Upper East Fork Poplar Creek Hydrogeologic Regime, April 2009

Well Number	Location [1]	Hydrogeologic Unit		Measuring Point [2]	Date Measured	Depth to Water [3]	Groundwater Elevation [4]
		Aquifer	Aquitard				
55-1A	GRIDB2		●	986.91	04/07/09	10.66	976.25
55-3A	B9201-5		●	972.46	04/07/09	11.38	961.08
55-6A	B9103		●	989.29	04/07/09	8.40	980.89
56-1A	Y12		●	969.25	04/07/09	7.84	961.41
56-2A	GRIDC3		●	963.53	04/07/09	8.50	955.03
56-8A	Y12	●		962.46	04/07/09	19.85	942.61
60-1A	Y12	●		929.66	04/07/09	12.80	916.86
GW-105	S3		●	1018.20	04/08/09	8.28	1009.92
GW-108	S3		●	999.00	04/08/09	6.85	992.15
GW-115	S3		●	1055.01	04/09/09	6.82	1048.19
GW-148	NHP	●		907.76	04/08/09	7.95	899.81
GW-152	NHP	●		921.18	04/07/09	19.90	901.28
GW-154	NHP	●		911.70	04/08/09	7.90	903.80
GW-167	EXP	●		931.95	04/07/09	27.10	904.85
GW-169	EXP-UV	●		932.12	04/07/09	26.82	905.30
GW-192	B4		●	1008.83	04/07/09	5.16	1003.67
GW-193	T2331	●		934.17	04/08/09	9.01	925.16
GW-195	B4		●	1002.90	04/07/09	5.47	997.43
GW-199	GRIDI1		●	961.08	04/07/09	15.81	945.27
GW-202	RDS		●	968.02	04/07/09	9.82	958.20
GW-204	T0134		●	958.74	04/08/09	8.80	949.94
GW-219	UOV	●		935.83	04/08/09	10.21	925.62
GW-251	S2	●		1003.80	04/08/09	11.88	991.92
GW-253	S2	●		1004.24	04/08/09	5.02	999.22
GW-261	SY		●	1049.99	04/08/09	17.93	1032.06
GW-263	SY		●	1057.73	04/08/09	29.01	1028.72
GW-334	WC		●	983.73	04/07/09	11.04	972.69
GW-335	WC		●	981.88	04/07/09	9.40	972.48
GW-349	S2	●		993.50	04/07/09	3.50	990.00
GW-380	NHP	●		913.55	04/07/09	10.18	903.37
GW-383	NHP		●	908.77	04/08/09	7.90	900.87
GW-603	EXP-J	●		961.32	04/07/09	57.41	903.91
GW-605	EXP-I	●		919.06	04/07/09	11.56	907.50
GW-606	EXP-I	●		919.59	04/07/09	13.42	906.17
GW-617	EXP-E	●		985.28	04/07/09	12.42	972.86
GW-619	FTF	●		1015.42	04/08/09	19.80	995.62

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-686	CPT	●		963.76	04/07/09	14.42	949.34
GW-691	CPT	●		968.59	04/07/09	11.12	957.47
GW-696	B8110	●		969.78	04/08/09	22.91	946.87
GW-733	EXP-J	●		959.84	04/08/09	57.90	901.94
GW-734	EXP-J	●		939.93	04/08/09	38.00	901.93
GW-735	EXP-J		●	924.46	04/08/09	22.21	902.25
GW-746	GRIDK1		●	906.88	04/07/09	6.42	900.46
GW-748	GRIDK2		●	921.17	04/08/09	6.52	914.65
GW-752	GRIDJ3		●	912.78	04/08/09	3.22	909.56
GW-754	GRIDJ2		●	928.78	04/08/09	7.88	920.90
GW-756	GRIDJ1		●	928.11	04/07/09	6.70	921.41
GW-759	GRIDG1		●	994.01	04/07/09	15.78	978.23
GW-761	GRIDG2		●	968.23	04/07/09	8.00	960.23
GW-763	GRIDJ3		●	915.03	04/07/09	8.58	906.45
GW-765	GRIDE1		●	1008.54	04/09/09	19.05	989.49
GW-767	GRIDI2		●	948.54	04/07/09	10.36	938.18
GW-770	GRIDG3		●	944.72	04/07/09	12.70	932.02
GW-774	GRIDH2		●	963.16	04/07/09	10.50	952.66
GW-776	GRIDH3		●	931.25	04/07/09	12.06	919.19
GW-778	GRIDB2		●	1001.84	04/09/09	7.34	994.50
GW-783	GRIDE3		●	948.49	04/07/09	10.43	938.06
GW-792	GRIDD2		●	992.74	04/07/09	24.16	968.58
GW-816	EXP-SR		●	898.42	04/07/09	11.92	886.50
GW-960	GRID F2		●	963.26	04/07/09	12.87	950.39

Table B.7 (continued)

Notes:

1 B4 - Beta-4 Security Pits
B8110 - Building 81-10
B9103 - Building 9103
B9201-2 - Building 9201-2
CPT - Coal Pile Trench
EXP - Exit Pathway (Maynardville Limestone) monitoring well
-E, -I, or -J: Maynardville Limestone Picket
-SR: Along Scarboro Road in the gap through Pine Ridge
-UV: Offsite in Union Valley
FTF - Fire Training Facility
GRID - Comprehensive Groundwater Monitoring Plan Grid Location
NHP - New Hope Pond
RDS - Ravine Disposal Site
S2 - S-2 Site
S3 - S-3 Site
SY - Y-12 Plant Salvage Yard
T0134 - Tank 0134-U
T2331 - Tank 2331-U
UOV - Uranium Oxide Vault
WC - Waste Coolant Processing Area
Y12 - Y-12 Complex

2 The measuring point is the surveyed elevation of a mark on either the top of the innermost well casing or the top of dedicated sampling equipment, in feet above mean sea level.

3 The depth to water is in feet below the measuring point.

4 The groundwater elevation (measuring point depth to water) is in feet above mean sea level.

Table B.8. Depth-to-water measurements and groundwater elevations for selected wells in the Chestnut Ridge Hydrogeologic Regime, April 2009

Well Number	Location [1]	Measuring Point [2]	Date Measured	Depth to Water [3]	Groundwater Elevation [4]
1082	ORSF	837.28	04/07/09	23.08	814.20
1084	ORSF	965.40	04/08/09	62.88	902.52
1090	UNCS	1104.48	04/08/09	44.14	1060.34
GW-141	LIV	1186.23	04/08/09	92.65	1093.58
GW-142	KHQ	971.15	04/08/09	133.91	837.24
GW-144	KHQ	913.54	04/08/09	78.51	835.03
GW-145	KHQ	840.24	04/08/09	3.68	836.56
GW-156	CRSDB	1049.28	04/07/09	142.82	906.46
GW-159	CRSDB	1051.38	04/07/09	117.03	934.35
GW-160	CRBAWP	1093.09	04/07/09	134.08	959.01
GW-173	CRSP	1115.00	04/07/09	130.00	985.00
GW-174	CRSP	1116.66	04/07/09	104.22	1012.44
GW-175	CRSP	1084.19	04/08/09	112.89	971.30
GW-176	CRSP	1125.30	04/07/09	115.92	1009.38
GW-177	CRSP	1158.20	04/07/09	117.30	1040.90
GW-178	CRSP	1143.49	04/07/09	88.47	1055.02
GW-179	CRSP	1128.00	04/07/09	113.86	1014.14
GW-180	CRSP	1104.14	04/07/09	97.83	1006.31
GW-184	RQ	927.63	04/07/09	109.81	817.82
GW-186	RQ	831.32	04/07/09	13.91	817.41
GW-188	RQ	837.09	04/07/09	20.02	817.07
GW-203	UNCS	1105.45	04/07/09	80.65	1024.80
GW-205	UNCS	1104.14	04/07/09	76.54	1027.60
GW-217	LIV	1177.03	04/08/09	106.21	1070.82
GW-221	UNCS	1106.16	04/07/09	83.07	1023.09
GW-231	KHQ	849.67	04/08/09	12.40	837.27
GW-241	CRSDB	982.84	04/07/09	44.06	938.78
GW-292	ECRWP	1073.00	04/07/09	109.87	963.13
GW-298	CRBAWP	1049.01	04/07/09	106.32	942.69
GW-299	CRBAWP	1053.86	04/07/09	98.60	955.26
GW-300	CRBAWP	1073.12	04/07/09	111.40	961.72
GW-301	CRBAWP	1086.55	04/07/09	129.60	956.95
GW-302	UNCS	1141.84	04/07/09	95.10	1046.74
GW-303	CRSDB	1007.16	04/07/09	83.93	923.23
GW-304	CRSDB	1045.49	04/07/09	116.28	929.21
GW-305	LIV	1183.72	04/08/09	117.76	1065.96
GW-322	CRSP	1134.98	04/07/09	145.03	989.95
GW-339	UNCS	1124.83	04/07/09	65.08	1059.75

Table B.8 (continued)

Well Number	Location [1]	Measuring Point [2]	Date Measured	Depth to Water [3]	Groundwater Elevation [4]
GW-511	CRSP	1093.21	04/07/09	103.45	989.76
GW-512	FCAP	1001.54	04/07/09	21.73	979.81
GW-521	LIV	1182.88	04/08/09	80.68	1102.20
GW-522	LIV	1175.48	04/08/09	89.65	1085.83
GW-539	LII	1093.20	04/08/09	105.18	988.02
GW-541	CDLVI	1058.40	04/08/09	63.15	995.25
GW-542	CDLVI	1051.81	04/08/09	69.96	981.85
GW-543	CDLVI	1024.01	04/08/09	63.21	960.80
GW-544	CDLVI	1045.19	04/08/09	51.96	993.23
GW-546	CDLVI	1072.21	04/08/09	80.30	991.91
GW-557	LV	1081.36	04/07/09	124.81	956.55
GW-558	SSCR	981.42	04/07/09	48.75	932.67
GW-559	SSCR	1102.79	04/07/09	138.33	964.46
GW-560	CDLVII	949.05	04/07/09	50.43	898.62
GW-562	CDLVII	934.69	04/07/09	16.00	918.69
GW-564	CDLVII	938.07	04/07/09	11.09	926.98
GW-608	CRSP	1075.38	04/07/09	127.03	948.35
GW-609	CRSP	1112.31	04/07/09	161.23	951.08
GW-610	CRSP	1059.44	04/08/09	80.29	979.15
GW-611	CRSP	1048.38	04/08/09	98.52	949.86
GW-612	CRSP	1131.03	04/07/09	118.51	1012.52
GW-674	FCAP	883.79	04/07/09	6.10	877.69
GW-676	FCAP	846.50	04/07/09	2.61	843.89
GW-677	FCAP	1030.40	04/07/09	24.44	1005.96
GW-678	FCAP	1000.70	04/07/09	17.13	983.57
GW-679	FCAP	1026.90	04/07/09	48.65	978.25
GW-680	FCAP	1001.50	04/07/09	27.08	974.42
GW-709	LII	906.81	04/08/09	24.98	881.83
GW-731	CRSDB	1049.38	04/07/09	124.76	924.62
GW-732	CRSDB	1064.29	04/07/09	157.41	906.88
GW-743	CRSP	1100.36	04/07/09	123.86	976.50
GW-757	LII	961.64	04/08/09	82.21	879.43
GW-796	LV	1052.62	04/07/09	74.57	978.05
GW-797	LV	1060.00	04/07/09	72.66	987.34
GW-798	CDLVII	1006.00	04/07/09	84.00	922.00
GW-799	LV	981.29	04/07/09	23.46	957.83
GW-801	LV	1097.16	04/07/09	110.71	986.45
GW-827	CDLVI	1051.60	04/08/09	43.18	1008.42
GW-831	FCAP	1091.29	04/07/09	128.76	962.53

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 2009 sampling locations in the Bear Creek Hydrogeologic Regime

Sampling Location[1]	Hydro. Unit[2]		Contaminant Type and Long-Term Trend[3] (○ = indeterminate, ✚ = increasing, ▼= decreasing)							
	AQT	AQF	Inorganics[4]		VOCs[5]				Radioactivity[6]	
			NO^3	U	Ethenes	Ethanes	Methanes	Petrol.	Alpha	Beta
GW-008	●		NA	.	✚	✚	.	.	.	.
GW-014	●		.	.	▼	▼	.	.	.	.
GW-046	●		NA	.	○	○	.	○	.	.
GW-053		●	.	.	▼	.	.	.	.	.
GW-058		●	✚	.	.	.	.	.	.	.
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-098	●		.	.	▼	.	.	.	.	.
GW-100		●	▼	.	.	.	.	.	.	.
GW-101	●		▼	.	.	.	.	.	.	.
GW-122		●	▼	.	.	.	.	.	.	.
GW-127	●		.	▼	.	.	.	.	▼	.
GW-225		●	.	.	.	.	○	.	.	.
GW-229		●	.	✚	✚	✚	.	✚	✚	.
GW-236		●	▼	.	.	.	.	.	.	.
GW-242	●		.	.	○	.	.	.	.	.
GW-246	●		○	○	✚	.	✚	.	○	○
GW-276	●		▼	▼	▼	.	.	.	▼	▼
GW-289	●		.	.	○	.	.	.	.	.
GW-307		●	.	.	▼	.	.	.	.	.
GW-315		●	.	.	.	.	.	.	.	.
GW-363	●		NA	.	.	NA	.	.	NA	NA
GW-365		●	.	.	▼	.	.	.	.	.
GW-526	●		✚	.	.	.	.	.	.	.
GW-537	●		.	.	.	.	.	.	.	○
GW-601		●	▼	.	▼	.	.	.	.	.
GW-615	●		○	✚	.	.	○	.	○	○
GW-616	●		○	.	.	.	.	.	.	.
GW-623	●		.	.	○	○	○	○	.	.
GW-627	●		.	.	✚	✚	.	.	.	.
GW-629	●		.	.	✚	✚	○	✚	.	.
GW-639	●		NA	.	.	NA	.	.	NA	NA
GW-648		●	.	.	.	.	.	.	.	.
GW-653	●		.	.	✚	✚	.	.	.	.
GW-683		●	.	.	.	.	.	.	.	.

Table B.9 (continued)

Sampling Location[1]	Hydro. Unit[2]		Contaminant Type and Long-Term Trend[3] (○ = indeterminate, ✚ = increasing, ▼= decreasing)							
			Inorganics[4]		VOCs[5]				Radioactivity[6]	
	AQT	AQF	NO^{3}	U	Ethenes	Ethanes	Methanes	Petrol.	Alpha	Beta
GW-684		●	.	.	.	.	.	.	.	.
GW-703		●	.	.	▼	.	.	.	.	.
GW-704		●	▼	.	▼	.	.	.	.	.
GW-706		●	▼	▼	○	.	.	.	▼	▼
GW-712		●	.	.	.	.	.	.	.	.
GW-713		●	.	.	.	.	.	.	.	.
GW-714		●	.	.	.	.	.	.	.	.
GW-724		●	▼	.	○	.	.	.	.	.
GW-725		●	.	.	.	.	.	.	.	.
GW-726-04	●		.	.	.	.	.	.	.	.
GW-726-06	●		.	.	.	.	.	.	Q	.
GW-726-09	●		.	.	.	.	.	.	.	.
GW-726-12	●		.	.	.	.	.	.	.	.
GW-726-16	●		.	.	.	.	.	.	.	.
GW-726-20	●		.	.	.	.	.	.	.	.
GW-726-23	●		.	.	.	.	.	.	.	.
GW-738		●	▼	.	▼	.	.	.	.	.
GW-740		●	.	.	▼	.	.	.	.	.
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
GW-961	●		NA	.	.	NA	.	.	NA	NA
BCK-03.30	.	.	.	.	.	.	.	.	NA	NA
BCK-04.55	.	.	.	.	.	.	.	.	.	.
BCK-07.87	.	.	.	○	.	.	.	.	NA	NA
BCK-09.20	.	.	.	○	○	.	.	.	NA	NA
BCK-09.40	.	.	.	○	.	.	.	.	○	.
BCK-11.54	.	.	○	○	.	.	.	.	NA	NA
BCK-11.84	.	.	○	○	.	.	.	.	NA	NA
BCK-11.97	.	.	○	○	.	.	.	.	○	○
BCK-12.34	.	.	.	○	○	.	.	.	NA	NA
EMWNT-03A	.	.	NA	.	.	.	.	.	.	.
EMWNT-05	.	.	NA	.	.	.	.	.	.	.
EMW-VWEIR	.	.	NA	.	.	.	.	.	NA	NA
EMW-VWUND	.	.	NA	.	.	NA	.	.	NA	NA
NT-01	.	.	○	○	○	.	.	.	.	.
NT-02 (S07)	.	.	.	.	.	.	.	.	NA	NA
NT-03	.	.	.	.	.	.	.	.	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]	
			NO^3	**U**	**Ethenes**	**Ethanes**	**Methanes**	**Petrol.**	**Alpha**	**Beta**
NT-04	.	.	NA	.	.	NA	.	.	NA	NA
NT-07	.	.	.	.	▼	▼	.	.	NA	NA
NT-08	.	.	.	▼	▼	▼	.	.	NA	NA
SS-4	.	.	○	○	○	.	.	.	.	.
SS-5	.	.	.	.	.	.	.	.	.	.
SS-6	.	.	.	.	.	.	.	.	.	.
SS-6.6	.	.	.	.	.	.	.	.	NA	NA
SS-7	.	.	.	.	.	.	.	.	NA	NA
SS-8	.	.	.	.	.	.	.	.	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 - Monitoring interval in the formations comprising the aquitard

3 Trend types were interpreted from data tables or plots of concentration changes over time.

. - Not a contaminant (criteria defined below, in notes 4, 5, and 6).
NA - Not analyzed
Q - Results inconsistent (higher) with respect to historical data.
○ - Indeterminate trend: insufficient data, fairly stable trend, affected by sampling methods, or highly fluctuating with no clear upward or downward trend.
▼ - Generally decreasing trend
✚ - Generally increasing trend.

4 CY 2009 nitrate (NO^3) concentration greater than or equal to 10 mg/L.
Total uranium (U) concentration greater than or equal to 0.03 mg/L.

5 Summed CY 2009 concentration of a VOC group (see below) greater than or equal to 5µg/L.

Ethenes = Summed chloroethenes (PCE, TCE, 12DCE, 11DCE, vinyl chloride
Ethanes = Summed chloroethanes (111TCA, 11DCE, chloroethane)
Methanes = Summed chloromethanes (carbon tetrachloride, chloroform, methylene chloride)
Petrol = Summed petroleum hydrocarbons (benzene, toluene, ethylbenzene, xylene)

6 Maximum CY 2009 gross alpha activity greater than or equal to 15 pCi/L
Maximum CY 2009 gross beta activity greater than or equal to 50 pCi/L

Table B.10 Concentration trends for the principal contaminants detected at CY 2009 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)							
			Inorganics [4]		VOCs [5]				Radioactivity [6]	
	AQT	AQF	NO^3	U	Ethenes	Ethanes	Methanes	Petrol.	Alpha	Beta
55-2A	●		○	NA	▼	▼	.	.	NA	NA
55-2B	●		✚	.	▼	▼	.	.	NA	NA
55-2C	●		✚	NA	▼	▼	.	.	.	.
55-3A	●		.	.	○	○	.	.	.	.
55-3B	●		.	.	○	○	.	○	.	.
55-3C	●		.	.	○	○	.	.	.	.
56-1A	●		.	.	.	.	.	.	.	.
56-1C	●		.	.	.	.	.	.	.	.
56-2A	●		.	.	▼	.	.	.	.	.
56-2B	●		.	.	○	.	.	.	.	.
56-2C	●		NA	NA	▼	.	.	.	NA	NA
56-3A	●		.	.	▼	.	.	.	.	.
56-3B	●		.	.	○	.	.	.	.	.
56-3C	●		.	.	○	.	.	.	.	.
56-4A	●		.	.	.	.	.	.	.	.
GW-108	●		▼	.	✚	.	○	.	○	✚
GW-151		●	.	.	✚	.	✚	.	.	.
GW-153		●	.	.	.	.	▼	.	.	.
GW-154		●	NA	○	.	.	.	.	○	○
GW-169		●	.	NA	.	.	.	.	.	.
GW-170		●	.	NA	.	.	.	.	.	.
GW-171		●	NA	NA	.	.	.	.	NA	NA
GW-172		●	NA	NA	.	.	.	.	NA	NA
GW-193		●	NA	NA	NA	NA	NA	NA	NA	NA
GW-204	●		NA	○	NA	NA	NA	NA	○	.
GW-219		●	NA	○	NA	NA	NA	NA	○	○
GW-220		●	NA	NA	✚	.	✚	.	NA	NA
GW-222		●	.	○	○	.	.	.	○	.
GW-223		●	.	✚	▼	.	.	.	.	.
GW-230		●	NA	NA	▼	.	.	.	NA	NA
GW-240		●	NA	NA	.	.	.	.	NA	NA
GW-251		●	▼	.	○	.	○	.	.	.
GW-253		●	○	.	○	.	○	.	○	.
GW-269	●		NA	NA	✚	○	.	.	NA	NA
GW-270	●		▼	.	.	.	.	.	.	.
GW-272	●		✚	.	.	.	.	.	.	.
GW-274	●		▼	.	✚	.	○	✚	.	.
GW-275	●		○	.	.	.	.	.	.	.
GW-281	●		NA	NA	.	.	.	.	NA	NA
GW-332	●		NA	NA	▼	▼	.	.	NA	NA
GW-337	●		NA	NA	▼	▼	.	.	NA	NA
GW-380		●	.	.	.	.	.	.	.	.

Table B.10 (continued)

Sampling Location[1]	Hydro. Unit[2] AQT	Hydro. Unit[2] AQF	Contaminant Type and Long-Term Trend[3] (○ = indeterminate, ✚ = increasing, ▼= decreasing) Inorganics[4] NO3	Inorganics[4] U	VOCs[5] Ethenes	VOCs[5] Ethanes	VOCs[5] Methanes	VOCs[5] Petrol.	Radioactivity[6] Alpha	Radioactivity[6] Beta
GW-381		●	NA	NA	○	.	▼	.	NA	NA
GW-382		●	.	.	▼	.	▼	.	.	.
GW-383	●		.	.	✚	.	.	.	.	.
GW-505	●		NA	Q	NA	NA	NA	NA	Q	.
GW-508	●		NA	NA	.	.	.	▼	NA	NA
GW-605		●	.	○	✚	.	✚	.	○	.
GW-606		●	✚	.	○	.	▼	.	.	.
GW-618		●	.	.	▼	.	.	.	.	.
GW-633	●		▼	.	✚	.	○	✚	.	.
GW-656	●		NA	NA	▼	▼	.	.	NA	NA
GW-658	●		NA	NA	.	○	.	○	NA	NA
GW-686		●	.	NA	○	.	.	.	NA	NA
GW-690		●	.	NA	▼	.	.	.	NA	NA
GW-691		●	.	NA	○	.	Q	.	NA	NA
GW-692		●	.	NA	○	.	▼	.	NA	NA
GW-698		●	○	NA	○	.	○	.	NA	NA
GW-700		●	NA	NA	▼	.	.	.	NA	NA
GW-722-14		●	.	.	▼	.	▼	.	.	.
GW-722-17		●	.	.	.	.	▼	.	.	.
GW-722-20		●	.	.	▼	.	▼	.	.	.
GW-722-22		●	.	.	.	.	▼	.	.	.
GW-722-33		●	.	.	.	.	.	.	.	.
GW-733		●	NA	NA	.	.	▼	.	.	.
GW-735		●	.	.	.	.	.	.	.	.
GW-744	●		.	.	.	.	.	.	.	.
GW-747	●		.	.	.	.	.	.	.	.
GW-750	●		.	.	.	.	.	.	.	.
GW-762	●		.	.	✚	○	.	.	.	.
GW-763	●		NA	NA	○	.	.	.	NA	NA
GW-765	●		.	.	.	.	.	.	.	.
GW-769	●		NA	NA	✚	.	✚	.	NA	NA
GW-770	●		NA	NA	.	.	✚	.	NA	NA
GW-775	●		NA	NA	.	.	.	.	NA	NA
GW-776	●		.	.	.	.	.	.	.	.
GW-779	●		.	.	.	.	.	.	.	.
GW-781	●		.	.	.	.	.	.	.	.
GW-782	●		.	.	▼	○	.	.	.	.
GW-783	●		NA	NA	▼	.	.	.	NA	NA
GW-791	●		.	.	▼	.	.	.	.	.
GW-802	●		NA	NA	.	.	.	.	NA	NA
GW-816	●		.	.	.	.	.	.	.	.
GW-820		●	NA	NA	○	.	.	.	NA	NA
GW-832		●	.	.	.	.	▼	.	.	.
GW-959		●	.	.	▼	.	.	.	.	.
GW-960	●		.	.	.	.	.	.	.	.

Table B.10 (continued)

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

Notes:

1 The exit pathway/perimeter monitoring locations are in bold typeface.

2 Hydrostratigraphic Unit

AQF - Monitored interval in the formations comprising the aquifer
AQT - Monitored interval in the formations comprising the aquitard

3 Trend types were interpreted from data tables or plots of concentration changes over time.

. - Not a contaminant (criteria defined below, in notes 4, 5, and 6).
NA - Not analyzed
Q - Elevated concentration, unsupported by other samples from the location (suspect data)
○ - Indeterminate trend: insufficient data, fairly stable trend, affected by sampling methods, or highly fluctuating with no clear upward or downward trend.
▼ - Generally decreasing trend
✚ - Generally increasing trend.

4 CY 2009 nitrate (NO^3) concentration greater than or equal to 10 mg/L.
Total uranium (U) concentration greater than or equal to 0.03 mg/L.

5 Summed CY 2009 concentration of a solvent group (see below) greater than or equal to 5µg/L.

Ethenes = Summed chloroethenes (PCE, TCE, 12DCE, 11DCE, vinyl chloride)
Ethanes = Summed chloroethanes (111TCA, 11DCE, chloroethane)
Methanes = Summed chloromethanes (carbon tetrachloride, chloroform, methylene chloride)
Petrol = Summed petroleum hydrocarbons (benzene, ethylbenzene, toluene, and total xylene)

6 Maximum CY 2009 gross alpha activity greater than or equal to 15 pCi/L
Maximum CY 2009 gross beta activity greater than or equal to 50 pCi/L

Table B.11 Concentration trends for contaminants detected at CY 2009 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	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-174	.	.	.	○	.	.
GW-175	.	.	.	○	.	.
GW-176	○	▼	.	○	.	.
GW-177	○	▼	.	NA	.	.
GW-180	▼	.	.	○	.	.
GW-203	NA	NA	NA	NA	.	.
GW-205	NA	NA	NA	NA	.	○
GW-217	Q	.	.	.	.	.
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-521	.	.	.	.	.	.
GW-522	.	.	.	.	.	.
GW-540	.	.	.	.	.	.
GW-557	.	.	.	.	.	.
GW-560	.	.	.	.	.	.
GW-562	.	.	.	.	.	.
GW-564	.	.	.	.	.	.
GW-709	.	.	.	.	.	.
GW-731	NA	NA	NA	NA	NA	NA
GW-732	NA	NA	NA	NA	NA	NA
GW-757	.	.	.	.	.	.
GW-796	.	.	.	.	.	.
GW-797	.	.	.	.	.	.
GW-798	○	○	.	○	.	.
GW-799	.	.	.	.	.	.
GW-801	.	.	.	.	.	.
GW-831	.	.	.	NA	NA	NA

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
MCK 1.4	NA	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:

1 The exit pathway/perimeter monitoring locations are in bold typeface.

2 Trend types were interpreted from data tables or plots of concentration changes over time.

. - Not a contaminant (criteria defined below, in notes 3 and 4).
NA - Not analyzed
○ - Indeterminate trend: fairly stable trend, insufficient data.
▼ - Generally decreasing trend
✚ - Generally increasing trend.

3 Summed CY 2009 concentration of a VOC group (see below) greater than or equal to 1µg/L. (excluding trace levels of common laboratory reagents or suspected artifacts).

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

Note that individual compounds have different long-term concentration trends at wells GW-177, GW-178, GW-305 and GW-322.

4 Maximum CY 2009 gross alpha activity greater than or equal to 15 pCi/L
Maximum CY 2009 gross beta activity greater than or equal to 50 pCi/L

APPENDIX C

MONITORING WELL CONSTRUCTION DETAILS

EXPLANATION

Hydrogeologic Regime:

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

Location:

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

EXPLANATION (continued)

General Information:

Depth	-	Feet below ground surface (rounded to nearest 0.1 ft)
Coordinates	-	Y-12 grid system (rounded to nearest foot)
Measuring Point	-	Top of well casing (TOC) or top of Well Wizard™ (TOWW)
Elevation	-	Feet above mean sea level (rounded to nearest 0.01 ft)
Tag Depth	-	Depth to the bottom of the well (feet below the 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
S/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) and subsequent updates maintained electronically.

APPENDIX C: MONITORING WELL CONSTRUCTION DETAILS, CY 2009

Well Number Hydrogeologic Regime Functional Area	1090 CR UNCS	55-2A EF GRIDB3	55-2B EF GRIDB3	55-2C EF GRIDB3	55-3A EF B9201-5	55-3B EF B9201-5	55-3C EF B9201-5	56-1A EF Y12	56-1C EF Y12	56-2A EF GRIDC3
General Information										
Date Installed	1982	08/08/83	1983	08/22/83	1983	1983	1983	1983	08/25/83	1983
Total Depth Drilled	96.7	14.1	27.6	75.9	14.3	38.1	77.5	19.0	75.3	15.1
East Coordinate	53,853	55,195	55,199	55,203	55,695	55,699	55,703	56,079	56,077	56,229
North Coordinate	28,718	30,085	30,085	30,085	29,959	29,959	29,959	30,351	30,355	29,881
Measuring Point	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW	TOC	TOWW
Measuring Point Elevation	1,104.48	976.74	977.42	977.02	972.46	973.32	974.34	969.25	969.49	963.53
Ground Surface Elevation	1,101.58	976.17	976.17	976.07	971.59	971.57	971.76	968.72	968.89	962.52
Tag Depth-(TOC)	98.02	13.98	27.69	76.00	14.25	37.98	77.43	18.95	73.45	15.03
Geologic Information										
Hydrostratigraphic Unit	AQF	AQT	AQT	AQT	AQT	AQT	AQT	AQT	AQT	AQT
Geologic Formation	OCk	Cn	Cn	Cn	Cn	Cn	Cn	Cn	Cn	Cn
Aquifer Zone	WT	WT	WT	BDR	WT	WT	BDR	WT	BDR	WT
Weathered Rock-Depth	.	11.5	10.0	14.5	7.0	5.0	7.0	2.0	6.0	.
Fresh Rock-Depth	.	.	.	47.2	.	.	.	.	10.0	.
Conductor Casing										
Casing Depth	.	.	.	15.5	.	.	.	.	7.0	.
Outside Diameter	.	.	.	4.5	.	.	.	.	4.5	.
Inside Diameter	.	.	.	.	.	.	.	.	.	.
Casing Material	.	.	.	STL	.	.	.	.	STL	.
Well Casing									.	
Borehole Depth	96.7	14.1	27.6	75.9	14.3	38.1	77.5	19.0	75.3	15.1
Borehole Diameter	8	6	6	6	6	6	6	6	6	6
Casing Depth	.	9.1	22.6	70.9	9.3	33.1	72.5	14.0	70.3	10.1
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	.	6.1	19.6	67.9	6.3	30.1	69.5	11.0	67.3	7.1
Midpoint-Depth	.	10.1	23.6	71.9	10.3	34.1	73.5	15.0	71.3	11.1
Pump Intake-Depth	84.80	11.43	25.00	73.30	12.13	33.75	72.42	15.97	.	12.00
Bottom of Screen-Depth	.	14.1	27.6	75.9	14.3	38.1	77.5	19.0	75.3	15.1
Bottom-Depth	96.7	14.1	27.6	75.9	14.3	38.1	77.5	19.0	75.3	15.1
Top-Elevation	.	970.07	956.57	908.17	965.29	941.47	902.26	957.72	901.59	955.42
Midpoint-Elevation	.	966.07	952.57	904.17	961.29	937.47	898.26	953.72	897.59	951.42
Pump Intake-Elevation	1016.78	964.74	951.22	902.82	959.46	937.82	899.34	952.75	.	950.53
Bottom-Elevation	1,004.88	962.07	948.57	900.17	957.29	933.47	894.26	949.72	893.59	947.42
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 2009

Well Number Hydrogeologic Regime Functional Area	56-2B EF GRIDC3	56-2C EF GRIDC3	56-3A EF Y12	56-3B EF Y12	56-3C EF Y12	56-4A EF Y12	GW-008 BC OLF	GW-014 BC BG	GW-046 BC BG	GW-053 BC BG
General Information										
Date Installed	1983	08/18/83	1983	1983	08/02/83	1983	09/21/83	09/29/83	10/27/83	11/04/83
Total Depth Drilled	38.8	77.3	17.8	33.4	55.5	12.1	25.5	13.2	20.5	39.7
East Coordinate	56,226	56,231	56,453	56,478	56,449	56,802	47,596	44,308	43,284	43,086
North Coordinate	29,884	29,885	29,867	29,866	29,859	29,820	29,783	29,848	29,562	29,066
Measuring Point	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW
Measuring Point Elevation	962.45	965.11	963.03	964.33	962.86	962.07	965.39	934.50	921.17	903.42
Ground Surface Elevation	962.21	962.44	962.35	962.74	962.36	960.10	962.11	931.50	918.13	900.50
Tag Depth-(TOC)	38.63	77.03	17.92	30.85	55.35	12.60	26.69	14.50	23.85	35.13
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	WT	BDR	WT	WT	BDR	WT	WT	WT	WT	WT
Weathered Rock-Depth	.	11.5	3.5	.	8.0	8.5	0.6	4.0	7.7	4.0
Fresh Rock-Depth	.	17.0	.	.	.	.	.	.	.	.
Conductor Casing										
Casing Depth	.	11.5	.	.	.	.	.	.	.	6.0
Outside Diameter	.	4.5	.	.	.	.	.	.	.	6.5
Inside Diameter	.	.	.	.	.	.	.	.	.	.
Casing Material	.	STL	.	.	.	.	.	.	.	STL
Well Casing										
Borehole Depth	38.8	77.3	17.8	33.4	55.5	12.1	25.5	13.2	20.5	39.7
Borehole Diameter	6	6	6	6	6	6	4.5	6	6	4
Casing Depth	33.8	72.3	12.8	28.4	50.5	7.1	15.7	10.0	8.1	26.6
Outside Diameter	4.5	4.5	4.5	4.5	4.5	4.5	2.37	2.37	2.37	2.37
Inside Diameter	4	4	4	4	4	4	2	2	2	2
Casing Material	PVC40	PVC40	PVC40	PVC40	PVC40	PVC40	SS304	SS304	SS304	SS304
Monitored Interval										
Top-Depth	30.8	69.3	9.8	25.4	47.5	4.1	13.0	5.0	5.0	11.4
Midpoint-Depth	34.8	73.3	13.8	29.4	51.5	8.1	19.3	9.1	12.7	22.1
Pump Intake-Depth	35.80	72.30	14.82	26.91	52.00	9.53	17.70	9.00	12.00	871.42
Bottom of Screen-Depth	38.8	77.3	17.8	33.4	55.5	12.1	20.7	12.0	18.1	31.6
Bottom-Depth	38.8	77.3	17.8	33.4	55.5	12.1	25.5	13.2	20.3	32.8
Top-Elevation	931.41	893.14	952.55	937.34	914.86	956.00	949.11	926.50	913.13	889.10
Midpoint-Elevation	927.41	889.14	948.55	933.34	910.86	952.00	942.86	922.40	905.48	878.40
Pump Intake-Elevation	926.45	890.11	947.53	935.83	910.36	950.57	944.39	922.50	906.17	29.08
Bottom-Elevation	923.41	885.14	944.55	929.34	906.86	948.00	936.61	918.30	897.83	867.70
Screen Length	5	5	5	5	5	5	5	2	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 2009

Well Number	GW-058	GW-065	GW-068	GW-071	GW-077	GW-078	GW-079	GW-080	GW-082	GW-085
Hydrogeologic Regime	BC	BC	BC	BC	BC	BC	BC	BC	BC	BC
Functional Area	BG	OLF	BG	BG	BG	BG	BG	BG	BG	OLF
General Information										
Date Installed	03/06/84	03/14/84	03/22/84	03/25/84	03/29/84	03/30/84	03/23/84	03/24/84	03/17/84	03/22/84
Total Depth Drilled	45.2	35.0	85.0	220.6	100.5	21.1	65.0	30.0	35.0	62.0
East Coordinate	43,211	49,167	43,377	44,191	41,234	41,209	41,616	41,621	42,090	49,058
North Coordinate	28,714	29,185	29,500	29,495	29,729	29,730	30,630	30,622	30,434	30,003
Measuring Point	TOC	TOC	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW
Measuring Point Elevation	913.30	982.50	924.61	928.90	919.30	918.10	981.20	981.00	964.00	983.57
Ground Surface Elevation	910.00	979.70	921.20	925.40	914.70	914.50	977.20	977.10	960.52	979.80
Tag Depth-(TOC)	48.90	36.89	86.10	218.40	104.10	23.40	64.70	33.00	38.45	62.34
Geologic Information										
Hydrostratigraphic Unit	AQF	AQF	AQT	AQT	AQT	AQT	AQT	AQT	AQT	AQT
Geologic Formation	Cmn	Cmn	Cn	Cn	Cn	Cn	Crg	Crg	Cm	Cn
Aquifer Zone	BDR	WT	BDR	BDR	BDR	BDR	BDR	WT	BDR	BDR
Weathered Rock-Depth	.	.	.	5.5	7.0	6.5	4.0	3.5	7.0	2.0
Fresh Rock-Depth	20.8	30.1	25.0	16.0	13.0	8.5	26.5	23.5	23.0	40.0
Conductor Casing										
Casing Depth	.	.	.	16.0	35.0	.	.	.	25.0	.
Outside Diameter	.	.	.	10.63	4.5	.	.	.	6.5	.
Inside Diameter	.	.	.	10	4	.	.	.	.	.
Casing Material	.	.	.	PVC40	STL	.	.	.	STL	.
Well Casing		.								
Borehole Depth	45.2	35.0	85.0	220.6	100.5	21.1	65.0	30.0	35.0	62.0
Borehole Diameter	4	4	8.75	8.75	3.88	6.5	6.5	6.5	4	4
Casing Depth	42.2	29.0	71.9	198.4	90.3	16.1	59.9	24.7	29.4	53.8
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	38.8	24.5	70.0	195.1	87.4	11.7	49.9	20.8	24.1	48.4
Midpoint-Depth	41.5	29.3	76.8	207.1	93.9	16.4	57.4	25.3	29.3	53.6
Pump Intake-Depth	43.70	.	77.59	208.50	.	.	61.80	.	31.50	51.20
Bottom of Screen-Depth	44.2	34.0	82.1	219.0	100.3	21.1	64.9	29.7	34.4	58.8
Bottom-Depth	44.2	34.0	83.6	219.0	100.3	21.1	64.9	29.7	34.4	58.8
Top-Elevation	871.20	955.20	851.20	730.30	827.30	902.80	927.30	956.30	936.42	931.40
Midpoint-Elevation	868.50	950.45	844.40	718.35	820.85	898.10	919.80	951.85	931.27	926.20
Pump Intake-Elevation	866.30	.	843.61	716.90	.	.	915.40	.	929.00	928.57
Bottom-Elevation	865.80	945.70	837.60	706.40	814.40	893.40	912.30	947.40	926.12	921.00
Screen Length	2	5	10.2	20.6	10	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 2009

Well Number	GW-098	GW-100	GW-101	GW-108	GW-122	GW-127	GW-141	GW-143	GW-144	GW-145
Hydrogeologic Regime	BC	BC	BC	EF	BC	BC	CR	CR	CR	CR
Functional Area	OLF	S3	S3	S3	S3	S3	LIV	KHQ	KHQ	KHQ
General Information										
Date Installed	09/21/84	09/12/84	09/12/84	09/26/84	07/25/85	1984	09/04/87	10/24/85	10/24/85	10/14/85
Total Depth Drilled	104.0	20.7	17.5	58.6	142.0	24.0	156.0	253.0	195.0	110.0
East Coordinate	46,959	50,957	51,844	53,207	51,807	51,828	52,463	63,522	63,502	63,266
North Coordinate	29,452	29,759	30,241	30,070	29,741	29,850	28,755	24,257	24,255	24,441
Measuring Point	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW
Measuring Point Elevation	945.95	987.40	1,007.40	999.00	1,007.20	1,005.90	1,186.23	913.98	913.54	840.24
Ground Surface Elevation	942.40	984.60	1,005.10	995.80	1,004.15	1,003.67	1,183.45	911.04	910.48	837.29
Tag Depth-(TOC)	105.65	17.87	19.18	58.30	145.28	26.52	158.81	252.70	194.34	113.49
Geologic Information										
Hydrostratigraphic Unit	AQT	AQF	AQT	AQT	AQF	AQT	AQF	AQF	AQF	AQF
Geologic Formation	Cn	Cmn	Cn	Cn	Cmn	Cn	OCk	OCk	OCk	OCk
Aquifer Zone	BDR	WT	WT	BDR	BDR	WT	BDR	BDR	BDR	BDR
Weathered Rock-Depth	1.0	14.0	14.0	4.0	.	.	.	.	.	.
Fresh Rock-Depth	7.5	.	17.5	.	37.0	.	57.0	18.0	40.0	12.0
Conductor Casing										
Casing Depth	20.0	0.3	2.7	20.7	39.0	.	65.0	20.0	40.0	12.0
Outside Diameter	10.63	7	7	10.63	10.75	.	10.75	10.63	12.5	12.5
Inside Diameter	10	.	.	10	10	.	10	9.87	11.75	11.75
Casing Material	PVC40	S/GAL	S/GAL	PVC40	SF25	SS	SF25	PVC40	PVC40	PVC40
Well Casing										
Borehole Depth	104.0	20.7	17.5	58.6	92.0	24.0	156.0	205.0	195.0	110.0
Borehole Diameter	9	6.5	6.5	9	9.79	6.5	10	10	11	11
Casing Depth	82.4	10.2	12.3	46.7	92.0	18.8	144.5	205.0	150.0	88.5
Outside Diameter	4.5	2.37	2.37	4.5	4.5	2.37	4.5	6.62	4.5	4.5
Inside Diameter	4	2	2	4	4	2	4	6.12	4	4
Casing Material	SS304	PVC	PVC	PVC40	SF25	SS304	SS304	SF25	PVC40	PVC40
Monitored Interval										
Top-Depth	76.6	3.8	10.1	41.0	92.0	14.0	141.0	205.0	148.0	86.0
Midpoint-Depth	90.3	12.3	13.8	49.8	117.0	19.0	148.5	229.0	171.5	98.0
Pump Intake-Depth	96.40	.	989.40	49.80	131.90	981.40	147.70	226.10	170.90	100.00
Bottom of Screen-Depth	103.4	14.2	16.3	55.7	.	22.8	155.2	.	190.0	108.5
Bottom-Depth	104.0	20.7	17.5	58.6	142.0	24.0	156.0	253.0	195.0	110.0
Top-Elevation	865.80	980.80	995.00	954.80	912.15	989.67	1,042.45	706.04	762.48	751.29
Midpoint-Elevation	852.10	972.35	991.30	946.00	887.15	984.67	1,034.95	682.04	738.98	739.29
Pump Intake-Elevation	845.95	.	15.70	946.00	872.20	22.27	1035.73	684.98	739.54	737.24
Bottom-Elevation	838.40	963.90	987.60	937.20	862.15	979.67	1,027.45	658.04	715.48	727.29
Screen Length	21	4	4	9	.	4	10.7	.	40	20
Screen Material	SS/sw	PVC/sl	PVC/sl	PVC/sl	.	PVC/SL	SS/sw	.	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 2009

Well Number	GW-151	GW-153	GW-154	GW-156	GW-159	GW-161	GW-169	GW-170	GW-171	GW-172
Hydrogeologic Regime	EF	EF	EF	CR	CR	CR	EF	EF	EF	EF
Functional Area	NHP	NHP	NHP	CRSDB	CRSDB	ECRWP	EXP-UV	EXP-UV	EXP-UV	EXP-UV
General Information										
Date Installed	08/14/85	10/31/85	07/30/85	10/18/85	10/18/85	07/07/87	09/16/86	04/01/86	02/26/86	05/05/86
Total Depth Drilled	96.5	60.0	11.2	157.6	157.0	400.0	34.8	156.9	31.2	133.9
East Coordinate	64,232	63,728	63,346	64,020	63,496	62,146	66,854	66,843	69,654	69,579
North Coordinate	28,958	28,613	28,987	27,626	27,764	27,805	28,545	28,545	28,403	28,358
Measuring Point	TOWW	TOWW	TOWW	TOWW	TOWW	TOC	TOWW	TOWW	TOWW	TOWW
Measuring Point Elevation	916.17	921.68	911.70	1,049.28	1,051.38	1,093.54	932.12	932.64	920.72	926.69
Ground Surface Elevation	913.06	918.53	908.60	1,046.94	1,048.79	1,090.91	929.95	930.70	918.55	922.85
Tag Depth-(TOC)	99.63	60.84	13.35	157.65	155.87	402.88	36.23	156.16	32.64	137.50
Geologic Information										
Hydrostratigraphic Unit	AQF	AQF	AQF	AQF	AQF	AQF	AQF	AQF	AQF	AQF
Geologic Formation	Cmn	Cmn	Cmn	OCk	OCk	OCk	Cmn	Cmn	Cmn	Cmn
Aquifer Zone	BDR	BDR	WT	BDR	BDR	BDR	WT	BDR	WT	BDR
Weathered Rock-Depth	.	.	11.2	84.0	.	65.0	.	.	.	15.0
Fresh Rock-Depth	12.0	14.0	.	93.0	100.0	95.5	.	30.0	.	19.0
Conductor Casing										
Casing Depth	12.0	29.0	.	94.0	123.0	108.0	.	30.0	.	35.0
Outside Diameter	12.5	10.63	.	10.75	10.75	12.5	.	8.63	.	8.63
Inside Diameter	11.75	9.88	.	10	10	.	.	.	.	.
Casing Material	PVC40	PVC40	.	SF25	SF25	SF25	.	PVC40	.	SF25
Well Casing										
Borehole Depth	96.5	60.0	11.2	157.0	157.0	350.0	42.0	104.0	31.2	105.0
Borehole Diameter	11	11	8	8.5	8.5	11	8	6.62	8	6.62
Casing Depth	86.0	49.5	5.7	147.0	147.0	350.0	29.7	104.0	26.8	105.0
Outside Diameter	4.5	4.5	4.5	4.5	4.5	6.62	2.37	4.38	2.37	4.38
Inside Diameter	4	4	4	4	4	.	2	4	2	4
Casing Material	PVC40	PVC40	PVC40	PVC40	PVC40	SF25	PVC40	STL	PVC40	STL
Monitored Interval										
Top-Depth	85.0	45.0	4.7	145.0	145.0	350.0	28.7	104.0	25.8	105.0
Midpoint-Depth	90.8	52.5	8.0	151.3	151.0	375.0	31.8	130.5	28.5	119.4
Pump Intake-Depth	90.80	52.90	8.40	150.70	148.40	.	.	124.10	.	123.20
Bottom of Screen-Depth	96.0	59.5	10.7	157.0	157.0	.	34.7	.	31.2	.
Bottom-Depth	96.5	60.0	11.2	157.6	157.0	400.0	34.8	156.9	31.2	133.8
Top-Elevation	828.06	873.53	903.90	901.94	903.79	740.91	901.25	826.70	892.75	817.85
Midpoint-Elevation	822.31	866.03	900.65	895.64	897.79	715.91	898.20	800.25	890.05	803.45
Pump Intake-Elevation	822.27	865.68	900.20	896.28	900.38	.	.	806.64	.	799.69
Bottom-Elevation	816.56	858.53	897.40	889.34	891.79	690.91	895.15	773.80	887.35	789.05
Screen Length	10	10	5	10	10	.	5	.	4.4	.
Screen Material	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	.
Open-Hole Length	.	.	.	.	.	50	.	52.9	.	28.8
Open-Hole Diameter	.	.	.	.	.	11	.	3.88	.	3.63

APPENDIX C: MONITORING WELL CONSTRUCTION DETAILS, CY 2009

Well Number Hydrogeologic Regime Functional Area	GW-174 CR CRSP	GW-175 CR CRSP	GW-176 CR CRSP	GW-177 CR CRSP	GW-180 CR CRSP	GW-193 EF T2331	GW-203 CR UNCS	GW-204 EF T0134	GW-205 CR UNCS	GW-217 CR LIV
General Information										
Date Installed	08/15/85	06/22/88	08/27/85	10/24/85	08/11/87	08/04/89	10/24/85	08/30/89	10/25/85	08/13/87
Total Depth Drilled	145.0	166.7	145.0	145.0	144.0	18.5	156.0	17.5	164.0	180.0
East Coordinate	59,215	58,686	58,450	57,497	59,220	59,536	54,190	57,411	54,008	53,020
North Coordinate	28,205	28,677	28,294	28,483	28,494	29,344	28,356	29,956	28,363	28,758
Measuring Point	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW
Measuring Point Elevation	1,116.66	1,084.19	1,125.30	1,158.20	1,104.14	934.17	1,105.45	958.74	1,104.14	1,177.03
Ground Surface Elevation	1,114.06	1,081.89	1,122.13	1,155.52	1,101.43	931.11	1,102.34	955.47	1,101.46	1,174.29
Tag Depth-(TOC)	151.94	169.49	147.33	150.69	146.08	21.17	157.61	20.23	165.13	179.13
Geologic Information										
Hydrostratigraphic Unit	AQF	AQF	AQF	AQF	AQF	AQF	AQF	AQT	AQF	AQF
Geologic Formation	OCk	OCk	OCk	OCk	OCk	Cmn	OCk	Cc	OCk	OCk
Aquifer Zone	BDR	BDR	BDR	BDR	BDR	WT	BDR	WT	BDR	BDR
Weathered Rock-Depth	51.0	46.0	.	62.0	58.0	2.5	86.0	10.0	100.0	55.0
Fresh Rock-Depth	80.0	98.5	84.0	98.0	90.0	.	93.0	.	146.0	75.0
Conductor Casing										
Casing Depth	80.0	61.3	88.0	82.0	90.6	5.0	94.0	.	154.0	81.7
Outside Diameter	10.75	10.75	10.75	10.75	10.75	9.63	10.75	.	10.75	10.75
Inside Diameter	10	10	10	10	10	.	10	.	10	10
Casing Material	SF25	.	SF25	SF25	SF25	STL	SF25	.	SF25	SF25
Well Casing										
Borehole Depth	145.0	166.7	145.0	145.0	144.0	18.5	156.0	17.5	164.0	180.0
Borehole Diameter	10	9.5	10	8	10	8	8.5	6	10	10
Casing Depth	135.0	150.6	135.0	133.0	132.2	8.2	146.0	7.3	154.0	166.8
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	PVC40	SS304	SS304	PVC40	SS304	PVC40	SS304
Monitored Interval										
Top-Depth	134.0	148.3	134.0	130.0	126.0	5.5	144.0	6.5	152.0	165.2
Midpoint-Depth	139.5	157.5	139.5	137.5	135.0	12.0	150.0	11.9	158.0	172.6
Pump Intake-Depth	969.66	162.70	983.30	.	963.14	13.90	146.90	11.70	147.30	172.10
Bottom of Screen-Depth	145.0	166.4	145.0	143.0	143.0	18.5	156.0	17.3	164.0	177.4
Bottom-Depth	145.0	166.7	145.0	145.0	144.0	18.5	156.0	17.3	164.0	180.0
Top-Elevation	980.06	933.59	988.13	1,025.52	975.43	925.61	958.34	948.97	949.46	1,009.09
Midpoint-Elevation	974.56	924.39	982.63	1,018.02	966.43	919.14	952.34	943.57	943.46	1,001.69
Pump Intake-Elevation	144.40	919.19	138.83	.	138.29	917.17	955.45	943.74	954.14	1002.23
Bottom-Elevation	969.06	915.19	977.13	1,010.52	957.43	912.66	946.34	938.17	937.46	994.29
Screen Length	10	15.8	10	10	10.8	10.3	10	10	10	10.6
Screen Material	SS/sw	SS/sw	SS/sw	PVC/sl	SS/sw	SS/sw	PVC/sl	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	0.01
Open-Hole Length	.	.	.	.	.	.	.	.	.	.
Open-Hole Diameter	.	.	.	.	.	.	.	.	.	.

APPENDIX C: MONITORING WELL CONSTRUCTION DETAILS, CY 2009

Well Number	GW-219	GW-220	GW-221	GW-222	GW-223	GW-225	GW-229	GW-230	GW-231	GW-236
Hydrogeologic Regime	EF	EF	CR	EF	EF	BC	BC	EF	CR	BC
Functional Area	UOV	NHP	UNCS	NHP	NHP	OLF	OLF	EXP-UV	KHQ	S3
General Information										
Date Installed	07/30/87	08/22/85	10/24/85	08/24/85	08/21/85	10/08/85	10/30/85	05/12/86	10/02/85	10/16/85
Total Depth Drilled	11.3	45.2	158.0	25.0	90.5	200.0	55.0	406.4	35.0	18.5
East Coordinate	58,929	64,225	54,389	63,324	63,311	47,461	47,017	69,617	63,410	50,453
North Coordinate	29,163	28,949	28,359	28,954	28,938	29,155	29,256	28,388	24,725	29,712
Measuring Point	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW
Measuring Point Elevation	935.83	915.64	1,106.16	911.82	911.62	943.11	949.00	923.11	849.67	983.21
Ground Surface Elevation	931.27	912.74	1,103.36	908.82	908.97	940.21	945.71	919.57	846.90	980.39
Tag Depth-(TOC)	15.59	49.00	159.34	28.55	93.57	203.30	51.45	409.48	37.70	21.14
Geologic Information										
Hydrostratigraphic Unit	AQF	AQF	AQF	AQF	AQF	AQF	AQF	AQF	AQF	AQF
Geologic Formation	Cmn	Cmn	OCk	Cmn	Cmn	Cmn	Cmn	Cmn	OCk	Cmn
Aquifer Zone	WT	BDR	BDR	BDR	BDR	BDR	BDR	BDR	BDR	WT
Weathered Rock-Depth	.	.	36.0	.	.	.	.	19.0	.	9.0
Fresh Rock-Depth	.	11.0	90.0	10.0	10.0	25.0	30.0	38.0	10.5	18.5
Conductor Casing										
Casing Depth	.	13.0	92.0	11.0	11.0	32.0	37.0	31.0	11.0	.
Outside Diameter	.	12.5	6.63	12.5	12.5	10.75	10.75	8.63	10.63	.
Inside Diameter	.	11.75	.	11.75	11.75	10	10	.	10	.
Casing Material	NONE	PVC40	SF25	PVC40	PVC40	STL	STL	STL	PVC40	NONE
Well Casing										
Borehole Depth	11.3	45.2	158.0	25.0	90.5	150.0	40.0	341.0	35.0	18.5
Borehole Diameter	10	11	6	11	11	10	10	5.5	11	8
Casing Depth	5.7	34.7	148.0	19.5	80.0	150.0	40.0	341.0	24.5	13.0
Outside Diameter	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.38	4.5	4.5
Inside Diameter	4	4	4	4	4	4	4	4	4	.
Casing Material	SS304	PVC40	PVC40	PVC40	PVC40	STL	STL	STL	PVC40	PVC40
Monitored Interval										
Top-Depth	4.3	31.0	146.0	18.0	79.0	150.0	40.0	341.0	22.8	10.0
Midpoint-Depth	7.8	38.1	152.0	21.5	84.8	175.0	47.5	373.7	28.9	14.3
Pump Intake-Depth	922.33	41.10	149.20	23.00	84.40	190.10	44.70	383.50	28.70	964.71
Bottom of Screen-Depth	11.3	44.7	158.0	24.5	90.0	.	.	.	34.5	18.0
Bottom-Depth	11.3	45.2	158.0	25.0	90.5	200.0	55.0	406.4	35.0	18.5
Top-Elevation	926.97	881.74	957.36	890.82	829.97	790.21	905.71	578.57	824.10	970.39
Midpoint-Elevation	923.47	874.64	951.36	887.32	824.22	765.21	898.21	545.87	818.00	966.14
Pump Intake-Elevation	8.94	871.64	954.16	885.82	824.62	750.11	901.00	536.11	818.17	15.68
Bottom-Elevation	919.97	867.54	945.36	883.82	818.47	740.21	890.71	513.17	811.90	961.89
Screen Length	5.6	10	10	5	10	.	.	.	10	5
Screen Material	SS/sw	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
Open-Hole Length	.	.	.	.	.	50	15	65.4	.	.
Open-Hole Diameter	.	.	.	.	.	4	4	3.63	.	.

APPENDIX C: MONITORING WELL CONSTRUCTION DETAILS, CY 2009

Well Number	GW-240	GW-242	GW-246	GW-251	GW-253	GW-269	GW-270	GW-272	GW-274	GW-275
Hydrogeologic Regime	EF	BC	BC	EF	EF	EF	EF	EF	EF	EF
Functional Area	NHP	BG	S3	S2	S2	SY	SY	SY	SY	SY
General Information										
Date Installed	10/31/85	11/20/85	03/11/86	04/08/86	04/11/86	06/16/86	06/09/86	06/16/86	06/09/86	05/30/86
Total Depth Drilled	29.5	17.0	76.0	51.0	50.0	30.0	18.5	16.2	35.0	65.5
East Coordinate	63,726	43,144	52,098	53,843	54,057	53,779	53,236	53,737	53,673	53,688
North Coordinate	28,604	31,004	29,992	29,467	29,404	30,649	30,424	30,485	30,152	30,151
Measuring Point	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW
Measuring Point Elevation	922.90	978.69	1,009.19	1,003.80	1,004.24	1,027.81	1,008.96	1,009.16	995.60	995.53
Ground Surface Elevation	919.50	974.78	1,006.07	1,001.60	1,001.60	1,025.38	1,006.35	1,006.62	992.94	993.08
Tag Depth-(TOC)	32.55	20.18	76.50	50.04	50.51	33.50	21.50	19.16	36.12	68.47
Geologic Information										
Hydrostratigraphic Unit	AQF	AQT	AQT	AQF	AQF	AQT	AQT	AQT	AQT	AQT
Geologic Formation	Cmn	Cpv	Cn	Cmn	Cmn	Cm	Cn	Cn	Cn	Cn
Aquifer Zone	BDR	WT	WT	BDR	WT	WT	BDR	WT	WT	BDR
Weathered Rock-Depth	.	9.0	26.0	32.5	.	10.0	5.0	5.0	3.0	5.0
Fresh Rock-Depth	14.0	.	.	.	.	.	11.0	15.0	35.0	35.0
Conductor Casing										
Casing Depth	14.0	.	27.0	.	.	.	.	.	.	38.0
Outside Diameter	12.5	.	12.5	.	.	.	.	.	.	10.63
Inside Diameter	12	.	12	.	.	.	.	.	.	10
Casing Material	PVC40	.	PVC40	.	.	.	NONE	NONE	.	PVC40
Well Casing										
Borehole Depth	29.5	17.0	76.0	51.0	50.0	30.0	18.5	16.2	35.0	65.5
Borehole Diameter	11	8	11	8.25	8.25	10	10	10	8	10
Casing Depth	24.0	10.6	46.5	37.5	37.0	23.7	13.0	10.9	28.5	54.8
Outside Diameter	4.5	2.37	6.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Inside Diameter	4	.	6	4	4	4	4	4	4	4
Casing Material	PVC40	SS304	PVC40	PVC40	PVC40	PVC40	SS304	SS304	SS304	SS304
Monitored Interval										
Top-Depth	21.0	9.0	34.2	35.0	36.2	21.9	11.0	8.8	25.8	53.3
Midpoint-Depth	25.3	13.0	55.1	43.0	43.1	26.0	14.8	12.5	30.4	59.4
Pump Intake-Depth	26.60	13.1	59.40	42.80	41.60	28.10	989.96	992.66	30.80	62.60
Bottom of Screen-Depth	29.0	17.0	74.6	47.1	46.7	29.4	18.4	16.2	33.9	65.2
Bottom-Depth	29.5	17.0	76.0	51.0	50.0	30.0	18.5	16.2	35.0	65.5
Top-Elevation	898.50	965.78	971.87	966.60	965.40	1,003.48	995.35	997.82	967.14	939.78
Midpoint-Elevation	894.25	961.78	950.97	958.60	958.50	999.43	991.60	994.12	962.54	933.68
Pump Intake-Elevation	892.90	961.69	946.69	958.80	960.04	997.31	16.39	13.96	962.10	930.53
Bottom-Elevation	890.00	957.78	930.07	950.60	951.60	995.38	987.85	990.42	957.94	927.58
Screen Length	5	6.4	28.1	9.6	9.7	5.7	5.4	5.3	5.4	10.4
Screen Material	PVC/sl	SS/sw	PVC/sl	PVC/sl	PVC/sl	PVC/sl	SS/sw	SS/sw	SS/sw	SS/sw
Slot Size	0.01	0.01	0.03	0.01	0.01	0.02	0.01	0.01	0.01	0.01
Open-Hole Length	.	.	.	.	.	.	.	.	.	.
Open-Hole Diameter	.	.	.	.	.	.	.	.	.	.

APPENDIX C: MONITORING WELL CONSTRUCTION DETAILS, CY 2009

Well Number Hydrogeologic Regime Functional Area	GW-276 BC S3	GW-281 EF FF	GW-289 BC BG	GW-293 CR ECRWP	GW-294 CR ECRWP	GW-296 CR ECRWP	GW-298 CR ECRWP	GW-301 CR CRBAWP	GW-305 CR LIV	GW-307 BC RS
General Information										
Date Installed	07/15/86	08/20/86	11/20/86	06/11/87	05/01/87	05/11/87	07/27/87	07/02/87	08/25/87	07/15/87
Total Depth Drilled	18.5	17.5	40.8	214.0	128.0	147.0	190.0	182.0	179.6	41.6
East Coordinate	52,557	61,907	42,875	62,321	62,483	62,023	62,445	61,964	52,962	49,655
North Coordinate	29,926	29,771	29,982	28,112	27,958	27,994	27,495	27,662	28,548	29,346
Measuring Point	TOWW	TOC	TOWW	TOC	TOC	TOC	TOC	TOWW	TOWW	TOWW
Measuring Point Elevation	1,001.57	946.10	948.73	1,063.90	1,083.60	1,090.99	1,049.01	1,086.55	1,183.72	993.14
Ground Surface Elevation	998.70	946.53	946.32	1,061.70	1,083.67	1,088.29	1,046.40	1,083.94	1,181.07	991.01
Tag Depth-(TOC)	21.34	14.85	43.14	216.40	130.76	148.16	189.36	165.23	181.06	43.60
Geologic Information										
Hydrostratigraphic Unit	AQT	AQT	AQT	AQF	AQF	AQF	AQF	AQF	AQF	AQF
Geologic Formation	Cn	Cn	Cm	OCk	OCk	OCk	OCk	OCk	OCk	Cmn
Aquifer Zone	WT	WT	WT	BDR	BDR	BDR	BDR	BDR	BDR	WT
Weathered Rock-Depth	18.5	17.5	24.0	57.0	62.0	67.0	65.0	94.0	53.0	41.6
Fresh Rock-Depth	.	.	38.0	110.0	87.0	81.5	80.0	136.0	84.0	.
Conductor Casing										
Casing Depth	.	.	.	57.8	74.5	86.5	83.3	105.0	64.0	.
Outside Diameter	.	.	.	10.75	10.75	10.75	10.75	10.75	10.75	.
Inside Diameter	.	.	.	10	10	10	10	10	10	.
Casing Material	.	.	.	SF25	SF25	SF25	SF25	SF25	SF25	NONE
Well Casing										
Borehole Depth	18.5	17.5	40.8	197.0	128.0	147.0	190.0	163.5	179.6	41.6
Borehole Diameter	8	6	9	10	10	10	10	10	10	10
Casing Depth	13.0	5.0	30.6	197.0	117.6	136.3	176.0	151.0	168.9	30.9
Outside Diameter	4.5	4.5	4.5	6.62	4.5	4.5	4.5	4.5	4.5	4.5
Inside Diameter	4	4	4	.	4	4	4	4	4	4
Casing Material	SS304	SS304	SS304	SF25	SS304	SS304	SS304	SS304	SS304	SS304
Monitored Interval										
Top-Depth	11.3	4.0	28.9	197.0	113.0	134.4	171.1	148.5	165.3	28.7
Midpoint-Depth	14.9	9.5	34.9	205.5	120.5	140.7	180.6	156.0	172.5	35.2
Pump Intake-Depth	14.10	.	35.60	.	.	.	.	157.40	173.40	954.64
Bottom of Screen-Depth	18.3	15.0	40.6	.	128.0	146.8	186.0	161.0	179.6	41.6
Bottom-Depth	18.5	15.0	40.8	214.0	128.0	147.0	190.0	163.5	179.6	41.6
Top-Elevation	987.40	942.53	917.42	864.70	970.67	953.89	875.30	935.44	1,015.77	962.31
Midpoint-Elevation	983.80	937.03	911.47	856.20	963.17	947.59	865.85	927.94	1,008.62	955.86
Pump Intake-Elevation	984.57	.	910.73	.	.	.	.	926.55	1007.62	36.37
Bottom-Elevation	980.20	931.53	905.52	847.70	955.67	941.29	856.40	920.44	1,001.47	949.41
Screen Length	5.3	10	10	.	10.4	10.5	10	10	10.7	10.7
Screen Material	SS/sw	SS/sl	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	.	.	.	17	.	.	.	.	.	.
Open-Hole Diameter	.	.	.	6	.	.	.	.	.	.

APPENDIX C: MONITORING WELL CONSTRUCTION DETAILS, CY 2009

Well Number Hydrogeologic Regime Functional Area	GW-315 BC SPI	GW-322 CR CRSP	GW-332 EF WCPA	GW-337 EF WCPA	GW-363 BC EMWMF	GW-365 BC OLF	GW-380 EF NHP	GW-381 EF NHP	GW-382 EF NHP	GW-383 EF NHP
General Information										
Date Installed	09/25/87	09/02/87	08/11/87	08/12/87	03/16/88	05/02/88	08/19/88	04/25/88	04/11/88	04/04/88
Total Depth Drilled	104.0	193.0	24.1	22.1	75.0	150.0	15.5	60.4	173.0	24.1
East Coordinate	52,268	58,912	54,882	54,519	46,872	46,490	62,938	62,948	62,956	63,522
North Coordinate	29,455	28,241	30,058	30,057	29,961	29,150	28,714	28,715	28,716	29,201
Measuring Point	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW	TOC	TOWW
Measuring Point Elevation	1,047.45	1,134.98	981.24	987.48	957.91	935.58	913.55	913.36	913.17	908.77
Ground Surface Elevation	1,044.84	1,131.81	979.55	984.12	955.41	933.03	913.66	913.44	913.16	906.00
Tag Depth-(TOC)	105.98	191.99	27.07	25.33	77.27	152.49	15.80	61.01	173.20	26.54
Geologic Information										
Hydrostratigraphic Unit	AQF	AQF	AQT	AQT	AQT	AQF	AQF	AQF	AQF	AQT
Geologic Formation	Cmn	OCk	Cn	Cn	Cn	Cmn	Cmn	Cmn	Cmn	Cn
Aquifer Zone	BDR	BDR	WT	WT	BDR	BDR	WT	BDR	BDR	WT
Weathered Rock-Depth	54.0	49.0	6.0	.	9.0	11.0	15.5	13.5	12.7	11.5
Fresh Rock-Depth	71.0	120.0	.	.	21.0	15.0	.	26.0	17.0	.
Conductor Casing										
Casing Depth	84.4	61.0	.	.	36.0	18.5	.	13.5	12.7	5.0
Outside Diameter	10.75	10.75	.	.	10.75	11.75	.	13	10.75	10.75
Inside Diameter	10	10	.	.	10	11	.	.	10	10
Casing Material	SF25	SF25	.	.	STL	STL	.	STL	STL	STL
Well Casing						.				
Borehole Depth	104.0	135.0	24.1	22.1	50.0	126.7	15.5	49.3	125.0	24.1
Borehole Diameter	10	10	10	10	9.5	10.75	10	9.5	9.5	8.75
Casing Depth	93.3	128.0	18.7	16.7	48.3	124.2	4.8	47.8	123.2	18.1
Outside Diameter	4.5	7	4.5	4.5	6.62	6.62	4.5	6.62	6.62	4.5
Inside Diameter	4	.	4	4	.	.	.	.	.	4
Casing Material	SS304	STL	SS304	SS304	SF25	SF25	SS304	SF25	SF25	SS304
Monitored Interval										
Top-Depth	90.0	128.0	16.8	15.0	50.0	126.7	2.8	49.3	125.0	16.6
Midpoint-Depth	97.0	160.5	20.5	18.6	62.5	138.4	9.2	54.9	149.0	20.1
Pump Intake-Depth	97.40	182.30	21.30	16.60	62.50	787.58	12.60	55.50	.	20.50
Bottom of Screen-Depth	103.3	.	24.1	22.1	.	.	15.2	.	.	23.1
Bottom-Depth	104.0	193.0	24.1	22.1	75.0	150.0	15.5	60.4	173.0	23.6
Top-Elevation	954.84	1,003.81	962.75	969.12	905.41	806.33	910.86	864.14	788.16	889.40
Midpoint-Elevation	947.84	971.31	959.10	965.57	892.91	794.68	904.51	858.59	764.16	885.90
Pump Intake-Elevation	947.45	949.48	958.24	967.48	892.91	145.45	901.05	857.96	.	885.47
Bottom-Elevation	940.84	938.81	955.45	962.02	880.41	783.03	898.16	853.04	740.16	882.40
Screen Length	10	.	5.4	5.4	.	.	10.4	.	.	5
Screen Material	SS/sw	.	SS/sw	SS/sw	.	.	SS/sw	.	.	SS/sw
Slot Size	0.01	.	0.01	0.01	.	.	0.01	.	.	0.01
Open-Hole Length	.	65	.	.	25	23.3	.	11.1	48	.
Open-Hole Diameter	.	6	.	.	6	6	.	6.1	6.13	.

APPENDIX C: MONITORING WELL CONSTRUCTION DETAILS, CY 2009

Well Number Hydrogeologic Regime Functional Area	GW-505 EF RG	GW-508 EF RG	GW-521 CR LIV	GW-522 CR LIV	GW-526 BC S3	GW-537 BC OLF	GW-540 CR LII	GW-557 CR LV	GW-560 CR CDLVII	GW-562 CR CDLVII
General Information										
Date Installed	04/06/88	04/18/88	09/14/88	09/20/88	06/13/88	09/14/88	06/02/89	12/02/88	12/30/88	01/13/89
Total Depth Drilled	13.5	15.0	136.0	195.5	123.0	24.5	171.5	139.0	117.0	133.0
East Coordinate	53,037	53,148	52,040	52,612	50,708	49,539	52,371	59,520	60,743	61,640
North Coordinate	30,400	30,281	28,541	28,377	30,033	30,057	27,489	26,450	25,692	26,276
Measuring Point	TOWW	TOC	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW
Measuring Point Elevation	1,015.19	1,010.74	1,182.88	1,175.48	998.25	976.65	1,072.31	1,081.36	949.05	934.69
Ground Surface Elevation	1,011.60	1,009.41	1,179.46	1,172.04	995.34	974.49	1,069.38	1,078.63	945.76	931.86
Tag Depth-(TOC)	16.80	15.11	136.70	197.10	123.80	27.35	173.83	136.07	82.90	61.24
Geologic Information										
Hydrostratigraphic Unit	AQT	AQT	AQF	AQF	AQT	AQT	AQF	AQF	AQF	AQF
Geologic Formation	Cn	Cn	OCk	OCk	Cn	Cn	OCk	OCk	OCk	OCk
Aquifer Zone	WT	WT	BDR	BDR	BDR	WT	BDR	WT	WT	WT
Weathered Rock-Depth	.	.	.	85.0	3.5	14.9	110.0	113.8	92.0	.
Fresh Rock-Depth	.	.	54.0	130.0	23.6	.	150.0	134.0	.	52.0
Conductor Casing										
Casing Depth	.	.	60.5	90.0	23.6	.	154.0	85.0	.	.
Outside Diameter	.	.	10.75	10.75	10.75	.	10.75	10.75	.	.
Inside Diameter	.	.	10	10	10	.	10	10	.	.
Casing Material	NONE	.	STL	STL	STL	.	STL	STL	.	.
Well Casing		.								
Borehole Depth	13.5	15.0	136.0	195.5	101.0	24.5	171.5	138.0	117.0	60.0
Borehole Diameter	7	7	9.5	9.5	9.5	8.75	9.25	9.5	9.5	9.5
Casing Depth	1.9	2.2	124.9	184.6	99.7	8.0	161.2	115.8	49.0	38.0
Outside Diameter	2.37	2.37	4.5	4.5	6.62	4.5	4.5	4.5	4.5	4.5
Inside Diameter	2	2	4	4	.	4	4	4	4	4
Casing Material	SS304	SS304	SS304	SS304	SF25	SS304	SS304	SS304	SS304	SS304
Monitored Interval										
Top-Depth	1.5	1.3	123.2	183.0	101.0	4.8	158.5	112.9	45.2	36.0
Midpoint-Depth	7.5	8.2	129.6	189.2	112.0	14.1	165.0	125.5	57.1	48.0
Pump Intake-Depth	997.69	.	129.00	187.60	112.10	22.80	166.10	123.60	59.40	48.20
Bottom of Screen-Depth	12.3	12.5	135.2	195.0	.	23.0	171.5	135.8	69.0	58.0
Bottom-Depth	13.5	15.0	136.0	195.3	123.0	23.3	171.5	138.0	69.0	60.0
Top-Elevation	1,010.10	1,008.11	1,056.26	989.04	894.34	969.69	910.88	965.73	900.56	895.86
Midpoint-Elevation	1,004.10	1,001.26	1,049.86	982.89	883.34	960.44	904.38	953.18	888.66	883.86
Pump Intake-Elevation	13.91	.	1050.48	984.48	883.25	951.65	903.31	955.06	886.35	883.69
Bottom-Elevation	998.10	994.41	1,043.46	976.74	872.34	951.19	897.88	940.63	876.76	871.86
Screen Length	10.4	10.3	10.3	10.4	.	15	10.3	20	20	20
Screen Material	SS/sw	SS/sw	SS/sw	SS/sw	.	SS/sw	SS/sl	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	.	.	.	.	22	.	.	.	.	.
Open-Hole Diameter	.	.	.	.	6.1	.	.	.	.	.

APPENDIX C: MONITORING WELL CONSTRUCTION DETAILS, CY 2009

Well Number Hydrogeologic Regime Functional Area	GW-564 CR CDLVII	GW-601 BC OLF	GW-605 EF EXP-I	GW-606 EF EXP-I	GW-615 BC S3	GW-616 BC S3	GW-618 EF EXP-E	GW-623 BC BG	GW-627 BC BG	GW-629 BC BG
General Information										
Date Installed	01/27/89	08/31/89	03/19/91	03/20/91	02/13/90	03/10/90	03/15/90	08/02/90	12/11/89	02/02/90
Total Depth Drilled	88.0	356.0	40.5	175.0	245.0	269.0	37.0	349.0	270.0	312.0
East Coordinate	59,865	47,629	62,002	61,951	52,224	51,907	54,738	44,138	42,774	43,047
North Coordinate	25,873	28,903	28,707	28,708	30,009	29,724	29,798	29,388	29,505	29,522
Measuring Point	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW	TOC	TOWW	TOWW
Measuring Point Elevation	938.07	1,002.80	919.06	919.59	1,017.55	1,011.81	985.14	925.21	943.51	928.03
Ground Surface Elevation	935.12	999.09	916.97	916.98	1,014.17	1,009.81	982.64	922.01	940.39	924.42
Tag Depth-(TOC)	78.74	358.61	42.00	174.36	246.84	270.59	38.30	277.93	270.96	314.59
Geologic Information										
Hydrostratigraphic Unit	AQF	AQF	AQF	AQF	AQT	AQT	AQF	AQT	AQT	AQT
Geologic Formation	OCk	Cmn	Cmn	Cmn	Cn	Cn	Cmn	Cn	Cn	Cn
Aquifer Zone	WT	BDR	BDR	BDR	BDR	BDR	WT	BDR	BDR	BDR
Weathered Rock-Depth	.	8.0	.	.	15.0	35.0	25.0	16.0	3.0	12.0
Fresh Rock-Depth	72.0	54.0	9.5	10.8	40.0	42.0	27.0	38.0	43.0	42.0
Conductor Casing										
Casing Depth	.	41.4	9.5	64.7	84.5	45.6	27.5	218.0	47.5	45.1
Outside Diameter	.	11.75	11.75	7	11.75	11.75	10.75	7	11.75	11.75
Inside Diameter	.	11	11	6.4	11	11	10	6.54	11	11
Casing Material	.	STL	SJ55	SJ55	SJ55	SJ55	SJ55	SJ55	SJ55	SJ55
Well Casing								.		
Borehole Depth	81.0	319.0	40.5	175.0	222.5	219.7	37.0	274.5	254.0	262.3
Borehole Diameter	9.5	10.63	10.6	9.63	10.63	10.63	9.5	6	10.63	10.63
Casing Depth	55.3	317.2	29.7	161.0	221.2	217.8	26.7	244.0	252.7	266.3
Outside Diameter	4.5	7	4.25	4.25	7	7	4.5	2.37	7	7
Inside Diameter	4	.	4	4	6.54	6.54	4.25	2	6.54	6.54
Casing Material	SS304	STL	SS304	SS304	SF25	SF25	SS304	SS304	SF25	SF25
Monitored Interval										
Top-Depth	52.0	318.5	28.2	155.0	222.5	219.1	26.0	238.1	254.0	262.3
Midpoint-Depth	66.5	337.3	34.1	163.0	233.8	244.1	31.5	256.2	262.0	287.2
Pump Intake-Depth	65.50	657.80	33.90	166.40	68.60	263.00	32.50	.	255.90	286.40
Bottom of Screen-Depth	75.3	.	39.7	171.0	.	.	37.0	274.2	.	.
Bottom-Depth	81.0	356.0	39.9	171.0	245.0	269.0	37.0	274.2	270.0	312.0
Top-Elevation	883.12	680.59	888.77	761.98	791.67	790.71	956.64	683.91	686.39	662.12
Midpoint-Elevation	868.62	661.84	882.92	753.98	780.42	765.76	951.14	665.86	678.39	637.27
Pump Intake-Elevation	869.57	341.29	883.06	750.59	945.55	746.81	950.14	.	684.51	638.03
Bottom-Elevation	854.12	643.09	877.07	745.98	769.17	740.81	945.64	647.81	670.39	612.42
Screen Length	20	.	10	10	.	.	10.3	30.2	.	.
Screen Material	SS/sw	.	SS/sw	SS/ppk	.	.	SS/sw	SS/sw	.	.
Slot Size	0.01	.	0.01	0.01	.	.	0.01	0.01	.	.
Open-Hole Length	.	37.5	.	.	22.5	49.9	.	.	16	49.7
Open-Hole Diameter	.	6.25	.	.	6.25	6.25	.	.	6.25	6.5

APPENDIX C: MONITORING WELL CONSTRUCTION DETAILS, CY 2009

Well Number	GW-633	GW-639	GW-648	GW-653	GW-656	GW-658	GW-683	GW-684	GW-686	GW-690
Hydrogeologic Regime	**EF**	**BC**	**BC**	**BC**	**EF**	**EF**	**BC**	**BC**	**EF**	**EF**
Functional Area	**RG**	**EMWMF**	**RS**	**BG**	**T0134**	**FF**	**EXP-A**	**EXP-A**	**CPT**	**CPT**
General Information										
Date Installed	05/03/90	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
Total Depth Drilled	15.0	125.5	80.1	39.0	21.5	19.1	197.5	129.6	17.0	53.0
East Coordinate	53,100	45,260	49,888	42,317	57,439	62,146	41,552	41,354	55,956	55,990
North Coordinate	30,145	29,626	29,088	29,660	29,895	29,638	28,282	28,525	29,540	29,787
Measuring Point	TOWW	TOWW	TOC	TOWW	TOWW	TOWW	TOWW	TOWW	TOC	TOWW
Measuring Point Elevation	996.43	940.95	1,029.20	931.84	954.79	944.81	972.23	898.83	963.76	967.36
Ground Surface Elevation	996.66	937.98	1,026.50	928.85	954.90	942.04	969.45	895.53	964.43	967.71
Tag Depth-(TOC)	15.15	129.64	82.47	41.53	20.60	20.64	199.83	132.21	16.23	53.25
Geologic Information										
Hydrostratigraphic Unit	AQT	AQT	AQF	AQT	AQT	AQT	AQF	AQF	AQF	AQF
Geologic Formation	Cn	Cn	Cmn	Cn	Cn	Cn	OCk	Cmn	Cmn	Cmn
Aquifer Zone	WT	BDR	WT	WT	WT	WT	BDR	BDR	WT	BDR
Weathered Rock-Depth	8.5	3.0	49.5	3.5	12.0	1.5	22.0	.	17.0	24.0
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	15.0	95.5	80.1	39.0	21.5	19.1	197.5	129.6	16.0	53.0
Borehole Diameter	10.5	10	9.5	9.5	9.5	9.5	10.63	10.5	12	8.5
Casing Depth	5.0	94.5	70.1	29.0	10.7	8.8	146.0	113.8	6.0	42.8
Outside Diameter	4.5	7	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Inside Diameter	4	6.54	4.25	4.25	4.25	4.25	4.25	4.25	4.25	4.25
Casing Material	PVC	SF25	SS304	SS304	SS304	SS304	SS304	SS304	SS304	SS304
Monitored Interval										
Top-Depth	3.5	95.5	65.0	26.3	8.3	6.9	133.9	106.4	4.0	40.8
Midpoint-Depth	9.3	110.5	72.6	32.7	14.9	13.0	165.4	118.0	10.0	46.8
Pump Intake-Depth	12.20	.	.	33.50	18.10	13.80	171.20	119.70	15.67	48.40
Bottom of Screen-Depth	15.0	.	80.1	39.0	20.7	18.8	196.8	128.4	16.0	52.8
Bottom-Depth	15.0	125.5	80.1	39.0	21.5	19.1	196.8	129.6	16.0	52.8
Top-Elevation	993.16	842.48	961.50	902.55	946.60	935.14	835.55	789.13	960.43	926.91
Midpoint-Elevation	987.41	827.48	953.95	896.20	940.00	929.04	804.10	777.53	954.43	920.91
Pump Intake-Elevation	984.43	.	.	895.34	936.79	928.21	798.23	775.83	948.76	919.36
Bottom-Elevation	981.66	812.48	946.40	889.85	933.40	922.94	772.65	765.93	948.43	914.91
Screen Length	10	.	10	10	10	10	50.8	14.6	10	10
Screen Material	PVC/sl	.	SS/sw	SS/sw	SS/sw	SS/sw	SS/ppk	SS/ppk	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-691 EF CPT	GW-692 EF CPT	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	10/24/90	10/25/90	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	20.0	53.0	75.0	31.0	182.0	256.0	182.5	80.6	457.5	315.2
East Coordinate	55,983	56,001	56,804	56,828	44,931	44,935	44,944	52,372	36,507	36,434
North Coordinate	29,794	29,653	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	968.59	964.38	970.09	960.18	955.29	945.33	929.47	906.81	877.89	881.43
Ground Surface Elevation	968.09	964.55	970.09	957.78	951.80	941.99	925.78	903.84	873.61	877.83
Tag Depth-(TOC)	20.39	53.05	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	WT	BDR	BDR	WT	BDR	BDR	BDR	BDR	BDR	BDR
Weathered Rock-Depth	20.0	23.0	42.0	31.0	7.0	16.0	17.0	39.0	12.0	26.8
Fresh Rock-Depth	.	.	.	.	10.0	23.0	27.0	43.0	66.0	63.8
Conductor Casing										
Casing Depth	.	25.0	42.0	.	.	21.0	40.3	50.0	44.8	80.2
Outside Diameter	.	10.5	10.5	.	.	11.75	11.75	11.75	11.75	.
Inside Diameter	.	10	10	.	.	11	11	11	11	.
Casing Material	.	PVC40	PVC40	.	.	SJ55	SJ55	SJ55	SJ55	SJ55
Well Casing										
Borehole Depth	20.0	53.0	75.0	31.0	135.0	246.0	157.0	80.6	441.5	305.0
Borehole Diameter	12	8.5	8.5	12	10.63	10.63	10.6	10.6	10.6	10.6
Casing Depth	10.0	43.0	65.0	21.0	132.8	243.5	155.1	70.4	440.2	303.7
Outside Diameter	4.5	4.5	4.5	4.5	7	7	7	4.25	7	7
Inside Diameter	4.25	4.25	4.25	4.25	6.54	6.54	6.54	4	6.54	6.54
Casing Material	SS304	SS304	SS304	SS304	SF25	SF25	SF25	SS304	SF25	SF25
Monitored Interval										
Top-Depth	8.0	41.0	63.0	19.0	133.8	244.5	156.1	68.7	441.5	305.0
Midpoint-Depth	14.0	47.0	69.0	25.0	157.9	250.3	169.3	74.7	449.5	310.1
Pump Intake-Depth	14.50	48.20	71.00	26.10	158.50	250.20	174.80	75.50	446.20	307.40
Bottom of Screen-Depth	20.0	53.0	75.0	31.0	.	.	.	80.4	.	.
Bottom-Depth	20.0	53.0	75.0	31.0	182.0	256.0	182.5	80.6	457.5	315.2
Top-Elevation	960.09	923.55	907.09	938.78	818.00	697.49	769.68	835.14	432.11	572.83
Midpoint-Elevation	954.09	917.55	901.09	932.78	793.90	691.74	756.48	829.19	424.11	567.73
Pump Intake-Elevation	953.59	916.38	899.09	931.68	793.29	691.83	750.97	828.31	427.39	570.43
Bottom-Elevation	948.09	911.55	895.09	926.78	769.80	685.99	743.28	823.24	416.11	562.63
Screen Length	10	10	10	10	.	.	.	10	.	.
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	.	.	.	.	48.2	11.5	26.4	.	16	10.2
Open-Hole Diameter	.	.	.	.	6.25	6.5	6.25	.	6.25	6.25

APPENDIX C: MONITORING WELL CONSTRUCTION DETAILS, CY 2009

Well Number	GW-714	GW-722	GW-724	GW-725	GW-726	GW-731	GW-732	GW-733	GW-735	GW-738
Hydrogeologic Regime	BC	EF	BC	BC	BC	CR	CR	EF	EF	BC
Functional Area	EXP-W	EXP-J	EXP-C	EXP-C	BG	CRSDB	CRSDB	EXP-J	EXP-J	EXP-C
General Information										
Date Installed	01/24/92	08/09/91	08/12/91	08/27/91	07/24/92	09/12/91	09/11/91	10/02/91	10/30/91	11/21/91
Total Depth Drilled	145.0	644.3	301.6	142.5	600.0	180.4	190.6	256.5	83.0	90.1
East Coordinate	36,435	64,926	48,995	48,989	42,467	63,863	64,268	65,067	64,872	49,026
North Coordinate	28,422	28,532	29,198	29,405	29,201	27,464	27,717	28,447	28,867	29,150
Measuring Point	TOWW	TOC	TOWW	TOWW	TOC	TOWW	TOWW	TOWW	TOWW	TOWW
Measuring Point Elevation	875.88	953.71	979.75	961.63	925.39	1,049.38	1,064.29	959.84	924.46	983.31
Ground Surface Elevation	872.30	951.04	976.62	958.26	922.77	1,045.75	1,060.65	955.69	921.34	980.36
Tag Depth-(TOC)	146.90	642.68	293.60	145.42	602.62	178.53	192.84	259.93	81.81	91.78
Geologic Information										
Hydrostratigraphic Unit	AQF	AQF	AQF	AQF	AQT	AQF	AQF	AQF	AQT	AQF
Geologic Formation	Cmn	Cmn	Cmn	Cmn	Cn	OCk	OCk	Cmn	Cn	Cmn
Aquifer Zone	BDR	BDR	BDR	BDR	BDR	BDR	BDR	BDR	BDR	BDR
Weathered Rock-Depth	27.0	54.0	33.5	14.0	3.0	95.4	85.0	42.5	19.0	12.0
Fresh Rock-Depth	35.0	73.0	40.0	17.5	25.5	129.4	96.0	47.1	77.5	15.1
Conductor Casing										
Casing Depth	40.5	56.2	40.0	21.0	.	122.0	100.7	51.8	25.5	16.5
Outside Diameter	11.75	10.75	11.75	11.75	.	11.75	11.75	11.75	11.75	11.75
Inside Diameter	11	10	11	11	.	11	11	11	11	11
Casing Material	SJ55	SJ55	SJ55	SJ55	NONE	SJ55	SJ55	SJ55	SJ55	SJ55
Well Casing										
Borehole Depth	115.1	75.0	289.6	132.5	600.0	175.4	189.5	240.1	83.0	90.1
Borehole Diameter	10.6	6	10.6	10.6	3.64	10.6	10.6	10.6	10.6	10.6
Casing Depth	113.8	74.5	288.3	131.2	39.9	165.2	179.3	238.8	67.9	67.3
Outside Diameter	7	4.5	7	7	7	4.5	4.5	7	4.5	4.5
Inside Diameter	6.54	4	6.54	6.54	6.54	4.25	4.25	6.54	4.25	4.25
Casing Material	SF25	SJ55	SF25	SF25	SF25	SS304	SS304	SF25	SS304	SS304
Monitored Interval										
Top-Depth	115.1	74.5	289.6	132.5	39.9	164.0	178.3	240.1	67.5	63.5
Midpoint-Depth	130.1	359.4	295.6	137.5	320.0	171.4	184.2	248.3	73.4	75.8
Pump Intake-Depth	138.40	.	294.40	137.10	.	169.90	184.40	248.90	847.76	78.60
Bottom of Screen-Depth	.	.	.	.	.	175.2	189.3	.	77.9	87.3
Bottom-Depth	145.0	644.3	301.6	142.5	600.0	178.7	190.0	256.5	79.2	88.0
Top-Elevation	757.20	876.54	687.02	825.76	882.87	881.75	882.35	715.59	853.84	916.86
Midpoint-Elevation	742.25	591.64	681.02	820.76	602.82	874.40	876.50	707.39	847.99	904.61
Pump Intake-Elevation	733.88	.	682.25	821.13	.	875.88	876.29	706.84	73.58	901.81
Bottom-Elevation	727.30	306.74	675.02	815.76	322.77	867.05	870.65	699.19	842.14	892.36
Screen Length	.	.	.	.	.	10	10	.	10	20
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	560.1	.	.	16.4	.	.
Open-Hole Diameter	6.25	3.5	6.25	6.25	3.64	.	.	6.25	.	.

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Well Number Hydrogeologic Regime Functional Area	GW-740 BC EXP-C	GW-744 EF GRIDK1	GW-747 EF GRIDK2	GW-750 EF EXP-J	GW-757 CR LII	GW-762 EF GRIDJ3	GW-763 EF GRIDJ3	GW-765 EF GRIDE1	GW-769 EF GRIDG3	GW-770 EF GRIDG3
General Information										
Date Installed	12/20/91	01/08/92	01/28/92	02/06/92	04/24/92	05/15/92	05/13/92	05/13/92	06/04/92	06/04/92
Total Depth Drilled	190.0	69.5	73.3	72.8	166.5	60.2	17.0	32.5	61.4	20.0
East Coordinate	49,055	64,324	64,570	64,835	53,303	63,193	63,220	58,482	60,230	60,255
North Coordinate	29,027	30,282	29,730	28,975	25,410	29,115	29,117	31,026	29,510	29,505
Measuring Point	TOWW	TOWW	TOC	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW
Measuring Point Elevation	1,020.25	907.43	911.06	919.03	961.64	915.56	915.03	1,008.54	944.43	944.72
Ground Surface Elevation	1,016.95	905.05	911.68	915.96	958.65	911.85	911.38	1,005.53	941.53	941.67
Tag Depth-(TOC)	192.67	69.28	75.7	75.49	168.54	62.04	20.41	35.05	62.73	21.68
Geologic Information										
Hydrostratigraphic Unit	AQF	AQT	AQT	AQT	AQF	AQT	AQT	AQT	AQT	AQT
Geologic Formation	Cmn	Cpv	Cm	Cn	OCk	Cn	Cn	Crg	Cn	Cn
Aquifer Zone	BDR	BDR	BDR	BDR	BDR	BDR	WT	WT	BDR	WT
Weathered Rock-Depth	38.1	9.6	3.9	18.5	29.5	12.0	17.0	24.5	14.2	12.0
Fresh Rock-Depth	45.1	14.6	5.4	24.8	48.0	14.5	.	.	.	16.5
Conductor Casing										
Casing Depth	46.9	27.6	17.2	21.7	46.8	19.4	.	.	17.2	.
Outside Diameter	11.75	10.75	10.75	11.75	10.75	11.75	.	.	11.75	.
Inside Diameter	11	10	10	11	10.25	11	.	.	11	.
Casing Material	SJ55	SJ55	SJ55	SJ55	SJ55	SJ55	.	NONE	SJ55	.
Well Casing										
Borehole Depth	165.6	69.5	73.3	72.8	166.5	60.2	17.0	32.5	61.4	20.0
Borehole Diameter	10.6	9.87	9.87	10.6	9.62	9.87	8	9.87	10.62	10.62
Casing Depth	164.3	57.0	62.6	62.4	135.5	48.2	5.2	21.2	49.4	8.5
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	165.6	55.0	60.8	61.2	134.0	46.4	4.0	19.9	48.2	7.5
Midpoint-Depth	177.8	62.3	66.9	67.0	150.3	52.6	10.0	26.2	54.3	13.3
Pump Intake-Depth	183.70	65.10	62.0	848.33	155.00	.	11.80	978.54	54.90	13.60
Bottom of Screen-Depth	.	66.9	72.5	72.3	165.5	58.1	15.2	31.5	59.3	18.4
Bottom-Depth	190.0	69.5	73.0	72.7	166.5	58.7	16.0	32.4	60.3	19.0
Top-Elevation	851.35	850.05	844.28	854.76	824.65	865.45	907.38	985.63	893.33	934.17
Midpoint-Elevation	839.15	842.80	838.18	849.01	808.40	859.30	901.38	979.38	887.28	928.42
Pump Intake-Elevation	833.25	839.93	843.06	67.63	803.64	.	899.63	26.99	886.63	928.02
Bottom-Elevation	826.95	835.55	832.08	843.26	792.15	853.15	895.38	973.13	881.23	922.67
Screen Length	.	9.9	9.9	9.9	30	9.9	10	10.3	9.9	9.9
Screen Material	.	SS/sw	SS/sw	SS/sw	SS/sw	SS/sw	SS/sw	SS/sw	SS/sw	SS/sw
Slot Size	.	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Open-Hole Length	24.4	.	.	.	.	.	.	.	.	.
Open-Hole Diameter	6.25	.	.	.	.	.	.	.	.	.

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Well Number Hydrogeologic Regime Functional Area	GW-775 EF GRIDH3	GW-776 EF GRIDH3	GW-779 EF GRIDF2	GW-781 EF GRIDE3	GW-782 EF GRIDE3	GW-783 EF GRIDE3	GW-791 EF GRIDD2	GW-796 CR LV	GW-797 CR LV	GW-798 CR CDLVII
General Information										
Date Installed	07/16/92	07/21/92	08/02/92	08/10/92	08/12/92	08/13/92	09/21/92	03/04/93	03/16/93	03/18/93
Total Depth Drilled	60.5	24.0	63.1	69.6	36.0	16.3	70.6	139.7	134.1	135.5
East Coordinate	61,278	61,309	59,247	58,118	58,099	58,113	57,423	58,206	58,550	60,310
North Coordinate	29,272	29,271	30,226	29,711	29,719	29,734	30,483	27,924	27,447	27,265
Measuring Point	TOWW	TOWW	TOC	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW
Measuring Point Elevation	931.35	931.25	963.09	947.89	947.73	948.49	992.13	1,052.62	1,060.00	1,006.00
Ground Surface Elevation	931.48	931.44	959.73	944.66	944.48	945.81	988.51	1,048.80	1,056.10	1,002.42
Tag Depth-(TOC)	55.98	21.92	65.35	71.07	38.23	17.98	72.45	139.82	135.71	134.00
Geologic Information										
Hydrostratigraphic Unit	AQT	AQT	AQT	AQT	AQT	AQT	AQT	AQF	AQF	AQF
Geologic Formation	Cn	Cn	Cm	Cn	Cn	Cn	Cm	OCk	OCk	OCk
Aquifer Zone	BDR	WT	BDR	BDR	BDR	WT	BDR	BDR	BDR	BDR
Weathered Rock-Depth	.	14.5	7.2	0.9	1.0	1.0	14.7	102.0	67.1	94.4
Fresh Rock-Depth	16.7	19.3	18.2	14.0	7.5	8.5	26.0	103.0	89.0	95.8
Conductor Casing										
Casing Depth	16.7	.	23.3	23.8	.	.	31.5	107.6	95.0	99.7
Outside Diameter	11.75	.	10.75	10.75	.	.	10.75	10.75	10.75	10.75
Inside Diameter	11	.	10	10	.	.	10	10	10	10
Casing Material	SJ55	NONE	SJ55	SJ55	.	.	SJ55	SJ55	SJ55	SJ55
Well Casing										
Borehole Depth	60.5	24.0	63.1	69.6	36.0	16.3	70.6	139.7	134.1	135.5
Borehole Diameter	10.62	9.87	9.87	9.87	9.87	9.87	9.87	9.5	9.5	9.5
Casing Depth	46.3	12.3	52.1	57.8	25.0	4.2	59.0	126.5	123.5	124.5
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	45.0	10.6	50.7	56.0	23.8	3.6	57.5	122.9	118.0	122.0
Midpoint-Depth	50.7	16.8	56.8	62.7	29.9	10.0	64.1	129.7	126.1	128.7
Pump Intake-Depth	880.35	914.25	.	62.80	29.80	10.30	63.80	131.20	128.10	125.90
Bottom of Screen-Depth	56.2	22.2	62.0	68.0	34.9	13.9	68.9	136.4	133.4	134.4
Bottom-Depth	56.4	23.0	62.9	69.3	35.9	16.3	70.6	136.5	134.1	135.4
Top-Elevation	886.48	920.84	909.03	888.66	920.68	942.21	931.01	925.90	938.10	880.42
Midpoint-Elevation	880.78	914.64	902.93	882.01	914.63	935.86	924.46	919.10	930.05	873.72
Pump Intake-Elevation	51.13	17.19	.	881.89	914.73	935.49	924.73	917.62	928.00	876.50
Bottom-Elevation	875.08	908.44	896.83	875.36	908.58	929.51	917.91	912.30	922.00	867.02
Screen Length	9.9	9.9	9.9	10.2	9.9	9.7	9.9	9.9	9.9	9.9
Screen Material	SS/sw	SS/sw	SS/sw	SS/sw	SS/sw	SS/sw	SS/sw	SS/sw	SS/sw	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-799 CR LV	GW-801 CR LV	GW-802 EF FF	GW-816 EF EXP-SR	GW-820 EF B9201-2	GW-831 CR FCAP	GW-832 EF NHP	GW-916 BC EMWMF	GW-917 BC EMWMF	GW-918 BC EMWMF
General Information										
Date Installed	03/25/93	07/01/93	06/25/93	06/02/94	.	07/30/96	05/09/96	01/29/01	01/22/01	02/02/01
Total Depth Drilled	92.0	188.9	26.5	16.1	17.3	200.0	11.9	36.0	51.0	75.0
East Coordinate	59,961	58,780	62,217	64,031	59,773	56,593	64,134	48,276	47,914	47,549
North Coordinate	26,746	26,808	29,655	31,582	29,175	26,654	29,142	31,186	30,463	31,672
Measuring Point	TOWW	TOWW	TOC	TOWW	TOWW	TOWW	TOC	TOWW	TOWW	TOWW
Measuring Point Elevation	981.29	1,097.16	941.83	898.42	929.57	1,091.29	906.18	1,002.85	997.10	1,067.96
Ground Surface Elevation	978.10	1,093.82	942.30	894.56	929.67	1,088.04	906.83	1,000.00	994.00	1,065.00
Tag Depth-(TOC)	97.58	190.92	25.42	17.99	17.18	198.06	10.36	.	.	.
Geologic Information										
Hydrostratigraphic Unit	AQF	AQF	AQT	AQT	AQF	AQF	AQF	AQT	AQT	AQT
Geologic Formation	OCk	OCk	Cn	Cr	Cmn	OCk	Cmn	Cc	Cm	Cpv
Aquifer Zone	BDR	BDR	WT	WT	WT	BDR	WT	WT	WT	WT
Weathered Rock-Depth	60.8	112.5	10.0	.	.	134.8	.	10.0	21.0	.
Fresh Rock-Depth	62.8	113.4	15.0	.	.	140.8	.	15.0	27.0	30.0
Conductor Casing										
Casing Depth	65.0	115.4	.	.	.	138.3	.	.	.	.
Outside Diameter	10.75	10.75	.	.	.	10.75	.	.	.	.
Inside Diameter	10	10	.	.	.	10	.	.	.	.
Casing Material	SJ55	SJ55	.	.	.	STL	.	.	.	.
Well Casing										
Borehole Depth	92.0	188.9	26.5	15.8	.	200.0	11.9	.	.	.
Borehole Diameter	9.5	9.87	10.62	10	.	9.87	12	.	.	.
Casing Depth	81.0	178.1	15.5	4.2	.	183.2	5.9	.	20.0	20.0
Outside Diameter	4.5	4.5	4.5	4.5	4.5	4.5	6.63	.	2.37	.
Inside Diameter	4.25	4.25	4	4.25	4	4.25	6	.	2.07	.
Casing Material	SS304	SS304	PVC40	SS304	PVC	SS304	PVC	.	SS304	SS304
Monitored Interval										
Top-Depth	78.7	175.8	13.3	2.9	.	182.0	4.0	13.0	18.0	18.0
Midpoint-Depth	85.4	182.4	19.9	9.4	.	190.8	7.9	24.5	34.5	25.5
Pump Intake-Depth	84.80	177.70	.	11.10	15.60	188.80	.	.	.	.
Bottom of Screen-Depth	90.9	188.0	25.5	13.6	.	193.6	10.9	35.0	50.0	30.0
Bottom-Depth	92.0	188.9	26.5	15.8	17.3	199.6	11.8	36.0	51.0	33.0
Top-Elevation	899.40	918.02	929.00	891.66	.	906.04	902.83	.	.	.
Midpoint-Elevation	892.75	911.47	922.40	885.21	.	897.24	898.93	.	.	.
Pump Intake-Elevation	893.29	916.16	.	883.42	914.07	899.29	.	975.35	959.60	1039.46
Bottom-Elevation	886.10	904.92	915.80	878.76	912.37	888.44	895.03	.	.	.
Screen Length	9.9	9.9	10	9.4	.	10.4	5	20	30	10
Screen Material	SS/sw	SS/sw	PVC/sl	SS/sw	.	SS/sw	PVC/sl	SS/sw	SS/sw	SS/sw
Slot Size	0.01	0.01	0.01	0.01	.	0.01	0.02	0.01	0.01	0.01
Open-Hole Length	.	.	.	.	.	.	.	.	.	.
Open-Hole Diameter	.	.	.	.	.	.	.	.	.	.

APPENDIX C: MONITORING WELL CONSTRUCTION DETAILS, CY 2009

Well Number	GW-920	GW-921	GW-922	GW-923	GW-924	GW-925	GW-926	GW-927	GW-959	GW-960	GW-961
Hydrogeologic Regime	BC	BC	BC	BC	BC	BC	BC	BC	EF	EF	BC
Functional Area	EMWMF	EMWMF	EMWMF	EMWMF	EMWMF	EMWMF	EMWMF	EMWMF	B9201-2	GridF2	EMWMF
General Information											
Date Installed	01/16/01	01/31/01	01/17/01	02/01/01	01/29/01	02/05/01	02/01/01	02/01/01	03/11/05	07/28/06	09/09/10
Total Depth Drilled	55.0	50.0	46.0	102.0	54.0	170.0	145.0	172.0	9.0	25.4	27.0
East Coordinate	47,375	47,139	47,147	48,184	46,300	47,128	46,290	47,906	60,189	59,228	46,092
North Coordinate	30,193	30,350	30,024	30,822	30,185	30,349	30,185	30,463	29,115	30,212	30,347
Measuring Point	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW	TOWW	TOC	TOWW
Measuring Point Elevation	967.43	971.29	956.91	1,016.73	968.90	971.14	968.94	997.19	927.69	963.26	963.57
Ground Surface Elevation	965.00	968.00	955.00	1,013.00	966.00	968.00	966.00	994.00	928.32	959.88	961.08
Tag Depth-(TOC)	.	.	.	.	.	.	.	.	.	.	.
Geologic Information											
Hydrostratigraphic Unit	AQT	AQT	AQT	AQT	AQT	AQT	AQT	AQT	AQF	AQT	AQT
Geologic Formation	Cn	Cm	Cn	Cm	Cn	Cm	Cn	Cm	Cmn	Cn	Cn
Aquifer Zone	BDR	BDR	BDR	WT	WT	BDR	BDR	BDR	WT	WT	WT
Weathered Rock-Depth	.	.	10.0	.	21.8	.	15.0	25.0	.	17.0	1.0
Fresh Rock-Depth	12.0	13.0	13.0	62.0	22.0	15.0	18.0	30.0	.	17.2	9.0
Conductor Casing											
Casing Depth	.	.	.	.	.	.	.	.	.	.	.
Outside Diameter	.	.	.	.	.	.	.	.	.	.	.
Inside Diameter	.	.	.	.	.	.	.	.	.	.	.
Casing Material	.	.	.	.	.	.	.	.	.	.	.
Well Casing											
Borehole Depth	.	.	.	.	.	.	.	.	9.0	25.4	25.5
Borehole Diameter	.	.	.	.	.	.	.	.	7.5	.	6
Casing Depth	24.0	18.0	25.0	40.0	23.0	97.0	113.0	60.0	3.4	14.6	5.3
Outside Diameter	2.37	2.37	2.37	2.37	2.37	2.37	2.37	2.37	4.5	4.5	2.38
Inside Diameter	2.07	2.07	2.07	2.07	2.07	2.07	2.07	2.07	4.25	4	2.16
Casing Material	SS304	SS304	SS304	SS304	SS304	SS304	SS304	SS304	SS304	PVC	SS304
Monitored Interval											
Top-Depth	22.0	16.0	23.0	36.0	21.0	92.0	103.0	57.0	2.4	12.2	3.4
Midpoint-Depth	38.5	33.0	34.5	55.5	37.5	120.0	124.0	74.5	5.4	18.8	14.5
Pump Intake-Depth	.	.	.	.	.	.	.	.	8.13	.	.
Bottom of Screen-Depth	54.0	48.0	45.0	70.0	53.0	147.0	143.0	90.0	8.4	24.6	25.3
Bottom-Depth	55.0	50.0	46.0	75.0	54.0	148.0	145.0	92.0	9.0	25.4	25.5
Top-Elevation	.	.	.	.	.	.	.	.	925.92	947.68	957.68
Midpoint-Elevation	.	.	.	.	.	.	.	.	922.92	941.08	946.63
Pump Intake-Elevation	925.93	935.29	919.41	958.23	928.40	848.14	841.94	919.69	920.19	.	.
Bottom-Elevation	.	.	.	.	.	.	.	.	919.32	934.48	935.58
Screen Length	30	30	20	30	30	50	30	30	5	10	20
Screen Material	SS/sw	SS/sw	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	0.01	0.01
Open-Hole Length	.	.	.	.	.	.	.	.	.	.	.
Open-Hole Diameter	.	.	.	.	.	.	.	.	.	.	.

APPENDIX D

CY 2009 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:

- BAIL - Sample collected with a disposable bailer (free product investigation)
- Dup - Field duplicate sample
- PDB - Passive diffusion bag sample

Units:

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

EXPLANATION (continued)

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

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

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

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

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

The Y-12 GWPP sampling and analysis plan (SAP) for CY 2009 (B&W Y-12 2008) 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 2009a) 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 2009 and are presented in Appendix D.1.

EXPLANATION (continued)

Analyte	Reporting Limit (µg/L)		Analyte	Reporting Limit (µg/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**	0.00005	0.0002
Barium	0.004	0.005	**Molybdenum**	0.05	NS
Beryllium	0.0005	0.001	**Nickel**	0.005**	0.01
Boron	0.1	0.01*	**Selenium**	0.01**	0.0025*
Cadmium	0.0025**	0.00013*	**Silver**	0.02	0.0015*
Chromium	0.01**	0.005*	**Strontium**	0.005	0.005
Cobalt	0.02	0.005*	**Thallium**	0.0005**	0.001
Copper	0.02	0.005*	Thorium	0.2	NS
Iron	0.05	0.01*	**Uranium**	0.0005**	0.004
Lead	0.0005**	0.002	Vanadium	0.02	0.01*
			Zinc	0.05	0.01*

Note: * - the GWPP reporting limit is used instead of the BJC reporting limit; ** - samples collected after June 2009 were diluted (additional 2X) before analysis which doubled the reporting limit; "NS" - not specified.

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

Sampling Location	Mercury Concentration (µg/L) by Method EPA-1631		
	Feb. & Mar. 2009	July 2009	Dec. 2009
GW-683	0.0000064	0.0000014	.
GW-684	0.0000050	0.0000005	.
BCK-03.30	.	.	0.0000019
BCK-04.55	.	.	0.0000020
BCK-07.87	.	.	0.0000028
BCK-09.20	0.0000037	0.0000039	0.0000033
BCK-11.54	0.0000083	0.0000042	0.0000058
BCK-11.84	.	.	0.0000076
BCK-12.34	0.0000114	**0.0001272**	0.0000090
NT-01	.	.	0.0000067
NT-03	.	.	0.0000076
NT-08	0.0000048	0.0000038	0.0000038
S07	.	.	0.0000030
SS-4	0.0000166	0.0000090	.
SS-5	0.0000019	0.0000044	0.0000016
SS-6.6	.	.	0.0000029
SS-7	.	.	0.0000005
SS-8	.	.	0.0000011

Note: The only result above the Y-12 GWPP reporting limit is shown in bold typeface (BCK-12.34 in July).

EXPLANATION (continued)

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	-	The ion charge balance error (percent difference between summed cation charge and summed anion charge) exceeds 20%

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 2009 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 (m/L)	Compound	No. Detected	Maximum (m/L)
Trichloroethene	46	24,000	1,1,2-Trichloro-1,2,2-trifluoroethane	5	190
cis-1,2-Dichloroethene	45	2,730	Ethylbenzene	5	11
Tetrachloroethene	35	180,000	Methylene chloride	4	29
1,1-Dichloroethene	29	2,700	1,2-Dichloroethane	3	24
1,1-Dichloroethane	28	11,000	Dichlorodifluoromethane	3	16
Vinyl chloride	19	320	2-Butanone	3	10
Benzene	13	1,500	1,1,2-Trichloroethane	2	43
1,1,1-Trichloroethane	12	1,200	Carbon disulfide	2	3 J
Chloroform	10	30	1,2-Dichloropropane	2	1.16 J
trans-1,2-Dichloroethene	9	74	Acetone	1	81
Chloroethane	8	26	Chlorobenzene	1	13
Total Xylene	6	43	Carbon tetrachloride	1	4 J
Toluene	6	32	1,4-Dichlorobenzene	1	3 J

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

- . - Not analyzed
- < - Analyzed but not detected (also false-positive results)
- J - Positively identified, estimated concentration below the contract-required quantitation limit
- 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. The following summary shows the primary radiological analytes relevant to DOE Order monitoring collected during CY 2009 in the Bear Creek Regime.

Analyte	No. of Results	No. Detected	Analyte	No. of Results	No. Detected
Gross Alpha	64	33	Strontium-89/90*	2	0
Gross Beta	64	41	Technetium-99	42	22
Americium-241	2	0	Uranium-234*	34	26
Neptunium-237	2	2	Uranium-235*	34	10
Total Radium Alpha	2	2	Uranium-238	34	23

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.

Gross alpha and gross beta results 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.3-7).

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)

D.4 Monitoring data for the EMWMF:

As with previous tables in Appendix D, only the analytes that were detected above the program reporting limits in at least one sample are included. Results for all field measurements and major cations are presented, along with results for 18 metals and one volatile organic compound (cis-1,2-dichloroethene).

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

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

Sampling Location	Date Sampled	Field Measurements	Sampling Location	Date Sampled	Field Measurements
GW-363	02/18/09	02/17/09	GW-923	02/18/09	02/17/09
GW-363	04/23/09	04/22/09	GW-923	04/21/09	04/20/09
GW-363	08/20/09	08/19/09	GW-923	08/12/09	08/11/09
GW-363	11/18/09	08/20/09	GW-923	11/11/09	11/10/09
GW-639	02/18/09	02/17/09	GW-925	02/12/09	02/11/09
GW-639	04/23/09	04/22/09	GW-925	04/15/09	04/14/09
GW-639	08/19/09	08/18/09	GW-925	08/18/09	08/17/09
GW-639	11/18/09	11/17/09	GW-925	11/11/09	11/10/09
			GW-926	11/17/09	11/16/09

EXPLANATION (continued)

Quarterly monitoring at the EMWMF includes analyses for an extensive list of isotopes with low detection limits. The radiological data obtained for sampling locations at the EMWMF are summarized below.

Analyte	No. of Results	No. Detected	Analyte	No. of Results	No. Detected
Actinium-227*	79	4	Plutonium-239/240	79	1
Americium-241	79	4	Plutonium-241	79	0
Americium-243	79	5	Plutonium-242	79	4
Carbon-14	79	0	Plutonium-244	79	0
Cesium-137	79	2	Potassium-40	79	3
Chlorine-36	79	6	Radium-226	79	37
Cobalt-60	79	0	Radium-228	79	10
Curium-242	79	0	**Strontium-90**	79	29
Curium-243/244	79	0	Technetium-99	79	17
Curium-245	79	8	**Thorium-227**	79	4
Curium-246*	79	8	Thorium-228	79	2
Curium-247	79	1	Thorium-229	79	2
Curium-248	79	0	Thorium-230	78	30
Europium-152	79	0	Thorium-231+234*	79	30
Europium-154	79	0	Thorium-232	79	3
Europium-155	79	0	Tritium	79	3
Iodine-129	79	0	Uranium-232	79	1
Neptunium-237	79	1	Uranium-233/234	79	48
Nickel-63	79	1	Uranium-235/236	79	9
Plutonium-236	79	0	**Uranium-238**	79	30
Plutonium-238	79	0	Yttrium-90*	79	29

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

* The results for these isotopes are not presented because they are identical to the ones that are included (shown in bold typeface): **Thorium-227** for Actinium-227*; **Curium-245** for Curium-246*; **Strontium-90** for Yttrium-90*; and **Uranium-238** for Thorium231+234*. The pairs of results are identical because the isotopes are in secular equilibrium, with the parent isotope having the longer half-life.

EXPLANATION (continued)

Additional Analytes Not Presented in Appendix D.4 tables:

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

Sampling Location	Date Sampled	Compound	Result (µg/L)
Semivolatile Organics			
GW-639	11/18/09	Bis(2-ethylhexyl)phthalate	8.49 Q
GW-917	04/14/09	Bis(2-ethylhexyl)phthalate	3.22 J
GW-918	02/10/09	Bis(2-ethylhexyl)phthalate	4 J
GW-918	08/12/09	Bis(2-ethylhexyl)phthalate	5.19
GW-925	08/18/09	Bis(2-ethylhexyl)phthalate	31 Q
GW-926	02/10/09	Bis(2-ethylhexyl)phthalate	4 J
GW-927	08/12/09	Bis(2-ethylhexyl)phthalate	29.5 Q
GW-961	11/23/09	Bis(2-ethylhexyl)phthalate	3.25 J
EMWNT-05	11/09/09	Bis(2-ethylhexyl)phthalate	3.37 Q
Pesticides			
GW-923	08/12/09	Heptachlor	0.02 J
EMWNT-03A	02/09/09	Endrin aldehyde	0.01 J
EMWNT-05	08/10/09	Aldrin	0.02 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 2009 MONITORING DATA FOR THE BEAR CREEK HYDROGEOLOGIC REGIME
Field Measurements, Miscellaneous Analytes, Major Ions, and Trace Metals

Sampling Point	GW-008		GW-014	GW-046		GW-058	GW-065		GW-068	GW-071	
Functional Area	**OLF**		**BG**	**BG**		**BG**	**OLF**		**BG**	**BG**	
Date Sampled	**01/06/09**	**07/06/09**	**03/04/09**	**01/07/09**	**07/06/09**	**02/10/09**	**02/25/09**	**08/06/09**	**03/03/09**	**03/04/09**	**08/10/09**
Program	**BJC**	**BJC**	**GWPP**	**BJC**	**BJC**	**GWPP**	**GWPP**	**GWPP**	**GWPP**	**GWPP**	**GWPP**
Sample Type							**NP**	**NP**			
Field Measurements											
Time Sampled	13:40	9:45	14:30	14:00	10:55	13:35	10:00	8:15	14:45	10:10	9:45
Measuring Point Elev. (ft)	965.39	965.39	934.50	921.17	921.17	913.30	982.50	982.50	924.61	928.90	928.90
Depth to Water (ft)	13.12	14.66	5.86	3.31	3.44	22.13	26.44	26.95	6.19	8.04	8.38
Groundwater Elevation (ft)	952.27	950.73	928.64	917.86	917.73	891.17	956.06	955.55	918.42	920.86	920.52
Conductivity (μmho/cm)	143	175	436	160	250	712	538	484	695	1,792	1,716
Dissolved Oxygen (ppm)	0.84	12.63	0.83	13.05	0.38	4.21	5.4	6.7	1.14	0.39	0.29
Oxidation/Reduction (mV)	75	54	60	140	197	197	180	227	-60	-350	-370
Temperature (degrees C)	16.3	16.2	12.4	14.5	16.9	15.1	12.6	16.2	11.2	7.7	22.6
Turbidity (NTU)	2	1	.	11	3	.	.	.	.	.	.
pH	4.89	4.49	6.84	5.12	5.25	7.11	6.87	6.7	7.38	10.56	10.2
Miscellaneous Analytes											
Dissolved Solids (mg/L)	.	.	.	.	.	508	204	239	303	.	.
Suspended Solids (mg/L)	.	.	.	.	.	6	<	2	<	.	.
Major Ions (mg/L)											
Calcium	13.3	13	.	.	.	90.7	75.6	76.4	67.2	.	.
Magnesium	6.65	7	.	.	.	21.9	12.6	11.9	18.1	.	.
Potassium	1.38	1.2	.	.	.	2.68	<	3.01	7.17	.	.
Sodium	3.04	2.6	.	.	.	17.2	1.31	1.28	36.8	.	.
Bicarbonate	.	.	.	.	.	218	207	227	162	.	.
Carbonate	.	.	.	.	.	<	<	<	<	.	.
Chloride	.	.	.	.	.	35	0.611	0.889	105	.	.
Fluoride	.	.	.	.	.	0.231	0.107	0.128	0.118	.	.
Nitrate as N	.	.	.	.	.	11.4	<	<	<	.	.
Sulfate	.	.	.	.	.	31.4	19.8	17.2	4.3	.	.
Charge balance error (%)						2.3	3.1	0	2.6		
Trace Metals (mg/L)											
Aluminum	<	<	.	.	.	5.24	<	0.286	<	.	.
Arsenic	<	<	.	.	.	<	<	<	0.00556	0.00932	<
Barium	0.0968	0.099	.	.	.	0.0932	0.0174	0.0261	0.829	.	.
Beryllium	<	<	.	.	.	<	<	<	<	.	.
Boron	<	<	.	.	.	<	<	<	0.107	.	.
Cadmium	<	<	.	.	.	<	<	<	<	<	<
Chromium	<	<	.	.	.	0.016	<	<	<	<	<
Cobalt	0.0274	0.03	.	.	.	<	<	<	<	.	.
Iron	3.65	5	.	.	.	2.74	<	0.277	0.295	.	.
Lead	<	<	.	.	.	0.00169	0.00349	0.00585	0.00109	0.00059	0.00101
Lithium	<	<	.	.	.	0.012	<	<	0.0581	.	.
Manganese	2.93	2.6	.	.	.	0.0777	0.019	0.161	0.0288	.	.
Mercury	<	<	.	.	.	<	<	<	<	.	.
Molybdenum	.	.	.	.	.	<	<	<	<	.	.
Nickel	0.0236	0.029	.	.	.	<	<	<	0.0763	<	<
Selenium	<	<	.	.	.	<	<	<	<	<	<
Silver	<	<	.	.	.	<	<	<	<	.	.
Strontium	0.0368	0.037	.	.	.	0.17	0.131	0.14	2.06	.	.
Thallium	<	<	.	.	.	<	<	<	<	<	<
Uranium	<	<	.	<	<	0.014	0.00814	0.0148	<	<	<
Zinc	<	<	.	.	.	<	<	<	<	.	.

APPENDIX D.1: CY 2009 MONITORING DATA FOR THE BEAR CREEK HYDROGEOLOGIC REGIME
Field Measurements, Miscellaneous Analytes, Major Ions, and Trace Metals

Sampling Point	GW-077		GW-078		GW-079		GW-080				GW-082
Functional Area	BG		BG		BG		BG				BG
Date Sampled	03/02/09	07/21/09	03/02/09	07/21/09	03/02/09	07/22/09	03/02/09		07/22/09		08/10/09
Program	BJC	BJC	BJC	BJC	BJC	BJC	BJC	BJC	BJC	BJC	GWPP
Sample Type								Dup		Dup	
Field Measurements											
Time Sampled	16:30	14:15	16:05	14:50	15:20	10:15	15:00	.	10:00	.	14:00
Measuring Point Elev. (ft)	919.30	919.30	918.10	918.10	981.20	981.20	981.00	.	981.00	.	964.00
Depth to Water (ft)	5.00	9.67	4.03	8.98	18.50	21.59	21.65	.	22.80	.	21.26
Groundwater Elevation (ft)	914.30	909.63	914.07	909.12	962.70	959.61	959.35	.	958.20	.	942.74
Conductivity (μmho/cm)	318	417	346	466	204	267	144	.	219	.	971
Dissolved Oxygen (ppm)	1.39	0.77	1.61	2.01	0.96	1.04	7.67	.	9.05	.	0.17
Oxidation/Reduction (mV)	-20	114	10	134	-92	-120	-14	.	-22	.	-137
Temperature (degrees C)	12.8	18.5	13.9	16.5	12	14.9	13.1	.	16.9	.	18.8
Turbidity (NTU)	11	0	14	1	3	1	3	.	13	.	.
pH	7.9	7.4	6.93	7.36	6.79	7.58	6.6	.	6.6	.	6.7
Miscellaneous Analytes											
Dissolved Solids (mg/L)	.	202	233	243	134	144	86	97	104	106	.
Suspended Solids (mg/L)	<	<	6	<	<	<	22	24	8	11	.
Major Ions (mg/L)											
Calcium	.	.	.	.	.	.	.	.	.	.	.
Magnesium	.	.	.	.	.	.	.	.	.	.	.
Potassium	.	.	.	.	.	.	.	.	.	.	.
Sodium	.	.	.	.	.	.	.	.	.	.	.
Bicarbonate	.	.	.	.	.	.	.	.	.	.	.
Carbonate	.	.	.	.	.	.	.	.	.	.	.
Chloride	.	.	.	.	.	.	.	.	.	.	.
Fluoride	.	.	.	.	.	.	.	.	.	.	.
Nitrate as N	.	.	.	.	.	.	.	.	.	.	.
Sulfate	.	.	.	.	.	.	.	.	.	.	.
Charge balance error (%)											
Trace Metals (mg/L)											
Aluminum	.	.	.	.	.	.	.	.	.	.	.
Arsenic	.	.	.	.	.	.	.	.	.	.	.
Barium	.	.	.	.	.	.	.	.	.	.	.
Beryllium	.	.	.	.	.	.	.	.	.	.	.
Boron	.	.	.	.	.	.	.	.	.	.	.
Cadmium	.	.	.	.	.	.	.	.	.	.	.
Chromium	.	.	.	.	.	.	.	.	.	.	.
Cobalt	.	.	.	.	.	.	.	.	.	.	.
Iron	.	.	.	.	.	.	.	.	.	.	.
Lead	.	.	.	.	.	.	.	.	.	.	.
Lithium	.	.	.	.	.	.	.	.	.	.	.
Manganese	.	.	.	.	.	.	.	.	.	.	.
Mercury	.	.	.	.	.	.	.	.	.	.	.
Molybdenum	.	.	.	.	.	.	.	.	.	.	.
Nickel	.	.	.	.	.	.	.	.	.	.	.
Selenium	.	.	.	.	.	.	.	.	.	.	.
Silver	.	.	.	.	.	.	.	.	.	.	.
Strontium	.	.	.	.	.	.	.	.	.	.	.
Thallium	.	.	.	.	.	.	.	.	.	.	.
Uranium	<	<	<	<	<	<	<	<	<	<	.
Zinc	.	.	.	.	.	.	.	.	.	.	.

APPENDIX D.1: CY 2009 MONITORING DATA FOR THE BEAR CREEK HYDROGEOLOGIC REGIME
Field Measurements, Miscellaneous Analytes, Major Ions, and Trace Metals

Sampling Point	GW-085		GW-100	GW-101	GW-122	GW-127	GW-225	GW-229	GW-236	GW-242	GW-246
Functional Area	OLF		S3	S3	S3	S3	OLF	OLF	S3	BG	S3
Date Sampled	02/23/09		02/19/09	02/19/09	02/17/09	02/17/09	02/26/09	02/26/09	02/23/09	03/05/09	08/05/09
Program	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP
Sample Type		Dup									
Field Measurements											
Time Sampled	13:30	13:30	14:30	9:35	14:25	10:25	8:30	9:35	14:55	9:10	9:35
Measuring Point Elev. (ft)	983.57	983.57	987.40	1,007.40	1,007.20	1,005.90	943.11	949.00	983.21	978.69	1,009.19
Depth to Water (ft)	13.35	13.35	5.18	8.67	16.39	13.92	10.03	16.00	10.20	5.88	12.38
Groundwater Elevation (ft)	970.22	970.22	982.22	998.73	990.81	991.98	933.08	933.00	973.01	972.81	996.81
Conductivity (μmho/cm)	1,213	1,213	2,020	1,077	3,240	1,121	1,180	1,653	814	382	19,420
Dissolved Oxygen (ppm)	0.94	0.94	1.1	0.27	0.29	4.32	0.14	0.08	0.55	0.64	0.35
Oxidation/Reduction (mV)	144	144	154	-64	136	167	159	-61	252	-13	305
Temperature (degrees C)	15.2	15.2	11.6	10.8	15.7	8.6	11.2	14.8	12.2	13.1	19
Turbidity (NTU)	.	.	.	.	.	.	.	.	.	.	.
pH	6.75	6.75	6.59	6.81	6.58	6.94	7.25	6.48	5.25	6.11	4.66
Miscellaneous Analytes											
Dissolved Solids (mg/L)	.	.	1,050	703	1,910	650	.	776	486	66	15,800
Suspended Solids (mg/L)	.	.	2	11	1	1	.	28	<	272	2
Major Ions (mg/L)											
Calcium	.	.	317	177	363	149	.	197	98	39.7	2,630
Magnesium	.	.	23.6	29	109	24	.	36.5	12.6	14.4	576
Potassium	.	.	2.72	2.33	22.3	2.14	.	13.6	3.2	8	36
Sodium	.	.	7.11	15.4	89.7	57.8	.	75.3	17.5	11.3	454
Bicarbonate	.	.	251	455	392	364	.	615	67.5	137	58.7
Carbonate	.	.	<	<	<	<	.	<	<	<	<
Chloride	7.19	7.28	360	10.2	88.4	112	85.4	127	25.4	12.2	276
Fluoride	.	.	<	0.261	<	0.431	.	0.12	0.154	0.192	1.08
Nitrate as N	97.4	96.4	25.4	20.1	260	0.448	0.313 Q	<	35.9	<	2,829
Sulfate	8.04	7.87	22.6	37.3	14.5	48.5	46	14.5	76.4	19.2	23.3
Charge balance error (%)			1.9	1.4	3.9	2		0.8	4.2	5	-3
Trace Metals (mg/L)											
Aluminum	.	.	<	<	<	<	.	<	0.306	16.4	44.2
Arsenic	.	.	<	<	<	<	.	0.0094	<	<	<
Barium	.	.	0.675	0.753	0.981	0.02	.	1.36	0.0691	0.208	4.64
Beryllium	.	.	<	<	<	<	.	<	0.00083	0.00054	0.0272
Boron	.	.	<	<	0.432	<	.	3.44	<	<	<
Cadmium	.	.	<	<	<	<	.	<	<	<	0.279
Chromium	.	.	0.0584	<	<	<	.	<	<	0.0158	<
Cobalt	.	.	<	<	<	<	.	<	<	<	0.442
Iron	.	.	0.201	4.48	0.251	<	.	26.1	<	21	<
Lead	.	.	0.00623	0.00296	0.00056	<	.	0.00243	<	0.0045	<
Lithium	.	.	0.0174	<	0.159	<	.	0.123	<	0.139	0.58
Manganese	.	.	0.0822	5.07	0.0814	0.207	.	7.49	1.83	2.61	106
Mercury	.	.	<	<	<	<	.	<	<	<	0.00025
Molybdenum	.	.	<	<	<	<	.	<	<	<	<
Nickel	.	.	0.0292	0.00539	<	0.0059	.	<	0.0166	0.0158	4.1
Selenium	.	.	<	<	<	<	.	<	<	<	<
Silver	.	.	<	<	<	<	.	<	<	<	<
Strontium	.	.	0.569	0.745	11.7	0.305	.	0.599	0.216	0.242	9.97
Thallium	.	.	<	<	<	<	.	<	<	<	<
Uranium	.	.	0.00172	0.00342	0.00206	0.0534	.	0.143	0.00793	0.00072	0.436
Zinc	.	.	0.0551	<	<	0.114	.	<	<	<	<

APPENDIX D.1: CY 2009 MONITORING DATA FOR THE BEAR CREEK HYDROGEOLOGIC REGIME
Field Measurements, Miscellaneous Analytes, Major Ions, and Trace Metals

Sampling Point	GW-276		GW-307		GW-526	GW-537	GW-601	GW-615	GW-616	GW-623
Functional Area	S3		RS		S3	OLF	OLF	S3	S3	BG
Date Sampled	01/07/09	07/06/09	02/10/09		02/24/09	08/05/09	03/02/09	02/18/09	08/05/09	03/03/09
Program	BJC	BJC	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP
Sample Type				Dup						NP
Field Measurements										
Time Sampled	10:30	14:45	9:15	9:15	13:25	8:20	13:40	14:00	11:05	13:00
Measuring Point Elev. (ft)	1,001.57	1,001.57	993.14	993.14	998.25	976.65	1,002.80	1,017.55	1,011.81	925.21
Depth to Water (ft)	3.62	5.84	30.14	30.14	13.20	5.97	64.22	12.69	9.45	5.29
Groundwater Elevation (ft)	997.95	995.73	963.00	963.00	985.05	970.68	938.58	1,004.86	1,002.36	919.92
Conductivity (μmho/cm)	446	755	951	951	10,350	3,710	979	60,700	2,400	1,491
Dissolved Oxygen (ppm)	13.44	1.5	0.81	0.81	0.5	0.18	0.7	0.38	0.29	0.61
Oxidation/Reduction (mV)	257	207	188	188	115	246	116	76	81	-43
Temperature (degrees C)	13.9	24.2	12.8	12.8	10.8	16.3	9.8	12.8	22.6	12.1
Turbidity (NTU)	3	0	.	.	.	.	.	.	.	.
pH	3.5	4.6	6.43	6.43	7.81	6.58	7.38	5.89	9.79	10.17
Miscellaneous Analytes										
Dissolved Solids (mg/L)	.	.	541	482	.	.	.	64,400	.	924
Suspended Solids (mg/L)	.	.	<	<	.	.	.	1	.	<
Major Ions (mg/L)										
Calcium	26	34	169	162	.	.	.	9,430	.	1.04
Magnesium	4.66	5.4	16.2	15.7	.	.	.	2,400	.	<
Potassium	4.81	5	4.04	4.01	.	.	.	124	.	4.33
Sodium	52.8	48	12.7	12.2	.	.	.	2,550	.	355
Bicarbonate	.	.	370	370	.	.	.	250	.	269
Carbonate	.	.	<	<	.	.	.	<	.	236
Chloride	.	.	35.6	31.4	30.9	23.4	87.7	110	17.2	95.2
Fluoride	.	.	<	<	.	.	.	0.156	.	6.02
Nitrate as N	12.2	11	0.301	0.284	1,560	397	16.6	10,400	255	<
Sulfate	.	.	91	90.4	2.72	5.5	75.7	<	16.4	79.6
Charge balance error (%)			0.5	-0.9				2		2.3
Trace Metals (mg/L)										
Aluminum	1.96	1.6	<	<	.	.	.	<	.	0.386
Arsenic	<	<	<	<	.	.	.	<	.	0.00789
Barium	0.0652	0.06	0.0795	0.0761	.	.	.	376	.	0.0386
Beryllium	0.00248	0.0021	<	<	.	.	.	0.00529 Q	.	<
Boron	<	0.49	<	<	.	.	.	<	.	0.807
Cadmium	0.00788	0.0068	<	<	.	.	.	<	.	<
Chromium	<	<	<	<	.	.	.	<	.	<
Cobalt	0.0432	0.036	<	<	.	.	.	<	.	<
Iron	0.0975	<	<	<	.	.	.	1.21	.	<
Lead	<	<	<	<	.	.	.	<	.	0.00122
Lithium	0.0125	0.015	<	<	.	.	.	1.16	.	0.171
Manganese	1.8	1.5	0.135	0.132	.	.	.	22.4	.	<
Mercury	0.000264	<	<	<	.	.	.	<	.	<
Molybdenum	.	.	<	<	.	.	.	<	.	<
Nickel	0.0964	0.095	<	0.00552	.	.	.	0.15	.	<
Selenium	<	<	<	<	.	.	.	<	.	<
Silver	<	<	<	<	.	.	.	<	.	<
Strontium	0.0638	0.078	0.267	0.257	.	.	.	304	.	0.111
Thallium	<	<	<	<	.	.	.	<	.	<
Uranium	0.39	0.35	0.0017	0.00175	.	.	.	1.33	.	0.00171
Zinc	<	<	<	<	.	.	.	<	.	<

Sampling Point	GW-648			GW-683		GW-684		GW-703	GW-704	
Functional Area	RS			EXP-A		EXP-A		EXP-B	EXP-B	
Date Sampled	02/09/09		08/05/09	03/04/09	07/21/09	03/03/09	07/20/09	02/26/09	03/03/09	07/21/09
Program	GWPP	GWPP	GWPP	BJC	BJC	BJC	BJC	GWPP	BJC	BJC
Sample Type		Dup								
Field Measurements										
Time Sampled	8:45	8:45	14:50	10:00	10:40	11:15	14:00	13:50	10:10	14:45
Measuring Point Elev. (ft)	1,029.20	1,029.20	1,029.20	972.23	972.23	898.83	898.83	955.29	945.33	945.33
Depth to Water (ft)	67.46	67.46	68.26	88.64	89.15	15.37	15.69	39.91	30.26	36.08
Groundwater Elevation (ft)	961.74	961.74	960.94	883.59	883.08	883.46	883.14	915.38	915.07	909.25
Conductivity (μmho/cm)	470	470	401	322	343	438	360	718	510	374
Dissolved Oxygen (ppm)	3.52	3.52	2.1	12.2	3.19	12.41	0.6	0.43	1.03	0.27
Oxidation/Reduction (mV)	227	227	177	143	101	119	198	118	156	44
Temperature (degrees C)	12.7	12.7	15.4	12.32	14.2	12.2	14.6	15.2	9.7	15.9
Turbidity (NTU)	.	.	.	2	2	7	2	.	3	62
pH	7.65	7.65	7.91	7.17	7.48	7.4	7.61	7.44	6.61	8.47
Miscellaneous Analytes										
Dissolved Solids (mg/L)	118	235	182	247	278	271	482	328	374	343
Suspended Solids (mg/L)	<	<	2	<	<	<	<	1	<	16
Major Ions (mg/L)										
Calcium	51	50.6	38.2	50.6	52.9	67.8	63.3	82.6	72.8	37.6
Magnesium	30.9	28.9	27.1	17.8	21.4	18.1	18.1	32.3	28.4	28.2
Potassium	<	<	<	1.09	1.08	5.25	4.77	5.43	2.99	15
Sodium	1.63	1.53	0.814	4.92	3.74	7.19	7.2	13.7	15.9	14.6
Bicarbonate	235	234	207	186	203	218	209	238	238	167
Carbonate	<	<	<	<	<	<	<	<	<	<
Chloride	4.19	4.25	1.6	10.8	7.42	15.3	18	25	35	30.4
Fluoride	0.239	0.239	0.259	0.18	0.128	0.15	0.208	0.162	0.27	0.202
Nitrate as N	0.154	0.617	0.152	2.3	0.7	2.1	<	0.509	12.6	3.7
Sulfate	4.12	4.07	2.24	18.7	21.9	15.6	16.4	25.7	26.1	24.4
Charge balance error (%)	2.3	0.3	-1	-4	-2	0.5	0.4	10.9	-3.3	2.3
Trace Metals (mg/L)										
Aluminum	<	<	<	<	<	<	<	<	<	<
Arsenic	<	<	<	<	<	<	<	<	<	<
Barium	0.202	0.188	0.162	0.0975	0.116	0.1	0.0976	0.107	0.119	0.0644
Beryllium	<	<	<	<	<	<	<	<	<	<
Boron	<	<	<	<	<	<	<	<	<	<
Cadmium	<	<	<	<	<	<	<	<	<	<
Chromium	<	<	<	<	0.0179	<	<	<	<	<
Cobalt	<	<	<	<	<	<	<	<	<	<
Iron	<	<	<	0.0821	0.113	<	<	0.127	1.76	9.3
Lead	<	<	<	<	<	<	<	<	<	<
Lithium	0.0251	0.0251	0.0216	<	<	0.0269	0.0265	0.0193	0.0143	0.03
Manganese	<	<	<	<	<	0.042	0.0508	<	0.0109	0.0681
Mercury	<	<	<	<	<	<	<	<	.	.
Molybdenum	<	<	<	.	.	.	.	<	.	.
Nickel	<	<	<	<	<	<	<	<	<	<
Selenium	<	<	<	<	<	<	<	<	<	<
Silver	<	<	<	<	<	<	<	<	<	<
Strontium	0.0735	0.0687	0.0613	0.112	0.14	0.185	0.171	0.274	0.374	0.152
Thallium	<	<	<	<	<	<	<	<	<	<
Uranium	<	<	<	.	0.016	.	0.02	0.0138	0.013	0.0071
Zinc	<	<	<	<	<	<	<	<	<	<

APPENDIX D.1: CY 2009 MONITORING DATA FOR THE BEAR CREEK HYDROGEOLOGIC REGIME
Field Measurements, Miscellaneous Analytes, Major Ions, and Trace Metals

Sampling Point	GW-706		GW-712		GW-713				GW-714		GW-724
Functional Area	EXP-B		EXP-W		EXP-W				EXP-W		EXP-C
Date Sampled	03/03/09	07/22/09	01/07/09	07/06/09	01/07/09		07/07/09		01/06/09	07/06/09	02/25/09
Program	BJC	BJC	BJC	BJC	BJC	BJC	BJC	BJC	BJC	BJC	GWPP
Sample Type						Dup		Dup			
Field Measurements											
Time Sampled	10:55	10:15	15:30	14:00	12:00	.	9:15	.	10:40	13:40	8:20
Measuring Point Elev. (ft)	929.47	929.47	877.89	877.89	881.43	.	881.43	.	875.88	875.88	979.75
Depth to Water (ft)	11.71	18.15	26.09	35.55	32.68	.	38.46	.	28.44	31.11	28.59
Groundwater Elevation (ft)	917.76	911.32	851.80	842.34	848.75	.	842.97	.	847.44	844.77	951.16
Conductivity (μmho/cm)	703	644	378	891	476	.	567	.	394	665	883
Dissolved Oxygen (ppm)	0.17	0.33	0.55	0.42	0.65	.	11.96	.	1.59	8.5	1.55
Oxidation/Reduction (mV)	113	-26	-60	37	-112	.	-164	.	129	42	165
Temperature (degrees C)	11.5	16.1	10	19.6	10.6	.	16.5	.	12	21.4	13.4
Turbidity (NTU)	2	17	15	27	8	.	2	.	6	13	.
pH	6.9	7.43	7.97	7.45	7.26	.	7.78	.	6.99	7.35	7.02
Miscellaneous Analytes											
Dissolved Solids (mg/L)	522	475	.	.	.	.	.	.	.	.	.
Suspended Solids (mg/L)	<	11	.	.	.	.	.	.	.	.	.
Major Ions (mg/L)											
Calcium	115	94.9	52.2	21	58.7	57.8	16	26	59.7	63	.
Magnesium	22.8	20.2	30.9	30	30.8	30.4	28	28	24.2	25	.
Potassium	6.72	7.76	1.8	3	2.42	2.41	2.9	2.8	1.65	1.5	.
Sodium	22.5	21	6.88	11	12.2	12.2	10	11	6.32	5.8	.
Bicarbonate	285	207	.	.	.	.	.	.	.	.	.
Carbonate	<	<	.	.	.	.	.	.	.	.	.
Chloride	49.5	52.7	.	.	.	.	.	.	.	.	64.2
Fluoride	0.28	0.251	.	.	.	.	.	.	.	.	.
Nitrate as N	21.4	8.1	0.052	<	0.028	0.029	0.01	0.015	0.24	0.34	12.9
Sulfate	31.2	28.1	.	.	.	.	.	.	.	.	32.3
Charge balance error (%)	-2.9	5									
Trace Metals (mg/L)											
Aluminum	<	<	<	<	<	<	<	<	<	<	.
Arsenic	<	<	<	<	<	<	<	<	<	<	.
Barium	0.158	0.145	0.0325	0.016	0.0451	0.0443	0.014	0.021	0.0858	0.086	.
Beryllium	<	<	<	<	<	<	<	<	<	<	.
Boron	0.114	<	<	<	<	<	<	<	<	<	.
Cadmium	<	<	<	<	<	<	<	<	<	<	.
Chromium	<	<	<	<	<	<	<	<	<	<	.
Cobalt	<	<	<	<	<	<	<	<	<	<	.
Iron	0.945	3.32	1.61	1.8	0.783	0.871	0.21	1.4	0.274	2.4	.
Lead	<	<	<	<	<	<	<	<	<	<	.
Lithium	0.0193	0.0169	<	0.016	0.0133	0.0137	0.016	0.016	<	0.01	.
Manganese	0.0222	0.0496	0.0667	0.037	0.144	0.15	0.051	0.087	0.0703	0.022	.
Mercury	.	.	.	.	.	.	.	.	.	.	.
Molybdenum	.	.	.	.	.	.	.	.	.	.	.
Nickel	<	<	<	<	<	<	<	<	<	<	.
Selenium	<	<	<	<	<	<	<	<	<	<	.
Silver	<	<	<	<	<	<	<	<	<	<	.
Strontium	0.398	0.312	0.616	0.3	1.29	1.27	0.29	0.55	0.358	0.37	.
Thallium	<	<	<	<	<	<	<	<	<	<	.
Uranium	0.066	0.058	<	<	<	<	<	<	<	<	.
Zinc	<	<	<	<	<	<	<	<	<	<	.

APPENDIX D.1: CY 2009 MONITORING DATA FOR THE BEAR CREEK HYDROGEOLOGIC REGIME
Field Measurements, Miscellaneous Analytes, Major Ions, and Trace Metals

Sampling Point	GW-725	GW-726-04	GW-726-06	GW-726-09	GW-726-12	GW-726-16	GW-726-20	GW-726-23	GW-738
Functional Area	EXP-C	BG	BG	BG	BG	BG	BG	BG	EXP-C
Date Sampled	02/25/09	05/04/09	05/04/09	05/05/09	05/05/09	05/06/09	05/06/09	05/06/09	02/25/09
Program	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP
Sample Type									
Field Measurements									
Time Sampled	14:10	14:25	8:36	10:06	11:25	8:20	9:25	10:22	9:15
Measuring Point Elev. (ft)	961.63	.	.	.	.	.	.	.	983.31
Depth to Water (ft)	9.51	.	.	.	.	.	.	.	28.70
Groundwater Elevation (ft)	952.12	.	.	.	.	.	.	.	.
Conductivity (μmho/cm)	921	5,720	4,710	2,770	1,992	1,427	886	444	917
Dissolved Oxygen (ppm)	0.08	.	.	.	.	.	.	.	0.99
Oxidation/Reduction (mV)	113	.	.	.	.	.	.	.	175
Temperature (degrees C)	14.1	16.4	16.1	15.1	15.3	14.8	14.6	14.7	11.5
Turbidity (NTU)	.	.	.	.	.	.	.	.	.
pH	6.69	8.06	7.97	8.06	8.18	8.84	9.13	8.89	6.74
Miscellaneous Analytes									
Dissolved Solids (mg/L)	560	3,020	2,490	1,550	1,160	832	496	258	458
Suspended Solids (mg/L)	2	1	1	<	1	1	<	1	<
Major Ions (mg/L)									
Calcium	149	8.74	5.59	2.57	1.83	1.3	0.973	1.73	139
Magnesium	23.6	2.55	1.65	0.737	0.495	0.383	0.215	0.568	23.9
Potassium	3.05	6.55	4.94	3.26	2.8	2.95	<	2.22	3.1
Sodium	28.3	1,230	985	616	487	341	206	101	10.6
Bicarbonate	337	508	541	741	682	547	344	200	336
Carbonate	<	<	<	<	36.6	67.2	80.3	22.6	<
Chloride	66.7	1,520	1,110	399	165	37.6	4.97	1.03	22.9
Fluoride	0.241	3.25	3.67	5.22	6.68	6.1	2.01	0.386	<
Nitrate as N	0.315 Q	<	<	<	<	<	<	<	12.7
Sulfate	38.2	4.02	19.2	36.3	46.3	45.2	17.6	7.11	34.2
Charge balance error (%)	6.2	1	0.8	-0.1	2.5	1.4	-0.4	-0.8	2.5
Trace Metals (mg/L)									
Aluminum	<	0.304	<	<	<	1.04	<	0.296	<
Arsenic	<	<	<	<	<	<	<	<	<
Barium	0.208	0.401	0.248	0.0993	0.0694	0.058	0.032	0.0583	0.065
Beryllium	<	<	<	<	<	<	<	<	<
Boron	<	0.365	0.39	0.467	0.683	0.891	1.07	0.534	<
Cadmium	<	<	<	<	<	<	<	<	<
Chromium	<	0.0163	<	0.012	<	0.0106	<	<	<
Cobalt	<	<	<	<	<	<	<	<	<
Iron	0.492	0.458	0.0703	0.069	0.197	0.434	0.125	0.28	<
Lead	<	0.00116	<	<	0.0182	0.00116	0.0006	<	0.00409
Lithium	<	0.617	0.496	0.317	0.286	0.188	0.108	0.0601	<
Manganese	0.853	0.0108	<	<	<	<	<	<	0.0212
Mercury	<	<	<	<	<	<	<	<	<
Molybdenum	<	<	0.0238	0.0226	<	<	<	<	<
Nickel	<	0.00769	<	<	<	<	<	<	<
Selenium	<	0.0231	<	<	<	<	<	<	<
Silver	<	<	<	<	<	<	<	<	<
Strontium	0.353	1.06	0.719	0.317	0.21	0.12	0.0735	0.112	0.156
Thallium	<	<	<	<	<	<	<	<	<
Uranium	0.0114	<	<	<	0.000605	0.00064	<	<	0.00324
Zinc	<	0.321	0.107	0.182	0.0797	0.178	0.152	0.0957	<

APPENDIX D.1: CY 2009 MONITORING DATA FOR THE BEAR CREEK HYDROGEOLOGIC REGIME
Field Measurements, Miscellaneous Analytes, Major Ions, and Trace Metals

Sampling Point	BCK-03.30	BCK-04.55		BCK-07.87	BCK-09.20	BCK-09.40		BCK-11.54	BCK-11.84
Functional Area	EXP-SW	EXP-SW		EXP-SW	EXP-SW	EXP-SW		EXP-SW	EXP-SW
Date Sampled	12/07/09	08/03/09	12/07/09	12/07/09	12/07/09	08/03/09		12/07/09	12/07/09
Program	BJC	GWPP	BJC	BJC	BJC	GWPP	GWPP	BJC	BJC
Sample Type							Dup		
Field Measurements									
Time Sampled	11:00	8:35	10:40	10:00	12:00	9:15	9:15	10:15	9:10
Measuring Point Elev. (ft)	.	.	.	.	.	.	.	.	.
Depth to Water (ft)	.	.	.	.	.	.	.	.	.
Groundwater Elevation (ft)	.	.	.	.	.	.	.	.	.
Conductivity (μmho/cm)	362	374	263	475	314	511	511	351	816
Dissolved Oxygen (ppm)	11.91	5.03	7.21	10.12	1.89	4.72	4.72	2.48	11.24
Oxidation/Reduction (mV)	31.9	243	193	17.8	124.9	245	245	152.4	140.5
Temperature (degrees C)	7.65	18.8	7.4	6.17	8.7	19.1	19.1	6.31	4.86
Turbidity (NTU)	6	.	6	8	8.54	.	.	5.87	4
pH	6.97	7.61	7.39	5.82	7.29	7.81	7.81	7.26	6.89
Miscellaneous Analytes									
Dissolved Solids (mg/L)	150	191	160	210	230	231	262	280	400
Suspended Solids (mg/L)	<	6	<	<	<	5	6	<	<
Major Ions (mg/L)									
Calcium	35.8	52.4	37.6	50.1	55.3	66.8	69.7	63.5	86.4
Magnesium	9.24	11.6	9.81	11.3	12.5	11.9	12	11.8	11.5
Potassium	1.18	2.25	1.08	1.26	1.4	2.91	2.71	1.57	1.89
Sodium	3.3	6.24	3.53	5.84	6.55	13.1	12.9	10.6	16.5
Bicarbonate	120	156	130	160	170	180	180	150	170
Carbonate	<	<	<	<	<	<	<	<	<
Chloride	4	9.25	4.7	8.4	9.6	19.9	19.1	15	23
Fluoride	<	0.121	<	<	<	0.237	0.239	<	<
Nitrate as N	0.81	1.56	1	4.2	.	5.86	5.94	19	31
Sulfate	12	14.2	8.6	14	15	26.1	26.3	19	24
Charge balance error (%)	-1.8	1.4	-2	-4	1.6	-1.8	-0.2	-5.4	-5.8
Trace Metals (mg/L)									
Aluminum	<	0.42	<	<	<	0.245	0.305	<	<
Arsenic	<	<	<	<	<	<	<	<	<
Barium	0.0485	0.0702	0.0481	0.0696	0.0764	0.0957	0.0947	0.102	0.124
Beryllium	<	<	<	<	<	<	<	<	<
Boron	<	<	<	<	<	0.161	0.161	<	<
Cadmium	<	<	<	<	<	<	<	<	<
Chromium	<	<	<	<	<	<	<	<	<
Cobalt	<	<	<	<	<	<	<	<	<
Iron	0.303	0.382	0.176	0.266	0.222	0.324	0.36	0.126	0.14
Lead	<	<	<	<	<	0.00914 R	< R	<	<
Lithium	<	0.01	<	0.0136	0.014	0.0265	0.0249	0.0121	0.0159
Manganese	0.0491	0.0462	0.0624	0.0243	0.0328	0.0434	0.0432	0.104	0.244
Mercury	<	<	<	<	<	<	<	<	<
Molybdenum	.	<	.	.	.	<	<	.	.
Nickel	<	<	<	<	<	<	<	<	<
Selenium	<	<	<	<	<	<	<	<	<
Silver	4.31	<	3.81	4.26	4.26	<	<	4.41	4.52
Strontium	<	0.1	<	<	<	0.172	0.171	<	<
Thallium	0.0788	<	0.0634	0.108	0.117	<	<	0.169	0.249
Uranium	0.0127	0.0283	0.0137	0.0396	0.044	0.0812	0.0792	0.0545	0.0816
Zinc	<	<	<	<	<	<	<	<	<

APPENDIX D.1: CY 2009 MONITORING DATA FOR THE BEAR CREEK HYDROGEOLOGIC REGIME
Field Measurements, Miscellaneous Analytes, Major Ions, and Trace Metals

Sampling Point	BCK-11.97	BCK-12.34	NT-01							
Functional Area	EXP-SW	EXP-SW	EXP-SW							
Date Sampled	08/03/09	12/07/09	06/25/09		07/20/09		08/03/09	11/17/09		12/07/09
Program	GWPP	BJC	BJC	BJC	BJC	BJC	GWPP	BJC	BJC	BJC
Sample Type				Dup		Dup			Dup	
Field Measurements										
Time Sampled	13:25	8:30	8:55	.	9:10	.	14:05	8:15	.	8:45
Measuring Point Elev. (ft)	.	.	.	.	.	.	.	.	.	.
Depth to Water (ft)	.	.	.	.	.	.	.	.	.	.
Groundwater Elevation (ft)	.	.	.	.	.	.	.	.	.	.
Conductivity (μmho/cm)	1,061	658	.	.	.	.	1,490	.	.	1,122
Dissolved Oxygen (ppm)	5.26	1.35	.	.	.	.	5.06	.	.	11.06
Oxidation/Reduction (mV)	235	183.3	.	.	.	.	235	.	.	105.4
Temperature (degrees C)	21.8	7.69	.	.	.	.	24	.	.	7.2
Turbidity (NTU)	.	4.31	.	.	.	.	.	.	.	5
pH	7.89	6.93	.	.	.	.	7.26	.	.	6.57
Miscellaneous Analytes										
Dissolved Solids (mg/L)	621	550	.	.	.	.	1,150	.	.	510
Suspended Solids (mg/L)	2	<	.	.	.	.	3	.	.	<
Major Ions (mg/L)										
Calcium	133	110	116	113	36.4	36.3	205	140	150	101
Magnesium	19.1	15.2	17.6	17.1	5.36	5.31	30.1	19	20	15.7
Potassium	3.61	2.41	4.18	4	3.09	3.01	4.16	2.4	2.5	2.24
Sodium	52	27.7	15.6	15.2	4.9	4.9	27.6	16 J	16	13.6
Bicarbonate	568 Q	220	.	.	.	.	217	.	.	130
Carbonate	<	<	.	.	.	.	<	.	.	<
Chloride	70.1	40	.	.	.	.	24.5	.	.	11
Fluoride	0.552	<	.	.	.	.	0.67	.	.	<
Nitrate as N	28.5	.	.	.	.	.	122	.	.	61
Sulfate	34.6	26	.	.	.	.	20.4	.	.	14
Charge balance error (%)	-20.8 R	13.8					-0.7			-4
Trace Metals (mg/L)										
Aluminum	<	<	1.76	1.39	2.07	1.94	0.287	0.35	0.42	0.314
Arsenic	<	<	<	<	<	<	<	<	<	<
Barium	0.169	0.153	0.203	0.196	0.0843	0.0844	0.376	0.25	0.26	0.202
Beryllium	<	<	<	<	<	<	<	<	<	<
Boron	0.174	<	0.47	0.466	0.448	0.452	0.542	0.15	0.16	0.152
Cadmium	<	0.0034	0.00949	0.00922	<	<	0.0101	0.011	0.011	0.0076
Chromium	<	<	<	<	<	<	<	<	<	<
Cobalt	<	<	<	<	<	<	<	<	<	<
Iron	0.122	0.162	1.41	1.11	1.78	1.76	0.196	0.13	0.18	0.361
Lead	<	<	<	<	<	<	<	<	<	<
Lithium	0.0237	0.018	0.0836	0.081	0.0702	0.0703	0.0826	0.026	0.027	0.0286
Manganese	0.157	0.959	1.87	1.79	0.638	0.632	2.68	2.2	2.3	2.07
Mercury	<	<	.	.	.	.	<	.	.	<
Molybdenum	<	.	.	.	.	.	<	.	.	.
Nickel	<	0.0148	0.0382	0.0368	0.0123	0.012	0.049	0.044	0.047	0.0318
Selenium	<	<	<	<	<	<	<	<	<	<
Silver	<	4.27	<	<	<	<	<	4.4	4.6	4.58
Strontium	0.393	<	0.347	0.338	0.0999	0.0997	0.595	<	<	<
Thallium	<	0.311	<	<	<	<	<	0.37	0.38	0.302
Uranium	0.158	0.11	.	.	.	.	0.0213	0.011	0.01	0.0082
Zinc	<	<	<	<	<	<	<	<	<	<

APPENDIX D.1: CY 2009 MONITORING DATA FOR THE BEAR CREEK HYDROGEOLOGIC REGIME
Field Measurements, Miscellaneous Analytes, Major Ions, and Trace Metals

Sampling Point	NT-03	NT-07		NT-08				S07	SS-4	SS-5	
Functional Area	EXP-SW	EXP-SW		EXP-SW				EXP-SW	EXP-SW	EXP-SW	
Date Sampled	12/07/09	02/10/09	08/04/09	02/10/09	08/04/09	12/07/09		12/07/09	08/03/09	08/03/09	12/07/09
Program	BJC	BJC	BJC	BJC	BJC	BJC	BJC	BJC	GWPP	GWPP	BJC
Sample Type							Dup				
Field Measurements											
Time Sampled	10:45	9:24	14:00	9:52	14:25	9:40	.	9:40	10:15	9:45	11:25
Measuring Point Elev. (ft)	.	.	.	.	.	.	.	.	.	.	.
Depth to Water (ft)	.	.	.	.	.	.	.	.	.	.	.
Groundwater Elevation (ft)	.	.	.	.	.	.	.	.	.	.	.
Conductivity (μmho/cm)	143	277	482	196	355	343	.	238	749	510	291
Dissolved Oxygen (ppm)	0.95	12.88	5.75	9.81	6.89	9.55	.	2.95	3.18	3.82	1.12
Oxidation/Reduction (mV)	123.3	119	157.4	110.1	140.9	55.4	.	144.3	249	251	127.4
Temperature (degrees C)	5.34	8.5	25.09	9.55	22.9	5.44	.	5.55	18.6	14.8	11.11
Turbidity (NTU)	11	2.2	2	6.5	11.6	8	.	8.8	.	.	4.71
pH	7.41	7.21	7.6	7.09	7.61	4.9	.	7.06	7.32	7.2	6.7
Miscellaneous Analytes											
Dissolved Solids (mg/L)	120	212	334	158	239	150	160	210	402	195	200
Suspended Solids (mg/L)	<	<	21	<	<	8.4	<	<	8	4	<
Major Ions (mg/L)											
Calcium	23.6	57	70.8	42.2	56.8	39.1	39.3	42.3	95	63.6	46.1
Magnesium	5.4	9.45	11.7	4.23	5.87	4.33	4.35	5.64	17.6	16.7	14.1
Potassium	1.02	2.3	2.53	1.6	2.61	1.35	1.28	1.04	2.67	<	0.996
Sodium	2.63	6.04	6.34	3.72	4.35	3	3.03	3.95	25.4	9.75	4.26
Bicarbonate	68	154	175	114	146	120	110	57	239	205	170
Carbonate	<	<	<	<	<	<	<	<	<	<	<
Chloride	1.8	17.9	28.5	8.3	9.38	5.5	5.4	2.7	37.2	16.5	6.3
Fluoride	<	<	0.125	<	0.131	<	<	<	0.324	0.14	<
Nitrate as N	0.017	0.61	<	<	0.04	0.018	<	.	15.3	2.78	1.4
Sulfate	18	23	15.9	11.9	10.3	8.3	8.4	9	26.3	20.2	11
Charge balance error (%)	-0.7	-2	2.1	-1.9	2.4	-4.7			-0.8	-2.1	-3.1
Trace Metals (mg/L)											
Aluminum	<	<	<	0.452	0.524	<	<	<	0.241	<	<
Arsenic	<	<	<	<	<	<	<	<	<	<	<
Barium	0.0298	0.0334	0.053	0.0689	0.09	0.0629	0.0631	0.115	0.129	0.0805	0.0598
Beryllium	<	<	<	<	<	<	<	<	<	<	<
Boron	<	0.286	0.392	0.538	0.882	0.38 J	0.36 J	<	<	<	<
Cadmium	<	<	<	<	<	<	<	<	<	<	<
Chromium	<	<	<	<	<	<	<	<	<	<	<
Cobalt	<	<	<	<	<	<	<	<	<	<	<
Iron	0.575	0.0856	<	0.378	0.676	0.365	0.377	0.403	0.442	0.156	0.0902
Lead	<	<	<	<	<	<	<	<	<	<	<
Lithium	<	0.055	0.0648	0.125	0.165	0.0848	0.0857	<	0.0117	<	<
Manganese	0.129	0.00718	0.0456	0.039	0.13	0.19	0.192	0.181	0.108	0.00677	0.0057
Mercury	<	.	.	.	.	<	<	<	<	<	<
Molybdenum	.	.	.	.	.	.	.	.	<	<	.
Nickel	<	<	<	<	<	<	<	<	<	<	<
Selenium	<	<	<	<	<	<	<	<	<	<	<
Silver	4.79	<	<	<	<	5.1	5.19	5.25	<	<	3.89
Strontium	<	0.116	0.153	0.0944	0.134	<	<	<	0.246	0.118	<
Thallium	0.0717	<	<	<	<	0.0915	0.0917	0.134	<	<	0.0735
Uranium	0.0303	0.029	0.031	0.42	0.3	0.277	0.275	<	0.0801	0.0242	0.0154
Zinc	<	<	<	<	<	<	<	<	<	<	<

APPENDIX D.1: CY 2009 MONITORING DATA FOR THE BEAR CREEK HYDROGEOLOGIC REGIME
Field Measurements, Miscellaneous Analytes, Major Ions, and Trace Metals

Sampling Point	SS-6		SS-6.6	SS-7	SS-8	
Functional Area	**EXP-SW**		**EXP-SW**	**EXP-SW**	**EXP-SW**	
Date Sampled	**01/05/09**	**07/06/09**	**12/07/09**	**12/07/09**	**12/07/09**	
Program	**BJC**	**BJC**	**BJC**	**BJC**	**BJC**	**BJC**
Sample Type						**Dup**
Field Measurements						
Time Sampled	14:40	13:10	10:30	10:00	9:00	.
Measuring Point Elev. (ft)	.	.	.	.	.	.
Depth to Water (ft)	.	.	.	.	.	.
Groundwater Elevation (ft)	.	.	.	.	.	.
Conductivity (μmho/cm)	319	410	394	292	247	.
Dissolved Oxygen (ppm)	7.28	9.21	.	5.94	5.33	.
Oxidation/Reduction (mV)	68.3	72	.	201	190	.
Temperature (degrees C)	12.81	16.06	9.9	13.1	10.3	.
Turbidity (NTU)	1.75	11.4	4	4	5	.
pH	6.92	7.86	.	6.87	6.64	.
Miscellaneous Analytes						
Dissolved Solids (mg/L)	.	.	140	140	130	130
Suspended Solids (mg/L)	.	.	22	<	<	<
Major Ions (mg/L)						
Calcium	47.4	53	31.1	29.3	33.5	31.4
Magnesium	16	19	14.2	14.3	9.46	9.09
Potassium	0.873	0.9	0.521	0.676	0.748	0.651
Sodium	3.88	3.2	1.33	2.67	2.84	2.69
Bicarbonate	.	.	140	140	120	130
Carbonate	.	.	<	<	<	<
Chloride	.	.	2.1	4.2	4.5	4.5
Fluoride	.	.	<	<	<	<
Nitrate as N	0.68	0.6	0.1	0.064	0.19	0.19
Sulfate	.	.	5.3	4.1	2.9	2.9
Charge balance error (%)			-3.1	-4.1	-0.1	
Trace Metals (mg/L)						
Aluminum	<	<	<	<	<	<
Arsenic	<	<	<	<	<	<
Barium	0.0648	0.078	0.0572	0.0431	0.038	0.0366
Beryllium	<	<	<	<	<	<
Boron	<	<	<	<	<	<
Cadmium	<	<	<	<	<	<
Chromium	<	<	<	<	<	<
Cobalt	<	<	<	<	<	<
Iron	0.118	0.15	0.208	<	0.0897	0.16
Lead	<	<	<	<	<	<
Lithium	<	<	<	<	<	<
Manganese	0.00978	0.024	0.0231	<	0.0238	0.0251
Mercury	.	.	<	<	<	<
Molybdenum	.	.	.	.	.	.
Nickel	<	<	<	<	<	<
Selenium	<	<	<	<	<	<
Silver	<	<	3.76	3.57	3.83	3.73
Strontium	0.0696	0.077	<	<	<	<
Thallium	<	<	0.0362	0.0274	0.0376	0.0361
Uranium	0.0065	0.0057	<	<	<	<
Zinc	<	<	<	<	<	<

APPENDIX D.2

VOLATILE ORGANIC COMPOUNDS

APPENDIX D.2: CY 2009 MONITORING DATA FOR THE BEAR CREEK HYDROGEOLOGIC REGIME
Volatile Organic Compounds

Sampling Point	GW-008		GW-014	GW-046		GW-053		GW-058	GW-065	
Functional Area	OLF		BG	BG		BG		BG	OLF	
Date Sampled	01/06/09	07/06/09	03/04/09	01/07/09	07/06/09	03/03/09		02/10/09	02/25/09	08/06/09
Program	BJC	BJC	GWPP	BJC	BJC	GWPP	GWPP	GWPP	GWPP	GWPP
Sample Type						Dup	PDB		NP	NP
Chloroethenes (µg/L)										
Tetrachloroethene	30.3	51	28	306	1300	<	<	<	<	<
Trichloroethene	11.3	7.7	160	783	620	2 J	3 J	<	<	<
cis-1,2-Dichloroethene	23.1	24	710	2,730	2,400	11	11	<	<	<
trans-1,2-Dichloroethene	<	<	1 J	15.6	<	<	<	<	<	<
1,1-Dichloroethene	5.48	5.8	34	31	98	<	<	<	<	<
Vinyl chloride	<	<	120	223	320	<	<	<	<	<
Chloroethanes (µg/L)										
1,1,1-Trichloroethane	<	<	<	19	85	<	<	<	<	<
1,1,2-Trichloroethane	<	<	<	<	<	<	<	<	<	<
1,2-Dichloroethane	<	<	<	<	<	<	<	<	<	<
1,1-Dichloroethane	12.1	13	180	<	360	3 J	3 J	<	<	<
Chloroethane	<	<	<	<	<	<	<	<	<	<
Chloromethanes (µg/L)										
Carbon tetrachloride	<	<	<	<	<	<	<	<	<	<
Chloroform	<	<	<	<	<	<	<	<	<	<
Methylene chloride	<	<	<	<	<	<	<	<	<	<
Petrol. Hydrocarb. (µg/L)										
Benzene	1.09 J	1	1 J	9.06	180 Q	<	<	<	<	<
Ethylbenzene	<	<	<	<	<	<	<	<	<	<
Toluene	<	<	<	<	<	<	<	<	<	<
Total Xylene	<	.	<	<	.	<	<	<	<	<
Chlorofluorocarbons (µg/L)										
1,1,2-Trichloro-1,2,2-trifluoroethane	.	.	<	.	.	<	<	<	<	<
Dichlorodifluoromethane	.	.	<	.	.	<	<	<	<	<
Miscellaneous (µg/L)										
1,2-Dichloropropane	1.16 J	1.1	<	<	<	<	<	<	<	<
1,4-Dichlorobenzene	.	.	<	.	.	<	<	<	<	<
2-Butanone	<	<	<	<	<	<	<	<	<	<
Acetone	<	<	<	<	<	.	.	<	<	<
Carbon disulfide	<	<	<	<	<	.	.	<	<	<
Chlorobenzene	<	<	<	<	<	<	<	<	<	<

APPENDIX D.2: CY 2009 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	03/03/09	03/04/09	08/10/09	03/02/09	07/21/09	03/02/09	07/21/09	03/02/09	07/22/09
Program	GWPP	GWPP	GWPP	BJC	BJC	BJC	BJC	BJC	BJC
Sample Type									
Chloroethenes (µg/L)									
Tetrachloroethene	2 J	610	240	<	<	<	<	<	<
Trichloroethene	93	63	47	<	<	<	<	<	<
cis-1,2-Dichloroethene	1,900	38	25	<	<	<	<	<	<
trans-1,2-Dichloroethene	3 J	<	1 J	<	<	<	<	<	<
1,1-Dichloroethene	180	78	75	<	<	<	<	<	<
Vinyl chloride	320	2	3	<	<	<	<	<	<
Chloroethanes (µg/L)									
1,1,1-Trichloroethane	<	190	200	<	<	<	<	<	<
1,1,2-Trichloroethane	<	<	<	<	<	<	<	<	<
1,2-Dichloroethane	<	<	<	<	<	<	<	<	<
1,1-Dichloroethane	850	2,900	2,200	<	<	<	<	<	<
Chloroethane	6	20	20	<	<	<	<	<	<
Chloromethanes (µg/L)									
Carbon tetrachloride	<	<	<	<	<	<	<	<	<
Chloroform	<	<	<	<	<	<	<	<	<
Methylene chloride	<	<	<	<	<	<	<	<	<
Petrol. Hydrocarb. (µg/L)									
Benzene	110	1,500	740	<	<	<	<	<	<
Ethylbenzene	<	3 J	1 J	<	<	<	<	<	<
Toluene	8	30	16	<	<	<	<	<	<
Total Xylene	5 J	9	4 J	<	<	<	<	<	<
Chlorofluorocarbons (µg/L)									
1,1,2-Trichloro-1,2,2-trifluoroethane	<	190	120	.	.	.	.	.	.
Dichlorodifluoromethane	<	<	<	.	.	.	.	.	.
Miscellaneous (µg/L)									
1,2-Dichloropropane	<	<	<	<	<	<	<	<	<
1,4-Dichlorobenzene	<	<	<	.	.	.	.	.	.
2-Butanone	<	<	<	<	<	<	<	<	<
Acetone	<	<	<	<	<	<	<	<	<
Carbon disulfide	<	<	<	<	<	<	<	<	<
Chlorobenzene	<	<	<	<	<	<	<	<	<

APPENDIX D.2: CY 2009 MONITORING DATA FOR THE BEAR CREEK HYDROGEOLOGIC REGIME
Volatile Organic Compounds

Sampling Point	GW-080				GW-082	GW-098	GW-100	GW-101	GW-122	GW-127
Functional Area	BG				BG	OLF	S3	S3	S3	S3
Date Sampled	03/02/09		07/22/09		08/10/09	02/25/09	02/19/09	02/19/09	02/17/09	02/17/09
Program	BJC	BJC	BJC	BJC	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP
Sample Type		Dup		Dup		PDB				
Chloroethenes (μg/L)										
Tetrachloroethene	<	<	<	<	<	<	<	<	<	<
Trichloroethene	<	<	<	<	2 J	7	<	<	<	<
cis-1,2-Dichloroethene	<	<	<	<	150	2 J	<	<	<	<
trans-1,2-Dichloroethene	<	<	<	<	<	<	<	<	<	<
1,1-Dichloroethene	<	<	<	<	2 J	2 J	<	<	<	<
Vinyl chloride	<	<	<	<	92	<	<	<	<	<
Chloroethanes (μg/L)										
1,1,1-Trichloroethane	<	<	<	<	<	<	<	<	<	<
1,1,2-Trichloroethane	<	<	<	<	<	<	<	<	<	<
1,2-Dichloroethane	<	<	<	<	<	<	<	<	<	<
1,1-Dichloroethane	<	<	<	<	77	<	<	<	<	<
Chloroethane	<	<	<	<	7	<	<	<	<	<
Chloromethanes (μg/L)										
Carbon tetrachloride	<	<	<	<	<	<	<	<	<	<
Chloroform	<	<	<	<	<	<	<	<	<	<
Methylene chloride	<	<	<	<	<	<	<	<	<	<
Petrol. Hydrocarb. (μg/L)										
Benzene	<	<	<	<	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	<	<	<	<	<	<	<	<	<	<

APPENDIX D.2: CY 2009 MONITORING DATA FOR THE BEAR CREEK HYDROGEOLOGIC REGIME
Volatile Organic Compounds

Sampling Point	GW-225	GW-229	GW-236	GW-242	GW-246	GW-276		GW-289	
Functional Area	OLF	OLF	S3	BG	S3	S3		BG	
Date Sampled	02/26/09	02/26/09	02/23/09	03/05/09	08/05/09	01/07/09	07/06/09	08/06/09	
Program	GWPP	GWPP	GWPP	GWPP	GWPP	BJC	BJC	GWPP	GWPP
Sample Type								Dup	PDB
Chloroethenes (μg/L)									
Tetrachloroethene	1 J	<	<	5 J	97	6.43	6.1	270	260
Trichloroethene	280	6	<	2 J	1 J	<	<	11	12
cis-1,2-Dichloroethene	2 J	340	<	47	<	<	<	2 J	2 J
trans-1,2-Dichloroethene	<	<	<	<	<	<	<	<	<
1,1-Dichloroethene	2 J	42	<	<	3 J	<	<	<	<
Vinyl chloride	<	43	<	18	<	<	<	<	<
Chloroethanes (μg/L)									
1,1,1-Trichloroethane	<	5	<	<	<	<	<	<	<
1,1,2-Trichloroethane	<	<	<	<	<	<	<	<	<
1,2-Dichloroethane	<	<	<	<	<	<	<	<	<
1,1-Dichloroethane	<	9	<	4 J	<	<	<	<	<
Chloroethane	<	<	<	<	<	<	<	<	<
Chloromethanes (μg/L)									
Carbon tetrachloride	4 J	<	<	<	<	<	<	<	<
Chloroform	2 J	<	<	<	30	<	<	<	<
Methylene chloride	<	<	<	<	15	<	<	<	<
Petrol. Hydrocarb. (μg/L)									
Benzene	<	13	<	<	<	<	<	<	<
Ethylbenzene	<	<	<	<	<	<	<	<	<
Toluene	<	<	<	<	<	<	<	<	<
Total Xylene	<	<	<	<	<	<	.	<	<
Chlorofluorocarbons (μg/L)									
1,1,2-Trichloro-1,2,2-trifluoroethane	<	42	<	30	46	.	.	<	<
Dichlorodifluoromethane	<	<	<	16	<	.	.	<	<
Miscellaneous (μg/L)									
1,2-Dichloropropane	<	<	<	<	<	<	<	<	<
1,4-Dichlorobenzene	<	3 J	<	<	<	.	.	<	<
2-Butanone	<	<	<	<	<	<	<	9	9
Acetone	<	<	<	<	<	<	<	.	.
Carbon disulfide	<	<	<	<	<	<	<	.	.
Chlorobenzene	<	13	<	<	<	<	<	<	<

APPENDIX D.2: CY 2009 MONITORING DATA FOR THE BEAR CREEK HYDROGEOLOGIC REGIME
Volatile Organic Compounds

Sampling Point	GW-307		GW-315	GW-365	GW-601	GW-615	GW-623	GW-627	
Functional Area	RS		SPI	OLF	OLF	S3	BG	BG	
Date Sampled	02/10/09		02/17/09	03/02/09	03/02/09	02/18/09	03/03/09	03/05/09	08/06/09
Program	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP
Sample Type		Dup	PDB	PDB			NP	PDB	PDB
Chloroethenes (μg/L)									
Tetrachloroethene	<	<	<	<	<	<	25,000	710	870
Trichloroethene	12	13	<	14	83	<	19,000	230	330
cis-1,2-Dichloroethene	2 J	2 J	<	40	<	<	640	45	39
trans-1,2-Dichloroethene	<	<	<	<	<	<	22	4 J	5 J
1,1-Dichloroethene	<	<	<	14	<	<	290	48	49
Vinyl chloride	<	<	<	<	<	<	150	53	78
Chloroethanes (μg/L)									
1,1,1-Trichloroethane	<	<	<	<	<	<	<	<	<
1,1,2-Trichloroethane	<	<	<	<	<	<	<	<	<
1,2-Dichloroethane	<	<	<	<	<	<	<	<	<
1,1-Dichloroethane	1 J	1 J	<	3 J	<	<	3,300	130	130
Chloroethane	<	<	<	<	<	<	<	1 J	3 J
Chloromethanes (μg/L)									
Carbon tetrachloride	<	<	<	<	<	<	<	<	<
Chloroform	<	<	<	<	<	<	<	<	<
Methylene chloride	<	<	<	<	<	5	29	<	<
Petrol. Hydrocarb. (μg/L)									
Benzene	<	<	<	<	<	<	10	<	<
Ethylbenzene	<	<	<	<	<	<	11	<	<
Toluene	<	<	<	<	<	<	3 J	<	<
Total Xylene	<	<	<	<	<	<	43	<	<
Chlorofluorocarbons (μg/L)									
1,1,2-Trichloro-1,2,2-trifluoroethane	<	<	<	<	<	<	<	<	<
Dichlorodifluoromethane	<	<	<	<	<	<	<	<	<
Miscellaneous (μg/L)									
1,2-Dichloropropane	<	<	<	<	<	<	<	<	<
1,4-Dichlorobenzene	<	<	<	<	<	<	<	<	<
2-Butanone	<	<	<	<	<	<	<	<	10
Acetone	<	<	.	.	<	<	81	.	.
Carbon disulfide	<	<	.	.	<	<	<	.	.
Chlorobenzene	<	<	<	<	<	<	<	<	<

APPENDIX D.2: CY 2009 MONITORING DATA FOR THE BEAR CREEK HYDROGEOLOGIC REGIME
Volatile Organic Compounds

Sampling Point	GW-629			GW-648			GW-653	GW-683	
Functional Area	**BG**			**RS**			**BG**	**EXP-A**	
Date Sampled	**03/05/09**	**08/06/09**	**09/09/09**	**02/09/09**		**08/05/09**	**03/05/09**	**03/04/09**	**07/21/09**
Program	**GWPP**	**GWPP**	**GWPP**	**GWPP**	**GWPP**	**GWPP**	**GWPP**	**BJC**	**BJC**
Sample Type	**PDB**	**PDB**	**BAIL**		**Dup**		**PDB**		
Chloroethenes (µg/L)									
Tetrachloroethene	100,000 Q	130,000	180,000	<	<	<	13	<	<
Trichloroethene	21,000 Q	17,000	24,000	<	<	<	24	<	<
cis-1,2-Dichloroethene	220 Q	250 J	<	<	<	<	190	<	<
trans-1,2-Dichloroethene	74	72	<	<	<	<	<	<	<
1,1-Dichloroethene	1,200 Q	2,100	2,700 J	<	<	<	5 J	<	<
Vinyl chloride	120 Q	200	<	<	<	<	<	<	<
Chloroethanes (µg/L)									
1,1,1-Trichloroethane	560 Q	940	1,200 J	<	<	<	<	<	<
1,1,2-Trichloroethane	43 Q	43	<	<	<	<	<	<	<
1,2-Dichloroethane	<	24	<	<	<	<	<	<	<
1,1-Dichloroethane	6,500 Q	8,100	11,000	<	<	<	11	<	<
Chloroethane	11 Q	26	<	<	<	<	<	<	<
Chloromethanes (µg/L)									
Carbon tetrachloride	<	<	<	<	<	<	<	<	<
Chloroform	2 J	2 J	<	<	<	<	1 J	<	<
Methylene chloride	<	3 J	<	<	<	<	<	<	<
Petrol. Hydrocarb. (µg/L)									
Benzene	26 Q	28	<	<	<	<	<	<	<
Ethylbenzene	3 J	4 J	<	<	<	<	<	<	<
Toluene	29 Q	32	<	<	<	<	<	<	<
Total Xylene	15 Q	23	<	<	<	<	<	<	<
Chlorofluorocarbons (µg/L)									
1,1,2-Trichloro-1,2,2-trifluoroethane	<	<	<	<	<	<	<	.	.
Dichlorodifluoromethane	3 J	3 J	<	<	<	<	<	.	.
Miscellaneous (µg/L)									
1,2-Dichloropropane	<	<	<	<	<	<	<	<	<
1,4-Dichlorobenzene	<	<	<	<	<	<	<	.	.
2-Butanone	<	<	<	<	<	<	<	<	<
Acetone	.	.	<	<	<	<	.	<	<
Carbon disulfide	.	.	<	<	<	<	.	<	<
Chlorobenzene	<	<	<	<	<	<	<	<	<

APPENDIX D.2: CY 2009 MONITORING DATA FOR THE BEAR CREEK HYDROGEOLOGIC REGIME
Volatile Organic Compounds

Sampling Point	GW-684		GW-703	GW-704		GW-706		GW-712	
Functional Area	**EXP-A**		**EXP-B**	**EXP-B**		**EXP-B**		**EXP-W**	
Date Sampled	**03/03/09**	**07/20/09**	**02/26/09**	**03/03/09**	**07/21/09**	**03/03/09**	**07/22/09**	**01/07/09**	**07/06/09**
Program	**BJC**	**BJC**	**GWPP**	**BJC**	**BJC**	**BJC**	**BJC**	**BJC**	**BJC**
Sample Type									
Chloroethenes (µg/L)									
Tetrachloroethene	<	<	<	<	<	<	<	<	<
Trichloroethene	<	<	10	40	21.1	15.5	8.04	<	<
cis-1,2-Dichloroethene	<	<	9	5.53	3.62 J	28.6	12.8	<	<
trans-1,2-Dichloroethene	<	<	<	<	<	<	<	<	<
1,1-Dichloroethene	<	<	<	3.22 J	1.22 J	3.51	<	<	<
Vinyl chloride	<	<	<	<	<	<	<	<	<
Chloroethanes (µg/L)									
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	<	<	<	<	<	<	<	<	<

APPENDIX D.2: CY 2009 MONITORING DATA FOR THE BEAR CREEK HYDROGEOLOGIC REGIME
Volatile Organic Compounds

Sampling Point	GW-713				GW-714		GW-724	GW-725	GW-726-04
Functional Area	EXP-W				EXP-W		EXP-C	EXP-C	BG
Date Sampled	01/07/09		07/07/09		01/06/09	07/06/09	02/25/09	02/25/09	05/04/09
Program	BJC	BJC	BJC	BJC	BJC	BJC	GWPP	GWPP	GWPP
Sample Type		Dup		Dup					
Chloroethenes (µg/L)									
Tetrachloroethene	<	<	<	<	<	<	3 J	2 J	<
Trichloroethene	<	<	<	<	<	<	90	10	<
cis-1,2-Dichloroethene	<	<	<	<	<	<	2 J	<	<
trans-1,2-Dichloroethene	<	<	<	<	<	<	<	<	<
1,1-Dichloroethene	<	<	<	<	<	<	<	<	<
Vinyl chloride	<	<	<	<	<	<	<	<	<
Chloroethanes (µg/L)									
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	<	<	<	<	<	<	<	<	<

Sampling Point	GW-726-06	GW-726-09	GW-726-12	GW-726-16	GW-726-20	GW-726-23	GW-738	GW-740
Functional Area	**BG**	**BG**	**BG**	**BG**	**BG**	**BG**	**EXP-C**	**EXP-C**
Date Sampled	**05/04/09**	**05/05/09**	**05/05/09**	**05/06/09**	**05/06/09**	**05/06/09**	**02/25/09**	**02/24/09**
Program	**GWPP**	**GWPP**	**GWPP**	**GWPP**	**GWPP**	**GWPP**	**GWPP**	**GWPP**
Sample Type								**PDB**
Chloroethenes (μg/L)								
Tetrachloroethene	<	<	<	<	<	<	<	<
Trichloroethene	<	<	<	<	<	<	20	27
cis-1,2-Dichloroethene	<	<	<	<	<	<	<	3 J
trans-1,2-Dichloroethene	<	<	<	<	<	<	<	<
1,1-Dichloroethene	<	<	<	<	<	<	<	<
Vinyl chloride	<	<	<	<	<	<	<	<
Chloroethanes (μg/L)								
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	<	3 J	<	<	3 J	<	<	.
Chlorobenzene	<	<	<	<	<	<	<	<

APPENDIX D.2: CY 2009 MONITORING DATA FOR THE BEAR CREEK HYDROGEOLOGIC REGIME
Volatile Organic Compounds

Sampling Point	BCK-03.30	BCK-04.55		BCK-07.87	BCK-09.20	BCK-09.40		BCK-11.54	BCK-11.84
Functional Area	EXP-SW	EXP-SW		EXP-SW	EXP-SW	EXP-SW		EXP-SW	EXP-SW
Date Sampled	12/07/09	08/03/09	12/07/09	12/07/09	12/07/09	08/03/09		12/07/09	12/07/09
Program	BJC	GWPP	BJC	BJC	BJC	GWPP	GWPP	BJC	BJC
Sample Type							Dup		
Chloroethenes (μg/L)									
Tetrachloroethene	<	2 J	<	<	1.3	<	<	<	<
Trichloroethene	<	<	<	<	1.5	<	<	<	<
cis-1,2-Dichloroethene	<	<	<	1.2	7	3 J	3 J	<	<
trans-1,2-Dichloroethene	<	<	<	<	<	<	<	<	<
1,1-Dichloroethene	<	<	<	<	<	<	<	<	<
Vinyl chloride	<	<	<	<	<	<	<	<	<
Chloroethanes (μg/L)									
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	<	<	<	<	<	<	<	<	<

APPENDIX D.2: CY 2009 MONITORING DATA FOR THE BEAR CREEK HYDROGEOLOGIC REGIME
Volatile Organic Compounds

Sampling Point	BCK-11.97	BCK-12.34	NT-01		NT-03	NT-07		NT-08	
Functional Area	EXP-SW	EXP-SW	EXP-SW		EXP-SW	EXP-SW		EXP-SW	
Date Sampled	08/03/09	12/07/09	08/03/09	12/07/09	12/07/09	02/10/09	08/04/09	02/10/09	08/04/09
Program	GWPP	BJC	GWPP	BJC	BJC	BJC	BJC	BJC	BJC
Sample Type									
Chloroethenes (μg/L)									
Tetrachloroethene	<	7.5	20	26	<	35.3	36.5	17.8	5.59
Trichloroethene	<	<	<	<	<	31	34.1	19.2	6.15
cis-1,2-Dichloroethene	<	<	<	1.1	<	50.2	186	95.4	47.2
trans-1,2-Dichloroethene	<	<	<	<	<	<	<	<	<
1,1-Dichloroethene	<	<	<	<	<	4.78	7.33	2.88 J	<
Vinyl chloride	<	<	<	<	<	1.03	3.41	1.71	<
Chloroethanes (μg/L)									
1,1,1-Trichloroethane	<	<	<	<	<	1.36 J	3.47 J	<	<
1,1,2-Trichloroethane	<	<	<	<	<	<	<	<	<
1,2-Dichloroethane	<	<	<	<	<	<	<	<	<
1,1-Dichloroethane	<	<	<	<	<	16	23.5	7.13	3.19 J
Chloroethane	<	<	<	<	<	<	<	<	<
Chloromethanes (μg/L)									
Carbon tetrachloride	<	<	<	<	<	<	<	<	<
Chloroform	<	<	<	<	<	1.7 J	2.62 J	1.26 J	<
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	<	<	<	<	<	<	<	<	<

APPENDIX D.2: CY 2009 MONITORING DATA FOR THE BEAR CREEK HYDROGEOLOGIC REGIME
Volatile Organic Compounds

Sampling Point	NT-08		S07	SS-4	SS-5		SS-6	
Functional Area	**EXP-SW**		**EXP-SW**	**EXP-SW**	**EXP-SW**		**EXP-SW**	
Date Sampled	**12/07/09**		**12/07/09**	**08/03/09**	**08/03/09**	**12/07/09**	**01/05/09**	**07/06/09**
Program	**BJC**	**BJC**	**BJC**	**GWPP**	**GWPP**	**BJC**	**BJC**	**BJC**
Sample Type		**Dup**						
Chloroethenes (μg/L)								
Tetrachloroethene	24	23	<	<	<	<	<	<
Trichloroethene	28	27	<	3 J	<	<	<	<
cis-1,2-Dichloroethene	150	170	<	3 J	<	<	<	<
trans-1,2-Dichloroethene	<	<	<	<	<	<	<	<
1,1-Dichloroethene	4.7	4.6	<	<	<	<	<	<
Vinyl chloride	4.8	4.3	<	<	<	<	<	<
Chloroethanes (μg/L)								
1,1,1-Trichloroethane	1.6	1.6	<	<	<	<	<	<
1,1,2-Trichloroethane	<	<	<	<	<	<	<	<
1,2-Dichloroethane	1	1.1	<	<	<	<	<	<
1,1-Dichloroethane	9.8	9.5	<	<	<	<	<	<
Chloroethane	<	<	<	<	<	<	<	<
Chloromethanes (μg/L)								
Carbon tetrachloride	<	<	<	<	<	<	<	<
Chloroform	1.9	1.8	<	<	<	<	<	<
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	<	<	<	<	<	<	<	<

APPENDIX D.2: CY 2009 MONITORING DATA FOR THE BEAR CREEK HYDROGEOLOGIC REGIME
Volatile Organic Compounds

Sampling Point	SS-6.6	SS-7	SS-8	
Functional Area	EXP-SW	EXP-SW	EXP-SW	
Date Sampled	12/07/09	12/07/09	12/07/09	
Program	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)				
1,1,1-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	<	<	<	<

APPENDIX D.3

RADIOLOGICAL ANALYTES

APPENDIX D.3: CY 2009 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-008	OLF	01/06/09	BJC	<	.	1.2	<	.	2.96
GW-008	OLF	07/06/09	BJC	<	.	2.53	<	.	4.4
GW-046	BG	01/07/09	BJC	<	.	1.24	4.48	1.73	2.95
GW-046	BG	07/06/09	BJC	<	.	2.1	<	.	4.22
GW-058	BG	02/10/09	GWPP	34	4.6	3.1	54	5.3	5.4
GW-065 NP	OLF	02/25/09	GWPP	<	.	2.9	<	.	5.2
GW-065 NP	OLF	08/06/09	GWPP	12	3.5	2.6	7.4	3.5	5.7
GW-068	BG	03/03/09	GWPP	<	.	4.1	<	.	7.1
GW-085	OLF	02/23/09	GWPP	<	.	2.9	53	5.1	5.4
GW-085 Dup	OLF	02/23/09	GWPP	<	.	2.7	42	5	6.2
GW-100	S3	02/19/09	GWPP	<	.	3.5	<	.	6
GW-101	S3	02/19/09	GWPP	3.5	3.2	2.7	6.8	3	4.5
GW-122	S3	02/17/09	GWPP	<	.	7.8	16	6.7	11
GW-127	S3	02/17/09	GWPP	27	4.6	2.5	11	3.4	4.7
GW-229	OLF	02/26/09	GWPP	53	6.7	3.4	44	5.3	5.8
GW-236	S3	02/23/09	GWPP	3.8	2.8	1.9	31	4.4	6
GW-242	BG	03/05/09	GWPP	5.4	3.3	3.2	12	4.2	7.1
GW-246	S3	08/05/09	GWPP	380	100	76	11,000	360	140
GW-276	S3	01/07/09	BJC	136	23.2	2.55	144	23.6	4.65
GW-276	S3	07/06/09	BJC	107	18.4	2.42	148	24.4	5.01
GW-307	RS	02/10/09	GWPP	<	.	3	8.6	3.2	5.4
GW-307 Dup	RS	02/10/09	GWPP	3.1	2.9	2.1	10	3.6	6.1
GW-526	S3	02/24/09	GWPP	<	.	8	33	18	14
GW-537	OLF	08/05/09	GWPP	<	.	5.9	130	14	15
GW-615	S3	02/18/09	GWPP	400	250	93	570	190	170
GW-623 NP	BG	03/03/09	GWPP	<	.	5	<	.	8.2
GW-648	RS	02/09/09	GWPP	<	.	2.6	<	.	5.9
GW-648 Dup	RS	02/09/09	GWPP	2.7	2.6	2	12	3.3	4.6
GW-648	RS	08/05/09	GWPP	<	.	3.3	<	.	7.3
GW-683	EXP-A	03/04/09	BJC	5.99	2.61	2.85	15.5	4	4.85
GW-683	EXP-A	07/21/09	BJC	3.64	2.07	2.39	10	3.08	4.27
GW-684	EXP-A	03/03/09	BJC	5.04	2.49	2.92	18	4.19	4.31
GW-684	EXP-A	07/20/09	BJC	9.05	2.67	2.1	24.3	4.7	3.42
GW-703	EXP-B	02/26/09	GWPP	7.3	3.2	3.3	44	5.8	6.5
GW-704	EXP-B	03/03/09	BJC	3.69	1.94	2.68	23.4	4.98	5
GW-704	EXP-B	07/21/09	BJC	3.95	2.32	2.93	20.1	4.57	4.39
GW-706	EXP-B	03/03/09	BJC	18.1	5.24	3.83	51.2	9.24	5.07
GW-706	EXP-B	07/22/09	BJC	17.9	4.33	2.29	34.8	6.44	4.15
GW-712	EXP-W	01/07/09	BJC	<	.	1.8	<	.	2.91
GW-712	EXP-W	07/06/09	BJC	<	.	2.4	<	.	4.27
GW-713	EXP-W	01/07/09	BJC	<	.	1.36	<	.	2.75
GW-713 Dup	EXP-W	01/07/09	BJC	<	.	1.86	<	.	3.68
GW-713	EXP-W	07/07/09	BJC	<	.	2.25	<	.	4.46
GW-713 Dup	EXP-W	07/07/09	BJC	<	.	2.63	<	.	4.61
GW-714	EXP-W	01/06/09	BJC	<	.	1.48	<	.	2.55
GW-714	EXP-W	07/06/09	BJC	<	.	2.77	<	.	4.55
GW-725	EXP-C	02/25/09	GWPP	5.7	3.5	3.3	22	4.5	5.6
GW-726-04	BG	05/04/09	GWPP	<	.	30	<	.	36
GW-726-06	BG	05/04/09	GWPP	41 Q	21	18	<	.	30
GW-726-09	BG	05/05/09	GWPP	<	.	24	<	.	74

APPENDIX D.3: CY 2009 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-726-12	BG	05/05/09	GWPP	<	.	12	<	.	19
GW-726-16	BG	05/06/09	GWPP	<	.	9.5	<	.	17
GW-726-20	BG	05/06/09	GWPP	<	.	7.8	30	8.4	13
GW-726-23	BG	05/06/09	GWPP	<	.	3.2	<	.	7.5
GW-738	EXP-C	02/25/09	GWPP	<	.	4.3	37	5.6	6.9
BCK-04.55	EXP-SW	08/03/09	GWPP	12	3.5	3.4	14	4.1	6.5
BCK-09.40 Dup	EXP-SW	08/03/09	GWPP	31	5	2.9	36	5.4	5.5
BCK-09.40	EXP-SW	08/03/09	GWPP	36	5.1	2.9	22	5	6.9
BCK-11.97	EXP-SW	08/03/09	GWPP	64	7.6	5.1	84	7.9	7.1
NT-01	EXP-SW	08/03/09	GWPP	5.8	4.2	5.1	310	14	6.9
SS-4	EXP-SW	08/03/09	GWPP	42	5.5	3.4	33	5.4	6.5
SS-5	EXP-SW	08/03/09	GWPP	17	3.9	3	13	4.5	7.4
SS-6	EXP-SW	01/05/09	BJC	2.67	1.2	1.49	4.2	1.66	2.85
SS-6	EXP-SW	07/06/09	BJC	3.19	1.19	1.33	3.64	1.49	2.62

APPENDIX D.3: CY 2009 MONITORING DATA FOR THE BEAR CREEK HYDROGEOLOGIC REGIME
Radiological Analytes: Isotopic Analyses

Sampling Point	GW-276						GW-526			GW-537		
Functional Area	S3						S3			OLF		
Date Sampled	01/07/09			07/06/09			02/24/09			08/05/09		
Program	BJC			BJC			GWPP			GWPP		
Sample Type												
Result (pCi/L)	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA
Gross Alpha	136	23.2	2.55	107	18.4	2.42	<	.	8	<	.	5.9
Gross Beta	144	23.6	4.65	148	24.4	5.01	33	18	14	130	14	15
Americium-241	<	.	0.108	<	.	0.17	.	.	.	.	.	.
Neptunium-237	4.86	2.02	0.228	5.78	2.4	0.15	.	.	.	.	.	.
Total Radium Alpha	0.216	0.141	0.186	0.303	0.164	0.181	.	.	.	.	.	.
Strontium-89/90	<	.	2.26	<	.	2.03	.	.	.	.	.	.
Technetium-99	152	26.2	10.4	150	25.2	6.33	<	.	14	470	15	14
Uranium-234	58.7	9.84	0.186	54.6	9.7	0.561	.	.	.	.	.	.
Uranium-235	6.55	1.41	0.158	6.94	1.79	0.561	.	.	.	.	.	.
Uranium-238	126	20.6	0.158	122	20.7	0.584	.	.	.	.	.	.

Sampling Point	GW-683						GW-684					
Functional Area	EXP-A						EXP-A					
Date Sampled	03/04/09			07/21/09			03/03/09			07/20/09		
Program	BJC			BJC			BJC			BJC		
Sample Type												
Result (pCi/L)	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA
Gross Alpha	5.99	2.61	2.85	3.64	2.07	2.39	5.04	2.49	2.92	9.05	2.67	2.1
Gross Beta	15.5	4	4.85	10.1	3.08	4.27	17.6	4.19	4.31	24.3	4.7	3.42
Americium-241	.	.	.	.	.	.	.	.	.	.	.	.
Neptunium-237	.	.	.	.	.	.	.	.	.	.	.	.
Total Radium Alpha	.	.	.	.	.	.	.	.	.	.	.	.
Strontium-89/90	.	.	.	.	.	.	.	.	.	.	.	.
Technetium-99	21.1	7.94	11.1	7.82	4.34	6.52	21.1	7.53	10.3	11.9	4.45	6
Uranium-234	4.7	1.35	0.438	2.93	0.992	0.497	5.87	1.6	0.458	4.06	1.21	0.444
Uranium-235	<	.	0.438	0.188 R	0.223	0.17	<	.	0.422	0.528	0.386	0.382
Uranium-238	7.28	1.82	0.404	6.15	1.6	0.447	7.47	1.89	0.422	7.08	1.76	0.382

Sampling Point	GW-704						GW-706					
Functional Area	EXP-B						EXP-B					
Date Sampled	03/03/09			07/21/09			03/03/09			07/22/09		
Program	BJC			BJC			BJC			BJC		
Sample Type												
Result (pCi/L)	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA
Gross Alpha	3.69	1.94	2.68	3.95	2.32	2.93	18.1	5.24	3.83	17.9	4.33	2.29
Gross Beta	23.4	4.98	5	20.1	4.57	4.39	51.2	9.24	5.07	34.8	6.44	4.15
Americium-241	.	.	.	.	.	.	.	.	.	.	.	.
Neptunium-237	.	.	.	.	.	.	.	.	.	.	.	.
Total Radium Alpha	.	.	.	.	.	.	.	.	.	.	.	.
Strontium-89/90	.	.	.	.	.	.	.	.	.	.	.	.
Technetium-99	38	9.31	10.1	7.91	4.33	6.47	76	15.2	12	37.4	7.88	6.29
Uranium-234	3.31	1.06	0.471	1.77	0.717	0.367	11.9	2.6	0.453	12	2.58	0.43
Uranium-235	<	.	0.344	<	.	0.367	0.994	0.534	0.35	0.659	0.435	0.455
Uranium-238	4.1	1.21	0.344	2.81	0.939	0.281	24.2	4.64	0.35	19.4	3.8	0.37

APPENDIX D.3: CY 2009 MONITORING DATA FOR THE BEAR CREEK HYDROGEOLOGIC REGIME
Radiological Analytes: Isotopic Analyses

Sampling Point	GW-712						GW-713					
Functional Area	EXP-W						EXP-W					
Date Sampled	01/07/09			07/06/09			01/07/09					
Program	BJC			BJC			BJC					
Sample Type										Dup		
Result (pCi/L)	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA
Gross Alpha	<	.	1.8	<	.	2.4	<	.	1.36	<	.	1.86
Gross Beta	<	.	2.91	<	.	4.27	<	.	2.75	<	.	3.68
Americium-241	.	.	.	.	.	.	.	.	.	.	.	.
Neptunium-237	.	.	.	.	.	.	.	.	.	.	.	.
Total Radium Alpha	.	.	.	.	.	.	.	.	.	.	.	.
Strontium-89/90	.	.	.	.	.	.	.	.	.	.	.	.
Technetium-99	<	.	10.9	<	.	8.21	<	.	10.6	<	.	10.9
Uranium-234	0.373	0.331	0.364	<	.	0.372	<	.	0.325	<	.	0.214
Uranium-235	<	.	0.364	<	.	0.334	<	.	0.276	<	.	0.369
Uranium-238	<	.	0.31	<	.	0.284	<	.	0.276	<	.	0.369

Sampling Point	GW-713						GW-714					
Functional Area	EXP-W						EXP-W					
Date Sampled	07/07/09						01/06/09			07/06/09		
Program	BJC						BJC			BJC		
Sample Type				Dup								
Result (pCi/L)	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA
Gross Alpha	<	.	2.25	<	.	2.63	<	.	1.48	<	.	2.77
Gross Beta	<	.	4.46	<	.	4.61	<	.	2.55	<	.	4.55
Americium-241	.	.	.	.	.	.	.	.	.	.	.	.
Neptunium-237	.	.	.	.	.	.	.	.	.	.	.	.
Total Radium Alpha	.	.	.	.	.	.	.	.	.	.	.	.
Strontium-89/90	.	.	.	.	.	.	.	.	.	.	.	.
Technetium-99	<	.	6.55	<	.	7.02	<	.	10.9	<	.	6.26
Uranium-234	<	.	0.565	<	.	0.335	0.841	0.325	0.159	1.1	0.593	0.549
Uranium-235	<	.	0.36	<	.	0.335	<	.	0.159	<	.	0.499
Uranium-238	<	.	0.401	<	.	0.483	0.355	0.205	0.179	0.747	0.477	0.441

Sampling Point	BCK-03.30			BCK-04.55			BCK-07.87			BCK-09.20		
Functional Area	EXP-SW			EXP-SW			EXP-SW			EXP-SW		
Date Sampled	12/07/09			12/07/09			12/07/09			12/07/09		
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	.	.	.	.	.	.	.	.	.	.	.	.
Neptunium-237	.	.	.	.	.	.	.	.	.	.	.	.
Total Radium Alpha	.	.	.	.	.	.	.	.	.	.	.	.
Strontium-89/90	.	.	.	.	.	.	.	.	.	.	.	.
Technetium-99	12.6	6.52	9.8	9.44	6.06	9.41	27.5	8.24	10.4	19.5	7.2	9.95
Uranium-234	1.82	0.778	0.511	2.21	0.874	0.333	5.72	1.58	0.599	.	.	.
Uranium-235	<	.	0.5	<	.	0.333	<	.	0.523	.	.	.
Uranium-238	3.85	1.2	0.317	4.42	1.34	0.401	12.1	2.69	0.325	.	.	.

Sampling Point	BCK-11.54			BCK-11.84			BCK-12.34			NT-01		
Functional Area	EXP-SW			EXP-SW			EXP-SW			EXP-SW		
Date Sampled	12/07/09			12/07/09			12/07/09			12/07/09		
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	.	.	.	.	.	.	.	.	.	.	.	.
Neptunium-237	.	.	.	.	.	.	.	.	.	.	.	.
Total Radium Alpha	.	.	.	.	.	.	.	.	.	.	.	.
Strontium-89/90	.	.	.	.	.	.	.	.	.	.	.	.
Technetium-99	58.7	12.1	10.1	99.7	18.2	10.4	159	27	9.68	313	51.4	10.4
Uranium-234	.	.	.	13.3	2.86	0.41	.	.	.	3.71	1.19	0.624
Uranium-235	.	.	.	1.54	0.685	0.341	.	.	.	<	.	0.481
Uranium-238	.	.	.	23.8	4.6	0.41	.	.	.	2.79	0.987	0.449

Sampling Point	NT-03			NT-07						NT-08		
Functional Area	EXP-SW			EXP-SW						EXP-SW		
Date Sampled	12/07/09			02/10/09			08/04/09			12/07/09		
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	.	.	.	.	.	.	.	.	.	.	.	.
Neptunium-237	.	.	.	.	.	.	.	.	.	.	.	.
Total Radium Alpha	.	.	.	.	.	.	.	.	.	.	.	.
Strontium-89/90	.	.	.	.	.	.	.	.	.	.	.	.
Technetium-99	<	.	10.1	.	.	.	.	.	.	<	.	9.88
Uranium-234	.	.	.	6.77	1.74	0.409	7.64	1.97	0.56	.	.	.
Uranium-235	.	.	.	0.886	0.522	0.444	1.17	0.625	0.348	.	.	.
Uranium-238	.	.	.	9.42	2.21	0.475	12.5	2.82	0.494	.	.	.

Sampling Point	NT-08			S07			SS-5			SS-6		
Functional Area	EXP-SW			EXP-SW			EXP-SW			EXP-SW		
Date Sampled	12/07/09			12/07/09			12/07/09			01/05/09		
Program	BJC			BJC			BJC			BJC		
Sample Type	Dup											
Result (pCi/L)	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA
Gross Alpha	.	.	.	.	.	.	.	.	.	2.67	1.2	1.49
Gross Beta	.	.	.	.	.	.	.	.	.	4.2	1.66	2.85
Americium-241	.	.	.	.	.	.	.	.	.	.	.	.
Neptunium-237	.	.	.	.	.	.	.	.	.	.	.	.
Total Radium Alpha	.	.	.	.	.	.	.	.	.	.	.	.
Strontium-89/90	.	.	.	.	.	.	.	.	.	.	.	.
Technetium-99	<	.	10.1	.	.	.	<	.	11.1	<	.	11.1
Uranium-234	.	.	.	<	.	0.479	.	.	.	2.23	0.917	0.216
Uranium-235	.	.	.	<	.	0.412	.	.	.	<	.	0.566
Uranium-238	.	.	.	<	.	0.315	.	.	.	2.42	0.972	0.502

APPENDIX D.3: CY 2009 MONITORING DATA FOR THE BEAR CREEK HYDROGEOLOGIC REGIME
Radiological Analytes: Isotopic Analyses

Sampling Point	SS-6			SS-6.6			SS-7			SS-8		
Functional Area	EXP-SW			EXP-SW			EXP-SW			EXP-SW		
Date Sampled	07/06/09			12/07/09			12/07/09			12/07/09		
Program	BJC			BJC			BJC			BJC		
Sample Type												
Result (pCi/L)	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA
Gross Alpha	3.19	1.19	1.33	.	.	.	.	.	.	.	.	.
Gross Beta	3.64	1.49	2.62	.	.	.	.	.	.	.	.	.
Americium-241	.	.	.	.	.	.	.	.	.	.	.	.
Neptunium-237	.	.	.	.	.	.	.	.	.	.	.	.
Total Radium Alpha	.	.	.	.	.	.	.	.	.	.	.	.
Strontium-89/90	.	.	.	.	.	.	.	.	.	.	.	.
Technetium-99	<	.	6.25	<	.	9.72	<	.	10.6	<	.	9.9
Uranium-234	1.53	0.683	0.356	0.54	0.404	0.434	0.724	0.476	0.424	0.55	0.377	0.166
Uranium-235	<	.	0.303	<	.	0.358	<	.	0.381	<	.	0.166
Uranium-238	2	0.792	0.304	0.475	0.38	0.434	<	.	0.424	<	.	0.166

Sampling Point	SS-8		
Functional Area	EXP-SW		
Date Sampled	12/07/09		
Program	BJC		
Sample Type	Dup		
Result (pCi/L)	Activity	TPU	MDA
Gross Alpha	.	.	.
Gross Beta	.	.	.
Americium-241	.	.	.
Neptunium-237	.	.	.
Total Radium Alpha	.	.	.
Strontium-89/90	.	.	.
Technetium-99	10.9	6.52	10
Uranium-234	<	.	0.375
Uranium-235	<	.	0.319
Uranium-238	<	.	0.375

APPENDIX D.4

MONITORING DATA FOR THE EMWMF

APPENDIX D.4: CY 2009 MONITORING DATA FOR THE BEAR CREEK HYDROGEOLOGIC REGIME
Monitoring Data for the EMWMF: Field Measurements, Major Cations, Trace Metals, and Organics

Sampling Point	GW-363				GW-639				GW-916	
Date Sampled	**2/18/09***	**4/23/09***	**8/20/09***	**11/19/09***	**2/18/09***	**4/23/09***	**8/19/09***	**11/18/09***	**02/12/09**	**04/15/09**
Program	**BJC**	**BJC**	**BJC**	**BJC**	**BJC**	**BJC**	**BJC**	**BJC**	**BJC**	**BJC**
Sample Type										
Field Measurements										
Time Sampled	15:00	10:25	9:30	10:00	11:10	9:15	8:30	14:00	10:30	14:30
Measuring Point Elev. (ft)	957.91	957.91	957.91	957.91	940.95	940.95	940.95	940.95	1,002.85	1,002.85
Depth to Water (ft)	4.82	4.25	4.46	4.35	10.56	9.50	10.59	10.05	4.45	4.54
Groundwater Elevation (ft)	953.09	953.66	953.45	953.56	930.39	931.45	930.36	930.90	998.40	998.31
Conductivity (μmho/cm)	764	507	520	520	1,456	980	1,043	1,074	319	352
Dissolved Oxygen (ppm)	3.82	2.18	0.92	3.16	1.98	0.59	2.3	2.27	11.66	2.89
Oxidation/Reduction (mV)	133	111	136	79	153	143	120	140	11	67
Temperature (degrees C)	16.2	17	19.4	16	14.5	15.2	18.9	15.7	13.89	13.3
Turbidity (NTU)	5	4	1	5	5	8	1	2	9	3
pH	8.67	8.69	9.06	9.2	8.9	8.91	9.19	9.22	7.26	6.75
Major Cations (mg/L)										
Calcium	1.18	1.15	1.15	1.21	0.862	0.892	0.958	0.876	40	39.5
Magnesium	0.473	0.469	0.451	0.486	0.262	0.272	0.259	0.27	6.24	6.23
Potassium	1.24	1.31	1.04	1.22	1.66	1.79	1.55	1.56	3.25	3.28
Sodium	116	111	110	101	219	223	206	197	26.8	25.7
Trace Metals (mg/L)										
Aluminum	<	<	<	<	<	<	<	<	0.204	0.497
Arsenic	<	<	<	<	<	<	<	<	<	<
Barium	0.0459	0.0453	0.0452	0.0465	0.062	0.0628	0.06	0.062	0.129	0.133
Beryllium	<	<	<	<	<	<	<	<	<	<
Boron	0.314	0.314	0.315	0.285	0.592	0.59	0.588	0.578	<	<
Chromium	<	<	<	<	<	<	<	<	<	<
Copper	<	<	<	<	<	<	<	<	<	<
Iron	0.0574	<	0.175	0.236	<	0.0792	0.0565	0.0561	0.49	0.594
Lead	<	<	<	<	<	<	<	<	<	<
Lithium	0.04	0.0484	0.0358	0.0387	0.0872	0.092	0.0812	0.0857	0.0561	0.058
Manganese	<	<	<	<	<	<	<	<	0.154	0.139
Mercury	<	<	<	<	<	<	<	<	<	<
Nickel	<	<	<	<	<	<	<	<	<	<
Strontium	0.0683	0.0664	0.0652	0.068	0.0916	0.0924	0.0898	0.0932	1.09	1.08
Thallium	<	<	<	<	<	<	0.00108 J	<	<	<
Uranium	<	<	<	<	<	<	<	<	<	<
Vanadium	<	<	<	<	<	<	<	<	<	<
Zinc	<	<	<	<	<	<	<	<	<	<
Chloroethenes (μg/L)										
cis-1,2-Dichloroethene	<	<	<	<	<	<	<	<	<	<

APPENDIX D.4: CY 2009 MONITORING DATA FOR THE BEAR CREEK HYDROGEOLOGIC REGIME
Monitoring Data for the EMWMF: Field Measurements, Major Cations, Trace Metals, and Organics

Sampling Point	GW-916		GW-917				GW-918			
Date Sampled	08/11/09	11/11/09	02/09/09	04/14/09	08/12/09	11/09/09	02/10/09	04/15/09	08/12/09	11/12/09
Program	BJC	BJC	BJC	BJC	BJC	BJC	BJC	BJC	BJC	BJC
Sample Type										
Field Measurements										
Time Sampled	10:55	14:55	15:00	10:30	14:00	10:50	10:30	13:50	9:30	10:00
Measuring Point Elev. (ft)	1,002.85	1,002.85	997.10	997.10	997.10	997.10	1,067.96	1,067.96	1,067.96	1,067.96
Depth to Water (ft)	5.65	3.89	22.00	19.31	20.16	19.10	9.00	5.60	5.74	5.55
Groundwater Elevation (ft)	997.20	998.96	975.10	977.79	976.94	978.00	1,058.96	1,062.36	1,062.22	1,062.41
Conductivity (μmho/cm)	315	469	740	387	395	533	96	105	106	128
Dissolved Oxygen (ppm)	1.88	2.25	1.38	0.89	0.36	1.21	12.23	5.38	9.83	5.4
Oxidation/Reduction (mV)	-105	92	7	118	-24	-62	152	97	114	35
Temperature (degrees C)	15.9	15.8	18.1	15.9	16.8	16.2	15.3	14.6	16.1	15.49
Turbidity (NTU)	3	1	2	5	1	2	17	5	29	31
pH	7.47	7.43	6.91	6.54	7.09	7.32	5.56	6.44	6	5.18
Major Cations (mg/L)										
Calcium	41.6	40.3	62.6	57.6	63.4	67	10.4	10.4	10.2	11
Magnesium	6.56	5.87	8.35	7.94	7.96	8.8	4.29	4.21	4.15	4.61
Potassium	3.76	3.19	1.26	1.26	1.22	1.27	1.99	1.92	2.13	2.11
Sodium	27.8	28	9.29	8.75	9.15	9.9	4.56	4.44	4.35	4.68
Trace Metals (mg/L)										
Aluminum	1.49	0.238	<	<	0.229	0.223	0.373	0.28	1.84	1.32
Arsenic	<	<	<	<	<	<	<	<	<	<
Barium	0.157	0.165	0.17	0.162	0.188	0.181	0.114	0.113	0.129	0.127
Beryllium	<	<	<	<	<	<	<	<	<	<
Boron	<	<	<	<	<	<	<	<	<	<
Chromium	<	<	<	<	<	<	<	<	<	<
Copper	<	<	<	<	<	<	<	<	<	<
Iron	1.34	0.248	0.142	0.173	2.13	0.497	0.282	0.208	1.19	0.862
Lead	<	<	<	<	<	<	<	<	<	0.00282
Lithium	0.0612	0.062	0.0165	0.0157	0.0162	0.018	0.0124	0.0121	0.0138	0.0139
Manganese	0.203	0.0776	0.0285	0.0184	0.0506	0.0368	0.00532	<	0.0222	0.0146
Mercury	<	<	<	<	<	<	<	<	<	<
Nickel	<	<	<	<	<	<	<	<	<	<
Strontium	1.14	1.03	0.128	0.122	0.135	0.139	0.048	0.0471	0.0487	0.0493
Thallium	<	<	<	<	<	<	<	<	<	<
Uranium	<	<	<	<	<	<	<	<	<	<
Vanadium	<	<	<	<	<	<	<	<	<	<
Zinc	<	<	<	<	<	<	<	<	<	<
Chloroethenes (μg/L)										
cis-1,2-Dichloroethene	<	<	<	<	<	<	<	<	<	<

APPENDIX D.4: CY 2009 MONITORING DATA FOR THE BEAR CREEK HYDROGEOLOGIC REGIME
Monitoring Data for the EMWMF: Field Measurements, Major Cations, Trace Metals, and Organics

Sampling Point	GW-920				GW-921				GW-922	
Date Sampled	02/10/09	04/16/09	08/11/09	11/12/09	02/11/09	04/14/09	08/13/09	11/10/09	02/10/09	04/16/09
Program	BJC	BJC	BJC	BJC	BJC	BJC	BJC	BJC	BJC	BJC
Sample Type										
Field Measurements										
Time Sampled	14:40	10:20	10:30	15:10	14:50	14:30	14:15	14:00	10:20	10:00
Measuring Point Elev. (ft)	967.43	967.43	967.43	967.43	971.29	971.29	971.29	971.29	956.91	956.91
Depth to Water (ft)	6.65	6.08	7.47	6.42	6.21	5.28	6.12	6.23	5.40	4.97
Groundwater Elevation (ft)	960.78	961.35	959.96	961.01	965.08	966.01	965.17	965.06	951.51	951.94
Conductivity (μmho/cm)	609	346	375	426	755	728	417	572	605	298
Dissolved Oxygen (ppm)	1.96	0.79	3.44	0.75	1.01	3.2	1.65	0.67	1.6	2.4
Oxidation/Reduction (mV)	17	12	25	80	105	66	113	119	34	-7
Temperature (degrees C)	16	14.6	17	16	17	16.4	17.3	16.1	15.5	14.8
Turbidity (NTU)	1	2	1	2	1	1	1	2	2	6
pH	6.9	6.3	6.96	7.27	7.1	7.03	7.56	7.35	7.07	7.99
Major Cations (mg/L)										
Calcium	53.3	54.8	47.5	50	41.5	64.1	50.2	59.2	44.5	42.2
Magnesium	8.28	8.28	7.45	7.92	11.6	15.1	12.1	13.6	9.73	9.12
Potassium	1.62	1.47	1.52	1.51	2.66	2.9	2.68	2.73	2.81	2.72
Sodium	5.68	5.2	5.33	5.75	24.7	20.8	22.3	20.4	8.86	8.39
Trace Metals (mg/L)										
Aluminum	<	<	<	<	<	<	<	<	<	0.211
Arsenic	<	<	<	<	<	<	<	<	<	<
Barium	0.244	0.225	0.234	0.251	0.252	0.232	0.223	0.253	0.684	0.686
Beryllium	<	<	<	<	<	<	<	<	<	<
Boron	<	<	<	<	<	<	<	<	<	<
Chromium	<	<	<	<	<	<	<	<	<	<
Copper	<	<	<	<	<	<	<	<	<	<
Iron	0.233	0.165	0.138	0.229	0.0577	<	<	<	0.119	0.455
Lead	<	<	<	<	<	<	<	<	<	<
Lithium	0.0112	0.0116	<	0.011	0.0234	0.0204	0.0207	0.021	0.0133	0.0128
Manganese	0.0348	0.0781	0.0266	0.0457	0.00808	0.00542	0.011	0.00866	0.0203	0.0338
Mercury	<	<	<	<	<	<	<	<	<	<
Nickel	<	<	<	<	<	<	<	<	<	<
Strontium	0.426	0.391	0.411	0.436	1.13	1.08	1.1	1.13	0.767	0.76
Thallium	<	<	<	<	<	<	0.001 J	<	<	<
Uranium	<	<	<	.	0.00492	<	<	<	<	<
Vanadium	<	<	<	<	<	<	<	<	<	<
Zinc	<	<	<	<	<	<	<	<	<	<
Chloroethenes (μg/L)										
cis-1,2-Dichloroethene	<	<	<	<	<	<	<	<	<	<

APPENDIX D.4: CY 2009 MONITORING DATA FOR THE BEAR CREEK HYDROGEOLOGIC REGIME
Monitoring Data for the EMWMF: Field Measurements, Major Cations, Trace Metals, and Organics

Sampling Point	GW-922		GW-923				GW-924	
Date Sampled	08/10/09	11/11/09	2/18/09*	4/21/09*	8/12/09*	11/11/09*	02/11/09	
Program	BJC	BJC	BJC	BJC	BJC	BJC	BJC	BJC
Sample Type								Dup
Field Measurements								
Time Sampled	11:10	14:20	9:30	13:20	9:20	9:40	9:40	.
Measuring Point Elev. (ft)	956.91	956.91	1,016.73	1,016.73	1,016.73	1,016.73	968.90	.
Depth to Water (ft)	5.08	4.77	29.85	22.13	31.16	30.05	8.56	.
Groundwater Elevation (ft)	951.83	952.14	986.88	994.60	985.57	986.68	960.34	.
Conductivity (μmho/cm)	336	407	292	318	433	391	273	.
Dissolved Oxygen (ppm)	0.56	1.51	8.27	6.77	6.1	3.01	11.46	.
Oxidation/Reduction (mV)	29	-135	152	167	96	-55	70	.
Temperature (degrees C)	15.7	16.2	13.91	15.8	17.1	14.6	15.9	.
Turbidity (NTU)	1	1	681	316	1000	747	3	.
pH	7.51	7.57	6.99	6.6	6.56	6.84	7.16	.
Major Cations (mg/L)								
Calcium	39.9	40.3	25.2	37.7	31.2	29.2	57.3	56
Magnesium	9.24	9.92	10.7	12.2	12.1	14.5	4.81	4.75
Potassium	2.82	2.98	2.53	2.43	5.62	6.96	0.862	0.882
Sodium	9.31	10.1	2.05 Q	5.42	3.1	1.96	5.68	5.61
Trace Metals (mg/L)								
Aluminum	<	<	4.23	3.89	4.63	26.2	<	<
Arsenic	<	<	<	<	<	0.00539	<	<
Barium	0.695	0.709	0.149	0.202	0.231	0.555	0.3	0.296
Beryllium	<	<	<	<	<	0.0011	<	<
Boron	<	<	<	<	<	<	<	<
Chromium	<	<	0.0205	0.0178	0.0164	0.124 Q	<	<
Copper	<	<	<	<	<	0.045	<	<
Iron	0.301	0.159	2.72	2.56	3.63	19.3	0.138	0.148
Lead	<	<	0.00238	0.00209	0.00534	0.0218	<	<
Lithium	0.0134	0.0138	<	<	0.0103	0.0306	0.0119	0.0112
Manganese	0.0191	0.0103	0.0478	0.0525	0.0827	0.387	0.0348	0.0348
Mercury	<	<	<	<	<	<	<	<
Nickel	<	<	0.0159	0.0146	0.0171	0.0919 Q	<	<
Strontium	0.829	0.885	0.0694	0.0852	0.0847	0.0913	0.104	0.103
Thallium	<	<	<	<	<	<	<	<
Uranium	<	<	<	<	<	<	<	<
Vanadium	<	<	<	<	<	0.0356	<	<
Zinc	<	<	<	<	<	0.0653	<	<
Chloroethenes (μg/L)								
cis-1,2-Dichloroethene	<	<	<	<	<	<	<	<

APPENDIX D.4: CY 2009 MONITORING DATA FOR THE BEAR CREEK HYDROGEOLOGIC REGIME
Monitoring Data for the EMWMF: Field Measurements, Major Cations, Trace Metals, and Organics

Sampling Point	GW-924					GW-925			
Date Sampled	04/20/09		08/17/09		11/16/09	2/12/09*	4/15/09*	8/18/09*	11/11/09*
Program	BJC	BJC	BJC	BJC	BJC	BJC	BJC	BJC	BJC
Sample Type		Dup		Dup					
Field Measurements									
Time Sampled	10:40	.	10:30	.	10:00	10:00	9:00	9:30	10:00
Measuring Point Elev. (ft)	968.90	.	968.90	.	968.90	971.14	971.14	971.14	971.14
Depth to Water (ft)	6.71	.	9.64	.	9.15	4.40	3.46	4.12	4.02
Groundwater Elevation (ft)	962.19	.	959.26	.	959.75	966.74	967.68	967.02	967.12
Conductivity (μmho/cm)	355	.	366	.	547	1,162	694	631	735
Dissolved Oxygen (ppm)	1.11	.	7.2	.	1.06	2.92	12.17	1.84	1.7
Oxidation/Reduction (mV)	141	.	40	.	-69	116	38	98	114
Temperature (degrees C)	15.5	.	17.3	.	16.4	15.5	15.3	18.1	15.3
Turbidity (NTU)	1	.	1	.	1	9	26	7	8
pH	7.02	.	7.21	.	7.9	9.3	9.55	9.25	9.74
Major Cations (mg/L)									
Calcium	55.1	53.7	56	55.6	55.8	3.48	2.12	2.07	2.18
Magnesium	4.65	4.55	4.78	4.74	4.56	1.33	0.957	0.984	1
Potassium	0.83	0.842	0.77	0.706	0.784	2.07	1.76	1.56	1.52
Sodium	5.31	5.19	5.43	5.45	5.3	163	152	143	131
Trace Metals (mg/L)									
Aluminum	<	<	<	<	<	1.92	0.538	0.634	0.624
Arsenic	<	<	<	<	<	<	<	<	<
Barium	0.288	0.281	0.277	0.275	0.296	0.177	0.137	0.135	0.141
Beryllium	<	<	<	<	<	<	<	<	<
Boron	<	<	<	<	<	0.273	0.228	0.229	0.193
Chromium	<	<	<	<	<	<	<	<	<
Copper	<	<	<	<	<	<	<	<	<
Iron	0.0525	0.0515	0.059	0.0561	0.242	0.961	0.238	0.248	0.33
Lead	<	<	<	<	<	0.00378	<	<	<
Lithium	0.0134	0.0109	<	<	0.0122	0.0535	0.0566	0.0468	0.0489
Manganese	0.0269	0.0252	0.029	0.0286	0.0438	0.0222	<	0.00518	0.00746
Mercury	<	<	<	<	<	<	<	<	<
Nickel	<	<	<	<	<	0.0104	<	<	<
Strontium	0.102	0.1	0.1	0.0992	0.0997	0.224	0.198	0.187	0.196
Thallium	<	<	0.00101 J	<	<	<	<	<	<
Uranium	<	<	<	<	<	<	<	<	<
Vanadium	<	<	<	<	<	<	<	<	<
Zinc	<	<	<	<	<	<	<	<	<
Chloroethenes (μg/L)									
cis-1,2-Dichloroethene	<	<	<	<	<	<	<	<	<

Monitoring Data for the EMWMF: Field Measurements, Major Cations, Trace Metals, and Organics

Sampling Point	GW-926				GW-927				GW-961
Date Sampled	02/10/09	04/20/09	08/17/09	11/17/09*	02/09/09	04/14/09	08/12/09	11/10/09	11/23/09
Program	BJC	BJC	BJC	BJC	BJC	BJC	BJC	BJC	BJC
Sample Type									
Field Measurements									
Time Sampled	15:30	13:50	14:00	9:45	11:45	15:10	15:00	13:40	10:40
Measuring Point Elev. (ft)	968.94	968.94	968.94	968.94	997.19	997.19	997.19	997.19	963.57
Depth to Water (ft)	7.73	6.72	7.89	7.51	17.41	14.54	16.25	14.61	12.53
Groundwater Elevation (ft)	961.21	962.22	961.05	961.05	979.78	982.65	980.94	982.58	951.04
Conductivity (μmho/cm)	286	305	350	424	720	399	413	597	590
Dissolved Oxygen (ppm)	11.27	0.76	0.15	1.27	1.3	1.09	6.81	1.5	1.85
Oxidation/Reduction (mV)	-54	-15	-106	61	-74	-53	-134	-146	12
Temperature (degrees C)	16.8	15.1	15.4	15.6	15.6	15.5	18.5	14.6	15.58
Turbidity (NTU)	1	2	1	1	0	1	2	2	182
pH	7.41	7.86	7.7	7.49	6.89	6.8	7.39	7.9	6.2
Major Cations (mg/L)									
Calcium	42.6	41.2	43.6	41.1	67.7	65	66.8	68.8	45.9
Magnesium	10.1	10.4	10.9	9.96	6.79	6.61	6.57	6.99	7.31
Potassium	2.01	2.07	2.06	1.89	0.887	0.901	0.835	0.883	3.03
Sodium	9.61	9.34	10.8	9.7	7.77	7.74	7.46	7.78	7.59
Trace Metals (mg/L)									
Aluminum	<	<	<	<	<	<	<	<	7.52
Arsenic	<	<	<	<	<	<	<	<	<
Barium	0.208	0.209	0.224	0.208	0.201	0.198	0.204	0.209	0.181
Beryllium	<	<	<	<	<	<	<	<	<
Boron	<	<	<	<	<	<	<	<	<
Chromium	<	<	<	<	<	<	<	<	0.0132
Copper	<	<	<	<	<	<	<	<	<
Iron	0.132	0.115	0.125	0.127	0.124	0.115	0.127	0.275	5.72
Lead	<	<	<	<	<	<	<	<	0.00874
Lithium	0.0126	0.0117	0.0109	0.0124	0.0164	0.0162	0.0151	0.0177	0.0184
Manganese	0.0123	0.0126	0.0221	0.0203	0.0211	0.0222	0.021	0.0269	0.517
Mercury	<	<	<	<	<	<	<	<	<
Nickel	<	<	<	<	<	<	<	<	0.0122
Strontium	0.658	0.72	0.714	0.67	0.116	0.115	0.121	0.12	0.0887
Thallium	<	<	<	<	<	<	<	<	<
Uranium	<	<	<	<	<	<	<	<	<
Vanadium	<	<	<	<	<	<	<	<	<
Zinc	<	<	<	<	<	<	<	<	<
Chloroethenes (μg/L)									
cis-1,2-Dichloroethene	<	<	<	<	<	<	<	<	<

APPENDIX D.4: CY 2009 MONITORING DATA FOR THE BEAR CREEK HYDROGEOLOGIC REGIME
Monitoring Data for the EMWMF: Field Measurements, Major Cations, Trace Metals, and Organics

Sampling Point	EMWNT-03A				EMWNT-05				EMW-VWEIR	
Date Sampled	02/09/09	04/13/09	08/10/09	11/09/09	02/09/09	04/13/09	08/10/09	11/09/09	02/09/09	
Program	BJC	BJC	BJC	BJC	BJC	BJC	BJC	BJC	BJC	BJC
Sample Type										Dup
Field Measurements										
Time Sampled	9:40	10:45	14:05	11:55	10:15	10:15	13:15	11:20	9:20	.
Measuring Point Elev. (ft)	.	.	.	.	.	.	.	.	.	.
Depth to Water (ft)	.	.	.	.	.	.	.	.	.	.
Groundwater Elevation (ft)	.	.	.	.	.	.	.	.	.	.
Conductivity (μmho/cm)	78	91	428	176	185	133	327	240	334	.
Dissolved Oxygen (ppm)	9.71	7.72	4.09	9.86	12.7	8.44	8.11	10.11	14.29	.
Oxidation/Reduction (mV)	68	81.7	68	-5.8	-9.7	13.6	89	-52.6	100.9	.
Temperature (degrees C)	8.49	13.5	25.9	12.65	7.82	13.6	24.3	13.18	10.57	.
Turbidity (NTU)	11.7	16.3	35.9	17	5.46	9.97	35.2	18	2.4	.
pH	7.18	6.91	7.46	7.35	7.57	7.24	8.05	7.7	8.54	.
Major Cations (mg/L)										
Calcium	17.3	10.8	61	25.5	21.3	15.5	41	31.6	42.6	40.9
Magnesium	3.6	3	11.7	5.78	6.64	5.03	11.2	9.57	8.9	8.54
Potassium	1.27	1.45	1.64	1.6	1.52	1.66	2.45	1.99	2.7	2.6
Sodium	2.82	2.17	4.72	3.46	3.87	2.56	6.02	5	9.78	9.43
Trace Metals (mg/L)										
Aluminum	1.54	1.05	<	0.525	0.233	0.568	0.792	0.594	1.43	1.21
Arsenic	<	<	<	<	<	<	<	<	<	<
Barium	0.0356	0.0386	0.205	0.0539	0.0425	0.0422	0.0878	0.081	0.0464	0.0444
Beryllium	<	<	<	<	<	<	<	<	<	<
Boron	<	<	<	<	<	<	<	<	0.105	0.102
Chromium	<	<	<	<	<	<	<	<	<	<
Copper	<	<	<	<	<	<	<	<	<	<
Iron	1.13	1.04	2.75	3.72	0.682	0.772	3.22	2.75	1.11	1.08
Lead	0.00316	<	<	<	0.00245 J	<	0.00251 J	<	<	<
Lithium	<	<	<	<	<	<	<	<	<	<
Manganese	0.0574	0.122	5.59	1	0.123	0.127	1.47	1.61	0.082	0.0784
Mercury	<	<	<	0.000103 J	<	<	<	0.000097 J	<	<
Nickel	<	<	<	<	<	<	<	<	<	<
Strontium	0.0347	0.029	0.128	0.0625	0.0538	0.039	0.103	0.0819	0.115	0.111
Thallium	<	<	0.00547 Q	0.00147 J	<	<	0.0013 J	0.00196 J	<	<
Uranium	<	<	<	<	<	<	<	<	0.0084	0.00868
Vanadium	<	<	<	<	<	<	<	<	<	<
Zinc	<	<	<	<	<	<	<	<	<	<
Chloroethenes (μg/L)										
cis-1,2-Dichloroethene	<	<	<	<	<	<	<	<	<	<

APPENDIX D.4: CY 2009 MONITORING DATA FOR THE BEAR CREEK HYDROGEOLOGIC REGIME
Monitoring Data for the EMWMF: Field Measurements, Major Cations, Trace Metals, and Organics

Sampling Point	EMW-VWEIR				EMW-VWUNDER				
Date Sampled	04/13/09	08/10/09	11/09/09		02/12/09	04/16/09	08/11/09	11/12/09	
Program	BJC	BJC	BJC	BJC	BJC	BJC	BJC	BJC	BJC
Sample Type				Dup					Dup
Field Measurements									
Time Sampled	9:20	9:10	10:00	.	14:00	10:10	15:00	9:40	.
Measuring Point Elev. (ft)	.	.	.	.	.	.	.	.	.
Depth to Water (ft)	.	.	.	.	.	.	.	.	.
Groundwater Elevation (ft)	.	.	.	.	.	.	.	.	.
Conductivity (μmho/cm)	343	327	459	.	723	372	647	594	.
Dissolved Oxygen (ppm)	8.69	6.2	10.65	.	4.7	5.82	2.59	5.9	.
Oxidation/Reduction (mV)	150.5	144	205.8	.	183	43	100	165	.
Temperature (degrees C)	14.96	26.5	13.94	.	17.3	14.4	21.1	15.7	.
Turbidity (NTU)	90.3	15.4	13	.	2	1	21	11	.
pH	7.86	7.91	7.57	.	6.21	6.83	6.09	6.12	.
Major Cations (mg/L)									
Calcium	52.2	43.5	74.2	75.5	59.2	61.9	83.4 Q	70.2	68.9
Magnesium	9.94	9.06	11.3	11.4	9.22	10.5	11.6	11.3	11
Potassium	3.08	4.59	3.91	4.06	2.1	2.07	2.49	2.08	2.06
Sodium	6.48	6.79	11	11.4	8.4	8.86	8.06	9.56	9.69
Trace Metals (mg/L)									
Aluminum	3.07	0.271	0.386	0.424	<	<	<	<	<
Arsenic	<	<	<	<	<	<	<	<	<
Barium	0.048	0.0921	0.0846	0.0872	0.0824	0.0858	0.113	0.0912	0.0916
Beryllium	<	<	<	<	<	<	<	<	<
Boron	<	<	<	<	<	<	<	<	<
Chromium	<	<	<	<	<	<	<	<	<
Copper	<	<	<	<	<	<	<	<	<
Iron	2.36	0.334	0.288	0.295	<	0.0988	0.136	<	<
Lead	<	0.00287 J	<	<	<	<	<	<	<
Lithium	<	<	<	<	<	<	<	<	<
Manganese	0.235	0.165	0.222	0.229	<	0.015	0.404	0.00538	0.00548
Mercury	<	<	0.00008 J	0.000082 J	<	<	<	<	<
Nickel	<	<	<	<	<	<	<	<	<
Strontium	0.129	0.139	0.218	0.224	0.173	0.18	0.221	0.201	0.205
Thallium	<	<	<	<	<	<	<	<	<
Uranium	<	<	0.00593	0.0077	<	<	<	<	<
Vanadium	<	<	<	<	<	<	<	<	<
Zinc	<	<	0.0616	0.0644	<	<	<	<	<
Chloroethenes (μg/L)									
cis-1,2-Dichloroethene	<	<	<	<	<	<	<	<	<

APPENDIX D.4: CY 2009 MONITORING DATA FOR THE BEAR CREEK HYDROGEOLOGIC REGIME
Monitoring Data for the EMWMF: Field Measurements, Major Cations, Trace Metals, and Organics

Sampling Point	NT-04			
Date Sampled	**02/09/09**	**04/13/09**	**08/10/09**	**11/09/09**
Program	**BJC**	**BJC**	**BJC**	**BJC**
Sample Type				
Field Measurements				
Time Sampled	8:50	9:45	9:40	10:40
Measuring Point Elev. (ft)	.	.	.	.
Depth to Water (ft)	.	.	.	.
Groundwater Elevation (ft)	.	.	.	.
Conductivity (μmho/cm)	338	548	633	575
Dissolved Oxygen (ppm)	9.6	6.4	7.05	8.57
Oxidation/Reduction (mV)	16.5	12.3	146	21
Temperature (degrees C)	10.33	13.05	23.6	13.68
Turbidity (NTU)	2.2	10.1	6.2	7
pH	6.82	7.05	7.45	7.65
Major Cations (mg/L)				
Calcium	92.5	93.1	106	105
Magnesium	16.2	16.8	19.5	18.8
Potassium	1.94	1.91	2.47	2.4
Sodium	7.45	8.3	8.65	9.31
Trace Metals (mg/L)				
Aluminum	<	1.02	0.206	<
Arsenic	<	<	<	<
Barium	0.52	0.399	0.502	0.489
Beryllium	<	<	<	<
Boron	<	<	<	<
Chromium	<	<	<	<
Copper	<	<	<	<
Iron	1.09	2.07	0.692	0.502
Lead	<	<	<	<
Lithium	<	<	<	<
Manganese	0.6	0.785	0.696	0.594
Mercury	<	<	<	0.000108 J
Nickel	<	<	<	<
Strontium	0.241	0.237	0.279	0.272
Thallium	<	<	<	0.001 J
Uranium	<	<	<	<
Vanadium	<	<	0.0213	<
Zinc	<	<	<	<
Chloroethenes (μg/L)				
cis-1,2-Dichloroethene	3.14 J	5.83	1.15 J	<

Monitoring Data for the EMWMF: Radiological Analytes

Sampling Point	Date Sampled	Isotope	Result (pCi/L) Activity	TPU	MDA
GW-363	04/23/09	Americium-243	0.24	0.17	0.14
GW-363	08/20/09	Chlorine-36	4.19 Q	2.18	2.88
GW-363	04/23/09	Curium-245	0.24	0.18	0.14
GW-363	11/19/09	Curium-245	0.12	0.11	0.07
GW-363	11/19/09	Potassium-40	23.7	21.5	21.2
GW-363	02/18/09	Radium-226	0.17	0.13	0.17
GW-363	08/20/09	Radium-226	0.31	0.18	0.18
GW-363	08/20/09	Radium-228	0.68	0.26	0.62
GW-363	08/20/09	Strontium-90	1.58	0.65	1.21
GW-363	04/23/09	Technetium-99	3.08	1.82	3
GW-639	04/23/09	Americium-241	0.21	0.15	0.15
GW-639	08/19/09	Americium-241	0.16	0.14	0.16
GW-639	11/18/09	Chlorine-36	3.33	2.35	3.28
GW-639	08/19/09	Curium-245	0.28	0.23	0.26
GW-639	11/18/09	Plutonium-242	0.2	0.17	0.09
GW-639	02/18/09	Radium-226	0.48	0.21	0.2
GW-639	08/19/09	Radium-226	0.25	0.15	0.16
GW-639	04/23/09	Technetium-99	3.08	1.82	3.01
GW-639	08/19/09	Technetium-99	8.21	1.99	3.13
GW-639	11/18/09	Thorium-227	0.18	0.15	0.15
GW-639	04/23/09	Thorium-230	0.22	0.2	0.21
GW-639	11/18/09	Thorium-230	0.27	0.18	0.07
GW-639	02/18/09	Uranium-233/234	0.46	0.22	0.17
GW-639	04/23/09	Uranium-233/234	0.61	0.26	0.07
GW-639	08/19/09	Uranium-233/234	0.33	0.19	0.14
GW-639	11/18/09	Uranium-233/234	0.42	0.22	0.12
GW-639	04/23/09	Uranium-238	0.17	0.13	0.07
GW-639	11/18/09	Uranium-238	0.13	0.12	0.12
GW-916	02/12/09	Americium-243	0.33	0.22	0.18
GW-916	02/12/09	Curium-245	0.38	0.25	0.25
GW-916	02/12/09	Radium-226	0.22	0.16	0.2
GW-916	02/12/09	Strontium-90	2.88	0.77	1.28
GW-916	08/11/09	Strontium-90	1.69	0.64	1.19
GW-916	02/12/09	Thorium-230	0.27	0.2	0.19
GW-916	11/11/09	Thorium-230	0.12	0.11	0.11
GW-916	04/15/09	Uranium-233/234	0.28	0.17	0.15
GW-916	08/11/09	Uranium-233/234	0.18	0.15	0.18
GW-916	04/15/09	Uranium-235/236	0.17	0.14	0.07
GW-917	02/09/09	Americium-243	0.34	0.31	0.19
GW-917	02/09/09	Curium-245	1.01	0.57	0.37
GW-917	02/09/09	Plutonium-239/240	0.19	0.18	0.18
GW-917	04/14/09	Radium-226	0.19	0.13	0.12
GW-917	08/12/09	Radium-226	0.13	0.12	0.12
GW-917	11/09/09	Radium-226	0.23	0.16	0.2
GW-917	08/12/09	Strontium-90	1.82	0.62	1.12
GW-917	04/14/09	Thorium-229	0.85	0.74	0.18
GW-917	04/14/09	Uranium-233/234	0.12	0.11	0.07
GW-918	02/10/09	Americium-243	0.26	0.24	0.14
GW-918	02/10/09	Curium-245	0.3	0.26	0.28
GW-918	02/10/09	Radium-226	0.19	0.14	0.18
GW-918	04/15/09	Radium-226	0.2	0.13	0.12
GW-918	02/10/09	Strontium-90	3.1	1.15	2.12
GW-918	02/10/09	Thorium-230	0.19	0.16	0.13
GW-918	04/15/09	Thorium-230	0.37	0.28	0.22
GW-918	08/12/09	Uranium-233/234	0.24	0.17	0.19
GW-918	11/12/09	Uranium-238	0.22	0.17	0.16

Monitoring Data for the EMWMF: Radiological Analytes

Sampling Point	Date Sampled	Isotope	Result (pCi/L) Activity	TPU	MDA
GW-920	02/10/09	Radium-226	0.19	0.14	0.13
GW-920	04/16/09	Radium-226	0.16	0.12	0.14
GW-920	08/11/09	Radium-226	0.19	0.15	0.13
GW-920	02/10/09	Strontium-90	1.8	0.83	1.56
GW-920	08/11/09	Strontium-90	1.83	0.66	1.2
GW-920	04/16/09	Technetium-99	3.07	1.82	3
GW-920	11/12/09	Technetium-99	3.01	1.74	2.87
GW-920	08/11/09	Uranium-232	1.69	1.15	0.07
GW-920	02/10/09	Uranium-233/234	0.46	0.23	0.14
GW-920	04/16/09	Uranium-233/234	0.47	0.22	0.14
GW-920	08/11/09	Uranium-233/234	0.2	0.14	0.12
GW-920	02/10/09	Uranium-238	0.21	0.15	0.07
GW-920	04/16/09	Uranium-238	0.45	0.21	0.12
GW-920	08/11/09	Uranium-238	0.12	0.11	0.12
GW-921	02/11/09	Radium-226	0.3	0.17	0.14
GW-921	04/14/09	Radium-226	0.31	0.18	0.16
GW-921	08/13/09	Radium-226	0.24	0.15	0.18
GW-921	11/10/09	Radium-226	0.29	0.19	0.2
GW-921	02/11/09	Radium-228	0.68	0.23	0.56
GW-921	08/13/09	Radium-228	0.7	0.26	0.62
GW-921	04/14/09	Technetium-99	3.08	1.82	3
GW-921	11/10/09	Technetium-99	3.02	1.75	2.89
GW-921	08/13/09	Thorium-230	0.18	0.15	0.18
GW-921	11/10/09	Thorium-230	0.15	0.14	0.15
GW-921	04/14/09	Uranium-233/234	0.53	0.24	0.13
GW-921	08/13/09	Uranium-233/234	0.23	0.18	0.19
GW-921	11/10/09	Uranium-233/234	0.24	0.18	0.19
GW-921	11/10/09	Uranium-235/236	0.17	0.16	0.17
GW-921	04/14/09	Uranium-238	0.37	0.19	0.13
GW-921	11/10/09	Uranium-238	0.15	0.13	0.08
GW-922	02/10/09	Americium-243	1.36 Q	0.68	0.32
GW-922	02/10/09	Curium-245	1.52 Q	0.73	0.32
GW-922	02/10/09	Radium-226	0.24	0.17	0.17
GW-922	08/10/09	Radium-226	0.29	0.18	0.07
GW-922	02/10/09	Strontium-90	2.21	0.93	1.76
GW-922	08/10/09	Strontium-90	1.83	0.55	0.94
GW-922	04/16/09	Technetium-99	3.08	1.82	3
GW-922	02/10/09	Uranium-233/234	0.17	0.14	0.16
GW-922	08/10/09	Uranium-233/234	0.17	0.13	0.07
GW-923	02/18/09	Radium-226	0.14	0.11	0.13
GW-923	04/22/09	Radium-226	0.51	0.27	0.19
GW-923	11/11/09	Radium-226	0.22	0.16	0.17
GW-923	08/12/09	Strontium-90	1.74	0.61	1.11
GW-923	04/22/09	Technetium-99	3.09	1.83	3.02
GW-923	11/11/09	Technetium-99	3.08	1.78	2.95
GW-923	04/22/09	Thorium-228	0.44	0.29	0.27
GW-923	02/18/09	Thorium-230	0.18	0.15	0.18
GW-923	04/22/09	Thorium-230	0.46	0.29	0.18
GW-923	08/12/09	Thorium-230	0.34	0.21	0.2
GW-923	11/11/09	Thorium-230	0.24	0.18	0.08
GW-923	04/22/09	Thorium-232	0.49	0.3	0.21
GW-923	08/13/09	Tritium	403	189.07	301
GW-923	04/22/09	Uranium-233/234	0.6	0.27	0.14
GW-923	08/12/09	Uranium-233/234	0.55	0.33	0.24
GW-923	11/11/09	Uranium-233/234	0.22	0.21	0.21
GW-923	02/18/09	Uranium-238	0.15	0.14	0.14
GW-923	04/22/09	Uranium-238	0.45	0.23	0.12
GW-923	08/12/09	Uranium-238	0.28	0.24	0.28

Monitoring Data for the EMWMF: Radiological Analytes

Sampling Point	Date Sampled	Isotope	Result (pCi/L) Activity	TPU	MDA
GW-924	11/16/09	Americium-241	0.15	0.13	0.12
GW-924 Dup	02/11/09	Cesium-137	8.24 Q	4.86	3.95
GW-924	02/11/09	Chlorine-36	2.86	1.82	2.47
GW-924	04/20/09	Radium-226	0.18	0.12	0.16
GW-924 Dup	04/20/09	Radium-226	0.4	0.2	0.13
GW-924 Dup	08/17/09	Radium-226	0.19	0.14	0.15
GW-924	02/11/09	Radium-228	0.88	0.32	0.78
GW-924 Dup	02/11/09	Radium-228	1.12	0.28	0.65
GW-924	08/17/09	Strontium-90	1.41	0.63	1.19
GW-924	11/16/09	Technetium-99	3.02	1.75	2.89
GW-924	02/11/09	Thorium-230	0.28	0.22	0.26
GW-924 Dup	02/11/09	Thorium-230	0.26	0.2	0.24
GW-924	11/16/09	Thorium-230	0.28	0.19	0.2
GW-924	04/20/09	Uranium-233/234	0.12	0.11	0.12
GW-924 Dup	04/20/09	Uranium-233/234	0.24	0.16	0.11
GW-924 Dup	08/17/09	Uranium-233/234	0.21	0.16	0.17
GW-924	11/16/09	Uranium-233/234	0.13	0.12	0.07
GW-924 Dup	08/17/09	Uranium-238	0.21	0.16	0.17
GW-925	04/15/09	Curium-245	0.23	0.17	0.19
GW-925	08/18/09	Potassium-40	113	108.6	86.6
GW-925	02/12/09	Radium-226	0.17	0.14	0.15
GW-925	04/15/09	Technetium-99	3.1	1.83	3.02
GW-925	08/18/09	Thorium-227	0.23	0.16	0.12
GW-925	11/11/09	Thorium-230	0.14	0.13	0.14
GW-925	02/12/09	Uranium-233/234	0.22	0.16	0.19
GW-925	08/18/09	Uranium-233/234	0.4	0.21	0.12
GW-925	11/11/09	Uranium-233/234	0.31	0.19	0.18
GW-925	11/11/09	Uranium-238	0.18	0.15	0.15
GW-926	02/10/09	Cesium-137	4.78	4.31	3.86
GW-926	02/10/09	Radium-226	0.3	0.19	0.21
GW-926	08/17/09	Radium-226	0.16	0.12	0.14
GW-926	02/10/09	Radium-228	0.87	0.25	0.58
GW-926	08/17/09	Radium-228	0.71	0.24	0.57
GW-926	02/10/09	Strontium-90	2.06	0.88	1.65
GW-926	08/17/09	Strontium-90	1.69	0.61	1.1
GW-926	02/10/09	Thorium-230	0.31	0.24	0.27
GW-926	11/17/09	Thorium-230	0.25	0.17	0.14
GW-926	02/10/09	Thorium-232	0.18	0.17	0.18
GW-926	04/20/09	Uranium-233/234	0.19	0.14	0.14
GW-926	11/17/09	Uranium-233/234	0.23	0.16	0.07
GW-927	04/14/09	Curium-247	0.3	0.25	0.24
GW-927	02/09/09	Radium-226	0.38	0.17	0.1
GW-927	08/12/09	Radium-226	0.28	0.16	0.06
GW-927	04/14/09	Radium-228	1.34	0.3	0.6
GW-927	08/12/09	Radium-228	0.9	0.24	0.55
GW-927	02/09/09	Strontium-90	2.93	0.96	1.72
GW-927	08/12/09	Strontium-90	1.72	0.79	1.53
GW-927	11/10/09	Strontium-90	1.34	0.67	1.28
GW-927	04/14/09	Thorium-230	0.19	0.18	0.1
GW-927	04/14/09	Uranium-233/234	0.16	0.13	0.11
GW-961	11/23/09	Chlorine-36	6.51	2.43	2.98
GW-961	11/23/09	Radium-226	0.26	0.16	0.19
GW-961	11/23/09	Strontium-90	1.74	0.63	1.13
GW-961	11/23/09	Thorium-230	0.15	0.13	0.14
GW-961	11/23/09	Uranium-233/234	0.23	0.16	0.19
GW-961	11/23/09	Uranium-238	0.2	0.14	0.07

APPENDIX D.4: CY 2009 MONITORING DATA FOR THE BEAR CREEK HYDROGEOLOGIC REGIME
Monitoring Data for the EMWMF: Radiological Analytes

Sampling Point	Date Sampled	Isotope	Result (pCi/L)		
			Activity	TPU	MDA
EMWNT-03A	08/10/09	Chlorine-36	2.81 Q	1.97	2.73
EMWNT-03A	08/10/09	Plutonium-242	0.13	0.12	0.12
EMWNT-03A	08/10/09	Radium-226	0.48	0.4	0.38
EMWNT-03A	04/13/09	Strontium-90	3.5 Q	0.93	1.62
EMWNT-03A	11/09/09	Strontium-90	2.01	0.67	1.18
EMWNT-03A	11/09/09	Thorium-227	0.41	0.27	0.29
EMWNT-03A	08/10/09	Thorium-230	0.6	0.4	0.3
EMWNT-03A	11/09/09	Thorium-230	0.4	0.26	0.3
EMWNT-03A	04/13/09	Uranium-233/234	0.33	0.28	0.31
EMWNT-03A	08/10/09	Uranium-233/234	0.77	0.48	0.56
EMWNT-03A	08/10/09	Uranium-238	0.68	0.42	0.36
EMWNT-03A	11/09/09	Uranium-238	0.21	0.17	0.14
EMWNT-05	11/09/09	Neptunium-237	0.2	0.15	0.08
EMWNT-05	08/10/09	Radium-226	0.91	0.5	0.36
EMWNT-05	08/10/09	Thorium-227	0.18	0.14	0.07
EMWNT-05	08/10/09	Thorium-228	0.91	0.35	0.12
EMWNT-05	04/13/09	Thorium-229	1.34	1.33	0.2
EMWNT-05	08/10/09	Thorium-230	0.87	0.34	0.12
EMWNT-05	11/09/09	Thorium-230	0.29	0.2	0.16
EMWNT-05	08/10/09	Thorium-232	0.64	0.28	0.12
EMWNT-05	02/09/09	Uranium-233/234	0.28	0.23	0.26
EMWNT-05	04/13/09	Uranium-233/234	0.67	0.41	0.31
EMWNT-05	08/10/09	Uranium-233/234	0.96	0.53	0.54
EMWNT-05	08/10/09	Uranium-235/236	0.5	0.4	0.34
EMWNT-05	04/13/09	Uranium-238	0.37	0.31	0.34
EMWNT-05	08/10/09	Uranium-238	0.92	0.49	0.36
EMW-VWEIR Dup	11/09/09	Americium-241	0.4	0.28	0.12
EMW-VWEIR	11/09/09	Nickel-63	27.5	13.3	21.3
EMW-VWEIR	11/09/09	Plutonium-242	0.16	0.13	0.12
EMW-VWEIR	08/10/09	Potassium-40	62.2	47.92	48.6
EMW-VWEIR	11/09/09	Radium-226	0.74	0.5	0.63
EMW-VWEIR	02/09/09	Strontium-90	18.4	1.73	1.99
EMW-VWEIR Dup	02/09/09	Strontium-90	15.8	1.52	1.87
EMW-VWEIR	04/13/09	Strontium-90	25	2.02	2.28
EMW-VWEIR	08/10/09	Strontium-90	35.8	1.89	1.44
EMW-VWEIR	11/09/09	Strontium-90	17.1	1.26	1.23
EMW-VWEIR Dup	11/09/09	Strontium-90	14.5	1.17	1.39
EMW-VWEIR	04/13/09	Technetium-99	5.19	3.13	5.18
EMW-VWEIR	08/10/09	Technetium-99	6.92	3.22	5.28
EMW-VWEIR Dup	11/09/09	Technetium-99	6.85	3.13	5.12
EMW-VWEIR	02/09/09	Thorium-230	0.17	0.15	0.14
EMW-VWEIR	08/10/09	Thorium-230	0.2	0.16	0.16
EMW-VWEIR	11/09/09	Thorium-230	0.43	0.26	0.25
EMW-VWEIR Dup	11/09/09	Thorium-230	0.56	0.3	0.23
EMW-VWEIR	08/10/09	Tritium	837	199.94	279
EMW-VWEIR	02/09/09	Uranium-233/234	4.59	1.14	0.31
EMW-VWEIR Dup	02/09/09	Uranium-233/234	5.31	1.27	0.27
EMW-VWEIR	04/13/09	Uranium-233/234	8.4	1.68	0.31
EMW-VWEIR	08/10/09	Uranium-233/234	6.24	1.54	0.17
EMW-VWEIR	11/09/09	Uranium-233/234	44.7	6.65	0.16
EMW-VWEIR Dup	11/09/09	Uranium-233/234	51.3	7.67	0.18
EMW-VWEIR Dup	02/09/09	Uranium-235/236	0.42	0.33	0.28
EMW-VWEIR	04/13/09	Uranium-235/236	0.41	0.31	0.29
EMW-VWEIR	08/10/09	Uranium-235/236	0.44	0.38	0.35
EMW-VWEIR	11/09/09	Uranium-235/236	2.18	0.59	0.08
EMW-VWEIR Dup	11/09/09	Uranium-235/236	2.48	0.67	0.15

APPENDIX D.4: CY 2009 MONITORING DATA FOR THE BEAR CREEK HYDROGEOLOGIC REGIME
Monitoring Data for the EMWMF: Radiological Analytes

Sampling Point	Date Sampled	Isotope	Result (pCi/L)		
			Activity	TPU	MDA
EMW-VWEIR	02/09/09	Uranium-238	2.66	0.8	0.25
EMW-VWEIR Dup	02/09/09	Uranium-238	3.83	1.02	0.13
EMW-VWEIR	04/13/09	Uranium-238	1.74	0.6	0.12
EMW-VWEIR	08/10/09	Uranium-238	1.02	0.52	0.28
EMW-VWEIR	11/09/09	Uranium-238	2.84	0.66	0.13
EMW-VWEIR Dup	11/09/09	Uranium-238	2.62	0.64	0.16
EMW-VWUNDER	08/11/09	Chlorine-36	3.28 Q	2.11	2.9
EMW-VWUNDER	02/12/09	Plutonium-242	0.36	0.22	0.14
EMW-VWUNDER	02/12/09	Radium-226	0.17	0.12	0.14
EMW-VWUNDER	08/11/09	Radium-226	0.23	0.16	0.14
EMW-VWUNDER Dup	11/12/09	Radium-226	0.17	0.13	0.11
EMW-VWUNDER	08/11/09	Radium-228	0.63	0.23	0.56
EMW-VWUNDER	02/12/09	Strontium-90	1.48	0.75	1.43
EMW-VWUNDER	08/11/09	Strontium-90	4.7 Q	0.76	1.14
EMW-VWUNDER Dup	11/12/09	Technetium-99	3.04	1.76	2.91
EMW-VWUNDER	04/16/09	Thorium-230	0.18	0.17	0.17
EMW-VWUNDER	08/11/09	Thorium-230	0.2	0.16	0.16
EMW-VWUNDER	02/12/09	Uranium-233/234	0.33	0.2	0.16
EMW-VWUNDER	04/16/09	Uranium-233/234	0.17	0.13	0.11
EMW-VWUNDER	08/11/09	Uranium-233/234	0.51	0.25	0.13
EMW-VWUNDER	04/16/09	Uranium-235/236	0.18	0.15	0.08
EMW-VWUNDER	04/16/09	Uranium-238	0.2	0.14	0.07
EMW-VWUNDER	08/11/09	Uranium-238	0.17	0.14	0.13
NT-04	04/13/09	Strontium-90	2.31	0.93	1.76
NT-04	11/09/09	Strontium-90	1.74	0.77	1.44
NT-04	11/09/09	Technetium-99	5.03	3.03	5.01
NT-04	02/09/09	Tritium	351	158.67	251
NT-04	02/09/09	Uranium-233/234	1.69	0.59	0.26
NT-04	04/13/09	Uranium-233/234	1.52	0.62	0.38
NT-04	08/10/09	Uranium-233/234	0.64	0.4	0.37
NT-04	11/09/09	Uranium-233/234	1.07	0.4	0.2
NT-04	02/09/09	Uranium-238	1.39	0.53	0.23
NT-04	04/13/09	Uranium-238	1.88	0.69	0.15
NT-04	08/10/09	Uranium-238	0.83	0.45	0.26
NT-04	11/09/09	Uranium-238	1.6	0.5	0.21

APPENDIX E

CY 2009 MONITORING DATA FOR THE UPPER EAST FORK POPLAR CREEK HYDROGEOLOGIC REGIME

EXPLANATION

Sampling Point:

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

Location:

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

Monitoring Program:

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

Sample Type:

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

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	0.01	Bicarbonate	1.0	NS
Magnesium	0.2	0.05	Carbonate	1.0	NS
Potassium	2.0	0.025	Chloride	0.2	0.1
Sodium	0.2	0.01	Fluoride	0.1	0.05
			Nitrate (as Nitrogen)	0.05	0.1
			Sulfate	0.25	0.1
Note: "NS" = not specified.					

The major ion results for one of the samples collected from well GW-170 are qualitative because the ion charge balance error (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 > 10).

The Y-12 GWPP SAP (B&W Y-12 2008) 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 2009a) shown below. The trace metals shown in bold typeface below were detected in at least one sample collected during CY 2009 and are presented in Appendix E.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**	0.00005	0.0002
Barium	0.004	0.005	Molybdenum	0.05	NS
Beryllium	0.0005	0.001	**Nickel**	0.005**	0.01
Boron	0.1	0.01*	Selenium	0.01**	0.0025*
Cadmium	0.0025**	0.00013*	Silver	0.02	0.0015*
Chromium	0.01**	0.005*	**Strontium**	0.005	0.005
Cobalt	0.02	0.005*	**Thallium**	0.0005**	0.001
Copper	0.02	0.005*	Thorium	0.2	NS
Iron	0.05	0.01*	**Uranium**	0.0005**	0.004
Lead	0.0005**	0.002	Vanadium	0.02	0.01*
			Zinc	0.05	0.01*

Note: * - the GWPP reporting limit is used instead of the BJC reporting limit; ** - samples collected after June 2009 were diluted (additional 2X) before analysis which doubled the reporting limit; "NS" - not specified.

To evaluate mercury concentrations in surface water as it exits the Y-12 complex, monitoring by BJC included the following results that are not presented in Appendix E.1.

Station 17 Sampling Date	Mercury Concentration (mg/L) by Method EPA-1631	
	Total	Dissolved (filtered)
06/09/09	0.0002895	0.0000757
12/17/09	0.0002849	0.0001211

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
Q - Result is inconsistent with historical measurements for the location
R - Result does not meet data quality objectives

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, 30 compounds were detected in the CY 2009 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	79	51,000	Bromoform	5	10.1
Trichloroethene	65	6,400	Toluene	4	2,110
cis-1,2-Dichloroethene	59	1,500	Total Xylene	3	6,670
Chloroform	44	120	2-Butanone	3	6
Carbon tetrachloride	39	1,340	Ethylbenzene	2	837
1,1-Dichloroethene	34	210	1,1,1,2-Tetrachloroethane	2	2 J
Vinyl chloride	26	530	Ethylene	2	1.56 J
trans-1,2-Dichloroethene	24	76	1,2-Dichloroethane	1	373
1,1-Dichloroethane	20	46	Styrene	1	4 J
1,1,2-Trichloro-1,2,2-trifluoroethane	18	2,300	Trichlorofluoromethane	1	2 J
Methane	15	729	Ethane	1	1.76 J
Benzene	9	8,110	1,2-Dichloropropane	1	1 J
1,1,1-Trichloroethane	8	52	1,4-Dichlorobenzene	1	1 J
Acetone	6	45	Bromodichloromethane	1	1 J
Methylene chloride	5	48.8	Chloroethane	1	1 J

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

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

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

EXPLANATION (continued)

E.3 Radiological Analytes:

Reporting limits for radiological analytes are sample-specific and analyte-specific minimum detectable activities that are reported with each result. The following summary shows the radiological analytes reported for at least one groundwater sample collected during CY 2009 in the East Fork Regime.

Analyte	No. of Results	No. Detected	Analyte	No. of Results	No. Detected
Gross Alpha	89	34	Uranium-234*	14	13
Gross Beta	89	51	Uranium-235*	14	8
Technetium-99	12	2	Uranium-238	14	12

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 2009 MONITORING DATA FOR THE UPPER EAST FORK POPLAR CREEK HYDROGEOLOGIC REGIME
Field Measurements, Miscellaneous Analytes, Major Ions, and Trace Metals

Sampling Point	55-2A	55-2B	55-2C	55-3A		55-3B		55-3C		56-1A
Functional Area	GRIDB3	GRIDB3	GRIDB3	B9201-5		B9201-5		B9201-5		Y12
Date Sampled	10/27/09	10/26/09	10/26/09	05/14/09	10/20/09	05/14/09	10/21/09	05/13/09	10/21/09	07/28/09
Program	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP
Sample Type										
Field Measurements										
Time Sampled	9:35	9:50	11:00	10:30	14:50	8:50	9:50	14:15	11:10	10:30
Measuring Point Elev. (ft)	.	977.42	977.02	972.46	972.46	973.32	973.32	974.34	974.34	969.25
Depth to Water (ft)	.	7.69	8.18	11.68	11.71	12.25	12.66	12.65	13.92	7.88
Groundwater Elevation (ft)	.	.	.	.	.	.	.	.	.	.
Conductivity (μmho/cm)	.	2,570	2,430	754	693	443	439	451	454	494
Dissolved Oxygen (ppm)	.	0.35	1.72	2.43	0.9	1.69	0.46	0.76	1.73	0.95
Iron (++)	.	.	.	.	.	.	.	.	.	.
Manganese (++)	.	.	.	.	.	.	.	.	.	.
Oxidation/Reduction (mV)	.	194	144	160	137	141	-31	131	76	295
Temperature (degrees C)	.	17.8	16.8	17.8	19.7	18.4	15.8	21.6	15	24.1
Turbidity (NTU)	.	.	.	.	.	.	.	.	.	.
pH	.	6.21	6.83	7.02	6.82	7.36	7.23	7.33	7.39	7.53
Miscellaneous Analytes										
Dissolved Solids (mg/L)	.	2,030	.	404	360	233	195	208	251	313
Suspended Solids (mg/L)	.	<	.	<	<	<	<	<	<	1
Major Ions (mg/L)										
Calcium	.	384	.	103	102	58.8	58.1	52.3	55.2	66.4
Magnesium	.	33.5	.	14.6	13.1	11.5	11	12.3	12.3	11.9
Potassium	.	3.36	.	3.13	3.41	4.39	4.26	6.75	6.8	3.02
Sodium	.	11.7	.	8.98	9.37	3.49	3.83	12.6	13	13.6
Bicarbonate	.	139	.	151	166	137	146	167	172	130
Carbonate	.	<	.	<	<	<	<	<	<	<
Chloride	14.1	15	13.2	16.7	15.1	30.7	32.1	17.9	20.5	23.3
Fluoride	.	<	.	<	<	<	<	<	<	0.471
Nitrate as N	212	292	261	1.44	1.26	<	<	<	<	0.633
Sulfate	20.6	20.1	16.4	155	138	24.6	28.4	27.8	39.7	72
Charge balance error (%)	.	-4.2	.	-0.1	-0.3	0.3	-3.9	-0.9	-3.6	1.4
Trace Metals (mg/L)										
Aluminum	.	<	.	<	<	<	<	<	<	<
Antimony	.	.	.	<	.	<	<	<	<	<
Arsenic	.	.	.	<	.	<	<	<	<	<
Barium	.	0.964	.	0.0381	0.045	0.257	.	0.149	.	0.0639
Beryllium	.	<	.	<	<	<	<	<	<	<
Boron	.	<	.	0.131	0.131	<	<	0.108	0.103	<
Cadmium	.	.	.	<	.	<	<	<	<	<
Chromium	.	.	.	0.00392	.	<	<	<	<	0.145
Cobalt	.	<	.	<	<	<	<	<	<	<
Copper	.	<	.	<	<	<	<	<	<	<
Iron	.	<	.	<	<	<	0.101	<	<	0.904
Lead	.	.	.	<	.	<	0.00107	<	<	<
Lithium	.	0.0232	.	<	0.0108	0.0156	0.0158	0.0193	0.0207	0.0169
Manganese	.	0.712	.	0.0084	0.0056	0.00571	0.0356	0.0178	0.0251	0.0067
Mercury	.	<	.	<	<	<	<	<	<	0.0000835
Nickel	.	.	.	0.025	.	<	<	<	.	0.102
Strontium	.	1.23	.	0.273	0.269	0.725	0.686	1.37	1.37	0.414
Thallium	.	<	.	<	<	<	<	<	<	<
Uranium	.	<	.	0.000635	<	<	<	<	<	0.00194
Zinc	.	<	.	<	<	<	<	<	<	<

APPENDIX E.1: CY 2009 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	56-3A	56-3B	56-3C	56-4A	GW-108	
Functional Area	Y12		GRIDC3	GRIDC3	Y12	Y12	Y12	Y12	S3	
Date Sampled	07/28/09		07/29/09	07/29/09	07/30/09	07/29/09	07/30/09	05/12/09	01/12/09	07/08/09
Program	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP	BJC	BJC
Sample Type		Dup						NP		
Field Measurements										
Time Sampled	8:40	8:40	13:45	9:30	9:40	14:50	11:05	14:25	14:30	9:45
Measuring Point Elev. (ft)	969.49	969.49	963.53	962.45	963.03	964.33	962.86	962.07	999.00	999.00
Depth to Water (ft)	7.10	7.10	8.25	7.50	10.10	10.56	10.16	10.27	7.02	6.67
Groundwater Elevation (ft)	.	.	.	.	.	.	.	.	.	.
Conductivity (μmho/cm)	401	401	647	605	542	560	583	218	37,615	54,002
Dissolved Oxygen (ppm)	1.06	1.06	0.13	0.85	2.83	0.34	0.32	2.5	14.42	8.09
Iron (++)	.	.	.	.	.	.	.	.	.	.
Manganese (++)	.	.	.	.	.	.	.	.	.	.
Oxidation/Reduction (mV)	310	310	45	227	248	189	217	128	202	253
Temperature (degrees C)	23.2	23.2	20.8	21	20.2	20.4	20.3	19	17.1	21.8
Turbidity (NTU)	.	.	.	.	.	.	.	.	2	1
pH	7.52	7.52	7.01	7.15	6.87	7.03	7.11	7.26	5.28	5.4
Miscellaneous Analytes										
Dissolved Solids (mg/L)	275	231	376	366	246	300	340	115	.	.
Suspended Solids (mg/L)	<	<	3	2	3	1	3	3	.	.
Major Ions (mg/L)										
Calcium	28.3	28.2	101	90.2	76	94.3	97.6	22.6	9,840	12,000
Magnesium	8.5	8.61	7.92	12.3	7.07	4.43	6.44	3.25	996	980
Potassium	3.66	3.9	2.71	2.76	2.13	<	2.19	<	24.2	38
Sodium	46.5	48.6	8.71	11.8	4.95	5.21	8.13	6.07	48.7	520
Bicarbonate	189	189	196	185	203	193	174	69.1	894	780
Carbonate	<	<	<	<	<	<	<	<	<	<
Chloride	5.37	5.63	31	14.6	8.36	15	15.5	2.77	183	180
Fluoride	0.337	0.334	<	<	0.165	<	<	<	<	<
Nitrate as N	<	<	0.295	0.985	0.427	0.484	0.82	1.45	8,030	38,000 Q
Sulfate	11.6	11.6	73.3	95.1	29.7	62	101	9.85	9.3	<
Charge balance error (%)	0.5	1.6	-1.6	-0.5	-3.2	-2.8	-2.2	-3.2	-1.8	.
Trace Metals (mg/L)										
Aluminum	<	<	<	<	<	<	0.315	1.26	<	<
Antimony	<	<	<	<	<	<	<	<	<	<
Arsenic	<	<	<	<	<	<	<	<	<	0.0058
Barium	0.256	0.267	0.108	0.0561	0.0914	0.0949	0.0683	0.0402	75.4	67
Beryllium	<	<	<	<	<	<	<	<	<	0.0023 Q
Boron	0.141	0.144	0.122	0.141	0.164	<	<	<	<	<
Cadmium	<	<	<	<	<	<	<	<	0.00486 Q	<
Chromium	<	<	<	<	<	<	<	0.0204	<	0.017
Cobalt	<	<	<	<	<	<	<	<	0.16	0.16
Copper	<	<	<	<	<	<	<	<	<	<
Iron	<	<	0.206	<	0.0602	0.0568	0.213	0.663	<	<
Lead	<	<	<	<	<	<	<	<	<	0.0068
Lithium	0.0224	0.0234	0.013	0.0158	<	<	<	<	0.467	0.34
Manganese	0.0471	0.0465	<	<	<	<	<	0.0102	158	170
Mercury	<	<	<	<	<	5.2E-05	<	<	<	<
Nickel	<	<	0.0156	<	0.0102	<	<	0.0214	0.203	0.12
Strontium	0.855	0.885	0.244	0.299	0.139	0.136	0.184	0.0414	29.8	28
Thallium	<	<	<	<	<	<	<	<	<	<
Uranium	<	<	<	<	<	<	<	<	0.014	0.013
Zinc	<	<	<	<	<	<	<	<	<	<

APPENDIX E.1: CY 2009 MONITORING DATA FOR THE UPPER EAST FORK POPLAR CREEK HYDROGEOLOGIC REGIME
Field Measurements, Miscellaneous Analytes, Major Ions, and Trace Metals

Sampling Point	GW-151		GW-154		GW-169		GW-170				GW-171
Functional Area	NHP		NHP		EXP-UV		EXP-UV				EXP-UV
Date Sampled	03/03/09	07/23/09	03/03/09	07/23/09	03/04/09	07/23/09	03/04/09		07/23/09		03/05/09
Program	BJC	BJC	BJC	BJC	BJC	BJC	BJC	BJC	BJC	BJC	BJC
Sample Type								Dup		Dup	
Field Measurements											
Time Sampled	14:30	9:50	16:30	10:40	13:50	13:40	16:10	16:10	14:30	14:30	15:00
Measuring Point Elev. (ft)	916.17	916.17	911.70	911.70	932.12	932.12	932.64	932.64	932.64	932.64	920.72
Depth to Water (ft)	15.62	15.91	9.11	.	31.51	31.40	35.21	.	36.05	.	3.81
Groundwater Elevation (ft)	.	.	.	.	.	.	.	.	.	.	.
Conductivity (μmho/cm)	474	455	669	.	223	457	1,365	.	1,231	.	328
Dissolved Oxygen (ppm)	0.3	1.05	4.2	.	5.58	6.9	0.23	.	0.2	.	1.03
Iron (++)	.	.	.	.	.	.	.	.	.	.	1.47
Manganese (++)	.	.	.	.	.	.	.	.	.	.	5.4
Oxidation/Reduction (mV)	84	84	109	.	152	170	-178	.	-91	.	-9
Temperature (degrees C)	14.6	17.1	12.4	.	14.4	16.1	13.7	.	16.1	.	14.8
Turbidity (NTU)	1	2	4	.	14	5	1	.	3	.	61
pH	7.12	7.19	7.4	.	6.43	6.95	11.7	.	10.31	.	5.73
Miscellaneous Analytes											
Dissolved Solids (mg/L)	284	334	482	759	162	229	380	395	336	325	249
Suspended Solids (mg/L)	<	<	24	11	12	10	8	8	15	13	23
Major Ions (mg/L)											
Calcium	56.5	58.3	124	277	51.1	68.2	124	120	106	105	.
Magnesium	25.3	26.2	18.9	22	2.74	3.7	1.02	1.77	1.9	1.65	.
Potassium	2.24	2.23	5.47	6.96	2.45	2.58	12.5	12.2	12.7	12.4	.
Sodium	7.37	7.26	7.2	8.51	1.1	1.22	6.05	5.88	5.73	5.62	.
Bicarbonate	238	226	.	.	135	193	<	<	<	<	.
Carbonate	<	<	.	.	<	<	87.1	55.4	20.3	16.2	.
Chloride	19.9	20	.	.	1.4	1.83	5.5	5.4	5.75	5.86	.
Fluoride	0.16	0.134	.	.	<	<	0.17	0.18	0.123	0.124	.
Nitrate as N	0.74	0.38	.	.	0.62	0.35	0.27	0.27	0.22	0.23	.
Sulfate	22.4	24.4	.	.	4.5	7.06	7.1	7.1	8.03	8.04	.
Charge balance error (%)	-5.1	-1.7	.	.	0.2	-3.2	-1.6	.	72.5 R	.	.
Trace Metals (mg/L)											
Aluminum	<	<	<	2.83	0.769	0.2	0.225	0.312	0.359	0.308	.
Antimony	<	<	<	<	<	<	<	<	<	<	.
Arsenic	<	<	<	<	<	<	<	<	<	<	.
Barium	0.179	0.177	0.0878	0.394	0.0268	0.0308	0.16	0.156	0.159	0.156	.
Beryllium	<	<	<	<	<	<	<	<	<	<	.
Boron	<	<	<	0.101	<	<	<	<	<	<	.
Cadmium	<	<	<	0.00466	<	<	<	<	<	<	.
Chromium	<	<	<	<	<	<	<	<	<	<	.
Cobalt	<	<	<	<	<	<	<	<	<	<	.
Copper	<	<	<	0.0298	<	<	<	<	<	<	.
Iron	<	<	0.144	3.06	0.554	0.164	0.438	0.859	0.851	0.671	.
Lead	<	<	<	0.019	0.00244	<	<	<	<	<	.
Lithium	<	<	<	0.0142	<	<	0.0342	0.0332	0.0334	0.0327	.
Manganese	<	<	0.91	6.58	0.016	0.00582	<	0.0072	0.0073	0.0058	.
Mercury	.	.	.	.	.	.	.	.	.	.	.
Nickel	<	<	<	0.0229	<	<	<	<	<	<	.
Strontium	0.54	0.538	0.45	0.564	0.0638	0.0877	0.618	0.601	0.632	0.622	.
Thallium	<	<	<	0.00567	<	<	<	<	<	<	.
Uranium	<	<	0.6	0.56	.	.	.	.	.	.	.
Zinc	<	<	<	0.132	<	<	<	<	<	<	.

APPENDIX E.1: CY 2009 MONITORING DATA FOR THE UPPER EAST FORK POPLAR CREEK HYDROGEOLOGIC REGIME
Field Measurements, Miscellaneous Analytes, Major Ions, and Trace Metals

Sampling Point	GW-172	GW-193		GW-204	GW-219	GW-222		GW-223		GW-230	GW-251
Functional Area	EXP-UV	T2331		T0134	UOV	NHP		NHP		EXP-UV	S2
Date Sampled	03/05/09	01/13/09	07/07/09	05/12/09	05/11/09	04/30/09		03/03/09	07/22/09	03/05/09	04/30/09
Program	BJC	BJC	BJC	GWPP	GWPP	GWPP	GWPP	BJC	BJC	BJC	GWPP
Sample Type							Dup				
Field Measurements											
Time Sampled	14:00	.	13:35	13:50	15:25	8:35	8:35	16:40	14:20	14:20	13:40
Measuring Point Elev. (ft)	926.69	934.17	934.17	958.74	935.83	911.82	911.82	911.62	911.62	923.11	1,003.80
Depth to Water (ft)	13.76	8.62	9.23	8.68	9.79	9.91	9.91	9.45	9.81	11.03	15.10
Groundwater Elevation (ft)	.	.	.	.	.	.	.	.	.	.	.
Conductivity (μmho/cm)	571	517	910	254	668	746	746	560	613	939	694
Dissolved Oxygen (ppm)	0.46	3.3	1.7	3.03	0.9	2.9	2.9	1.13	0.77	0.29	0.35
Iron (++)	1.34	.	.	.	.	.	.	.	.	1.23	.
Manganese (++)	0.9	.	.	.	.	.	.	.	.	0.8	.
Oxidation/Reduction (mV)	-94	167	-157	134	139	146	146	-12	-25	-50	236
Temperature (degrees C)	15.3	11.3	29.3	22.5	19	15.8	15.8	14.1	19.1	14.7	16.8
Turbidity (NTU)	1	2	1	.	.	.	.	2	0	7	.
pH	6.29	7.27	7.35	7.6	6.66	7.26	7.26	6.79	7.07	7	6.1
Miscellaneous Analytes											
Dissolved Solids (mg/L)	365	.	.	.	.	435	396	360	440	587	383
Suspended Solids (mg/L)	<	.	.	.	.	<	<	<	<	5	<
Major Ions (mg/L)											
Calcium	.	.	.	.	.	86.9	90.3	86.8	91.5	.	87.7
Magnesium	.	.	.	.	.	15.2	16	12.7	13	.	9.42
Potassium	.	.	.	.	.	3.86	3.91	1.92	1.91	.	2.2
Sodium	.	.	.	.	.	45	47.3	14.7	20.2	.	8.37
Bicarbonate	.	.	.	.	.	211	211	226	211	.	142
Carbonate	.	.	.	.	.	<	<	<	<	.	<
Chloride	.	.	.	.	.	79	79.2	35.9	60.6	.	5.11
Fluoride	.	.	.	.	.	0.288	0.298	0.16	0.172	.	0.91
Nitrate as N	.	.	.	.	.	0.221	0.219	<	<	.	38.7
Sulfate	.	.	.	.	.	49.9	49.9	53.2	53.8	.	8.68
Charge balance error (%)	.	.	.	.	.	0.8	3.0	-4.6	-3.6	.	-3.5
Trace Metals (mg/L)											
Aluminum	.	.	.	.	.	<	<	<	<	.	<
Antimony	.	.	.	<	<	<	<	<	<	.	<
Arsenic	.	.	.	<	<	<	<	<	<	.	<
Barium	.	.	.	.	.	0.165	0.174	0.284	0.296	.	0.072
Beryllium	.	.	.	.	.	<	<	<	<	.	<
Boron	.	.	.	.	.	<	<	<	<	.	<
Cadmium	.	.	.	<	<	<	<	<	<	.	0.0788
Chromium	.	.	.	0.00464	0.00354	<	<	<	<	.	<
Cobalt	.	.	.	.	.	<	<	<	<	.	<
Copper	.	.	.	.	.	<	<	<	<	.	0.16
Iron	.	.	.	.	.	<	<	0.234	0.254	.	<
Lead	.	.	.	<	<	<	<	<	<	.	<
Lithium	.	.	.	.	.	<	<	<	<	.	<
Manganese	.	.	.	.	.	0.0071	0.0064	0.511	0.53	.	2.22
Mercury	.	.	.	.	.	<	<	.	.	.	<
Nickel	.	.	.	<	0.0216	<	<	<	<	.	0.0241
Strontium	.	.	.	.	.	0.299	0.314	0.24	0.246	.	0.171
Thallium	.	.	.	<	<	<	<	<	0.00103	.	0.00085
Uranium	.	.	.	0.0421	0.555	0.228	0.219	0.04	0.046	.	0.0022
Zinc	.	.	.	.	.	<	<	<	<	.	0.128

APPENDIX E.1: CY 2009 MONITORING DATA FOR THE UPPER EAST FORK POPLAR CREEK HYDROGEOLOGIC REGIME
Field Measurements, Miscellaneous Analytes, Major Ions, and Trace Metals

Sampling Point	GW-253	GW-270	GW-272	GW-274		GW-275	GW-281	GW-380		GW-381
Functional Area	S2	SY	SY	SY		SY	FF	NHP		NHP
Date Sampled	03/04/09	04/28/09	04/21/09	04/21/09		04/27/09	08/13/09	03/04/09	07/23/09	10/19/09
Program	BJC	GWPP	GWPP	GWPP	GWPP	GWPP	BJC	BJC	BJC	GWPP
Sample Type					Dup					
Field Measurements										
Time Sampled	17:05	9:00	10:40	14:25	14:25	13:20	14:20	10:40	10:10	11:05
Measuring Point Elev. (ft)	1,004.24	1,008.96	1,009.16	995.60	995.60	995.53	946.10	913.55	913.55	913.36
Depth to Water (ft)	5.87	2.31	5.25	3.52	3.52	4.08	3.15	10.71	.	10.98
Groundwater Elevation (ft)	.	.	.	.	.	.	.	.	.	.
Conductivity (μmho/cm)	5,734	1,506	5,790	12,360	12,360	45,400	747	395	.	708
Dissolved Oxygen (ppm)	1.51	2.79	0.88	0.23	0.23	0.3	1.83	5.44	.	0.36
Iron (++)	0.09	.	.	.	.	.	.	.	.	.
Manganese (++)	57	.	.	.	.	.	.	.	.	.
Oxidation/Reduction (mV)	235	130	137	215	215	100	154	147	.	-122
Temperature (degrees C)	14	19.4	15.4	16.1	16.1	21.8	19.1	12.9	.	16
Turbidity (NTU)	4	.	.	.	.	.	13	35	.	.
pH	5.3	7.06	6.68	5.57	5.57	6.71	6.8	6.9	.	7.1
Miscellaneous Analytes										
Dissolved Solids (mg/L)	4,010	1,060	4,280	10,400	10,500	45,900	.	263	274	.
Suspended Solids (mg/L)	5	3	<	<	<	<	.	37	9	.
Major Ions (mg/L)										
Calcium	547	202	824	1,970	1,980	10,100	.	49.4	43.5	.
Magnesium	122	36.2	136	306	309	1,430	.	19.4	16.2	.
Potassium	8.61	5.67	4.18	<	<	36	.	1.85	1.71	.
Sodium	128	14.3	15.5	219	221	127	.	17.5	14.6	.
Bicarbonate	63.4	192	104	600	629	59.8	.	182	166	.
Carbonate	<	<	<	<	<	<	.	<	<	.
Chloride	121	12.3	5.32	46.8	46.4	49.3	.	23.2	17.4	.
Fluoride	8.9	<	<	<	<	<	.	0.31	0.22	.
Nitrate as N	744	107	682	1,739	1,729	8,960	.	1.9	0.92	.
Sulfate	28.3	51.4	9.81	3.11	3.07	2.62	.	23.8	28.4	.
Charge balance error (%)	-15.4	3.5	1.9	-1.7	-1.3	-1.1	.	-0.7	-3.4	.
Trace Metals (mg/L)										
Aluminum	3.52	<	<	<	<	<	.	1.26	<	.
Antimony	<	<	<	<	<	<	.	0.00338	<	.
Arsenic	<	<	<	<	<	<	.	0.00534	0.0104	.
Barium	0.273	0.169	2.46	11.7	11.8	153	.	0.0396	0.0371	.
Beryllium	0.0123	<	<	<	<	<	.	<	<	.
Boron	0.3	<	<	<	<	<	.	<	<	.
Cadmium	4.2	<	<	<	<	<	.	<	<	.
Chromium	<	<	<	<	<	<	.	0.702	1.02	.
Cobalt	0.259	<	<	<	<	<	.	<	<	.
Copper	65.6	<	<	<	<	<	.	<	<	.
Iron	0.147	<	<	<	<	<	.	4.17	2.9	.
Lead	0.0638	0.00101	0.00231	<	<	<	.	0.00251	<	.
Lithium	0.0554	0.0267	0.0428	<	<	0.418	.	<	<	.
Manganese	46.8	0.0071	0.0068	55.8	56.2	1.88	.	0.0735	0.0242	.
Mercury	.	<	<	0.0001	0.0001	<	.	.	.	.
Nickel	2.25	<	0.00817	0.135	0.134	0.0738	.	0.119	0.15	.
Strontium	0.985	2.75	1.6	5.97	6.01	77.3	.	0.0706	0.0618	.
Thallium	0.00801	<	<	<	<	<	.	<	<	.
Uranium	0.0044	0.0011	0.0044	0.0099	0.0099	<	.	0.0051	<	.
Zinc	6.34	<	<	<	<	<	.	<	<	.

APPENDIX E.1: CY 2009 MONITORING DATA FOR THE UPPER EAST FORK POPLAR CREEK HYDROGEOLOGIC REGIME
Field Measurements, Miscellaneous Analytes, Major Ions, and Trace Metals

Sampling Point	GW-382		GW-505		GW-605				GW-606		GW-618
Functional Area	NHP		RG		EXP-I				EXP-I		EXP-E
Date Sampled	03/04/09	07/23/09	04/20/09		01/08/09		07/07/09		01/08/09	07/07/09	03/30/09
Program	BJC	BJC	GWPP	GWPP	BJC	BJC	BJC	BJC	BJC	BJC	BJC
Sample Type				Dup		Dup		Dup			
Field Measurements											
Time Sampled	14:20	10:30	9:05	9:05	10:00	.	9:40	.	14:20	10:00	9:55
Measuring Point Elev. (ft)	913.17	913.17	1,015.19	1,015.19	919.06	.	919.06	.	919.59	919.59	985.14
Depth to Water (ft)	11.75	11.22	4.51	4.51	11.27	.	11.45	.	12.28	13.63	12.55
Groundwater Elevation (ft)	.	.	.	.	.	.	.	.	.	.	.
Conductivity (μmho/cm)	644	638	352	352	1,160	.	818	.	1,158	1,344	594
Dissolved Oxygen (ppm)	1.36	1.42	5.26	5.26	0.49	.	0.92	.	2.42	1.46	0.28
Iron (++)	.	.	.	.	.	.	.	.	.	.	0.15
Manganese (++)	.	.	.	.	.	.	.	.	.	.	0.4
Oxidation/Reduction (mV)	124	121	187	187	168	.	193	.	170	102	7
Temperature (degrees C)	15.5	21.2	15.2	15.2	15.2	.	17.4	.	11.5	19.5	16.8
Turbidity (NTU)	31	14	.	.	10	.	0	.	5	2	0
pH	7.3	6.65	6.84	6.84	6.58	.	7	.	6.84	6.48	6.59
Miscellaneous Analytes											
Dissolved Solids (mg/L)	382	440	.	.	.	.	.	.	.	.	378
Suspended Solids (mg/L)	7	6	.	.	.	.	.	.	.	.	8
Major Ions (mg/L)											
Calcium	86.7	77	.	.	102	98.3	100	100	89.1	97	98
Magnesium	23.9	21.4	.	.	22.8	22	22	22	41.2	43	8.8
Potassium	3.56	3.82	.	.	2.74	2.63	2.6	2.6	4.05	4.9	3.92
Sodium	17.2	17.2	.	.	20.6	20.1	17	17	7.38	7.4	13.2
Bicarbonate	285	268	.	.	354	358	300	310	366	340	308
Carbonate	<	<	.	.	<	<	<	<	<	<	<
Chloride	59.3	65.9	.	.	31.2	32.9	40	39	29.2	24	7.7
Fluoride	0.28	0.168	.	.	0.1	0.1	<	<	0.2	<	0.29
Nitrate as N	0.2	0.07	.	.	0.2	0.22	0.17	0.17	12.8	16	0.029
Sulfate	4	4.39	.	.	32.8	32.2	33	32	31.6	61	17.2
Charge balance error (%)	-2.4	-6.3	.	.	-4.4	.	-1.4	.	-8.1	-5.7	-3.5
Trace Metals (mg/L)											
Aluminum	<	<	.	.	<	<	<	<	<	<	<
Antimony	<	<	<	<	<	<	<	<	<	<	<
Arsenic	<	<	<	<	<	<	<	<	<	<	<
Barium	0.588	0.528	.	.	0.0538	0.0522	0.05	0.051	0.194	0.19	0.0382
Beryllium	<	<	.	.	<	<	<	<	<	<	<
Boron	<	<	.	.	<	<	<	<	<	<	<
Cadmium	<	<	<	<	<	<	<	<	<	<	<
Chromium	<	<	0.113	0.0942	<	<	<	<	<	<	<
Cobalt	<	<	.	.	<	<	<	<	<	<	<
Copper	<	<	.	.	<	<	<	<	<	<	<
Iron	2.33	3.19	.	.	0.0659	0.0541	<	<	<	<	0.126
Lead	<	<	0.0147	0.0121	<	<	<	<	<	<	<
Lithium	<	<	.	.	<	<	<	<	0.0108	0.015	<
Manganese	0.0343	0.032	.	.	0.201	0.188	0.18	0.19	0.0105	0.0099	0.276
Mercury	.	.	.	.	.	.	.	.	.	.	.
Nickel	<	<	0.0195	0.0159	<	<	<	<	<	<	<
Strontium	0.31	0.29	.	.	0.201	0.196	0.2	0.2	0.612	0.71	0.201
Thallium	<	<	<	<	<	<	<	<	<	<	<
Uranium	<	<	0.0629 Q	0.0562	0.13	0.13	0.1	0.1	0.005	0.0051	<
Zinc	<	<	.	.	<	<	<	<	<	<	<

APPENDIX E.1: CY 2009 MONITORING DATA FOR THE UPPER EAST FORK POPLAR CREEK HYDROGEOLOGIC REGIME
Field Measurements, Miscellaneous Analytes, Major Ions, and Trace Metals

Sampling Point	GW-633	GW-658	GW-686	GW-690	GW-691			GW-692	GW-698	
Functional Area	**RG**	**FF**	**CPT**	**CPT**	**CPT**			**CPT**	**B8110**	
Date Sampled	**04/28/09**	**08/13/09**	**05/13/09**	**05/13/09**	**05/12/09**	**10/20/09**		**05/12/09**	**04/29/09**	
Program	**GWPP**	**BJC**	**GWPP**	**GWPP**	**GWPP**	**GWPP**	**GWPP**	**GWPP**	**GWPP**	**GWPP**
Sample Type							**Dup**			**Dup**
Field Measurements										
Time Sampled	15:55	15:40	9:05	10:20	9:10	10:40	10:40	10:10	13:35	13:35
Measuring Point Elev. (ft)	996.43	944.81	963.76	967.36	968.59	968.59	968.59	964.38	970.09	970.09
Depth to Water (ft)	3.02	10.97	12.39	10.02	11.58	11.89	11.89	9.06	30.74	30.74
Groundwater Elevation (ft)	.	.	.	.	.	.	.	.	.	.
Conductivity (μmho/cm)	6,380	651	1,049	1,237	888	961	961	836	1,734	1,734
Dissolved Oxygen (ppm)	0.48	0.93	1.49	0.77	0.77	0.41	0.41	0.25	0.17	0.17
Iron (++)	.	.	.	.	.	.	.	.	.	.
Manganese (++)	.	.	.	.	.	.	.	.	.	.
Oxidation/Reduction (mV)	244	-57	138	145	164	153	153	145	134	134
Temperature (degrees C)	23	27.9	17.5	17.7	14.8	15.9	15.9	17.7	18.8	18.8
Turbidity (NTU)	.	5	.	.	.	.	.	.	.	.
pH	5.12	6.06	6.62	6.76	6.24	6.42	6.42	7.12	6.67	6.67
Miscellaneous Analytes										
Dissolved Solids (mg/L)	5,430	.	.	.	.	.	.	.	.	.
Suspended Solids (mg/L)	1	.	.	.	.	.	.	.	.	.
Major Ions (mg/L)										
Calcium	1,130	.	.	.	.	.	.	.	.	.
Magnesium	112	.	.	.	.	.	.	.	.	.
Potassium	7.12	.	.	.	.	.	.	.	.	.
Sodium	98.9	.	.	.	.	.	.	.	.	.
Bicarbonate	306	.	.	.	.	.	.	.	.	.
Carbonate	<	.	.	.	.	.	.	.	.	.
Chloride	40	.	15.5	70.8	8.69	7.12	7.18	19.4	17.2	17.2
Fluoride	<	.	.	.	.	.	.	.	.	.
Nitrate as N	823	.	1.07	4.06	0.282	0.437	0.43	<	90.1	90.2
Sulfate	2.4	.	232	300	324 Q	338	342	277	60	59.9
Charge balance error (%)	3.0	.	.	.	.	.	.	.	.	.
Trace Metals (mg/L)										
Aluminum	<	.	.	.	.	.	.	.	.	.
Antimony	<	.	.	.	.	.	.	.	.	.
Arsenic	<	.	.	.	.	.	.	.	.	.
Barium	4.93	.	.	.	.	.	.	.	.	.
Beryllium	<	.	.	.	.	.	.	.	.	.
Boron	<	.	.	.	.	.	.	.	.	.
Cadmium	<	.	.	.	.	.	.	.	.	.
Chromium	<	.	.	.	.	.	.	.	.	.
Cobalt	<	.	.	.	.	.	.	.	.	.
Copper	<	.	.	.	.	.	.	.	.	.
Iron	<	.	.	.	.	.	.	.	.	.
Lead	<	.	.	.	.	.	.	.	.	.
Lithium	0.167	.	.	.	.	.	.	.	.	.
Manganese	3.81	.	.	.	.	.	.	.	.	.
Mercury	<	.	<	<	<	<	<	0.00051	0.00036	0.00038
Nickel	0.208	.	.	.	.	.	.	.	.	.
Strontium	2.69	.	.	.	.	.	.	.	.	.
Thallium	<	.	.	.	.	.	.	.	.	.
Uranium	<	.	.	.	.	.	.	.	.	.
Zinc	<	.	.	.	.	.	.	.	.	.

APPENDIX E.1: CY 2009 MONITORING DATA FOR THE UPPER EAST FORK POPLAR CREEK HYDROGEOLOGIC REGIME
Field Measurements, Miscellaneous Analytes, Major Ions, and Trace Metals

Sampling Point		**GW-722-14**		**GW-722-17**		**GW-722-20**		**GW-722-22**		**GW-7**
Functional Area		**EXP-J**		**EXP-J**		**EXP-J**		**EXP-J**		**EX**
Date Sampled	**10/21/09**	**03/02/09**	**09/02/09**	**03/02/09**	**09/02/09**	**03/02/09**	**09/02/09**	**03/02/09**	**09/02/09**	**03/02/09**
Program	**GWPP**	**BJC**	**GWPP**	**BJC**	**GWPP**	**BJC**	**GWPP**	**BJC**	**GWPP**	**BJC**
Sample Type										
Field Measurements										
Time Sampled	15:00	12:55	9:32	13:20	11:04	12:40	14:15	12:25	15:13	12:05
Measuring Point Elev. (ft)	970.09	953.71	953.71	953.71	953.71	953.71	953.71	953.71	953.71	953.71
Depth to Water (ft)	20.52	.	.	.	.	.	.	.	.	.
Groundwater Elevation (ft)	.	.	.	.	.	.	.	.	.	.
Conductivity (μmho/cm)	744	515	534	538	565	489	512	481	511	389
Dissolved Oxygen (ppm)	1.44	10.58	.	10.63	.	10.81	.	11.37	.	11.53
Iron (++)	.	.	.	.	.	.	.	.	.	.
Manganese (++)	.	.	.	.	.	.	.	.	.	.
Oxidation/Reduction (mV)	157	129	.	113	.	128	.	140	.	174
Temperature (degrees C)	19.2	14.28	17	14.61	17.5	14.01	18.4	14.1	18.3	14.78
Turbidity (NTU)	.	2	.	1	.	2	.	2	.	5
pH	6.64	7.21	7.1	7.48	7.44	7.35	7.02	7.31	7.17	7.22
Miscellaneous Analytes										
Dissolved Solids (mg/L)	.	.	268	.	319	.	252	.	260	.
Suspended Solids (mg/L)	.	.	4	.	<	.	<	.	<	.
Major Ions (mg/L)										
Calcium	.	.	58.8	.	42.7	.	52.9	.	56.9	.
Magnesium	.	.	27.9	.	26	.	29.8	.	28.1	.
Potassium	.	.	<	.	2.17	.	<	.	<	.
Sodium	.	.	15.6	.	32.9	.	15.5	.	12.7	.
Bicarbonate	.	.	256	.	217	.	245	.	254	.
Carbonate	.	.	<	.	<	.	<	.	<	.
Chloride	9.54	.	8.85	.	31	.	9.19	.	5.47	.
Fluoride	.	.	0.174	.	0.638	.	0.316	.	0.223	.
Nitrate as N	12.1	.	0.346	.	0.06	.	0.182	.	0.259	.
Sulfate	18.2	.	16.6	.	31.7	.	21.1	.	16.6	.
Charge balance error (%)	.	.	1.4	.	-1.3	.	1.2	.	0.9	.
Trace Metals (mg/L)										
Aluminum	.	.	<	.	<	.	<	.	<	.
Antimony	.	.	<	.	<	.	<	.	<	.
Arsenic	.	.	<	.	<	.	<	.	<	.
Barium	.	.	0.136	.	0.111	.	0.0964	.	0.1	.
Beryllium	.	.	<	.	<	.	<	.	<	.
Boron	.	.	0.112	.	0.128	.	<	.	<	.
Cadmium	.	.	<	.	<	.	<	.	<	.
Chromium	.	.	<	.	<	.	<	.	<	.
Cobalt	.	.	<	.	<	.	<	.	<	.
Copper	.	.	<	.	<	.	<	.	<	.
Iron	.	.	<	.	<	.	<	.	<	.
Lead	.	.	<	.	0.00109	.	<	.	<	.
Lithium	.	.	0.0179	.	0.0283	.	0.0175	.	0.0163	.
Manganese	.	.	<	.	<	.	<	.	<	.
Mercury	0.00079	.	<	.	<	.	<	.	<	.
Nickel	.	.	<	.	<	.	<	.	<	.
Strontium	.	.	0.716	.	1.2	.	0.69	.	0.667	.
Thallium	.	.	<	.	<	.	<	.	<	.
Uranium	.	.	<	.	<	.	<	.	<	.
Zinc	.	.	0.294	.	0.052	.	0.0523	.	<	.

APPENDIX E.1: CY 2009 MONITORING DATA FOR THE UPPER EAST FORK POPLAR CREEK HYDROGEOLOGIC REGIME
Field Measurements, Miscellaneous Analytes, Major Ions, and Trace Metals

Sampling Point	22-33	GW-733		GW-735	GW-744	GW-747	GW-750	GW-762		
Functional Area	P-J	EXP-J		EXP-J	GRIDK1	GRIDK2	EXP-J	GRIDJ3		
Date Sampled	09/03/09	01/12/09	07/07/09	08/26/09	08/26/09	08/31/09	04/29/09	03/04/09		07/2
Program	GWPP	BJC	BJC	GWPP	GWPP	GWPP	GWPP	BJC	BJC	BJC
Sample Type									Dup	
Field Measurements										
Time Sampled	8:30	10:05	15:15	14:25	10:05	14:00	15:05	10:30	10:30	15:15
Measuring Point Elev. (ft)	953.71	959.84	959.84	924.46	907.43	911.06	919.03	915.56	915.56	915.56
Depth to Water (ft)	.	56.43	59.34	23.02	7.15	5.10	12.52	13.61	.	13.87
Groundwater Elevation (ft)	.	.	.	.	.	.	.	.	.	.
Conductivity (μmho/cm)	424	469	505	691	489	298	546	579	.	606
Dissolved Oxygen (ppm)	.	1.24	1	0.35	0.23	0.33	0.52	0.54	.	1.27
Iron (++)	.	.	.	.	.	.	.	.	.	.
Manganese (++)	.	.	.	.	.	.	.	.	.	.
Oxidation/Reduction (mV)	.	94	72	81	-199	-78	-8	120	.	102
Temperature (degrees C)	16.7	9.1	24.9	18.6	22.2	20.8	17.2	16.6	.	21.2
Turbidity (NTU)	.	2	0	.	.	.	.	2	.	12
pH	6.92	7.02	7.63	6.81	7.48	7.23	6.95	6.7	.	7.07
Miscellaneous Analytes										
Dissolved Solids (mg/L)	232	.	.	251	176	270	288	381	365	404
Suspended Solids (mg/L)	<	.	.	<	<	4	<	6	<	9
Major Ions (mg/L)										
Calcium	69.7	.	.	130	47.7	39.9	88.6	75.2	80	78
Magnesium	9.37	.	.	9.1	10.9	9.69	11.8	21.7	23.2	22.6
Potassium	<	.	.	2.35	3.48	2.3	4.35	3.89	4.08	5.57
Sodium	2.57	.	.	4.2	36.1	33.4	7.22	12.1	12.7	13
Bicarbonate	207	.	.	317	230	199	245	277	285	260
Carbonate	<	.	.	<	<	<	<	<	<	<
Chloride	3.01	.	.	17.4	7.22	2.13	4.58	38.2	37.2	40.4
Fluoride	<	.	.	<	<	0.199	<	0.16	0.11	<
Nitrate as N	0.585	.	.	0.102	<	<	<	0.02	<	<
Sulfate	10.6	.	.	22.3	18	13.3	19.9	14.9	14.9	16.6
Charge balance error (%)	-1.4	.	.	1.2	-2.4	-0.3	3.4	-5.9	.	-1.7
Trace Metals (mg/L)										
Aluminum	<	.	.	<	<	<	<	<	<	0.725
Antimony	<	.	.	<	<	<	<	<	<	<
Arsenic	<	.	.	<	<	<	<	<	<	<
Barium	0.0288	.	.	0.334	0.302	0.174	0.735	0.484	0.518	0.538
Beryllium	<	.	.	<	<	<	<	<	<	<
Boron	<	.	.	<	<	<	<	<	<	<
Cadmium	<	.	.	<	<	<	<	<	<	<
Chromium	<	.	.	<	<	<	<	<	<	<
Cobalt	<	.	.	<	<	<	<	<	<	<
Copper	<	.	.	<	<	<	<	<	<	<
Iron	<	.	.	<	<	0.222	0.0928	<	<	0.444
Lead	<	.	.	<	<	<	<	<	0.00209	<
Lithium	<	.	.	<	0.0276	0.0177	0.0116	0.0134	0.0149	0.0207
Manganese	<	.	.	0.191	0.0172	0.0156	0.0606	0.0453	0.0482	0.085
Mercury	<	.	.	<	<	<	<	.	.	.
Nickel	<	.	.	<	<	<	<	<	<	<
Strontium	0.0584	.	.	0.273	1.4	0.757	0.678	0.678	0.725	0.73
Thallium	<	.	.	<	<	<	<	<	<	<
Uranium	<	.	.	<	<	<	<	<	<	<
Zinc	<	.	.	<	<	<	<	<	<	<

APPENDIX E.1: CY 2009 MONITORING DATA FOR THE UPPER EAST FORK POPLAR CREEK HYDROGEOLOGIC REGIME
Field Measurements, Miscellaneous Analytes, Major Ions, and Trace Metals

Sampling Point		GW-763	GW-765	GW-776	GW-779	GW-781	GW-782	GW-802	GW-816	GW
Functional Area		GRIDJ3	GRIDE1	GRIDH3	GRIDF2	GRIDE3	GRIDE3	FF	EXP-SR	NI
Date Sampled	3/09	10/14/09	05/07/09	09/01/09	08/31/09	08/27/09	08/27/09	08/13/09	08/26/09	03/03/09
Program	BJC	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP	BJC	GWPP	BJC
Sample Type	Dup									
Field Measurements										
Time Sampled	15:15	11:15	8:50	10:30	10:10	9:15	10:40	14:40	8:35	14:25
Measuring Point Elev. (ft)	915.56	915.03	1,008.54	931.25	963.09	947.89	947.73	941.83	898.42	906.18
Depth to Water (ft)	.	9.07	18.14	14.58	9.43	7.99	9.84	5.51	12.10	7.50
Groundwater Elevation (ft)	.	.	.	.	.	.	.	.	.	.
Conductivity (μmho/cm)	.	792	759	613	446	444	565	864	437	385
Dissolved Oxygen (ppm)	.	0.22	0.74	3.69	0.54	1.38	2.3	2.81	0.21	6.41
Iron (++)	.	.	.	.	.	.	.	.	.	.
Manganese (++)	.	.	.	.	.	.	.	.	.	.
Oxidation/Reduction (mV)	.	-84	149	125	87	93	128	158	-65	112
Temperature (degrees C)	.	21.7	17.8	21.1	21.2	22.2	19.6	23.4	19.6	11.6
Turbidity (NTU)	.	.	.	.	.	.	.	12	.	26
pH	.	6.48	6.78	7.02	9.1	8.17	7.01	7.07	6.3	7.4
Miscellaneous Analytes										
Dissolved Solids (mg/L)	392	.	425	333	248	181	331	.	178	253
Suspended Solids (mg/L)	<	.	<	2	2	<	3	.	20	26
Major Ions (mg/L)										
Calcium	76.6	.	129	95.1	3.14	9.02	78	.	49.4	68.8
Magnesium	22.2	.	13.7	6.05	2.28	3.04	9.74	.	13.4	13.5
Potassium	5.37	.	<	2.83	2.48	5.15	3.39	.	4.76	2.31
Sodium	12.8	.	10.9	15.6	96.2	83.6	11	.	5.96	10.1
Bicarbonate	264	.	324	191	154	195	206	.	178	202
Carbonate	<	.	<	<	57.1	<	<	.	<	<
Chloride	40.3	.	30.9	35.1	10.9	6.38	22.9	.	9.34	14.2
Fluoride	<	.	<	<	0.477	<	<	.	0.116	0.22
Nitrate as N	<	.	<	1.46	<	0.114	0.755	.	<	1.4
Sulfate	16.3	.	11.1	51.8	8.48	9.41	22	.	6.86	22.9
Charge balance error (%)	.	.	3.0	0.0	-1.6	2.1	-0.2	.	-0.3	0.2
Trace Metals (mg/L)										
Aluminum	0.388	.	<	<	<	<	<	.	<	0.726
Antimony	<	.	<	<	<	<	<	.	<	<
Arsenic	<	.	<	<	<	<	<	.	<	<
Barium	0.527	.	0.167	0.0874	0.222	0.267	0.367	.	0.0753	0.0579
Beryllium	<	.	<	<	<	<	<	.	<	<
Boron	<	.	<	<	0.19	0.556	<	.	<	<
Cadmium	<	.	<	<	<	<	<	.	<	<
Chromium	<	.	<	0.036	<	<	<	.	<	<
Cobalt	<	.	<	<	<	<	<	.	<	<
Copper	<	.	<	<	<	<	<	.	<	<
Iron	0.264	.	0.115	0.173	<	<	0.263	.	14	0.69
Lead	<	.	0.00088	0.072 Q	<	<	<	.	<	<
Lithium	0.0192	.	0.0161	<	0.0364	0.0628	0.0136	.	<	0.0111
Manganese	0.0655	.	0.0313	0.00742	<	<	0.00731	.	0.88	0.0281
Mercury	.	.	<	<	<	<	<	.	<	.
Nickel	<	.	0.0151	0.178	<	<	0.0323	.	<	<
Strontium	0.72	.	0.189	0.161	0.402	0.508	0.666	.	0.0649	0.142
Thallium	<	.	<	<	<	<	<	.	<	<
Uranium	<	.	<	<	<	<	<	.	<	0.0085
Zinc	<	.	0.0789	<	<	<	<	.	<	<

APPENDIX E.1: CY 2009 MONITORING DATA FOR THE UPPER EAST FORK POPLAR CREEK HYDROGEOLOGIC REGIME
Field Measurements, Miscellaneous Analytes, Major Ions, and Trace Metals

Sampling Point	-832	GW-959	GW-960	GHK2.51WSW	NPR12.0SW	NPR23.0SW	SCR7.1SP	SCR7.8SP	SP
Functional Area	HP	B9201-2	GRIDF2	EXP	EXP	EXP	EXP-SW	EXP-SW	EXP
Date Sampled	07/23/09	05/06/09	05/07/09	01/29/09	01/29/09	01/29/09	02/05/09	02/05/09	08/0
Program	BJC	GWPP	GWPP	GWPP	GWPP	GWPP	BJC	BJC	GWPP
Sample Type									
Field Measurements									
Time Sampled	9:05	14:10	10:25	13:35	14:15	13:55	10:50	10:30	14:50
Measuring Point Elev. (ft)	906.18	927.69	.	.	.	.	.	.	.
Depth to Water (ft)	7.07	2.51	12.68	.	.	.	.	.	.
Groundwater Elevation (ft)	.	.	.	.	.	.	.	.	.
Conductivity (μmho/cm)	506	581	820	118	86	91	381	340	570
Dissolved Oxygen (ppm)	4.39	0.28	0.51	6.5	6.5	6.49	10.42	12.94	3.69
Iron (++)	.	.	.	.	.	.	0	0.01	.
Manganese (++)	.	.	.	.	.	.	0	0.1	.
Oxidation/Reduction (mV)	159	140	-55	293	279	278	119.6	149	216
Temperature (degrees C)	20.2	18.1	18	8.4	7.4	7.9	5.69	7.89	16.1
Turbidity (NTU)	7	.	.	.	.	.	3.46	2.99	.
pH	7.25	6.98	6.97	6.82	6.78	6.81	7.63	7.77	7.21
Miscellaneous Analytes									
Dissolved Solids (mg/L)	266	313	456	213	112	124	242	213	250
Suspended Solids (mg/L)	<	1	3	5	4	2	<	20	2
Major Ions (mg/L)									
Calcium	49.1	81.9	105	11.8	5.64	7.41	.	.	55.1
Magnesium	11.5	8.73	19.4	3.5	3.01	3.18	.	.	32.9
Potassium	2.01	3.37	3.63	<	2.28	2.42	.	.	<
Sodium	8.8	26.7	26	1.28	2.16	1.69	.	.	2.17
Bicarbonate	141	164	222	43.3	30.4	33.1	.	.	245
Carbonate	<	<	<	<	<	<	.	.	<
Chloride	11.2	3.22	83.1	0.971	1.08	0.929	.	.	3.97
Fluoride	0.309	0.381	<	<	<	<	.	.	<
Nitrate as N	0.78	0.138	<	0.21	0.172	0.177	.	.	9.08
Sulfate	31.7	103	44.2	14.2	12.7	11.3	.	.	6.26
Charge balance error (%)	-0.5	4.4	2.3	-12.7	-14.6	-9.9	.	.	-2.1
Trace Metals (mg/L)									
Aluminum	<	<	<	0.4	<	1.02	.	.	<
Antimony	<	<	<	<	<	<	.	.	<
Arsenic	<	<	<	<	<	<	.	.	<
Barium	0.0464	0.0973	0.153	0.0363	0.0341	0.0394	.	.	0.158
Beryllium	<	<	<	<	<	<	.	.	<
Boron	<	<	<	<	<	<	.	.	<
Cadmium	<	<	<	<	<	<	.	.	<
Chromium	<	<	<	<	<	<	.	.	<
Cobalt	<	<	<	<	<	<	.	.	<
Copper	<	<	<	<	<	<	.	.	<
Iron	0.06	<	2.95	0.268	0.0825	0.643	.	.	<
Lead	<	<	<	0.00187	0.000745	0.00064	.	.	<
Lithium	0.0148	<	0.0114	<	<	<	.	.	<
Manganese	0.00619	0.031	0.289	0.0203	0.00773	0.0212	.	.	0.0108
Mercury	.	<	<	<	<	<	.	.	<
Nickel	<	<	<	<	<	<	.	.	<
Strontium	0.118	0.21	1.94	0.0351	0.0282	0.0235	.	.	0.0442
Thallium	<	<	<	<	<	<	.	.	<
Uranium	0.0068	0.00102	<	<	<	<	.	.	0.0013
Zinc	<	0.08	<	0.0783	0.0766	0.0833	.	.	<

APPENDIX E.1: CY 2009 MONITORING DATA FOR THE UPPER EAST FORK POPLAR CREEK HYDROGEOLOGIC REGIME
Field Measurements, Miscellaneous Analytes, Major Ions, and Trace Metals

Sampling Point	**-17**	**200A6**		**200A6**		**STATION 8**			
Functional Area	**-SW**	**EXP-SW**		**EXP-SW**		**EXP-SW**			
Date Sampled	**3/09**	**01/06/09**	**01/22/09**	**08/19/09**	**09/10/09**	**01/06/09**	**01/22/09**	**08/19/09**	**09/10/09**
Program	**GWPP**	**BJC**	**BJC**	**BJC**	**BJC**	**BJC**	**BJC**	**BJC**	**BJC**
Sample Type	**Dup**								
Field Measurements									
Time Sampled	14:50	9:15	9:40	10:15	9:00	9:00	9:25	9:45	9:15
Measuring Point Elev. (ft)	.	.	.	.	.	.	.	.	.
Depth to Water (ft)	.	.	.	.	.	.	.	.	.
Groundwater Elevation (ft)	.	.	.	.	.	.	.	.	.
Conductivity (μmho/cm)	570	309	341	434	397	301	262	430	317
Dissolved Oxygen (ppm)	3.69	9.19	7.12	5.72	10.92	9.53	8.26	5.93	9.88
Iron (++)	.	.	.	.	.	.	.	.	.
Manganese (++)	.	.	.	.	.	.	.	.	.
Oxidation/Reduction (mV)	216	114.2	149.6	13.6	164.3	130	153.2	4.4	143.2
Temperature (degrees C)	16.1	15.06	16.38	25.6	22.6	13.69	12	25.8	18.13
Turbidity (NTU)	.	9.37	2.07	25	1.19	6.61	4.65	7	4.66
pH	7.21	7.55	7.8	7.44	8.5	7.8	8.17	7.82	8.04
Miscellaneous Analytes									
Dissolved Solids (mg/L)	293	214	219	288	241	175	208	284	250
Suspended Solids (mg/L)	2	<	<	16	22	25	<	5	<
Major Ions (mg/L)									
Calcium	56.5	45.8	47.3	57.6	49.8	39.7	39	55.9	40.5
Magnesium	32.2	9.09	11.9	13.4	12.3	10.2	11.8	12.6	11.1
Potassium	<	2.18	2.09	2.83	2.3	2.08	1.94	2.9	1.82
Sodium	2.05	6.86	10.9	10.1	10.5	8.5	10.3	11.2	8.62
Bicarbonate	245	.	.	.	.	.	.	.	.
Carbonate	<	.	.	.	.	.	.	.	.
Chloride	4.06	.	.	.	.	.	.	.	.
Fluoride	<	.	.	.	.	.	.	.	.
Nitrate as N	9.12	.	.	.	.	.	.	.	.
Sulfate	6.31	.	.	.	.	.	.	.	.
Charge balance error (%)	-2.1	.	.	.	.	.	.	.	.
Trace Metals (mg/L)									
Aluminum	<	0.539	<	0.378	<	0.384	<	<	<
Antimony	<	<	<	<	<	<	<	<	<
Arsenic	<	<	<	<	<	<	<	<	<
Barium	0.154	0.0472	0.0464	0.063	0.0489	0.0409	0.0384	0.0579	0.0373
Beryllium	<	<	<	<	<	<	<	<	<
Boron	<	0.145	<	0.356	<	<	<	0.116	<
Cadmium	<	<	<	<	<	<	<	<	<
Chromium	<	<	<	<	<	<	<	<	<
Cobalt	<	<	<	<	<	<	<	<	<
Copper	<	<	<	<	<	<	<	<	<
Iron	<	0.41	0.0802	0.465	0.0524	0.303	0.153	0.207	0.136
Lead	<	<	<	<	<	<	<	<	<
Lithium	<	0.0695	0.0461	0.126	0.0271	0.0309	0.0118	0.0458	0.0121
Manganese	0.0122	0.0418	0.0492	0.0446	0.021	0.0502	0.0436	0.0364	0.0622
Mercury	<	.	.	.	.	.	.	.	.
Nickel	<	<	<	<	<	<	<	<	<
Strontium	0.0432	0.127	0.151	0.165	0.162	0.129	0.14	0.162	0.136
Thallium	<	<	<	<	<	<	<	<	<
Uranium	0.00133	0.088	0.042	0.043	0.014	0.036	0.013	0.031	<
Zinc	<	<	<	<	<	<	<	<	<

APPENDIX E.2

VOLATILE ORGANIC COMPOUNDS

APPENDIX E.2: CY 2009 MONITORING DATA FOR THE UPPER EAST FORK POPLAR CREEK HYDROGEOLOGIC REGIME
Volatile Organic Compounds

Sampling Point	55-2A	55-2B	55-2C	55-3A		55-3B		55-3C		56-1A
Functional Area	**GRIDB3**	**GRIDB3**	**GRIDB3**	**B9201-5**		**B9201-5**		**B9201-5**		**Y12**
Date Sampled	**10/27/09**	**10/26/09**	**10/26/09**	**05/14/09**	**10/20/09**	**05/14/09**	**10/21/09**	**05/13/09**	**10/21/09**	**07/28/09**
Program	**GWPP**	**GWPP**	**GWPP**	**GWPP**	**GWPP**	**GWPP**	**GWPP**	**GWPP**	**GWPP**	**GWPP**
Sample Type										
Chloroethenes (μg/L)										
Tetrachloroethene	200	390	260	17,000	17,000	46,000	51,000	8,300	4,500	<
Trichloroethene	100	170	140	1,600	1,700	5,000	6,400	1,500	1,200	<
cis-1,2-Dichloroethene	280	430	450	1,200	1,300	1,100	1,500	1,400	1,200	<
trans-1,2-Dichloroethene	4 J	7	7	24	38	52	76	23	24	<
1,1-Dichloroethene	7	13	15	31	50	140	210	37	37	<
Vinyl chloride	7	14	13	44	110	27 Q	530	150	160	<
Chloroethanes (μg/L)										
1,1,1,2-Tetrachloroethane	<	<	<	<	<	<	<	<	<	<
1,1,1-Trichloroethane	<	<	<	<	<	<	<	<	<	<
1,2-Dichloroethane	<	<	<	<	<	<	<	<	<	<
1,1-Dichloroethane	8	11	17	7	10	33	46	6	7	<
Chloroethane	<	<	<	<	1 J	<	<	<	<	<
Chloromethanes (μg/L)										
Carbon tetrachloride	<	<	<	<	<	<	<	<	<	<
Chloroform	<	<	<	<	<	<	<	<	<	3 J
Methylene chloride	<	<	<	<	<	<	<	<	<	<
Petrol. Hydrocarb. (μg/L)										
Benzene	<	<	<	<	<	2 J	1 J	<	<	<
Ethylbenzene	<	<	<	<	<	<	<	<	<	<
Toluene	<	<	<	<	<	2 J	4 J	<	<	<
Total Xylene	<	<	<	<	<	<	<	<	<	<
Styrene	<	<	<	<	<	<	<	<	<	<
Miscellaneous (μg/L)										
1,1,2-Trichloro-1,2,2-trifluoroethane	130	330	190	14	30	<	<	3 J	7	<
Trichlorofluoromethane	<	<	<	<	<	<	<	<	<	<
1,2-Dichloropropane	<	<	<	<	<	<	<	<	<	<
1,4-Dichlorobenzene	<	<	<	<	<	1 J	<	<	<	<
2-Butanone	<	<	<	<	<	<	<	<	<	<
Acetone	<	<	<	<	<	<	<	<	<	<
Bromodichloromethane	<	<	<	<	<	<	<	<	<	<
Bromoform	<	<	<	<	<	<	<	<	<	<
Natural Attenuation (μg/L)										
Ethane	.	.	.	.	.	.	.	.	.	.
Ethylene	.	.	.	.	.	.	.	.	.	.
Methane	.	.	.	.	.	.	.	.	.	.

APPENDIX E.2: CY 2009 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
Functional Area	Y12		GRIDC3	GRIDC3	GRIDC3	Y12	Y12	Y12	Y12
Date Sampled	07/28/09		07/29/09	07/29/09	07/28/09	07/30/09	07/29/09	07/30/09	05/12/09
Program	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP
Sample Type		Dup			PDB				NP
Chloroethenes (µg/L)									
Tetrachloroethene	<	<	12	1,000	40	14	150	520	2 J
Trichloroethene	<	<	3 J	75	170	5 J	15	38	<
cis-1,2-Dichloroethene	<	<	3 J	98	920	2 J	20	68	<
trans-1,2-Dichloroethene	<	<	<	2 J	7	<	<	1 J	<
1,1-Dichloroethene	<	<	<	2 J	13	<	<	2 J	<
Vinyl chloride	<	<	<	<	59	<	<	<	<
Chloroethanes (µg/L)									
1,1,1,2-Tetrachloroethane	<	<	<	<	.	<	<	<	<
1,1,1-Trichloroethane	<	<	<	<	<	<	<	<	<
1,2-Dichloroethane	<	<	<	<	<	<	<	<	<
1,1-Dichloroethane	<	<	<	<	<	<	<	<	3 J
Chloroethane	<	<	<	<	<	<	<	<	<
Chloromethanes (µg/L)									
Carbon tetrachloride	<	<	<	<	<	<	<	<	<
Chloroform	<	<	<	<	<	<	1 J	<	<
Methylene chloride	<	<	<	<	<	<	<	<	<
Petrol. Hydrocarb. (µg/L)									
Benzene	<	<	<	<	<	<	<	<	<
Ethylbenzene	<	<	<	<	<	<	<	<	<
Toluene	<	<	<	<	<	<	<	<	<
Total Xylene	<	<	<	<	<	<	<	<	<
Styrene	<	<	<	<	.	<	<	<	<
Miscellaneous (µg/L)									
1,1,2-Trichloro-1,2,2-trifluoroethane	<	<	<	2 J	<	<	<	1 J	<
Trichlorofluoromethane	<	<	<	<	<	<	<	<	<
1,2-Dichloropropane	<	<	<	<	<	<	<	<	<
1,4-Dichlorobenzene	<	<	<	<	<	<	<	<	<
2-Butanone	<	<	<	<	6	<	<	<	<
Acetone	<	<	<	<	.	<	<	<	<
Bromodichloromethane	<	<	<	<	<	<	<	<	<
Bromoform	<	<	<	<	<	<	<	<	<
Natural Attenuation (µg/L)									
Ethane	.	.	.	.	.	.	.	.	.
Ethylene	.	.	.	.	.	.	.	.	.
Methane	.	.	.	.	.	.	.	.	.

APPENDIX E.2: CY 2009 MONITORING DATA FOR THE UPPER EAST FORK POPLAR CREEK HYDROGEOLOGIC REGIME
Volatile Organic Compounds

Sampling Point	GW-108		GW-151		GW-153		GW-154		GW-169	
Functional Area	**S3**		**NHP**		**NHP**		**NHP**		**EXP-UV**	
Date Sampled	**01/12/09**	**07/08/09**	**03/03/09**	**07/23/09**	**10/14/09**		**03/03/09**	**07/23/09**	**03/04/09**	**07/23/09**
Program	**BJC**	**BJC**	**BJC**	**BJC**	**GWPP**	**GWPP**	**BJC**	**BJC**	**BJC**	**BJC**
Sample Type					**PDB**	**Dup**				
Chloroethenes (μg/L)										
Tetrachloroethene	11	6	691	731	<	<	<	<	1.03 J	1.25 J
Trichloroethene	5.7	3.4	110 J	115 J	<	<	<	<	<	<
cis-1,2-Dichloroethene	<	<	61.4 J	59.6 J	<	<	<	<	<	<
trans-1,2-Dichloroethene	<	<	<	<	<	<	<	<	<	<
1,1-Dichloroethene	1.37 J	1	1.54 J	1.63 J	<	<	<	<	<	<
Vinyl chloride	<	<	<	<	<	<	<	<	<	<
Chloroethanes (μg/L)										
1,1,1,2-Tetrachloroethane	.	.	.	.	.	.	.	.	.	.
1,1,1-Trichloroethane	<	<	<	<	<	<	<	<	<	<
1,2-Dichloroethane	<	<	<	<	<	<	<	<	<	<
1,1-Dichloroethane	<	<	<	<	<	<	<	<	<	<
Chloroethane	<	<	<	<	<	<	<	<	<	<
Chloromethanes (μg/L)										
Carbon tetrachloride	<	<	1,140	1,340	68	64	<	<	<	<
Chloroform	31.6	30	62.1 J	74.5 J	4 J	4 J	<	<	<	<
Methylene chloride	48.8	47	<	<	<	<	<	<	<	<
Petrol. Hydrocarb. (μg/L)										
Benzene	1.52 J	<	<	<	<	<	<	<	<	<
Ethylbenzene	<	<	<	<	<	<	<	<	<	<
Toluene	<	<	<	<	<	<	<	<	<	<
Total Xylene	<	.	<	<	<	<	<	<	<	<
Styrene	<	<	<	<	.	.	<	<	<	<
Miscellaneous (μg/L)										
1,1,2-Trichloro-1,2,2-trifluoroethane	.	.	.	.	<	<	.	.	.	.
Trichlorofluoromethane	.	.	.	.	<	<	.	.	.	.
1,2-Dichloropropane	<	<	<	<	<	<	<	<	<	<
1,4-Dichlorobenzene	.	.	.	.	<	<	.	.	.	.
2-Butanone	<	<	<	<	<	<	<	<	<	<
Acetone	<	<	<	<	.	.	<	<	<	<
Bromodichloromethane	<	<	<	<	<	<	<	<	<	<
Bromoform	10.1	3.9	<	<	<	<	<	<	<	<
Natural Attenuation (μg/L)										
Ethane	.	.	<	<	.	.	<	<	.	.
Ethylene	.	.	<	<	.	.	<	<	.	.
Methane	.	.	110	129	.	.	30.3	13.3	.	.

APPENDIX E.2: CY 2009 MONITORING DATA FOR THE UPPER EAST FORK POPLAR CREEK HYDROGEOLOGIC REGIME
Volatile Organic Compounds

Sampling Point	GW-170				GW-171	GW-172	GW-220		GW-222	
Functional Area	EXP-UV				EXP-UV	EXP-UV	NHP		NHP	
Date Sampled	03/04/09		07/23/09		03/05/09	03/05/09	04/29/09	10/14/09	04/30/09	
Program	BJC	BJC	BJC	BJC	BJC	BJC	GWPP	GWPP	GWPP	GWPP
Sample Type		Dup		Dup			PDB	PDB		Dup
Chloroethenes (µg/L)										
Tetrachloroethene	<	1.09 J	<	<	<	<	210	180	13	12
Trichloroethene	1.08 J	1.08 J	<	<	<	<	100	100	2 J	2 J
cis-1,2-Dichloroethene	<	<	<	<	<	<	65	56	5	5 J
trans-1,2-Dichloroethene	<	<	<	<	<	<	<	<	<	<
1,1-Dichloroethene	<	<	<	<	<	<	<	3 J	<	<
Vinyl chloride	<	<	<	<	<	<	<	<	<	<
Chloroethanes (µg/L)										
1,1,1,2-Tetrachloroethane	.	.	.	.	.	.	.	.	<	<
1,1,1-Trichloroethane	<	<	<	<	<	<	<	<	<	<
1,2-Dichloroethane	<	<	<	<	<	<	<	<	<	<
1,1-Dichloroethane	<	<	<	<	<	<	<	<	<	<
Chloroethane	<	<	<	<	<	<	<	<	<	<
Chloromethanes (µg/L)										
Carbon tetrachloride	1.79 J	1.8 J	2.1 J	1.8 J	<	<	670	690	<	<
Chloroform	<	<	<	1.03 J	<	<	71	70	<	<
Methylene chloride	<	<	<	<	<	<	<	<	<	<
Petrol. Hydrocarb. (µg/L)										
Benzene	<	<	<	<	<	<	<	<	<	<
Ethylbenzene	<	<	<	<	<	<	<	<	<	<
Toluene	<	<	<	<	<	<	<	<	<	<
Total Xylene	<	<	<	<	<	<	<	<	<	<
Styrene	<	<	<	<	<	<	.	.	<	<
Miscellaneous (µg/L)										
1,1,2-Trichloro-1,2,2-trifluoroethane	.	.	.	.	.	.	<	2 J	<	<
Trichlorofluoromethane	.	.	.	.	.	.	<	2 J	<	<
1,2-Dichloropropane	<	<	<	<	<	<	<	<	<	<
1,4-Dichlorobenzene	.	.	.	.	.	.	<	<	<	<
2-Butanone	<	<	<	<	<	<	<	<	<	<
Acetone	<	<	<	<	<	<	.	.	<	<
Bromodichloromethane	<	<	<	<	<	<	<	<	<	<
Bromoform	<	<	<	<	<	<	<	<	<	<
Natural Attenuation (µg/L)										
Ethane	.	.	.	.	.	.	.	.	.	.
Ethylene	.	.	.	.	.	.	.	.	.	.
Methane	.	.	.	.	.	.	.	.	.	.

APPENDIX E.2: CY 2009 MONITORING DATA FOR THE UPPER EAST FORK POPLAR CREEK HYDROGEOLOGIC REGIME
Volatile Organic Compounds

Sampling Point	GW-223		GW-230	GW-240	GW-251	GW-253	GW-269	GW-270	GW-272
Functional Area	NHP		EXP-UV	NHP	S2	S2	SY	SY	SY
Date Sampled	03/03/09	07/22/09	03/05/09	10/14/09	04/30/09	03/04/09	04/21/09	04/28/09	04/21/09
Program	BJC	BJC	BJC	GWPP	GWPP	BJC	GWPP	GWPP	GWPP
Sample Type				PDB			PDB		
Chloroethenes (μg/L)									
Tetrachloroethene	21.8	21	<	<	230	766	13	<	<
Trichloroethene	13.4	10.3	<	<	110	812	5 J	<	<
cis-1,2-Dichloroethene	80.2	52.8	9.05	<	14	257	63	<	<
trans-1,2-Dichloroethene	<	<	<	<	<	<	<	<	<
1,1-Dichloroethene	<	<	<	<	<	4.28	160	<	<
Vinyl chloride	5.04	4.71	1.72	<	<	75.6	<	<	<
Chloroethanes (μg/L)									
1,1,1,2-Tetrachloroethane	.	.	.	.	<	.	.	<	<
1,1,1-Trichloroethane	<	<	<	<	<	<	12	<	<
1,2-Dichloroethane	<	<	<	<	<	<	<	<	<
1,1-Dichloroethane	<	<	<	<	<	<	5 J	<	<
Chloroethane	<	<	<	<	<	<	<	<	<
Chloromethanes (μg/L)									
Carbon tetrachloride	<	<	<	3 J	2 J	42.4 J	<	<	<
Chloroform	<	<	<	<	7	42.9 J	4 J	<	<
Methylene chloride	<	<	<	<	<	<	<	<	<
Petrol. Hydrocarb. (μg/L)									
Benzene	<	<	<	<	<	<	<	<	<
Ethylbenzene	<	<	<	<	<	<	<	<	<
Toluene	<	<	<	<	<	<	<	<	<
Total Xylene	<	<	<	<	<	<	<	<	<
Styrene	<	<	<	.	<	<	.	<	<
Miscellaneous (μg/L)									
1,1,2-Trichloro-1,2,2-trifluoroethane	.	.	.	<	<	.	19	<	<
Trichlorofluoromethane	.	.	.	<	<	.	<	<	<
1,2-Dichloropropane	<	<	<	<	<	<	<	<	<
1,4-Dichlorobenzene	.	.	.	<	<	.	<	<	<
2-Butanone	<	<	<	<	<	<	<	<	<
Acetone	<	<	<	.	<	4.31 J	.	<	<
Bromodichloromethane	<	<	<	<	<	<	<	<	<
Bromoform	<	<	<	<	<	<	<	<	<
Natural Attenuation (μg/L)									
Ethane	<	<	.	.	.	1.76 J	.	.	.
Ethylene	<	<	.	.	.	<	.	.	.
Methane	43.9	57.2	.	.	.	8.95	.	.	.

APPENDIX E.2: CY 2009 MONITORING DATA FOR THE UPPER EAST FORK POPLAR CREEK HYDROGEOLOGIC REGIME
Volatile Organic Compounds

Sampling Point	GW-274		GW-275	GW-281	GW-332	GW-337	GW-380		GW-381
Functional Area	SY		SY	FF	WC	WC	NHP		NHP
Date Sampled	04/21/09		04/27/09	08/13/09	04/28/09	04/28/09	03/04/09	07/23/09	10/19/09
Program	GWPP	GWPP	GWPP	BJC	GWPP	GWPP	BJC	BJC	GWPP
Sample Type		Dup			PDB	PDB			
Chloroethenes (μg/L)									
Tetrachloroethene	1,600	1,600	<	<	560	380	<	<	4 J
Trichloroethene	11	10	<	<	170	450	<	<	<
cis-1,2-Dichloroethene	39	34	<	<	740	1,500	<	<	3 J
trans-1,2-Dichloroethene	<	<	<	<	9	17	<	<	<
1,1-Dichloroethene	<	<	<	<	20	55	<	<	<
Vinyl chloride	3	3	<	<	11	13	<	<	<
Chloroethanes (μg/L)									
1,1,1,2-Tetrachloroethane	2 J	2 J	<	.	.	.	.	.	<
1,1,1-Trichloroethane	<	<	<	<	4 J	52	<	<	<
1,2-Dichloroethane	<	<	<	<	<	<	<	<	<
1,1-Dichloroethane	<	<	<	<	17	43	<	<	<
Chloroethane	<	<	<	<	<	<	<	<	<
Chloromethanes (μg/L)									
Carbon tetrachloride	<	<	<	<	<	<	1.12 J	<	340
Chloroform	19	18	<	<	<	<	<	<	70
Methylene chloride	29	25	<	<	<	<	<	<	<
Petrol. Hydrocarb. (μg/L)									
Benzene	200	200	<	<	<	<	<	<	<
Ethylbenzene	<	<	<	<	<	<	<	<	<
Toluene	<	<	<	<	<	<	<	<	<
Total Xylene	<	<	<	<	<	<	<	<	<
Styrene	<	<	<	<	.	.	<	<	<
Miscellaneous (μg/L)									
1,1,2-Trichloro-1,2,2-trifluoroethane	<	<	<	.	2,300	1,100	.	.	<
Trichlorofluoromethane	<	<	<	.	<	<	.	.	<
1,2-Dichloropropane	<	<	<	<	<	1 J	<	<	<
1,4-Dichlorobenzene	<	<	<	.	<	<	.	.	<
2-Butanone	<	<	<	<	<	<	<	<	<
Acetone	<	<	<	<	.	.	<	<	6 J
Bromodichloromethane	<	<	<	<	<	<	<	<	<
Bromoform	9	8	<	<	<	<	<	<	<
Natural Attenuation (μg/L)									
Ethane	.	.	.	.	.	.	<	<	.
Ethylene	.	.	.	.	.	.	<	<	.
Methane	.	.	.	.	.	.	<	<	.

APPENDIX E.2: CY 2009 MONITORING DATA FOR THE UPPER EAST FORK POPLAR CREEK HYDROGEOLOGIC REGIME
Volatile Organic Compounds

Sampling Point	**GW-382**		**GW-383**	**GW-508**	**GW-605**				**GW-606**	
Functional Area	**NHP**		**NHP**	**RG**	**EXP-I**				**EXP-I**	
Date Sampled	**03/04/09**	**07/23/09**	**10/14/09**	**04/20/09**	**01/08/09**		**07/07/09**		**01/08/09**	**07/07/09**
Program	**BJC**	**BJC**	**GWPP**	**GWPP**	**BJC**	**BJC**	**BJC**	**BJC**	**BJC**	**BJC**
Sample Type			**PDB**	**PDB**		**Dup**		**Dup**		
Chloroethenes (µg/L)										
Tetrachloroethene	25.5	16.9 J	120	<	62	71	110	110	6	5
Trichloroethene	<	<	150	<	56	61	110	100	0.3 J	<
cis-1,2-Dichloroethene	6.65 J	<	210	<	81	81	160	160	<	<
trans-1,2-Dichloroethene	<	<	3 J	<	0.6 J	0.7 J	<	<	<	<
1,1-Dichloroethene	<	<	4 J	<	0.6 J	0.6 J	<	<	<	<
Vinyl chloride	<	<	5	<	0.9 J	0.8 J	<	<	<	<
Chloroethanes (µg/L)										
1,1,1,2-Tetrachloroethane	.	.	.	<	.	.	.	.	.	.
1,1,1-Trichloroethane	<	<	<	<	<	<	<	<	<	<
1,2-Dichloroethane	<	<	<	<	<	<	<	<	<	<
1,1-Dichloroethane	<	<	<	<	<	<	<	<	<	<
Chloroethane	<	<	<	<	<	<	<	<	<	<
Chloromethanes (µg/L)										
Carbon tetrachloride	439	378	<	<	48	54	81	81	61	50
Chloroform	120	107	<	<	12	11	15	14	46	42
Methylene chloride	<	<	<	<	<	<	<	<	<	<
Petrol. Hydrocarb. (µg/L)										
Benzene	<	<	<	280	<	<	<	<	0.4 J	<
Ethylbenzene	<	<	<	310	<	<	<	<	<	<
Toluene	<	<	<	890	<	<	<	<	<	<
Total Xylene	<	<	<	1,500	<	<	.	.	<	.
Styrene	<	<	.	4 J	<	<	<	<	<	<
Miscellaneous (µg/L)										
1,1,2-Trichloro-1,2,2-trifluoroethane	.	.	<	<	.	.	.	.	.	.
Trichlorofluoromethane	.	.	<	<	.	.	.	.	.	.
1,2-Dichloropropane	<	<	<	<	<	<	<	<	<	<
1,4-Dichlorobenzene	.	.	<	<	.	.	.	.	.	.
2-Butanone	<	<	<	<	<	<	<	<	<	<
Acetone	<	<	.	45	<	<	<	<	<	<
Bromodichloromethane	<	<	<	<	<	<	<	<	<	<
Bromoform	<	<	<	<	<	<	<	<	<	<
Natural Attenuation (µg/L)										
Ethane	<	<	.	.	.	.	.	.	.	.
Ethylene	<	<	.	.	.	.	.	.	.	.
Methane	666	729	.	.	.	.	.	.	.	.

APPENDIX E.2: CY 2009 MONITORING DATA FOR THE UPPER EAST FORK POPLAR CREEK HYDROGEOLOGIC REGIME
Volatile Organic Compounds

Sampling Point	GW-618	GW-633	GW-656	GW-658	GW-686	GW-690	GW-691			GW-692
Functional Area	EXP-E	RG	T0134	FF	CPT	CPT	CPT			CPT
Date Sampled	03/30/09	04/28/09	05/12/09	08/13/09	05/13/09	05/13/09	05/12/09	10/20/09		05/12/09
Program	BJC	GWPP	GWPP	BJC	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP
Sample Type			PDB						Dup	
Chloroethenes (µg/L)										
Tetrachloroethene	2.34 J	190	32	<	6	65	14 Q	5	4 J	7
Trichloroethene	7.81	7	2,700	<	4 J	2 J	<Q	<	<	1 J
cis-1,2-Dichloroethene	12	12	150	<	3 J	3 J	<Q	<	<	17
trans-1,2-Dichloroethene	<	<	19	<	<	<	<	<	<	<
1,1-Dichloroethene	<	2 J	150	<	<	<	<	<	<	<
Vinyl chloride	<	<	<	<	<	<	<	<	<	<
Chloroethanes (µg/L)										
1,1,1,2-Tetrachloroethane	.	<	.	.	<	<	<	<	<	<
1,1,1-Trichloroethane	<	<	<	<	<	<	<	<	<	<
1,2-Dichloroethane	<	<	<	373	<	<	<	<	<	<
1,1-Dichloroethane	<	<	12	<	<	<	<	<	<	<
Chloroethane	<	<	<	<	<	<	<	<	<	<
Chloromethanes (µg/L)										
Carbon tetrachloride	<	<	<	<	<	<	<	<	<	<
Chloroform	<	13	<	<	<	<	21 Q	<	<	4 J
Methylene chloride	<	18	<	<	<	<	<	<	<	<
Petrol. Hydrocarb. (µg/L)										
Benzene	<	2,100	<	8,110	<	<	<	<	<	<
Ethylbenzene	<	<	<	837	<	<	<	<	<	<
Toluene	<	<	<	2,110	<	<	<	<	<	<
Total Xylene	<	33	<	6,670	<	<	<	<	<	<
Styrene	<	<	.	<	<	<	<	<	<	<
Miscellaneous (µg/L)										
1,1,2-Trichloro-1,2,2-trifluoroethane	.	<	<	.	<	<	<	<	<	<
Trichlorofluoromethane	.	<	<	.	<	<	<	<	<	<
1,2-Dichloropropane	<	<	<	<	<	<	<	<	<	<
1,4-Dichlorobenzene	.	<	<	.	<	<	<	<	<	<
2-Butanone	<	<	<	<	<	<	<	<	<	<
Acetone	<	7 J	.	<	<	<	<	<	<	<
Bromodichloromethane	<	<	<	<	<	<	1 J	<	<	<
Bromoform	<	2 J	<	<	<	<	<	<	<	<
Natural Attenuation (µg/L)										
Ethane	<	.	.	.	.	.	.	.	.	.
Ethylene	<	.	.	.	.	.	.	.	.	.
Methane	12.7	.	.	.	.	.	.	.	.	.

APPENDIX E.2: CY 2009 MONITORING DATA FOR THE UPPER EAST FORK POPLAR CREEK HYDROGEOLOGIC REGIME
Volatile Organic Compounds

Sampling Point	GW-698			GW-700	GW-722-14		GW-722-17		GW-722-20	
Functional Area	B8110			B8110	EXP-J		EXP-J		EXP-J	
Date Sampled	04/29/09		10/21/09	07/28/09	03/02/09	09/02/09	03/02/09	09/02/09	03/02/09	09/02/09
Program	GWPP	GWPP	GWPP	GWPP	BJC	GWPP	BJC	GWPP	BJC	GWPP
Sample Type		Dup		PDB						
Chloroethenes (µg/L)										
Tetrachloroethene	100	100	14	17	3	4 J	4	1 J	8	3 J
Trichloroethene	280	270	35	10	1.04 J	1 J	<	<	1.72 J	<
cis-1,2-Dichloroethene	24	23	3 J	35	<	<	<	<	<	<
trans-1,2-Dichloroethene	<	<	<	<	<	<	<	<	<	<
1,1-Dichloroethene	<	<	<	<	<	<	<	<	<	<
Vinyl chloride	<	<	<	<	<	<	<	<	<	<
Chloroethanes (µg/L)										
1,1,1,2-Tetrachloroethane	<	<	<	.	.	<	.	<	.	<
1,1,1-Trichloroethane	<	<	<	<	<	<	<	<	<	<
1,2-Dichloroethane	<	<	<	<	<	<	<	<	<	<
1,1-Dichloroethane	<	<	<	<	<	<	<	<	<	<
Chloroethane	<	<	<	<	<	<	<	<	<	<
Chloromethanes (µg/L)										
Carbon tetrachloride	2 J	<	<	<	20.3	26	23	16	51.2	27
Chloroform	10	10	1 J	<	2.16 J	2 J	4.96 J	4 J	7.19	6
Methylene chloride	<	<	<	<	<	<	<	<	<	<
Petrol. Hydrocarb. (µg/L)										
Benzene	<	<	<	<	<	<	<	<	<	<
Ethylbenzene	<	<	<	<	<	<	<	<	<	<
Toluene	<	<	<	<	<	<	<	<	<	<
Total Xylene	<	<	<	<	<	<	<	<	<	<
Styrene	<	<	<	.	<	<	<	<	<	<
Miscellaneous (µg/L)										
1,1,2-Trichloro-1,2,2-trifluoroethane	12	13	2 J	<	.	<	.	<	.	<
Trichlorofluoromethane	<	<	<	<	.	<	.	<	.	<
1,2-Dichloropropane	<	<	<	<	<	<	<	<	<	<
1,4-Dichlorobenzene	<	<	<	<	.	<	.	<	.	<
2-Butanone	<	<	<	6	<	<	<	<	<	<
Acetone	<	<	<	.	<	<	<	<	<	3 J
Bromodichloromethane	<	<	<	<	<	<	<	<	<	<
Bromoform	<	<	<	<	<	<	<	<	<	<
Natural Attenuation (µg/L)										
Ethane	.	.	.	.	.	.	.	.	.	.
Ethylene	.	.	.	.	.	.	.	.	.	.
Methane	.	.	.	.	.	.	.	.	.	.

APPENDIX E.2: CY 2009 MONITORING DATA FOR THE UPPER EAST FORK POPLAR CREEK HYDROGEOLOGIC REGIME
Volatile Organic Compounds

Sampling Point	GW-722-22		GW-722-33		GW-733		GW-735	GW-744	GW-747	GW-750
Functional Area	EXP-J		EXP-J		EXP-J		EXP-J	GRIDK1	GRIDK2	EXP-J
Date Sampled	03/02/09	09/02/09	03/02/09	09/03/09	01/12/09	07/07/09	08/26/09	08/26/09	08/31/09	04/29/09
Program	BJC	GWPP	BJC	GWPP	BJC	BJC	GWPP	GWPP	GWPP	GWPP
Sample Type										
Chloroethenes (µg/L)										
Tetrachloroethene	3	2 J	<	<	<	<	<	<	1 J	<
Trichloroethene	1.26 J	<	<	<	<	<	<	<	<	<
cis-1,2-Dichloroethene	<	<	<	<	<	<	<	<	<	<
trans-1,2-Dichloroethene	<	<	<	<	<	<	<	<	<	<
1,1-Dichloroethene	<	<	<	<	<	<	<	<	<	<
Vinyl chloride	<	<	<	<	<	<	<	<	<	<
Chloroethanes (µg/L)										
1,1,1,2-Tetrachloroethane	.	<	.	<	.	.	<	<	<	<
1,1,1-Trichloroethane	<	<	<	<	<	<	<	<	<	<
1,2-Dichloroethane	<	<	<	<	<	<	<	<	<	<
1,1-Dichloroethane	<	<	<	<	<	<	<	<	<	<
Chloroethane	<	<	<	<	<	<	<	<	<	<
Chloromethanes (µg/L)										
Carbon tetrachloride	21.8	13	<	<	6.06	7.3	<	<	<	<
Chloroform	2.06 J	2 J	<	<	<	1	<	<	<	<
Methylene chloride	<	<	<	<	<	<	<	<	<	<
Petrol. Hydrocarb. (µg/L)										
Benzene	<	<	<	<	<	<	<	<	<	<
Ethylbenzene	<	<	<	<	<	<	<	<	<	<
Toluene	<	<	<	<	<	<	<	<	<	<
Total Xylene	<	<	<	<	<	.	<	<	<	<
Styrene	<	<	<	<	<	<	<	<	<	<
Miscellaneous (µg/L)										
1,1,2-Trichloro-1,2,2-trifluoroethane	.	<	.	<	.	.	<	<	<	<
Trichlorofluoromethane	.	<	.	<	.	.	<	<	<	<
1,2-Dichloropropane	<	<	<	<	<	<	<	<	<	<
1,4-Dichlorobenzene	.	<	.	<	.	.	<	<	<	<
2-Butanone	<	<	<	<	<	<	<	<	<	<
Acetone	<	8 J	<	<	<	<	<	<	<	<
Bromodichloromethane	<	<	<	<	<	<	<	<	<	<
Bromoform	<	<	<	<	<	<	<	<	<	<
Natural Attenuation (µg/L)										
Ethane	.	.	.	.	.	.	.	.	.	.
Ethylene	.	.	.	.	.	.	.	.	.	.
Methane	.	.	.	.	.	.	.	.	.	.

APPENDIX E.2: CY 2009 MONITORING DATA FOR THE UPPER EAST FORK POPLAR CREEK HYDROGEOLOGIC REGIME
Volatile Organic Compounds

Sampling Point	GW-762				GW-763	GW-765	GW-769	GW-769	GW-770	GW-775
Functional Area	**GRIDJ3**				**GRIDJ3**	**GRIDE1**	**GRIDG3**	**GRIDG3**	**GRIDG3**	**GRIDH3**
Date Sampled	**03/04/09**		**07/23/09**		**10/14/09**	**05/07/09**	**04/29/09**	**10/13/09**	**10/13/09**	**08/27/09**
Program	**BJC**	**BJC**	**BJC**	**BJC**	**GWPP**	**GWPP**	**GWPP**	**GWPP**	**GWPP**	**GWPP**
Sample Type		**Dup**		**Dup**			**PDB**	**PDB**	**PDB**	**PDB**
Chloroethenes (μg/L)										
Tetrachloroethene	2,460	2,430	2,090	2,140	<	<	22	9	<	<
Trichloroethene	172 J	180 J	101 J	145 J	<	<	7	4 J	<	4 J
cis-1,2-Dichloroethene	67.3 J	70.9 J	67.8 J	67.9 J	17	<	6	4 J	<	<
trans-1,2-Dichloroethene	3.1 J	3.08 J	3.04 J	2.64 J	<	<	<	<	<	<
1,1-Dichloroethene	54.2 J	56.9 J	52.8 J	52.4 J	<	<	2 J	2 J	<	<
Vinyl chloride	4.63	5.06	4.72	4.33	4	<	<	<	<	<
Chloroethanes (μg/L)										
1,1,1,2-Tetrachloroethane	.	.	.	.	<	<	.	.	.	.
1,1,1-Trichloroethane	1.37 J	1.59 J	1.5 J	1.6 J	<	<	<	<	<	<
1,2-Dichloroethane	<	<	<	<	<	<	<	<	<	<
1,1-Dichloroethane	11.5	11.6	13.1	12.9	<	<	<	<	<	<
Chloroethane	<	<	<	<	<	<	<	<	<	<
Chloromethanes (μg/L)										
Carbon tetrachloride	<	<	<	<	<	<	160	120	12	<
Chloroform	<	<	<	<	<	<	6	5 J	2 J	<
Methylene chloride	<	<	<	<	<	<	<	<	<	<
Petrol. Hydrocarb. (μg/L)										
Benzene	<	<	<	<	<	<	<	<	<	<
Ethylbenzene	<	<	<	<	<	<	<	<	<	<
Toluene	<	<	<	<	<	<	<	<	<	<
Total Xylene	<	<	<	<	<	<	<	<	<	<
Styrene	<	<	<	<	<	<	.	.	.	.
Miscellaneous (μg/L)										
1,1,2-Trichloro-1,2,2-trifluoroethane	.	.	.	.	<	<	2 J	<	<	<
Trichlorofluoromethane	.	.	.	.	<	<	<	<	<	<
1,2-Dichloropropane	<	<	<	<	<	<	<	<	<	<
1,4-Dichlorobenzene	.	.	.	.	<	<	<	<	<	<
2-Butanone	<	<	<	<	<	<	<	<	<	6
Acetone	<	<	<	<	<	<	.	.	.	.
Bromodichloromethane	<	<	<	<	<	<	<	<	<	<
Bromoform	<	<	<	<	<	<	<	<	<	<
Natural Attenuation (μg/L)										
Ethane	<	<	<	<	.	.	.	.	.	.
Ethylene	1.56 J	1.44 J	<	<	.	.	.	.	.	.
Methane	26.9	20.7	15.4	16.1	.	.	.	.	.	.

APPENDIX E.2: CY 2009 MONITORING DATA FOR THE UPPER EAST FORK POPLAR CREEK HYDROGEOLOGIC REGIME
Volatile Organic Compounds

Sampling Point	GW-776	GW-779	GW-781	GW-782	GW-783	GW-791	GW-802	GW-816	GW-820
Functional Area	GRIDH3	GRIDF2	GRIDE3	GRIDE3	GRIDE3	GRIDD2	FF	EXP-SR	B9201-2
Date Sampled	09/01/09	08/31/09	08/27/09	08/27/09	08/27/09	08/27/09	08/13/09	08/26/09	04/29/09
Program	GWPP	GWPP	GWPP	GWPP	GWPP	GWPP	BJC	GWPP	GWPP
Sample Type					PDB	PDB			PDB
Chloroethenes (μg/L)									
Tetrachloroethene	<	<	<	36	4 J	22	<	<	870
Trichloroethene	1 J	<	<	16	2 J	<	<	<	350
cis-1,2-Dichloroethene	<	<	<	8	1 J	<	<	<	490
trans-1,2-Dichloroethene	<	<	<	2 J	<	<	<	<	4 J
1,1-Dichloroethene	<	<	<	9	<	<	<	<	1 J
Vinyl chloride	<	<	<	<	<	<	<	<	<
Chloroethanes (μg/L)									
1,1,1,2-Tetrachloroethane	<	<	<	<	.	.	.	<	.
1,1,1-Trichloroethane	<	<	<	1 J	<	<	<	<	<
1,2-Dichloroethane	<	<	<	<	<	<	<	<	<
1,1-Dichloroethane	<	<	<	20	2 J	<	<	<	<
Chloroethane	<	<	<	<	<	<	<	<	<
Chloromethanes (μg/L)									
Carbon tetrachloride	<	<	<	4 J	<	<	<	<	<
Chloroform	<	<	<	<	<	<	<	<	<
Methylene chloride	<	<	<	<	<	<	<	<	<
Petrol. Hydrocarb. (μg/L)									
Benzene	<	<	<	<	<	<	<	<	<
Ethylbenzene	<	<	<	<	<	<	<	<	<
Toluene	<	<	<	<	<	<	<	<	<
Total Xylene	<	<	<	<	<	<	<	<	<
Styrene	<	<	<	<	.	.	<	<	.
Miscellaneous (μg/L)									
1,1,2-Trichloro-1,2,2-trifluoroethane	<	<	<	<	<	<	.	<	20
Trichlorofluoromethane	<	<	<	<	<	<	.	<	<
1,2-Dichloropropane	<	<	<	<	<	<	<	<	<
1,4-Dichlorobenzene	<	<	<	<	<	<	.	<	<
2-Butanone	<	<	<	<	<	<	<	<	<
Acetone	<	<	<	<	.	.	<	<	.
Bromodichloromethane	<	<	<	<	<	<	<	<	<
Bromoform	<	<	<	<	<	<	<	<	<
Natural Attenuation (μg/L)									
Ethane	.	.	.	.	.	.	.	.	.
Ethylene	.	.	.	.	.	.	.	.	.
Methane	.	.	.	.	.	.	.	.	.

APPENDIX E.2: CY 2009 MONITORING DATA FOR THE UPPER EAST FORK POPLAR CREEK HYDROGEOLOGIC REGIME
Volatile Organic Compounds

Sampling Point	GW-832		GW-959	GW-960	GHK2.51WSW	NPR12.0SW	NPR23.0SW
Functional Area	NHP		B9201-2	GRIDF2	EXP	EXP	EXP
Date Sampled	03/03/09	07/23/09	05/06/09	05/07/09	01/29/09	01/29/09	01/29/09
Program	BJC	BJC	GWPP	GWPP	GWPP	GWPP	GWPP
Sample Type							
Chloroethenes (μg/L)							
Tetrachloroethene	<	4	<	<	<	<	<
Trichloroethene	<	<	<	<	<	<	<
cis-1,2-Dichloroethene	<	<	9	<	<	<	<
trans-1,2-Dichloroethene	<	<	<	<	<	<	<
1,1-Dichloroethene	<	<	<	<	<	<	<
Vinyl chloride	<	<	<	<	<	<	<
Chloroethanes (μg/L)							
1,1,1,2-Tetrachloroethane	.	.	<	<	<	<	<
1,1,1-Trichloroethane	<	<	<	<	<	<	<
1,2-Dichloroethane	<	<	<	<	<	<	<
1,1-Dichloroethane	<	<	<	<	<	<	<
Chloroethane	<	<	<	<	<	<	<
Chloromethanes (μg/L)							
Carbon tetrachloride	<	6.77	<	<	<	<	<
Chloroform	<	1.49 J	<	<	<	<	<
Methylene chloride	<	<	<	<	<	<	<
Petrol. Hydrocarb. (μg/L)							
Benzene	<	<	<	<	<	<	<
Ethylbenzene	<	<	<	<	<	<	<
Toluene	<	<	<	<	<	<	<
Total Xylene	<	<	<	<	<	<	<
Styrene	<	<	<	<	<	<	<
Miscellaneous (μg/L)							
1,1,2-Trichloro-1,2,2-trifluoroethane	.	.	<	<	<	<	<
Trichlorofluoromethane	.	.	<	<	<	<	<
1,2-Dichloropropane	<	<	<	<	<	<	<
1,4-Dichlorobenzene	.	.	<	<	<	<	<
2-Butanone	<	<	<	<	<	<	<
Acetone	<	<	<	<	<	<	<
Bromodichloromethane	<	<	<	<	<	<	<
Bromoform	<	<	<	<	<	<	<
Natural Attenuation (μg/L)							
Ethane	<	<	.	.	.	.	.
Ethylene	<	<	.	.	.	.	.
Methane	<	5.18	.	.	.	.	.

APPENDIX E.2: CY 2009 MONITORING DATA FOR THE UPPER EAST FORK POPLAR CREEK HYDROGEOLOGIC REGIME
Volatile Organic Compounds

Sampling Point	SCR7.1SP	SCR7.8SP	SP-17	
Functional Area	EXP-SW	EXP-SW	EXP-SW	
Date Sampled	02/05/09	02/05/09	08/03/09	
Program	BJC	BJC	GWPP	GWPP
Sample Type				Dup
Chloroethenes (μg/L)				
Tetrachloroethene	<	<	<	<
Trichloroethene	<	<	<	<
cis-1,2-Dichloroethene	<	<	<	<
trans-1,2-Dichloroethene	<	<	<	<
1,1-Dichloroethene	<	<	<	<
Vinyl chloride	<	<	<	<
Chloroethanes (μg/L)				
1,1,1,2-Tetrachloroethane	.	.	<	<
1,1,1-Trichloroethane	<	<	<	<
1,2-Dichloroethane	<	<	<	<
1,1-Dichloroethane	<	<	<	<
Chloroethane	<	<	<	<
Chloromethanes (μg/L)				
Carbon tetrachloride	<	<	<	<
Chloroform	<	<	<	<
Methylene chloride	<	<	<	<
Petrol. Hydrocarb. (μg/L)				
Benzene	<	<	<	<
Ethylbenzene	<	<	<	<
Toluene	<	<	<	<
Total Xylene	<	<	<	<
Styrene	<	<	<	<
Miscellaneous (μg/L)				
1,1,2-Trichloro-1,2,2-trifluoroethane	.	.	<	<
Trichlorofluoromethane	.	.	<	<
1,2-Dichloropropane	<	<	<	<
1,4-Dichlorobenzene	.	.	<	<
2-Butanone	<	<	<	<
Acetone	<	<	<	<
Bromodichloromethane	<	<	<	<
Bromoform	<	<	<	<
Natural Attenuation (μg/L)				
Ethane	.	.	.	.
Ethylene	.	.	.	.
Methane	.	.	.	.

APPENDIX E.3

RADIOLOGICAL ANALYTES

APPENDIX E.3: CY 2009 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
55-2B	GRIDB3	10/26/09	GWPP	<	.	4	22	5	7.7
55-3A	B9201-5	05/14/09	GWPP	<	.	4.4	<	.	6.9
55-3A	B9201-5	10/20/09	GWPP	<	.	4.5	<	.	7.7
55-3B	B9201-5	05/14/09	GWPP	<	.	2.6	<	.	5.7
55-3B	B9201-5	10/21/09	GWPP	<	.	3	<	.	6.3
55-3C	B9201-5	05/13/09	GWPP	<	.	3	<	.	6.7
55-3C	B9201-5	10/21/09	GWPP	<	.	3.4	9	3.6	5.6
56-1A	Y12	07/28/09	GWPP	<	.	2.7	6	3.3	5.7
56-1C	Y12	07/28/09	GWPP	8.9	3.8	3.4	<	.	6.9
56-1C Dup	Y12	07/28/09	GWPP	<	.	2.5	<	.	7.4
56-2A	GRIDC3	07/29/09	GWPP	7.4	3.6	3.7	<	.	7.4
56-2B	GRIDC3	07/29/09	GWPP	5.3	3.2	4	<	.	6.5
56-3A	Y12	07/30/09	GWPP	<	.	3.2	<	.	6.5
56-3B	Y12	07/29/09	GWPP	9.4	3.5	2.9	<	.	7
56-3C	Y12	07/30/09	GWPP	<	.	4	<	.	7
56-4A NP	Y12	05/12/09	GWPP	<	.	2.2	<	.	7.2
GW-108	S3	01/12/09	BJC	186	75	101	16,200	2,600	101
GW-108	S3	07/08/09	BJC	<	.	61.2	13,400	2,140	108
GW-151	NHP	03/03/09	BJC	<	.	2.45	<	.	4.34
GW-151	NHP	07/23/09	BJC	<	.	2.51	5.29	2.5	4.63
GW-154	NHP	03/03/09	BJC	433	70.7	3.17	133	22.2	7.34
GW-154	NHP	07/23/09	BJC	354	59.5	3.55	68	12.8	8.9
GW-169	EXP-UV	03/04/09	BJC	4.66	1.94	2.26	6.09	2.07	3.36
GW-169	EXP-UV	07/23/09	BJC	<	.	2.21	7.44	2.53	3.96
GW-170	EXP-UV	03/04/09	BJC	<	.	3.98	12	4	5.03
GW-170 Dup	EXP-UV	03/04/09	BJC	<	.	2.98	11	3	5.01
GW-170	EXP-UV	07/23/09	BJC	<	.	2.31	14	3.37	3.93
GW-170 Dup	EXP-UV	07/23/09	BJC	<	.	2.91	12	3.16	4.22
GW-204	T0134	05/12/09	GWPP	35	4.7	3	7	3.9	6.4
GW-219	UOV	05/11/09	GWPP	140	9.4	2.9	82	8	7
GW-222	NHP	04/30/09	GWPP	70	6.7	3.1	21	5	8
GW-222 Dup	NHP	04/30/09	GWPP	69	7.2	4	38	6	7
GW-223	NHP	03/03/09	BJC	11.3	3.49	2.87	11.6	3.3	4.72
GW-223	NHP	07/22/09	BJC	12.6	3.41	2.38	8.23	2.82	4.55
GW-251	S2	04/30/09	GWPP	9.4	3.4	2.9	<	.	6.9
GW-253	S2	03/04/09	BJC	23.7	5.6	4.65	25	6	7.07
GW-270	SY	04/28/09	GWPP	7.3	3.9	3.4	<	.	7.6
GW-272	SY	04/21/09	GWPP	<	.	10	14	8.1	14
GW-274	SY	04/21/09	GWPP	<	.	0.024	3.4 Q	0.094	0.036
GW-274 Dup	SY	04/21/09	GWPP	<	.	0.023	3.5 Q	0.1	0.045
GW-275	SY	04/27/09	GWPP	<	.	0.21	<	.	0.36
GW-380	NHP	03/04/09	BJC	4.69	1.78	1.68	6.01	2.09	3.43
GW-380	NHP	07/23/09	BJC	2.74	1.48	1.92	5.69	2.47	4.46
GW-382	NHP	03/04/09	BJC	<	.	2	<	.	4.18
GW-382	NHP	07/23/09	BJC	<	.	1.17	6.18	2.15	3.31
GW-505	RG	04/20/09	GWPP	67 Q	5.6	2.3	18	4.3	5.8
GW-505 Dup	RG	04/20/09	GWPP	64 Q	5.5	3	18	4.2	5.8

APPENDIX E.3: CY 2009 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-605	EXP-I	01/08/09	BJC	71	12.8	2.47	25.3	5.2	4.76
GW-605 Dup	EXP-I	01/08/09	BJC	76.5	14.4	2.64	26.1	5.52	4.96
GW-605	EXP-I	07/07/09	BJC	51.8	9.74	2.34	13.8	3.59	4.65
GW-605 Dup	EXP-I	07/07/09	BJC	49.2	9.32	1.81	12.7	3.36	4.36
GW-606	EXP-I	01/08/09	BJC	7.4	2.13	1.9	5.17	1.98	3.36
GW-606	EXP-I	07/07/09	BJC	8.61	2.7	2.04	7.75	2.73	4.45
GW-618	EXP-E	03/30/09	BJC	<	.	3.07	<	.	3.73
GW-633	RG	04/28/09	GWPP	<	.	0.018	1.7 Q	0.058	0.024
GW-722-14	EXP-J	09/02/09	GWPP	<	.	2.8	5.7	2.8	4.5
GW-722-17	EXP-J	09/02/09	GWPP	<	.	2.4	<	.	5.1
GW-722-20	EXP-J	09/02/09	GWPP	<	.	3.3	<	.	6.5
GW-722-22	EXP-J	09/02/09	GWPP	<	.	2.6	<	.	5.2
GW-722-33	EXP-J	09/03/09	GWPP	<	.	1.1	<	.	4.8
GW-733	EXP-J	01/12/09	BJC	<	.	2.92	<	.	3.44
GW-733	EXP-J	07/07/09	BJC	<	.	1.76	<	.	3.22
GW-735	EXP-J	08/26/09	GWPP	<	.	3.2	<	.	6.9
GW-744	GRIDK1	08/26/09	GWPP	<	.	3.5	<	.	6.6
GW-747	GRIDK2	08/31/09	GWPP	<	.	3	<	.	6
GW-750	EXP-J	04/29/09	GWPP	6	3	2.6	9	4	7.2
GW-762	GRIDJ3	03/04/09	BJC	<	.	1.89	3.64	1.92	3.62
GW-762 Dup	GRIDJ3	03/04/09	BJC	<	.	2.41	4	1.99	3.73
GW-762	GRIDJ3	07/23/09	BJC	<	.	2.85	16	3.97	5.04
GW-762 Dup	GRIDJ3	07/23/09	BJC	<	.	1.44	9.8	2.76	3.82
GW-765	GRIDE1	05/07/09	GWPP	<	.	4	<	.	7
GW-776	GRIDH3	09/01/09	GWPP	<	.	2.3	<	.	6
GW-779	GRIDF2	08/31/09	GWPP	<	.	2.9	<	.	5.9
GW-781	GRIDE3	08/27/09	GWPP	<	.	1.8	6.1	3.5	6.1
GW-782	GRIDE3	08/27/09	GWPP	13	3.6	2.8	<	.	5.7
GW-816	EXP-SR	08/26/09	GWPP	<	.	2.8	<	.	6.7
GW-832	NHP	03/03/09	BJC	2.98	1.63	2.4	8.44	2.77	4.43
GW-832	NHP	07/23/09	BJC	4.26	2.01	2.27	6.74	2.53	4.22
GW-959	B9201-2	05/06/09	GWPP	<	.	4	<	.	6.9
GW-960	GRIDF2	05/07/09	GWPP	<	.	3.2	5.8	3.3	5.5
GHK2.51WSW	EXP	01/29/09	GWPP	<	.	2.1	<	.	5.9
NPR12.0SW	EXP	01/29/09	GWPP	2.2 R	2.3	2	5.8	3.1	5.5
NPR23.0SW	EXP	01/29/09	GWPP	<	.	2.6	<	.	5.5
SP-17	EXP-SW	08/03/09	GWPP	<	.	3.2	<	.	6.5
SP-17 Dup	EXP-SW	08/03/09	GWPP	<	.	3	<	.	7.5
STATION 8	EXP-SW	01/06/09	BJC	12.9	3.09	1.55	6.97	2.21	3.33
STATION 8	EXP-SW	01/22/09	BJC	5.24	1.98	2	4.81	2	3.46
STATION 8	EXP-SW	08/19/09	BJC	11.1	3.29	2.32	8.99	2.76	4.14
STATION 8	EXP-SW	09/10/09	BJC	<	.	1.91	4.81	1.89	3.28

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-151					
Functional Area	S3						NHP					
Date Sampled	01/12/09			07/08/09			03/03/09			07/23/09		
Program	BJC			BJC			BJC			BJC		
Sample Type												
Result (pCi/L)	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA
Gross Alpha	186	75	101	<	.	61.2	<	.	2.45	<	.	2.51
Gross Beta	16,200	2,600	101	13,400	2,140	108	<	.	4.34	5.29	2.5	4.63
Technetium-99	80,000	12,800	515	29,000	4,620	25.6	.	.	.	.	.	.
Uranium-234	.	.	.	.	.	.	0.73	0.507	0.555	<	.	0.494
Uranium-235	.	.	.	.	.	.	<	.	0.405	<	.	0.188
Uranium-238	.	.	.	.	.	.	<	.	0.405	<	.	0.188

Sampling Point	GW-154						GW-193					
Functional Area	NHP						T2331					
Date Sampled	03/03/09			07/23/09			01/13/09			07/07/09		
Program	BJC			BJC			BJC			BJC		
Sample Type												
Result (pCi/L)	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA
Gross Alpha	433	70.7	3.17	354	59.5	3.55	.	.	.	.	.	.
Gross Beta	133	22.2	7.34	67.6	12.8	8.9	.	.	.	.	.	.
Technetium-99	.	.	.	.	.	.	<	.	10.7	<	.	6.77
Uranium-234	406	68.2	1.74	294	48.9	1.18	.	.	.	.	.	.
Uranium-235	23.6	5.77	1.54	17	3.77	0.823	.	.	.	.	.	.
Uranium-238	218	37.8	1.38	169	28.6	0.824	.	.	.	.	.	.

Sampling Point	GW-204			GW-219			GW-223					
Functional Area	T0134			UOV			NHP					
Date Sampled	05/12/09			05/11/09			03/03/09			07/22/09		
Program	GWPP			GWPP			BJC			BJC		
Sample Type												
Result (pCi/L)	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA
Gross Alpha	35	4.7	3	140	9.4	2.9	11.3	3.49	2.87	12.6	3.41	2.38
Gross Beta	7.3	3.9	6.4	82	8.1	7	11.6	3.3	4.72	8.23	2.82	4.55
Technetium-99	.	.	.	.	.	.	.	.	.	.	.	.
Uranium-234	25	3.6	4.3	26	3.5	4.3	4.86	1.41	0.378	6.49	1.65	0.415
Uranium-235	0.85	0.4	0.43	2	0.55	0.4	0.538	0.4	0.322	0.725	0.448	0.343
Uranium-238	16	2.2	0.31	190	19	0.29	13.2	2.87	0.458	15.3	3.15	0.415

Sampling Point	GW-605											
Functional Area	EXP-I											
Date Sampled	01/08/09						07/07/09					
Program	BJC						BJC					
Sample Type				Dup						Dup		
Result (pCi/L)	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA
Gross Alpha	71	12.8	2.47	76.5	14.4	2.64	51.8	9.74	2.34	49.2	9.32	1.81
Gross Beta	25.3	5.2	4.76	26.1	5.52	4.96	13.8	3.59	4.65	12.7	3.36	4.36
Technetium-99	<	.	10.3	<	.	10.7	<	.	6.45	<	.	6.85
Uranium-234	.	.	.	.	.	.	.	.	.	.	.	.
Uranium-235	.	.	.	.	.	.	.	.	.	.	.	.
Uranium-238	.	.	.	.	.	.	.	.	.	.	.	.

Sampling Point	GW-606						GW-733					
Functional Area	EXP-I						EXP-J					
Date Sampled	01/08/09			07/07/09			01/12/09			07/07/09		
Program	BJC			BJC			BJC			BJC		
Sample Type												
Result (pCi/L)	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA
Gross Alpha	7.4	2.13	1.9	8.61	2.7	2.04	<	.	2.92	<	.	1.76
Gross Beta	5.17	1.98	3.36	7.75	2.73	4.45	<	.	3.44	<	.	3.22
Technetium-99	<	.	10.9	<	.	6.54	<	.	10.2	<	.	6.31
Uranium-234	.	.	.	.	.	.	.	.	.	.	.	.
Uranium-235	.	.	.	.	.	.	.	.	.	.	.	.
Uranium-238	.	.	.	.	.	.	.	.	.	.	.	.

Sampling Point	GW-832						STATION 8					
Functional Area	NHP						EXP-SW					
Date Sampled	03/03/09			07/23/09			01/06/09			01/22/09		
Program	BJC			BJC			BJC			BJC		
Sample Type												
Result (pCi/L)	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA
Gross Alpha	2.98	1.63	2.4	4.26	2.01	2.27	12.9	3.09	1.55	5.24	1.98	2
Gross Beta	8.44	2.77	4.43	6.74	2.53	4.22	6.97	2.21	3.33	4.81	2	3.46
Technetium-99	.	.	.	.	.	.	.	.	.	.	.	.
Uranium-234	1.56	0.705	0.445	1.04	0.543	0.432	3.35	1.07	0.667	1.91	0.787	0.319
Uranium-235	<	.	0.313	<	.	0.457	0.592	0.434	0.574	0.193 R	0.242	0.185
Uranium-238	2.24	0.863	0.41	2.27	0.834	0.372	13.2	2.76	0.401	4.09	1.24	0.185

Sampling Point	STATION 8					
Functional Area	EXP-SW					
Date Sampled	08/19/09			09/10/09		
Program	BJC			BJC		
Sample Type						
Result (pCi/L)	Activity	TPU	MDA	Activity	TPU	MDA
Gross Alpha	11.1	3.29	2.32	<	.	1.91
Gross Beta	8.99	2.76	4.14	4.81	1.89	3.28
Technetium-99	.	.	.	.	.	.
Uranium-234	4.24	1.25	0.543	1.11	0.595	0.526
Uranium-235	<	.	0.346	<	.	0.501
Uranium-238	11.1	2.46	0.386	1.32	0.648	0.501

APPENDIX F

CY 2009 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:

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
PDB	-	passive diffusion bag 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	0.01	Bicarbonate	1.0	NS
Magnesium	0.2	0.05	Carbonate	1.0	NS
Potassium	2.0	0.025	Chloride	0.2	0.1
Sodium	0.2	0.01	Fluoride	0.1	0.05
			Nitrate (as Nitrogen)	0.05	0.1
			Sulfate	0.25	0.1
Note: NS = not specified					

The Y-12 GWPP SAP (B&W Y-12 2008) 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 2009a) 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	0.00005	0.0002
Barium	0.004	0.005	Molybdenum	0.05	NS
Beryllium	0.0005	0.001	**Nickel**	0.005**	0.01
Boron	0.1	0.01*	Selenium	0.01**	0.0025*
Cadmium	0.0025**	0.00013*	Silver	0.02	0.0015*
Chromium	0.01**	0.005*	**Strontium**	0.005	0.005
Cobalt	0.02	0.005*	**Thallium**	0.0005**	0.001
Copper	0.02	0.005*	Thorium	0.2	NS
Iron	0.05	0.01*	**Uranium**	0.0005**	0.004
Lead	0.0005**	0.002	Vanadium	0.02	0.01*
			Zinc	0.05	0.01*

Note: * - the GWPP reporting limit is used instead of the BJC reporting limit; ** - samples collected after June 2009 were diluted (additional 2X) before analysis which doubled the reporting limit; “NS” - not specified.

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

Surface Water Station	Mercury Concentration (mg/L) by Method EPA-1631	
	03/18/09	09/03/09
MCK 2.0	0.0000027	0.0000016
MCK 1.4	0.0000006	0.0000008

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)

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, 20 compounds were detected in groundwater samples collected in the Chestnut Ridge Regime during CY 2009. 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	14	75	1,1,2-Trichloro-1,2,2-trifluoroethane	3	3
1,1-Dichloroethene	14	53	Benzene	3	0.061 J
1,1,1-Trichloroethane	14	21	1,2-Dichloroethane	2	0.12 J
Trichlorofluoromethane	9	32	Carbon disulfide	2	0.038 J
Chloromethane	8	1 J	Chloroethane	1	0.25 J
Tetrachloroethene	7	15	trans-1,2-Dichloroethene	1	0.16 J
Chloroform	7	0.13 J	1,4-Dichlorobenzene	1	0.12 J
cis-1,2-Dichloroethene	4	13	Toluene	1	0.11 J
Trichloroethene	4	6.8 Q	Carbon tetrachloride	1	0.059 J
Acetone	4	2 J	Total Xylene	1	0.056 J

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

- . - Not analyzed
- < - Analyzed but not detected at the project reporting level
- J - Positively identified; estimated concentration
- Q - Inconsistent with historical measurements for a sampling location

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 2009 in the Chestnut Ridge Regime.

Analyte	No. of Results	No. Detected	Analyte	No. of Results	No. Detected
Gross Alpha	82	17	Strontium-89/90	8	0
Gross Beta	72	19	Technetium-99	2	0
Cesium-137	4	0	Uranium-234	8	3
Cobalt-60	4	0	Uranium-235	8	0
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

APPENDIX F.1

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

APPENDIX F.1: CY 2009 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	03/05/09	07/27/09	01/29/09	07/16/09	01/08/09	01/06/09	01/08/09	01/13/09		01/13/09
Program	BJC	BJC	BJC	BJC	BJC	BJC	BJC	BJC	BJC	BJC
Sample Type									Dup	
Field Measurements										
Time Sampled	11:20	10:40	10:20	9:50	10:10	14:00	14:00	10:35	.	9:55
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)	49.06	54.97	94.04	96.27	78.07	79.77	14.42	142.31	.	116.96
Groundwater Elevation (ft)	1,055.42	1,049.51	1,092.19	1,089.96	835.91	833.77	825.82	906.97	.	934.42
Conductivity (μmho/cm)	479	652	309	565	355	280	394	536	.	533
Dissolved Oxygen (ppm)	1.92	2.15	8.1	7.38	18.05	6.55	2.59	15.04	.	3.62
Oxidation/Reduction (mV)	132	182	117	180	-103	132	167	171	.	135
Temperature (degrees C)	15.7	18.1	11.9	18.3	9.9	14.4	12.4	11.7	.	9.9
Turbidity (NTU)	1	1	1	1	2	1	1	0	.	1
pH	7.3	7.11	7.42	6.96	7.44	7.4	7.26	6.69	.	6.98
Miscellaneous Analytes										
Dissolved Solids (mg/L)	412	283	191	207	261	221	284	380	382	180
Suspended Solids (mg/L)	<	<	<	<	<	<	<	11	<	<
Major Ions (mg/L)										
Calcium	55.8	52.8	42.2	39	28.2	46.5	42	68.2	67.9	41.2
Magnesium	32.4	29.7	26.7	23.7	23.5	16	33.8	41.4	41.2	25.2
Potassium	0.896	0.942	<	<	17.1	1.4	11.7	19.8	19.6	0.947
Sodium	6.43	6.82	<	<	21.4	1.33	3.83	4.7	4.68	0.512
Bicarbonate	277	265	200	187	.	.	.	.	.	.
Carbonate	<	<	<	<	.	.	.	.	.	.
Chloride	13.1	17.8	<	<	.	.	.	.	.	.
Fluoride	<	<	<	<	.	.	.	.	.	.
Nitrate as N	0.7	0.32	<	<	.	.	.	.	.	.
Sulfate	3.1	3.72	<	<	.	.	.	.	.	.
Charge balance error (%)	-2.3	-4.4	3.7	2.1	.	.	.	.	.	.
Trace Metals (mg/L)										
Aluminum	<	<	<	<	<	<	<	<	<	<
Arsenic	<	<	<	<	<	<	<	<	<	<
Barium	0.0273	0.0266	0.014	0.017	0.0456	0.0408	0.09	0.0316	0.0312	0.0122
Boron	<	<	<	<	0.83	<	0.235	<	<	<
Chromium	<	<	<	0.067	<	<	<	<	<	<
Iron	<	<	<	<	0.894	0.0573	<	<	<	<
Lead	<	<	<	<	<	<	<	<	<	<
Lithium	<	<	.	.	0.276	0.0215	0.102	<	<	<
Manganese	<	<	<	<	0.0117	0.00556	0.00852	<	<	<
Nickel	<	<	<	0.023	<	<	<	<	<	<
Strontium	0.025	0.025	0.014	0.013	2.82	0.13	6.65	0.026	0.026	0.0195
Thallium	<	<	<	<	<	<	<	<	<	<
Uranium	<	<	<	<	<	<	0.01	<	<	<

APPENDIX F.1: CY 2009 MONITORING DATA FOR THE CHESTNUT RIDGE HYDROGEOLOGIC REGIME
Field Measurements, Miscellaneous Analytes, Major Ions, and Trace Metals

Sampling Point	GW-161		GW-175	GW-177		GW-203		GW-205		
Functional Area	ECRWP		CRSP	CRSP		UNCS		UNCS		
Date Sampled	01/14/09	07/08/09	12/15/09	01/14/09	07/09/09	03/05/09	07/27/09	03/05/09	07/27/09	10/15/09
Program	BJC	BJC	GWPP	BJC	BJC	BJC	BJC	BJC	BJC	BJC
Sample Type										
Field Measurements										
Time Sampled	10:20	14:40	10:10	10:00	10:05	11:00	14:10	11:15	15:10	13:50
Measuring Point Elev. (ft)	1,093.54	1,093.54	1,084.19	1,158.20	1,158.20	1,105.45	1,105.45	1,104.14	1,104.14	1,104.14
Depth to Water (ft)	156.38	159.98	109.81	117.47	117.95	82.96	78.99	78.95	76.41	75.88
Groundwater Elevation (ft)	937.16	933.56	974.38	1,040.73	1,040.25	1,022.49	1,026.46	1,025.19	1,027.73	1,028.26
Conductivity (μmho/cm)	280	565	460	615	569	271	374	320	430	430
Dissolved Oxygen (ppm)	1.13	0.62	3.74	3.73	3.06	10.19	4.62	3.02	8.16	1.82
Oxidation/Reduction (mV)	3	-76	209	161	184	86	168	54	-92	14
Temperature (degrees C)	11.4	17.8	12.9	8.9	19.4	14.6	20.5	14	21	16.8
Turbidity (NTU)	28	16	.	2	2	7	1	4	2	1
pH	7.42	6.65	7.09	6.96	7.44	7.46	7.73	9.41	10.05	9.87
Miscellaneous Analytes										
Dissolved Solids (mg/L)	.	.	.	241	250	180	164	194	243	.
Suspended Solids (mg/L)	.	.	.	<	<	7	<	<	<	.
Major Ions (mg/L)										
Calcium	38.8	39	.	49.9	49	35.6	28.6	1.27	1.66	.
Magnesium	24.3	24	.	29.8	29	19.9	15.7	12.5	12.7	.
Potassium	4.1	3.9	.	4.18	2.8	0.912	0.75	78.2	72	.
Sodium	2.92	3	.	1.35	1.1	0.719	0.5	10.9	9.94	.
Bicarbonate	241	200	.	.	.	186	147	55.4	92.9	.
Carbonate	<	<	.	.	.	<	<	119	76.8	.
Chloride	3	2.9	.	.	.	3.2	1.81	2.6	2.88	.
Fluoride	<	<	.	.	.	<	3.81	<	<	.
Nitrate as N	0.03	<	.	.	.	0.44	0.48	0.072	0.07	.
Sulfate	0.45	<	.	.	.	1.9	0.9	4	4.44	.
Charge balance error (%)	-8.2	0.9	.	.	.	-5.6	-8.1	-1.5	-4	.
Trace Metals (mg/L)										
Aluminum	<	<	.	<	<	0.28	<	<	<	.
Arsenic	<	<	.	<	<	<	<	<	<	.
Barium	0.00799	0.0077	.	0.0183	0.019	0.013	0.00924	<	<	.
Boron	<	<	.	<	<	<	<	<	<	.
Chromium	<	<	.	0.0144	<	<	<	<	<	.
Iron	2.31	2.3	.	<	<	0.246	<	<	<	.
Lead	<	<	.	<	<	<	<	<	<	.
Lithium	<	<	.	<	<	<	<	0.128	0.119	.
Manganese	0.0257	0.04	.	<	0.043	<	<	<	<	.
Nickel	<	<	.	0.0119	0.01	<	<	<	<	.
Strontium	0.016	0.017	.	0.0208	0.02	0.0124	0.0111	<	<	.
Thallium	<	<	.	<	<	<	<	<	<	.
Uranium	<	<	.	<	<	<	<	<	<	.

APPENDIX F.1: CY 2009 MONITORING DATA FOR THE CHESTNUT RIDGE HYDROGEOLOGIC REGIME
Field Measurements, Miscellaneous Analytes, Major Ions, and Trace Metals

Sampling Point	GW-217		GW-221		GW-231		GW-294			
Functional Area	LIV		UNCS		KHQ		ECRWP			
Date Sampled	01/28/09	07/13/09	03/05/09	07/27/09	01/12/09		01/14/09		07/08/09	
Program	BJC	BJC	BJC	BJC	BJC	BJC	BJC	BJC	BJC	BJC
Sample Type						Dup		Dup		Dup
Field Measurements										
Time Sampled	10:30	14:00	10:00	15:45	14:20	.	15:15	.	10:30	.
Measuring Point Elev. (ft)	1,177.03	1,177.03	1,106.16	1,106.16	849.67	.	1,083.60	.	1,083.60	.
Depth to Water (ft)	107.10	111.61	85.46	80.40	11.48	.	93.91	.	97.33	.
Groundwater Elevation (ft)	1,069.93	1,065.42	1,020.70	1,025.76	838.19	.	989.69	.	986.27	.
Conductivity (μmho/cm)	556	472	262	362	506	.	374	.	725	.
Dissolved Oxygen (ppm)	7.27	7.29	5.63	4.56	4.8	.	13.91	.	6.94	.
Oxidation/Reduction (mV)	139	184	126	176	169	.	197	.	159	.
Temperature (degrees C)	12.8	21.5	15.3	18.3	13.2	.	11.4	.	17.6	.
Turbidity (NTU)	1	1	1	2	1	.	0	.	1	.
pH	7.17	8.05	7.7	7.59	6.68	.	7.01	.	6.51	.
Miscellaneous Analytes										
Dissolved Solids (mg/L)	182	196	181	156	179	201	.	.	.	.
Suspended Solids (mg/L)	<	<	<	<	<	<	.	.	.	.
Major Ions (mg/L)										
Calcium	36.4	36.2	31	29	40.4	40.5	50.7	51.2	54	54
Magnesium	23.5	21.9	18.3	16.6	19.8	19.9	30.4	30.8	32	32
Potassium	<	<	0.901	0.984	1.1	1.1	1.31	1.33	1.1	1.1
Sodium	4.9	4.1	0.432	0.435	0.674	0.657	4.1	4.04	3.7	3.9
Bicarbonate	180	184	210	158	.	.	283	312	250	250
Carbonate	<	<	<	<	.	.	<	<	<	<
Chloride	<	<	1.5	1.75	.	.	7.7	7.4	7	7.1
Fluoride	<	<	<	<	.	.	<	<	<	<
Nitrate as N	<	<	0.47	0.21	.	.	2.5	1.9	1.6	1.6
Sulfate	5.3	<	1.5	1.58	.	.	2.3	2.2	2.5	2.3
Charge balance error (%)	3.3	1.4	-16.4	-6.5	.	.	-7.6	.	1.4	.
Trace Metals (mg/L)										
Aluminum	<	<	<	<	<	<	<	<	<	<
Arsenic	<	<	<	<	<	<	<	<	<	<
Barium	0.03	0.033 J	0.0075	0.00729	0.0718	0.0708	0.011	0.011	0.011	0.011
Boron	<	<	<	<	<	<	<	<	<	<
Chromium	<	<	<	<	<	<	<	<	<	<
Iron	<	<	<	<	<	<	<	<	<	<
Lead	<	<	<	<	<	<	<	<	<	<
Lithium	.	.	<	<	<	<	<	<	<	<
Manganese	<	<	<	<	<	<	<	<	<	<
Nickel	<	<	<	<	<	<	<	<	<	<
Strontium	0.017	0.017	0.00988	0.00996	0.0452	0.0446	0.0238	0.0238	0.025	0.025
Thallium	<	<	<	<	<	<	<	<	<	<
Uranium	<	<	<	<	<	<	<	<	<	<

APPENDIX F.1: CY 2009 MONITORING DATA FOR THE CHESTNUT RIDGE HYDROGEOLOGIC REGIME
Field Measurements, Miscellaneous Analytes, Major Ions, and Trace Metals

Sampling Point	GW-296		GW-298		GW-301				GW-305	
Functional Area	**ECRWP**		**ECRWP**		**CRBAWP**				**LIV**	
Date Sampled	**01/14/09**	**07/08/09**	**01/13/09**	**07/08/09**	**01/14/09**		**07/08/09**		**01/28/09**	**07/09/09**
Program	**BJC**	**BJC**	**BJC**	**BJC**	**BJC**	**BJC**	**BJC**	**BJC**	**BJC**	**BJC**
Sample Type						**Dup**		**Dup**		
Field Measurements										
Time Sampled	10:25	9:10	15:15	13:30	13:30	.	13:40	.	10:05	12:30
Measuring Point Elev. (ft)	1,090.99	1,090.99	1,049.01	1,049.01	1,086.55	.	1,086.55	.	1,183.72	1,183.72
Depth to Water (ft)	117.54	118.34	104.75	109.96	131.94	.	134.61	.	118.68	122.49
Groundwater Elevation (ft)	973.45	972.65	944.26	939.05	954.61	.	951.94	.	1,065.04	1,061.23
Conductivity (μmho/cm)	395	540	235	428	294	.	520	.	313	514
Dissolved Oxygen (ppm)	13.09	11.97	2.84	8.56	4.7	.	6.72	.	6.49	6.93
Oxidation/Reduction (mV)	204	102	165	20	151	.	201	.	140	44
Temperature (degrees C)	12.2	15.3	10.3	19.4	11.2	.	18	.	12.7	22
Turbidity (NTU)	5	3	1	1	1	.	0	.	10	1
pH	7.02	6.95	8.07	7.8	7.98	.	7.63	.	7.81	7.92
Miscellaneous Analytes										
Dissolved Solids (mg/L)	.	.	.	.	.	.	.	.	198	198
Suspended Solids (mg/L)	.	.	.	.	.	.	.	.	21.2	6.8
Major Ions (mg/L)										
Calcium	54.3	53	36.5	38	.	.	.	.	34.9	30.5
Magnesium	33	31	21.6	22	.	.	.	.	22.6	19.1
Potassium	0.925	0.87	0.992	1	.	.	.	.	<	<
Sodium	1.61	2.8	1.58	2.4	.	.	.	.	10.2	6.2
Bicarbonate	279	260	200	180	.	.	.	.	181	182
Carbonate	<	<	<	<	.	.	.	.	<	<
Chloride	2.9	4.5	0.91	0.72	.	.	.	.	3.1	<
Fluoride	<	<	<	<	.	.	.	.	<	<
Nitrate as N	0.37	0.21	0.069	0.09	.	.	.	.	<	<
Sulfate	1.3	1.3	5	5.5	.	.	.	.	8.4	<
Charge balance error (%)	-1.7	-0.2	-5.6	1.3	.	.	.	.	2.1	-3.9
Trace Metals (mg/L)										
Aluminum	<	<	<	<	.	.	.	.	<	<
Arsenic	<	<	<	<	.	.	.	.	<	<
Barium	0.0122	0.012	0.0172	0.017	.	.	.	.	<	<
Boron	<	<	<	<	.	.	.	.	<	<
Chromium	<	<	<	<	.	.	.	.	0.13	0.013
Iron	<	<	<	<	.	.	.	.	0.53	<
Lead	<	<	<	<	.	.	.	.	<	<
Lithium	<	<	<	<	.	.	.	.	.	.
Manganese	<	<	<	<	.	.	.	.	0.022	<
Nickel	<	<	<	<	.	.	.	.	0.07	0.028
Strontium	0.0185	0.02	0.0249	0.026	.	.	.	.	0.033	0.019
Thallium	<	<	<	<	.	.	.	.	<	<
Uranium	<	<	<	<	.	.	.	.	<	<

APPENDIX F.1: CY 2009 MONITORING DATA FOR THE CHESTNUT RIDGE HYDROGEOLOGIC REGIME
Field Measurements, Miscellaneous Analytes, Major Ions, and Trace Metals

Sampling Point	GW-305		GW-322	GW-521		GW-522			
Functional Area	LIV		CRSP	LIV		LIV			
Date Sampled	08/27/09	12/14/09	12/16/09	01/28/09	07/09/09	01/28/09		07/09/09	
Program	BJC	BJC	GWPP	BJC	BJC	BJC	BJC	BJC	BJC
Sample Type							Dup		Dup
Field Measurements									
Time Sampled	10:30	14:40	11:20	14:20	13:45	14:00	.	10:20	.
Measuring Point Elev. (ft)	1,183.72	1,183.72	1,134.98	1,182.88	1,182.88	1,175.48	.	1,175.48	.
Depth to Water (ft)	125.41	116.85	145.24	84.60	83.29	96.61	.	101.24	.
Groundwater Elevation (ft)	1,058.31	1,066.87	989.74	1,098.28	1,099.59	1,078.87	.	1,074.24	.
Conductivity (μmho/cm)	466	423	594	460	362	344	.	481	.
Dissolved Oxygen (ppm)	5.43	4.06	4.13	4.71	10.38	8.35	.	10.78	.
Oxidation/Reduction (mV)	96	88	187	103	13	132	.	68	.
Temperature (degrees C)	20.2	14.1	10	13.4	17.3	13.6	.	16.8	.
Turbidity (NTU)	3	2	.	2	2	1	.	2	.
pH	7.93	8.26	7	7.57	8.04	7.38	.	7.14	.
Miscellaneous Analytes									
Dissolved Solids (mg/L)	.	.	.	137	148	216	229	208	203
Suspended Solids (mg/L)	.	.	.	<	<	<	<	<	<
Major Ions (mg/L)									
Calcium	.	.	.	23.3	26.1	45.6	45.7	40.8	41.4
Magnesium	.	.	.	23.9	20.4	29.1	29.3	24.5	24.7
Potassium	.	.	.	<	<	<	<	<	<
Sodium	.	.	.	2.7	3.1	<	<	<	<
Bicarbonate	.	.	.	148	155	214	217	213	212
Carbonate	.	.	.	<	7	<	<	<	<
Chloride	.	.	.	<	<	<	<	<	<
Fluoride	.	.	.	<	<	<	<	<	<
Nitrate as N	.	.	.	<	<	<	<	<	<
Sulfate	.	.	.	<	<	6.9	7	<	<
Charge balance error (%)	.	.	.	4.6	-1.9	2.7	.	-2.5	.
Trace Metals (mg/L)									
Aluminum	.	.	.	<	<	<	<	<	<
Arsenic	.	.	.	<	<	<	<	<	<
Barium	.	.	.	<	<	0.011	0.012	0.012	0.012
Boron	.	.	.	<	<	<	<	<	<
Chromium	.	.	.	<	<	<	<	<	<
Iron	.	.	.	<	<	<	<	<	<
Lead	.	.	.	<	<	<	<	<	<
Lithium	.	.	.	.	.	.	.	.	.
Manganese	.	.	.	<	<	<	<	<	<
Nickel	.	.	.	<	<	<	<	<	<
Strontium	.	.	.	<	<	0.018	0.018	0.018	0.018
Thallium	.	.	.	<	<	<	<	<	<
Uranium	.	.	.	<	<	<	<	<	<

APPENDIX F.1: CY 2009 MONITORING DATA FOR THE CHESTNUT RIDGE HYDROGEOLOGIC REGIME
Field Measurements, Miscellaneous Analytes, Major Ions, and Trace Metals

Sampling Point	GW-540		GW-557		GW-560		GW-562		GW-564	
Functional Area	LII		LV		CDLVII		CDLVII		CDLVII	
Date Sampled	02/02/09	07/13/09	02/02/09	07/14/09	02/02/09	07/15/09	02/02/09	07/15/09	02/02/09	
Program	BJC	BJC	BJC	BJC	BJC	BJC	BJC	BJC	BJC	BJC
Sample Type										Dup
Field Measurements										
Time Sampled	10:15	14:00	14:15	13:30	14:15	13:35	10:15	10:20	13:45	.
Measuring Point Elev. (ft)	1,072.31	1,072.31	1,081.36	1,081.36	949.05	949.05	934.69	934.69	938.07	.
Depth to Water (ft)	85.07	84.07	125.59	124.43	53.45	51.45	18.80	15.64	12.21	.
Groundwater Elevation (ft)	987.24	988.24	955.77	956.93	895.60	897.60	915.89	919.05	925.86	.
Conductivity (μmho/cm)	361	614	256	387	540	600	552	435	206	.
Dissolved Oxygen (ppm)	13.57	11.28	13.56	11.9	6.91	5.08	5.71	12.71	6.64	.
Oxidation/Reduction (mV)	27	-1	29	27	175	89	179	73	113	.
Temperature (degrees C)	11.9	18.4	11.1	16.8	12.7	19.6	11.7	16.6	13.4	.
Turbidity (NTU)	6	6	7	5	2	4	28	21	1	.
pH	7.1	7.6	7.67	7.52	6.71	7.45	6.53	7.35	6.63	.
Miscellaneous Analytes										
Dissolved Solids (mg/L)	254	275	171	179	187	181	216	197	139	145
Suspended Solids (mg/L)	<	<	<	<	<	<	<	4	<	<
Major Ions (mg/L)										
Calcium	46.2	44.4	36.7	32.4	43.1	38.2	39.7	37.7	32.6	31.9
Magnesium	30.1	29.1	21	19.3	18.8	17	22.6	22.1	12.2	12
Potassium	2.8	<	<	<	<	<	<	<	<	<
Sodium	16.5	14.8	<	<	<	<	2.3	2	<	<
Bicarbonate	249	260	162	166	165	169	181	194	106	105
Carbonate	<	<	<	<	<	<	<	<	<	<
Chloride	<	<	<	<	<	<	<	<	<	<
Fluoride	<	<	<	<	<	<	<	<	<	<
Nitrate as N	<	<	<	<	<	<	<	<	0.54	0.54
Sulfate	6.8	<	<	<	<	<	<	<	11.1	11.2
Charge balance error (%)	4.2	0.5	4.7	-1.7	5.7	-1.1	4.3	-1.2	4.8	.
Trace Metals (mg/L)										
Aluminum	<	<	<	<	<	<	0.52	1	<	<
Arsenic	<	<	<	<	<	<	<	<	<	<
Barium	0.015	0.013 J	0.011	<	0.25	0.23	0.013	0.013	0.022	0.021
Boron	<	<	<	<	<	<	<	<	<	<
Chromium	<	<	<	<	<	<	<	<	<	<
Iron	<	<	<	<	<	<	0.36	0.55	<	<
Lead	<	<	<	<	<	<	<	<	<	<
Lithium	.	.	.	.	.	.	.	.	.	.
Manganese	<	<	<	<	<	<	<	0.01	<	<
Nickel	<	<	<	<	<	<	<	<	<	<
Strontium	0.033	0.032	0.016	0.015	0.027	0.024	0.021	0.02	0.053	0.052
Thallium	<	<	<	<	<	<	<	<	<	<
Uranium	<	<	<	<	<	<	<	<	<	<

APPENDIX F.1: CY 2009 MONITORING DATA FOR THE CHESTNUT RIDGE HYDROGEOLOGIC REGIME
Field Measurements, Miscellaneous Analytes, Major Ions, and Trace Metals

Sampling Point	GW-564		GW-709			GW-731	GW-732	GW-757		GW-796	
Functional Area	**CDLVII**		**LII**			**CRSDB**	**CRSDB**	**LII**		**LV**	
Date Sampled	**07/15/09**		**02/03/09**	**07/13/09**	**10/15/09**	**01/13/09**	**01/13/09**	**02/03/09**	**07/13/09**	**01/29/09**	**07/14/09**
Program	**BJC**	**BJC**	**BJC**	**BJC**	**BJC**	**BJC**	**BJC**	**BJC**	**BJC**	**BJC**	**BJC**
Sample Type		**Dup**									
Field Measurements											
Time Sampled	10:10	.	11:50	10:05	10:30	13:20	13:45	11:30	10:45	14:15	13:45
Measuring Point Elev. (ft)	938.07	.	906.81	906.81	906.81	1,049.38	1,064.29	961.64	961.64	1,052.62	1,052.62
Depth to Water (ft)	11.72	.	26.70	27.95	26.23	125.12	157.20	82.71	83.60	82.21	78.17
Groundwater Elevation (ft)	926.35	.	880.11	878.86	880.58	924.26	907.09	878.93	878.04	970.41	974.45
Conductivity (μmho/cm)	457	.	456	503	405	210	520	184	497	391	306
Dissolved Oxygen (ppm)	6.15	.	4.59	8.66	9.31	13.4	5.68	17.29	1.84	7.2	8.17
Oxidation/Reduction (mV)	123	.	115	36	30	144	137	-27	75	79	129
Temperature (degrees C)	16.7	.	7.1	20.8	15.1	13.1	13.9	8.5	20.7	14.7	17.9
Turbidity (NTU)	2	.	2	4	2	6	1	4	2	1	1
pH	6.9	.	7.55	8.02	8.14	7.81	7.1	9.71	9.34	7.55	8.12
Miscellaneous Analytes											
Dissolved Solids (mg/L)	146	149	165	207	.	116	77	129	148	127	133
Suspended Solids (mg/L)	<	<	<	<	.	<	<	<	<	<	<
Major Ions (mg/L)											
Calcium	31.9	30.8	31.3	31.9	.	27.3	36.8	3.7	3.2	25	23.8
Magnesium	13.3	13	29.2	27.6	.	16.6	2.3	7.9	5.6	15.7	14.4
Potassium	<	<	<	<	.	1.69	1.6	18.2	17.4	<	<
Sodium	<	<	2.9	2.5	.	0.989	0.607	36.2	37	<	<
Bicarbonate	131	145	176	190	.	.	.	53.6	50.6	122	124
Carbonate	<	<	<	<	.	.	.	68.3	63.2	<	<
Chloride	<	<	<	<	.	.	.	<	<	<	<
Fluoride	<	<	<	<	.	.	.	1.3	1.2	<	<
Nitrate as N	<	<	<	<	.	.	.	<	<	<	<
Sulfate	<	<	9.1	<	.	.	.	11.6	<	<	<
Charge balance error (%)	1.3	.	4.9	2.2	.	.	.	1.4	6.3	2	-2.2
Trace Metals (mg/L)											
Aluminum	<	<	<	<	.	0.21	<	<	<	<	<
Arsenic	<	<	<	<	.	<	<	<	<	<	<
Barium	0.016	0.015	0.62	0.63 J	.	0.00927	0.012	0.14	0.11 J	<	<
Boron	<	<	<	<	.	<	<	<	<	<	<
Chromium	<	<	<	<	.	<	<	0.012	<	<	<
Iron	<	<	<	<	.	0.213	<	<	<	<	<
Lead	<	<	<	<	.	<	<	<	<	<	<
Lithium	.	.	.	.	.	<	<	.	.	.	.
Manganese	<	<	<	<	.	0.00549	<	<	<	<	<
Nickel	<	<	<	<	.	<	<	<	<	<	<
Strontium	0.034	0.033	0.044	0.046	.	0.0219	0.0171	0.31	0.24	0.013	0.012
Thallium	<	<	<	<	.	<	<	<	<	<	<
Uranium	<	<	<	<	.	<	<	0.004	<	<	<

APPENDIX F.1: CY 2009 MONITORING DATA FOR THE CHESTNUT RIDGE HYDROGEOLOGIC REGIME
Field Measurements, Miscellaneous Analytes, Major Ions, and Trace Metals

Sampling Point	GW-797		GW-798		GW-799		GW-801		GW-831	
Functional Area	LV		CDLVII		LV		LV		FCAP	
Date Sampled	01/29/09	07/14/09	02/02/09	07/14/09	01/29/09	07/14/09	01/29/09	07/13/09	01/14/09	07/08/09
Program	BJC	BJC	BJC	BJC	BJC	BJC	BJC	BJC	BJC	BJC
Sample Type										
Field Measurements										
Time Sampled	10:00	10:30	9:40	13:45	14:15	9:50	13:45	14:15	13:55	14:55
Measuring Point Elev. (ft)	1,060.00	1,060.00	1,006.00	1,006.00	981.29	981.29	1,097.16	1,097.16	1,091.29	1,091.29
Depth to Water (ft)	75.20	74.71	86.95	82.73	25.45	24.31	116.43	114.94	132.12	129.66
Groundwater Elevation (ft)	984.80	985.29	919.05	923.27	955.84	956.98	980.73	982.22	959.17	961.63
Conductivity (μmho/cm)	785	670	227	452	238	350	225	476	462	405
Dissolved Oxygen (ppm)	5.2	8.98	5.8	4.98	5.45	5.76	13.05	6.76	2.14	3.18
Oxidation/Reduction (mV)	154	70	84	137	128	189	119	110	120	168
Temperature (degrees C)	10.5	19.3	14.2	18.9	14.6	17.2	12.2	17	9.9	19.6
Turbidity (NTU)	1	3	1	4	1	1	4	4	1	1
pH	6.76	7.41	7.53	5.81	8.61	8.31	7.47	6.59	7.99	8.21
Miscellaneous Analytes										
Dissolved Solids (mg/L)	299	303	149	153	148	152	152	157	.	.
Suspended Solids (mg/L)	<	<	<	<	<	<	<	<	.	.
Major Ions (mg/L)										
Calcium	55.1	50.4	30.2	27.9	31.8	29	32.6	31.4	.	.
Magnesium	33.8	29.8	16.9	16.1	18.3	16.1	19.9	18.2	.	.
Potassium	<	<	<	<	<	<	<	<	.	.
Sodium	5.2	4.6	<	<	<	<	<	<	.	.
Bicarbonate	200	203	135	136	137	142	149	152	.	.
Carbonate	<	<	<	<	<	<	<	<	.	.
Chloride	7.2	6.3	<	<	<	<	<	<	.	.
Fluoride	<	<	<	<	<	<	<	<	.	.
Nitrate as N	2.8	2.5	0.59	0.6	0.95	0.89	<	<	.	.
Sulfate	53.4	<	<	<	<	<	<	<	.	.
Charge balance error (%)	2.2	7.9	2.8	-0.8	4.8	-2.3	4.6	0.4	.	.
Trace Metals (mg/L)										
Aluminum	<	<	<	<	<	<	<	<	.	.
Arsenic	<	<	<	<	<	<	<	<	.	.
Barium	<	0.011	0.01	0.01	<	<	<	<	.	.
Boron	<	<	<	<	<	<	<	<	.	.
Chromium	<	<	<	<	0.026	0.033	<	<	.	.
Iron	<	<	<	<	0.11	<	<	<	.	.
Lead	<	<	<	<	<	<	<	<	.	.
Lithium	.	.	.	.	.	.	.	.	.	.
Manganese	<	<	<	<	<	<	<	<	.	.
Nickel	<	<	<	<	<	<	<	<	.	.
Strontium	0.032	0.03	0.017	0.016	0.019	0.018	0.016	0.016	.	.
Thallium	<	<	<	<	<	<	<	<	.	.
Uranium	<	<	<	<	0.004	<	<	<	.	.

APPENDIX F.1: CY 2009 MONITORING DATA FOR THE CHESTNUT RIDGE HYDROGEOLOGIC REGIME
Field Measurements, Miscellaneous Analytes, Major Ions, and Trace Metals

Sampling Point	MCK 1.4		MCK 2.0		MCK 2.05				S17
Functional Area	**EXP-SW**		**EXP-SW**		**EXP-SW**				**EXP-SW**
Date Sampled	**03/18/09**	**09/03/09**	**03/18/09**	**09/03/09**	**03/18/09**		**09/03/09**		**10/12/09**
Program	**BJC**	**BJC**	**BJC**	**BJC**	**BJC**	**BJC**	**BJC**	**BJC**	**GWPP**
Sample Type						**Dup**		**Dup**	
Field Measurements									
Time Sampled	10:30	9:30	9:35	8:45	9:50	9:50	9:05	9:05	10:20
Measuring Point Elev. (ft)	.	.	.	.	.	.	.	.	.
Depth to Water (ft)	.	.	.	.	.	.	.	.	.
Groundwater Elevation (ft)	.	.	.	.	.	.	.	.	.
Conductivity (μmho/cm)	260	.	187	648	296	.	690	.	499
Dissolved Oxygen (ppm)	10.25	.	9.32	10.4	6.22	.	8.84	.	3.5
Oxidation/Reduction (mV)	69	.	147	178	35.6	.	170	.	206
Temperature (degrees C)	10.39	.	10.39	16.5	13.1	.	15.3	.	14.5
Turbidity (NTU)	2.06	.	1.45	1.48	6.16	.	3.22	.	.
pH	7.77	.	7.63	7.25	6.64	.	6.84	.	7.08
Miscellaneous Analytes									
Dissolved Solids (mg/L)	.	.	114	233	195	252	268	271	228
Suspended Solids (mg/L)	.	.	<	67	17	43	<	<	2
Major Ions (mg/L)									
Calcium	38.4	37.7	20.2	48.4	39	39.5	57.8	59.4	51
Magnesium	11.6	11.2	4.98	15.6	14.3	14.5	14.9	14.4	29.9
Potassium	1.88	2.05	4.04	4.92	4.2	4.25	5.5	5.54	<
Sodium	2.01	1.95	1.15	2.12	1.61	1.63	2.59	2.65	1.58
Bicarbonate	.	.	38.6	166	148	143	172	178	230
Carbonate	.	.	<	<	<	<	<	<	<
Chloride	.	.	1.8	1.86	1.8	1.8	1.86	1.82	2.66
Fluoride	.	.	0.12	0.13	0.1	<	0.171	0.18	<
Nitrate as N	.	.	.	.	.	.	.	.	6.94
Sulfate	.	.	31.2	29.7	27.7	28.6	41.5	41	4.39
Charge balance error (%)	.	.	3	-1	-4.2	.	0	.	-1.8
Trace Metals (mg/L)									
Aluminum	<	<	<	<	<	<	<	<	<
Arsenic	0.005	0.00604	<	0.0159	0.101	0.0918	0.0212	0.0229	.
Barium	0.0525	0.0544	0.0401	0.0798	0.0865	0.0846	0.0708	0.0666	0.135
Boron	<	<	<	0.21	0.165	0.167	0.25	0.256	<
Chromium	<	<	<	<	<	<	<	<	.
Iron	<	<	0.114	0.374	4.56	3.56	0.402	0.428	<
Lead	<	<	<	<	<	<	<	<	.
Lithium	0.0137	0.0215	0.0378	0.0734	0.05	0.0502	0.0892	0.0959	<
Manganese	0.0519	0.0247	0.0176	0.425	0.655	0.622	0.387	0.339	0.00717
Nickel	<	<	<	<	<	<	<	<	.
Strontium	0.235	0.24	0.366	0.859	0.643	0.65	1.13	1.19	0.0284
Thallium	<	0.0011	<	<	<	<	<	<	.
Uranium	.	.	<	<	<	<	<	<	.

APPENDIX F.1: CY 2009 MONITORING DATA FOR THE CHESTNUT RIDGE HYDROGEOLOGIC REGIME
Field Measurements, Miscellaneous Analytes, Major Ions, and Trace Metals

Sampling Point	SCR1.25SP		SCR1.5SW	SCR2.1SP		SCR2.2SP	SCR3.5SP	
Functional Area	EXP-SW		EXP-SW	EXP-SW		EXP-SW	EXP-SW	
Date Sampled	03/11/09	09/03/09	10/12/09	05/04/09	10/12/09	10/12/09	03/11/09	09/03/09
Program	BJC	BJC	GWPP	GWPP	GWPP	GWPP	BJC	BJC
Sample Type								
Field Measurements								
Time Sampled	10:17	10:00	13:05	9:00	14:45	13:30	10:54	9:15
Measuring Point Elev. (ft)	.	.	.	.	.	.	.	.
Depth to Water (ft)	.	.	.	.	.	.	.	.
Groundwater Elevation (ft)	.	.	.	.	.	.	.	.
Conductivity (μmho/cm)	216	575	298	233	290	379	291	612
Dissolved Oxygen (ppm)	7.28	9.68	5.97	4.6	3.61	4.44	7.29	9.84
Oxidation/Reduction (mV)	172.2	107.8	198	147	219	217	161.2	122
Temperature (degrees C)	13.27	17.35	14.8	13	16.5	15	13.96	17.12
Turbidity (NTU)	1.2	5.33	.	.	.	.	1.47	3.1
pH	7.05	7.07	7.6	7.33	7.62	7	7.79	7.33
Miscellaneous Analytes								
Dissolved Solids (mg/L)	132	199	94	.	166	199	184	232
Suspended Solids (mg/L)	<	11	5	.	4	6	<	<
Major Ions (mg/L)								
Calcium	28.7	41.5	37.1	.	35.4	56.7	44	49.7
Magnesium	11.7	17.4	13.2	.	12.4	11.4	13.8	16
Potassium	0.827	1.15	<	.	<	<	2.27	2.67
Sodium	1.24	1.57	1.3	.	1.82	1.8	1.22	1.49
Bicarbonate	116	170	147	.	133	179	160	185
Carbonate	<	<	<	.	<	<	<	<
Chloride	2.4	3.1	1.85	.	2.46	2.15	1.7	1.83
Fluoride	<	<	<	.	<	<	0.13	0.13
Nitrate as N	0.058	0.08	<	.	0.059	0.882	0.29	0.23
Sulfate	8.7	8.11	7.48	.	6.75	8.75	18.7	14.8
Charge balance error (%)	-2	-0.8	-2.5	.	-0.1	-0.5	-3.1	-1.9
Trace Metals (mg/L)								
Aluminum	<	0.31	<	.	<	<	<	<
Arsenic	<	<	.	.	.	.	<	<
Barium	0.0414	0.0668	.	.	.	0.0408	0.0714	0.0846
Boron	<	<	<	.	<	<	<	<
Chromium	<	<	.	.	.	.	<	<
Iron	0.0931	0.394	<	.	<	<	0.165	0.183
Lead	<	<	.	.	.	.	<	<
Lithium	<	0.0114	<	.	<	<	0.0183	0.032
Manganese	0.0232	0.0628	<	.	<	0.00804	0.0305	0.0461
Nickel	<	<	.	.	.	.	<	<
Strontium	0.0355	0.0538	0.0475	.	0.0429	0.0698	0.306	0.39
Thallium	<	0.00112	.	.	.	.	<	0.00108
Uranium	<	<	.	.	.	.	<	<

APPENDIX F.1: CY 2009 MONITORING DATA FOR THE CHESTNUT RIDGE HYDROGEOLOGIC REGIME
Field Measurements, Miscellaneous Analytes, Major Ions, and Trace Metals

Sampling Point	SCR3.5SW	SCR4.3SP		UNC SW-1	
Functional Area	EXP-SW	EXP-SW		EXP-SW	
Date Sampled	10/12/09	01/29/09	07/14/09	03/11/09	08/19/09
Program	GWPP	BJC	BJC	BJC	BJC
Sample Type					
Field Measurements					
Time Sampled	14:00	9:00	10:15	10:00	9:00
Measuring Point Elev. (ft)	.	.	.	.	.
Depth to Water (ft)	.	.	.	.	.
Groundwater Elevation (ft)	.	.	.	.	.
Conductivity (μmho/cm)	380	221	435	90	183
Dissolved Oxygen (ppm)	5.85	13.24	5.56	5.51	6.29
Oxidation/Reduction (mV)	222	196	202	205.7	67.3
Temperature (degrees C)	15.3	12.1	18.2	14.88	20.6
Turbidity (NTU)	.	34	11	5.63	14
pH	7.6	6.58	6.73	6.04	6.03
Miscellaneous Analytes					
Dissolved Solids (mg/L)	217	191	219	.	.
Suspended Solids (mg/L)	4	<	12	.	.
Major Ions (mg/L)					
Calcium	51.4	33.3	41.1	7.14	18
Magnesium	14.3	10.5	12	2.33	4.83
Potassium	2.67	2.1	2.1	0.562	0.717
Sodium	1.39	2.6	2.7	2.52	3.48
Bicarbonate	183	85.1	131	30	51.8
Carbonate	<	<	<	<	<
Chloride	1.44	4.3	<	3.8	4.73
Fluoride	0.115	<	<	<	<
Nitrate as N	0.302	0.94	0.5	0.063	0.14
Sulfate	14.9	32.7	<	7.5	9.58
Charge balance error (%)	-2.1	2.3	9.5	-12.6	3.1
Trace Metals (mg/L)					
Aluminum	<	1.3	1.4	0.818	<
Arsenic	.	<	<	<	<
Barium	0.0843	0.07	0.097	0.0217	0.0348
Boron	<	<	<	<	<
Chromium	.	<	<	<	<
Iron	0.136	1.6	0.63	0.481	0.104
Lead	.	<	<	0.00312	<
Lithium	0.0209	.	.	<	<
Manganese	0.0607	0.025	0.011	0.0147	0.0108
Nickel	.	<	<	<	<
Strontium	0.332	0.11	0.13	0.0214	0.0448
Thallium	.	<	<	<	<
Uranium	.	<	<	.	.

APPENDIX F.2

VOLATILE ORGANIC COMPOUNDS

APPENDIX F.2: CY 2009 MONITORING DATA FOR THE CHESTNUT RIDGE HYDROGEOLOGIC REGIME
Volatile Organic Compounds

Sampling Point	GW-141		GW-143	GW-144	GW-145	GW-161	GW-161	GW-174
Functional Area	LIV		KHQ	KHQ	KHQ	ECRWP	ECRWP	CRSP
Date Sampled	01/29/09	07/16/09	01/08/09	01/06/09	01/08/09	01/14/09	07/08/09	10/13/09
Program	BJC	BJC	BJC	BJC	BJC	BJC	BJC	GWPP
Sample Type								PDB
Chloroethenes (μg/L)								
Tetrachloroethene	<	<	<	<	<	<	<	<
Trichloroethene	<	<	<	<	<	<	<	<
cis-1,2-Dichloroethene	<	<	<	<	<	<	<	<
trans-1,2-Dichloroethene	<	<	<	<	<	<	<	<
1,1-Dichloroethene	<	<	<	<	<	<	<	<
Chloroethanes (μg/L)								
1,1,1-Trichloroethane	<	<	<	<	<	<	<	<
1,2-Dichloroethane	<	<	<	<	<	<	<	<
1,1-Dichloroethane	<	<	<	<	<	<	<	<
Chloroethane	<	<	<	<	<	<	<	<
Chloromethanes (μg/L)								
Carbon tetrachloride	<	<	<	<	<	<	<	<
Choroform	<	<	<	<	<	<	<	<
Chloromethane	<	<	<	<	<	<	<	<
Miscellaneous (μg/L)								
1,1,2-Trichloro-1,2,2-trifluoroethane	.	.	.	.	.	.	.	3 J
Trichlorofluoromethane	<	<	.	.	.	.	.	10
1,4-Dichlorobenzene	<	<	.	.	.	.	.	<
Benzene	<	<	<	<	<	<	<	<
Toluene	<	<	<	<	<	<	<	<
Total Xylene	<	<	<	<	<	<	<	<
Acetone	<	<	<	<	<	<	<	.
Carbon disulfide	<	<	<	<	<	<	<	.

APPENDIX F.2: CY 2009 MONITORING DATA FOR THE CHESTNUT RIDGE HYDROGEOLOGIC REGIME
Volatile Organic Compounds

Sampling Point	GW-175		GW-176		GW-177		GW-180	GW-205
Functional Area	CRSP		CRSP		CRSP		CRSP	UNCS
Date Sampled	10/13/09	12/15/09	10/13/09		01/14/09	07/09/09	10/13/09	10/15/09
Program	GWPP	GWPP	GWPP	GWPP	BJC	BJC	GWPP	BJC
Sample Type	PDB		PDB	Dup			PDB	
Chloroethenes (μg/L)								
Tetrachloroethene	<	4 J	<	1 J	<	<	4 J	<
Trichloroethene	<	<	<	<	<	<	<	<
cis-1,2-Dichloroethene	<	<	<	<	<	<	1 J	<
trans-1,2-Dichloroethene	<	<	<	<	<	<	<	<
1,1-Dichloroethene	<	<	23	25	8.09	3.5	<	<
Chloroethanes (μg/L)								
1,1,1-Trichloroethane	<	<	20	21	7.75	2.7	<	<
1,2-Dichloroethane	<	<	<	<	<	<	<	<
1,1-Dichloroethane	<	<	46	49	39	19	<	<
Chloroethane	<	<	<	<	<	<	<	<
Chloromethanes (μg/L)								
Carbon tetrachloride	<	<	<	<	<	<	<	<
Choroform	<	<	<	<	<	<	<	<
Chloromethane	<	<	<	<	<	<	<	<
Miscellaneous (μg/L)								
1,1,2-Trichloro-1,2,2-trifluoroethane	<	<	<	<	.	.	2 J	.
Trichlorofluoromethane	<	3 J	2 J	1 J	.	.	5 J	<
1,4-Dichlorobenzene	<	<	<	<	.	.	<	<
Benzene	<	<	<	<	<	<	<	<
Toluene	<	<	<	<	<	<	<	<
Total Xylene	<	<	<	<	<	<	<	<
Acetone	.	<	.	.	<	<	.	<
Carbon disulfide	.	<	.	.	<	<	.	<

APPENDIX F.2: CY 2009 MONITORING DATA FOR THE CHESTNUT RIDGE HYDROGEOLOGIC REGIME
Volatile Organic Compounds

Sampling Point	GW-217		GW-231		GW-294		GW-294	
Functional Area	LIV		KHQ		ECRWP		ECRWP	
Date Sampled	01/28/09	07/13/09	01/12/09		01/14/09		07/08/09	
Program	BJC	BJC	BJC	BJC	BJC	BJC	BJC	BJC
Sample Type				Dup		Dup		Dup
Chloroethenes (µg/L)								
Tetrachloroethene	<	<	<	<	<	<	<	<
Trichloroethene	6.8 Q	<	<	<	<	<	<	<
cis-1,2-Dichloroethene	2.6 Q	<	<	<	<	<	<	<
trans-1,2-Dichloroethene	<	<	<	<	<	<	<	<
1,1-Dichloroethene	<	<	<	<	<	<	<	<
Chloroethanes (µg/L)								
1,1,1-Trichloroethane	<	<	<	<	<	<	<	<
1,2-Dichloroethane	<	<	<	<	<	<	<	<
1,1-Dichloroethane	<	<	<	<	<	<	<	<
Chloroethane	<	<	<	<	<	<	<	<
Chloromethanes (µg/L)								
Carbon tetrachloride	<	<	<	<	<	<	<	<
Choroform	<	<	<	<	<	<	<	<
Chloromethane	<	<	<	<	<	<	0.64 J	0.4 J
Miscellaneous (µg/L)								
1,1,2-Trichloro-1,2,2-trifluoroethane	.	.	.	.	.	.	.	.
Trichlorofluoromethane	<	<	.	.	.	.	.	.
1,4-Dichlorobenzene	<	<	.	.	.	.	.	.
Benzene	<	<	<	<	<	<	<	<
Toluene	<	<	<	<	<	<	<	<
Total Xylene	<	<	<	<	<	<	<	<
Acetone	<	<	<	<	<	<	<	<
Carbon disulfide	<	<	<	<	<	<	<	<

APPENDIX F.2: CY 2009 MONITORING DATA FOR THE CHESTNUT RIDGE HYDROGEOLOGIC REGIME
Volatile Organic Compounds

Sampling Point	GW-296		GW-298		GW-301			
Functional Area	**ECRWP**		**ECRWP**		**CRBAWP**			
Date Sampled	**01/14/09**	**07/08/09**	**01/13/09**	**07/08/09**	**01/14/09**		**07/08/09**	
Program	**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	<	<	<	<	<	<	<	<
1,2-Dichloroethane	<	<	<	<	<	<	<	<
1,1-Dichloroethane	<	<	<	<	<	<	<	<
Chloroethane	<	<	<	<	<	<	<	<
Chloromethanes (μg/L)								
Carbon tetrachloride	<	<	<	<	<	<	<	<
Choroform	<	<	<	<	<	<	<	<
Chloromethane	<	<	<	<	<	<	<	<
Miscellaneous (μg/L)								
1,1,2-Trichloro-1,2,2-trifluoroethane	.	.	.	.	.	.	.	.
Trichlorofluoromethane	.	.	.	.	.	.	.	.
1,4-Dichlorobenzene	.	.	.	.	.	.	.	.
Benzene	<	<	<	<	<	<	<	<
Toluene	<	<	<	<	<	<	<	<
Total Xylene	<	<	<	<	<	<	<	<
Acetone	<	<	<	<	<	<	<	<
Carbon disulfide	<	<	<	<	<	<	<	<

APPENDIX F.2: CY 2009 MONITORING DATA FOR THE CHESTNUT RIDGE HYDROGEOLOGIC REGIME
Volatile Organic Compounds

Sampling Point	**GW-305**				**GW-322**		**GW-521**	
Functional Area	**LIV**				**CRSP**		**LIV**	
Date Sampled	**01/28/09**	**07/09/09**	**08/27/09**	**12/14/09**	**10/13/09**	**12/16/09**	**01/28/09**	**07/09/09**
Program	**BJC**	**BJC**	**BJC**	**BJC**	**GWPP**	**GWPP**	**BJC**	**BJC**
Sample Type					**PDB**			
Chloroethenes (μg/L)								
Tetrachloroethene	<	<	<	<	1 J	4 J	<	<
Trichloroethene	<	<	<	<	<	<	<	<
cis-1,2-Dichloroethene		<	<	<	<	<	<	<
trans-1,2-Dichloroethene	<	<	<	<	<	<	<	<
1,1-Dichloroethene	9.1	8.6	8.7	7.9	53	43	<	<
Chloroethanes (μg/L)								
1,1,1-Trichloroethane	18	16	16	14	15	16	<	<
1,2-Dichloroethane	<	<	<	<	<	<	<	<
1,1-Dichloroethane	38	39	40	36	75	61	<	<
Chloroethane	<	<	<	<	<	<	<	<
Chloromethanes (μg/L)								
Carbon tetrachloride	<	0.059 J	<	<	<	<	<	<
Choroform	0.13 J	0.067 J	0.076 J	<	<	<	<	<
Chloromethane	<	<	<	<	<	<	<	<
Miscellaneous (μg/L)								
1,1,2-Trichloro-1,2,2-trifluoroethane	.	.	.	.	<	3 J	.	.
Trichlorofluoromethane	<	<	<	<	32	25	<	<
1,4-Dichlorobenzene	<	<	<	<	<	<	<	<
Benzene	0.027 J	0.031 J	0.061 J	<	<	<	<	<
Toluene	<	<	<	<	<	<	<	<
Total Xylene	<	<	<	<	<	<	<	<
Acetone	<	<	1.5 J	<	.	<	<	<
Carbon disulfide	0.038 J	<	<	<	.	<	<	<

APPENDIX F.2: CY 2009 MONITORING DATA FOR THE CHESTNUT RIDGE HYDROGEOLOGIC REGIME
Volatile Organic Compounds

Sampling Point	GW-522				GW-540		GW-557	
Functional Area	LIV				LII		LV	
Date Sampled	01/28/09		07/09/09		02/02/09	07/13/09	02/02/09	07/14/09
Program	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	<	<	<	<	<	<	<	<
1,2-Dichloroethane	<	<	<	<	<	<	<	<
1,1-Dichloroethane	<	<	<	<	<	<	<	<
Chloroethane	<	<	<	0.25 J	<	<	<	<
Chloromethanes (μg/L)								
Carbon tetrachloride	<	<	<	<	<	<	<	<
Choroform	<	<	<	<	<	<	<	<
Chloromethane	<	<	<	<	<	<	0.37 J	<
Miscellaneous (μg/L)								
1,1,2-Trichloro-1,2,2-trifluoroethane	.	.	.	.	.	.	.	.
Trichlorofluoromethane	<	<	<	<	<	<	<	<
1,4-Dichlorobenzene	<	<	<	<	<	<	<	<
Benzene	<	<	<	<	<	<	<	<
Toluene	<	<	<	<	<	<	<	<
Total Xylene	<	<	<	<	<	<	<	<
Acetone	<	<	<	<	<	<	<	<
Carbon disulfide	<	<	<	<	0.029 J	<	<	<

APPENDIX F.2: CY 2009 MONITORING DATA FOR THE CHESTNUT RIDGE HYDROGEOLOGIC REGIME
Volatile Organic Compounds

Sampling Point	GW-560		GW-562		GW-564			
Functional Area	CDLVII		CDLVII		CDLVII			
Date Sampled	02/02/09	07/15/09	02/02/09	07/15/09	02/02/09		07/15/09	
Program	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	<	<	<	<	<	<	<	<
1,2-Dichloroethane	<	<	<	<	<	<	<	<
1,1-Dichloroethane	<	<	<	<	<	<	<	<
Chloroethane	<	<	<	<	<	<	<	<
Chloromethanes (µg/L)								
Carbon tetrachloride	<	<	<	<	<	<	<	<
Choroform	<	<	<	<	<	<	0.045 J	0.051 J
Chloromethane	0.25 J	<	<	<	<	0.6 J	<	<
Miscellaneous (µg/L)								
1,1,2-Trichloro-1,2,2-trifluoroethane	.	.	.	.	.	.	.	.
Trichlorofluoromethane	<	<	<	<	<	<	<	<
1,4-Dichlorobenzene	<	<	<	<	<	<	<	<
Benzene	<	<	<	<	<	<	<	<
Toluene	<	<	<	<	<	<	<	<
Total Xylene	<	<	<	<	<	<	<	<
Acetone	<	<	<	<	<	<	<	<
Carbon disulfide	<	<	<	<	<	<	<	<

APPENDIX F.2: CY 2009 MONITORING DATA FOR THE CHESTNUT RIDGE HYDROGEOLOGIC REGIME
Volatile Organic Compounds

Sampling Point	GW-709			GW-757		GW-796	
Functional Area	LII			LII		LV	
Date Sampled	02/03/09	07/13/09	10/15/09	02/03/09	07/13/09	01/29/09	07/14/09
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	<	<	<	<	<	0.081 J	0.2 J
Chloroethanes (µg/L)							
1,1,1-Trichloroethane	<	<	<	<	<	0.46 J	0.41 J
1,2-Dichloroethane	<	<	<	<	<	<	<
1,1-Dichloroethane	<	<	<	<	<	0.39 J	0.41 J
Chloroethane	<	<	<	<	<	<	<
Chloromethanes (µg/L)							
Carbon tetrachloride	<	<	<	<	<	<	<
Choroform	0.076 J	0.059 J	<	<	<	<	<
Chloromethane	<	0.53 J	<	<	<	<	<
Miscellaneous (µg/L)							
1,1,2-Trichloro-1,2,2-trifluoroethane	.	.	.	.	.	.	.
Trichlorofluoromethane	<	<	<	<	<	<	<
1,4-Dichlorobenzene	<	<	<	<	<	<	<
Benzene	<	<	<	<	<	<	<
Toluene	<	<	<	<	<	<	<
Total Xylene	<	<	<	<	<	<	<
Acetone	<	<	<	<	<	<	<
Carbon disulfide	<	<	<	<	<	<	<

APPENDIX F.2: CY 2009 MONITORING DATA FOR THE CHESTNUT RIDGE HYDROGEOLOGIC REGIME
Volatile Organic Compounds

Sampling Point	GW-797		GW-798		GW-799		GW-801	
Functional Area	LV		CDLVII		LV		LV	
Date Sampled	01/29/09	07/14/09	02/02/09	07/14/09	01/29/09	07/14/09	01/29/09	07/13/09
Program	BJC	BJC	BJC	BJC	BJC	BJC	BJC	BJC
Sample Type								
Chloroethenes (µg/L)								
Tetrachloroethene	<	<	15	11	<	<	<	<
Trichloroethene	<	<	1.2 J	1.3 J	0.045 J	<	<	<
cis-1,2-Dichloroethene	<	<	13	13	<	<	<	<
trans-1,2-Dichloroethene	<	<	<	0.16 J	<	<	<	<
1,1-Dichloroethene	<	<	8.7	6.7	<	<	<	<
Chloroethanes (µg/L)								
1,1,1-Trichloroethane	<	<	2.9 J	2.4 J	<	<	<	<
1,2-Dichloroethane	<	<	0.12 J	0.12 J	<	<	<	<
1,1-Dichloroethane	<	<	4.5 J	4.7 J	<	<	<	<
Chloroethane	<	<	<	<	<	<	<	<
Chloromethanes (µg/L)								
Carbon tetrachloride	<	<	<	<	<	<	<	<
Choroform	<	<	<	<	<	<	<	<
Chloromethane	<	<	<	0.35 J	<	<	<	<
Miscellaneous (µg/L)								
1,1,2-Trichloro-1,2,2-trifluoroethane	.	.	.	.	.	.	.	.
Trichlorofluoromethane	<	<	22	18	<	<	<	<
1,4-Dichlorobenzene	<	<	<	<	<	0.12 J	<	<
Benzene	<	<	<	<	<	<	<	<
Toluene	<	<	<	<	<	0.11 J	<	<
Total Xylene	<	<	<	<	<	0.056 J	<	<
Acetone	<	1.8 J	<	2 J	<	1.6 J	<	<
Carbon disulfide	<	<	<	<	<	<	<	<

APPENDIX F.2: CY 2009 MONITORING DATA FOR THE CHESTNUT RIDGE HYDROGEOLOGIC REGIME
Volatile Organic Compounds

Sampling Point	GW-831		S17	SCR1.25SP		SCR1.5SW	SCR2.1SP	
Functional Area	FCAP		EXP-SW	EXP-SW		EXP-SW	EXP-SW	
Date Sampled	01/14/09	07/08/09	10/12/09	03/11/09	09/03/09	10/12/09	05/04/09	10/12/09
Program	BJC	BJC	GWPP	BJC	BJC	GWPP	GWPP	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	<	<	<	<	<	<	<	<
1,2-Dichloroethane	<	<	<	<	<	<	<	<
1,1-Dichloroethane	<	<	<	<	<	<	<	<
Chloroethane	<	<	<	<	<	<	<	<
Chloromethanes (μg/L)								
Carbon tetrachloride	<	<	<	<	<	<	<	<
Choroform	<	<	<	<	<	<	<	<
Chloromethane	<	<	<	<	<	<	<	<
Miscellaneous (μg/L)								
1,1,2-Trichloro-1,2,2-trifluoroethane	.	.	<	.	.	<	<	<
Trichlorofluoromethane	.	.	<	.	.	<	<	<
1,4-Dichlorobenzene	.	.	<	.	.	<	<	<
Benzene	<	<	<	<	<	<	<	<
Toluene	<	<	<	<	<	<	<	<
Total Xylene	<	<	<	<	<	<	<	<
Acetone	<	<	<	<	<	<	<	<
Carbon disulfide	<	<	<	<	<	<	<	<

APPENDIX F.2: CY 2009 MONITORING DATA FOR THE CHESTNUT RIDGE HYDROGEOLOGIC REGIME
Volatile Organic Compounds

Sampling Point	SCR2.2SP	SCR3.5SP		SCR3.5SW	SCR4.3SP	
Functional Area	EXP-SW	EXP-SW		EXP-SW	EXP-SW	
Date Sampled	10/12/09	03/11/09	09/03/09	10/12/09	01/29/09	07/14/09
Program	GWPP	BJC	BJC	GWPP	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	<	<	<	<	<	<
1,2-Dichloroethane	<	<	<	<	<	<
1,1-Dichloroethane	<	<	<	<	<	<
Chloroethane	<	<	<	<	<	<
Chloromethanes (μg/L)						
Carbon tetrachloride	<	<	<	<	<	<
Choroform	<	<	<	<	<	<
Chloromethane	<	<	<	<	<	1 J
Miscellaneous (μg/L)						
1,1,2-Trichloro-1,2,2-trifluoroethane	<	.	.	<	.	.
Trichlorofluoromethane	<	.	.	<	<	<
1,4-Dichlorobenzene	<	.	.	<	<	<
Benzene	<	<	<	<	<	<
Toluene	<	<	<	<	<	<
Total Xylene	<	<	<	<	<	<
Acetone	<	<	<	<	<	<
Carbon disulfide	<	<	<	<	<	<

APPENDIX F.3

RADIOLOGICAL ANALYTES

APPENDIX F.3: CY 2009 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	03/05/09	BJC	<	.	2.64	<	.	4.16
1090	UNCS	07/27/09	BJC	<	.	2.73	<	.	4.6
GW-141	LIV	01/29/09	BJC	<	.	1.18	<	.	3.14
GW-141	LIV	07/16/09	BJC	1.27	0.62	0.24	3.12	1.47	2.78
GW-143	KHQ	01/08/09	BJC	<	.	2.25	14.2	3.23	3.28
GW-144	KHQ	01/06/09	BJC	2.44	1.51	2.29	<	.	2.91
GW-145	KHQ	01/08/09	BJC	10.5	3.28	2.42	13	3.07	3.33
GW-161	ECRWP	01/14/09	BJC	<	.	1.76			
GW-161	ECRWP	07/08/09	BJC	<	.	1.38			
GW-177	CRSP	01/14/09	BJC	<	.	2.41	4.71	1.9	3.27
GW-177	CRSP	07/09/09	BJC	2.46	1.19	1.49	4.84	1.8	3.03
GW-203	UNCS	03/05/09	BJC	4.34	2.71	3.73	<	.	4.7
GW-203	UNCS	07/27/09	BJC	<	.	1.68	<	.	3.76
GW-205	UNCS	03/05/09	BJC	<	.	2.7	59.1	10.3	3.62
GW-205	UNCS	07/27/09	BJC	<	.	2.52	64.3	11.1	3.88
GW-217	LIV	01/28/09	BJC	<	.	1.51	<	.	2.98
GW-217	LIV	07/13/09	BJC	<	.	1.4	<	.	2.91
GW-221	UNCS	03/05/09	BJC	<	.	2.01	<	.	4.02
GW-221	UNCS	07/27/09	BJC	<	.	3.25	<	.	4.04
GW-231	KHQ	01/12/09	BJC	<	.	1.95	<	.	3.39
GW-231 Dup	KHQ	01/12/09	BJC	<	.	2.96	<	.	3.39
GW-294	ECRWP	01/14/09	BJC	<	.	1.85	.	.	.
GW-294 Dup	ECRWP	01/14/09	BJC	<	.	2.28	.	.	.
GW-294	ECRWP	07/08/09	BJC	<	.	1.45	.	.	.
GW-294 Dup	ECRWP	07/08/09	BJC	<	.	1.98	.	.	.
GW-296	ECRWP	01/14/09	BJC	<	.	1.39	.	.	.
GW-296	ECRWP	07/08/09	BJC	<	.	1.79	.	.	.
GW-298	ECRWP	01/13/09	BJC	<	.	1.73	.	.	.
GW-298	ECRWP	07/08/09	BJC	<	.	2.33	.	.	.
GW-305	LIV	01/28/09	BJC	<	.	1.58	<	.	3.1
GW-305	LIV	07/09/09	BJC	<	.	2.24	<	.	3.15
GW-521	LIV	01/28/09	BJC	<	.	1.91	<	.	2.85
GW-521	LIV	07/09/09	BJC	<	.	1.51	<	.	2.83
GW-522	LIV	01/28/09	BJC	<	.	1.46	<	.	2.9
GW-522 Dup	LIV	01/28/09	BJC	<	.	1.66	<	.	3.2
GW-522	LIV	07/09/09	BJC	<	.	1.42	<	.	3.56
GW-522 Dup	LIV	07/09/09	BJC	<	.	2.06	<	.	4.08
GW-540	LII	02/02/09	BJC	<	.	1.92	<	.	3.19
GW-540	LII	07/13/09	BJC	2.58	1.16	1.49	3.72	1.51	2.79
GW-557	LV	02/02/09	BJC	<	.	0.82	<	.	2.85
GW-557	LV	07/14/09	BJC	1.45	0.72	0.85	<	.	2.61
GW-560	CDLVII	02/02/09	BJC	<	.	1.74	<	.	2.93
GW-560	CDLVII	07/15/09	BJC	<	.	1.36	<	.	2.81
GW-562	CDLVII	02/02/09	BJC	<	.	1.09	<	.	2.86
GW-562	CDLVII	07/15/09	BJC	<	.	1.2	<	.	3.16
GW-564	CDLVII	02/02/09	BJC	<	.	1.34	<	.	3.14
GW-564 Dup	CDLVII	02/02/09	BJC	<	.	1.46	<	.	3.02
GW-564	CDLVII	07/15/09	BJC	<	.	1.05	<	.	2.95
GW-564 Dup	CDLVII	07/15/09	BJC	<	.	0.83	<	.	3.08
GW-709	LII	02/03/09	BJC	1.17	0.67	0.86	3.49	1.36	2.48
GW-709	LII	07/13/09	BJC	3.34	1.19	1.3	<	.	3.48

APPENDIX F.3: CY 2009 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-757	LII	02/03/09	BJC	<	.	2.86	12.3	1.99	3.03
GW-757	LII	07/13/09	BJC	4.39	1.54	1.95	16.7	2.09	2.82
GW-796	LV	01/29/09	BJC	0.83	0.54	0.77	<	.	3.52
GW-796	LV	07/14/09	BJC	1.2	0.56	0.2	3.27	1.4	2.62
GW-797	LV	01/29/09	BJC	<	.	2.06	<	.	3.35
GW-797	LV	07/14/09	BJC	2.16	1.05	1.41	<	.	2.96
GW-798	CDLVII	02/02/09	BJC	<	.	1.04	<	.	2.69
GW-798	CDLVII	07/14/09	BJC	<	.	1.04	<	.	2.95
GW-799	LV	01/29/09	BJC	1.03	0.61	0.81	<	.	2.72
GW-799	LV	07/14/09	BJC	<	.	1.61	<	.	3.59
GW-801	LV	01/29/09	BJC	0.89	0.61	0.89	<	.	3.5
GW-801	LV	07/13/09	BJC	1.51	0.66	0.23	<	.	2.86
MCK 2.0	EXP-SW	03/18/09	BJC	<	.	1.46	4.36	1.75	3.06
MCK 2.0	EXP-SW	09/03/09	BJC	<	.	1.69	5.26	1.89	3.16
MCK 2.05	EXP-SW	03/18/09	BJC	<	.	2.38	4.59	2.14	3.94
MCK 2.05 Dup	EXP-SW	03/18/09	BJC	<	.	2.01	<	.	4.17
MCK 2.05	EXP-SW	09/03/09	BJC	<	.	1.67	7.74	2.2	3.19
MCK 2.05 Dup	EXP-SW	09/03/09	BJC	<	.	1.57	6.46	1.96	2.94
S17	EXP-SW	10/12/09	GWPP	<	.	2.5	<	.	6.6
SCR1.25SP	EXP-SW	03/11/09	BJC	<	.	2	<	.	4.26
SCR1.25SP	EXP-SW	09/03/09	BJC	<	.	1.64	<	.	2.99
SCR1.5SW	EXP-SW	10/12/09	GWPP	<	.	3	<	.	7
SCR2.1SP	EXP-SW	10/12/09	GWPP	<	.	3.4	<	.	6.7
SCR2.2SP	EXP-SW	10/12/09	GWPP	<	.	4.2	<	.	5.9
SCR3.5SP	EXP-SW	03/11/09	BJC	<	.	2.44	<	.	4.52
SCR3.5SP	EXP-SW	09/03/09	BJC	<	.	1.79	3.18	1.61	3.04
SCR3.5SW	EXP-SW	10/12/09	GWPP	5	2.9	3	<	.	6.3
SCR4.3SP	EXP-SW	01/29/09	BJC	<	.	2.09	4.55	1.62	2.97
SCR4.3SP	EXP-SW	07/14/09	BJC	<	.	1.2	<	.	3.16
UNC SW-1	EXP-SW	03/11/09	BJC	<	.	2.64	<	.	4.43
UNC SW-1	EXP-SW	08/19/09	BJC	<	.	1.84	<	.	2.74

APPENDIX F.3: CY 2009 MONITORING DATA FOR THE CHESTNUT RIDGE HYDROGEOLOGIC REGIME
Radiological Analytes: Isotopic Analyses

Sampling Point	1090						GW-203					
Functional Area	UNCS						UNCS					
Date Sampled	03/05/09			07/27/09			03/05/09			07/27/09		
Program	BJC			BJC			BJC			BJC		
Sample Type												
Result (pCi/L)	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA
Gross Alpha	<	.	2.64	<	.	2.73	4.34	2.71	3.73	<	.	1.68
Gross Beta	<	.	4.16	<	.	4.6	<	.	4.7	<	.	3.76
Cesium-137	.	.	.	.	.	.	.	.	.	.	.	.
Cobalt-60	.	.	.	.	.	.	.	.	.	.	.	.
Potassium-40	.	.	.	.	.	.	.	.	.	.	.	.
Strontium-89/90	<	.	1.54	<	.	1.84	<	.	1.92	<	.	1.93
Technetium-99	.	.	.	.	.	.	.	.	.	.	.	.
Uranium-234	<	.	0.78	0.786	0.444	0.266	0.632	0.437	0.409	<	.	0.409
Uranium-235	<	.	0.603	<	.	0.313	<	.	0.313	<	.	0.382
Uranium-238	<	.	0.517	0.388	0.308	0.266	0.377	0.335	0.367	<	.	0.352

Sampling Point	GW-205						GW-221					
Functional Area	UNCS						UNCS					
Date Sampled	03/05/09			07/27/09			03/05/09			07/27/09		
Program	BJC			BJC			BJC			BJC		
Sample Type												
Result (pCi/L)	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA	Activity	TPU	MDA
Gross Alpha	<	.	2.7	<	.	2.52	<	.	2.01	<	.	3.25
Gross Beta	59.1	10.3	3.62	64.3	11.1	3.88	<	.	4.02	<	.	4.04
Cesium-137	<	.	7.21	<	.	7.97	.	.	.	.	.	.
Cobalt-60	<	.	8.99	<	.	10.6	.	.	.	.	.	.
Potassium-40	<	.	134	<	.	156	.	.	.	.	.	.
Strontium-89/90	<	.	1.61	<	.	2.3	<	.	1.61	<	.	2.16
Technetium-99	<	.	11.5	<	.	10.5	.	.	.	.	.	.
Uranium-234	0.517	0.396	0.455	<	.	0.536	<	.	0.347	<	.	0.352
Uranium-235	<	.	0.506	<	.	0.442	<	.	0.419	<	.	0.316
Uranium-238	<	.	0.551	<	.	0.381	<	.	0.386	<	.	0.317

Sampling Point	UNC SW-1					
Functional Area	UNCS					
Date Sampled	03/11/09			08/19/09		
Program	BJC			BJC		
Sample Type						
Result (pCi/L)	Activity	TPU	MDA	Activity	TPU	MDA
Gross Alpha	<	.	2.64	<	.	1.84
Gross Beta	<	.	4.43	<	.	2.74
Cesium-137	<	.	9.99	<	.	9.25
Cobalt-60	<	.	10.4	<	.	11.6
Potassium-40	<	.	158	<	.	162
Strontium-89/90	.	.	.	.	.	.
Technetium-99	.	.	.	.	.	.
Uranium-234	.	.	.	.	.	.
Uranium-235	.	.	.	.	.	.
Uranium-238	.	.	.	.	.	.

APPENDIX G

CY 2009 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)
SP-17	-	Spring (East Fork Regime)
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 2009. Each method and trip blank was analyzed for volatile organic compounds (VOCs). None of the method blank samples contained VOCs. However, chloroform was detected (2 µg/L) in one trip blank sample (sample number A090900098) that was associated with well GW-508. Chloroform was not detected in the groundwater sample.

Two field blank samples were collected and analyzed for VOCs during CY 2009. These samples were collected at well GW-623 (03/03/09) in the Bear Creek Regime and well 56-3C (07/30/09) in the East Fork Regime. The field blank samples were analyzed for VOCs and acetone was detected (9 µg/L) in the sample collected at well 56-3C.

Two equipment rinsate samples were collected and analyzed for VOCs at Westbay wells during CY 2009: one in the Bear Creek Regime at well GW-726 (second quarter), and the other in the East Fork Regime at well GW-722 (third quarter). None of the VOCs were detected in the rinsate sample from well GW-726, 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	A091820230	09/02/09	2-Butanone	4 J	µg/L
			Acetone	30	µg/L
			Tetrachloroethene	2 J	µg/L

Of the VOCs detected, only tetrachloroethene was detected (1 µg/L) in the groundwater sample from the zone, and it was less than the value reported for the rinsate sample.

APPENDIX G: CY 2009 QUALITY ASSURANCE/QUALITY CONTROL DATA
Correlation with Associated Groundwater and Surface Water Samples

Sampling Point	Hydrogeologic Regime	Date Sampled	Sample Number	Trip Blank Sample Number	Method Blank Sample Number
55-2A	EF	10/27/09	A092670158	A092710314	Q093280106
55-2B	EF	10/26/09	A092670157	A092710315	Q093280106
55-2C	EF	10/26/09	A092670156	A092710315	Q093280106
55-3A	EF	05/14/09	A090850256	A090900085	Q091610083
55-3A	EF	10/20/09	A092670155	A092710317	Q093200289
55-3B	EF	05/14/09	A090850255	A090900085	Q091610083
55-3B	EF	10/21/09	A092670154	A092710316	Q093230109
55-3C	EF	05/13/09	A090850254	A090900086	Q091610003
55-3C	EF	10/21/09	A092670153	A092710316	Q093230109
56-1A	EF	07/28/09	A091820243	A091820195	Q092320136
56-1C	EF	07/28/09	A091820242	A091820195	Q092320136
56-1C D	EF	07/28/09	A091820241	A091820195	Q092320136
56-2A	EF	07/29/09	A091820240	A091820194	Q092320144
56-2B	EF	07/29/09	A091820239	A091820194	Q092320144
56-2C	EF	07/28/09	A091820238	A091820195	Q092320136
56-3A	EF	07/30/09	A091820237	A091820193	Q092320140
56-3B	EF	07/29/09	A091820236	A091820194	Q092320136
56-3C	EF	07/30/09	A091820235	A091820193	Q092320140
56-4A	EF	05/12/09	A090850253	.	Q091610000
GW-014	BC	03/04/09	A090060070	A090060121	Q090910118
GW-053	BC	03/03/09	A090060079	A090060122	Q090920030
GW-053 D	BC	03/03/09	A090060077	A090060122	Q090920030
GW-058	BC	02/10/09	A090060078	A090060117	Q090710000
GW-065	BC	02/25/09	A090060076	A090060111	Q090820069
GW-065	BC	08/06/09	A091820209	A091820190	Q092320152
GW-068	BC	03/03/09	A090060075	A090060122	Q090920030
GW-071	BC	03/04/09	A090060074	A090060121	Q090910118
GW-071	BC	08/10/09	A091820208	A091820189	Q092320155
GW-082	BC	08/10/09	A091820207	A091820189	Q092320155
GW-098	BC	02/25/09	A090060071	A090060110	Q090840133
GW-100	BC	02/19/09	A090060089	A090060114	Q090820069
GW-101	BC	02/19/09	A090060088	A090060114	Q090820069
GW-122	BC	02/17/09	A090060087	A090060116	Q090710004
GW-127	BC	02/17/09	A090060086	A090060116	Q090710004
GW-153	EF	10/14/09	A092670171	A092710319	Q093130088
GW-153 D	EF	10/14/09	A092670170	A092710319	Q093130088
GW-175	CR	12/15/09	A093200191	A093290070	Q100070025
GW-220	EF	04/29/09	A090850250	A090900093	Q091470000
GW-220	EF	10/14/09	A092670152	A092710319	Q093130088
GW-222	EF	04/30/09	A090850249	A090900092	Q091470003
GW-222 D	EF	04/30/09	A090850248	A090900092	Q091470007
GW-225	BC	02/26/09	A090060085	A090060125	Q090840133
GW-229	BC	02/26/09	A090060084	A090060125	Q090840133
GW-236	BC	02/23/09	A090060083	A090060113	Q090820069
GW-240	EF	10/14/09	A092670151	A092710319	Q093130088
GW-242	BC	03/05/09	A090060082	A090060120	Q090920034
GW-246	BC	08/05/09	A091820206	A091820191	Q092320148
GW-251	EF	04/30/09	A090850247	A090900092	Q091470007

APPENDIX G: CY 2009 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-269	EF	04/21/09	A090850246	A090900097	Q091400123
GW-270	EF	04/28/09	A090850245	A090900095	Q091420052
GW-272	EF	04/21/09	A090850244	A090900097	Q091400117
GW-274	EF	04/21/09	A090850243	A090900097	Q091400123
GW-274 D	EF	04/21/09	A090850241	A090900097	Q091400123
GW-275	EF	04/27/09	A090850240	A090900096	Q091420052
GW-289	BC	08/06/09	A091820205	A091820190	Q092320152
GW-289 D	BC	08/06/09	A091820204	A091820190	Q092320152
GW-307	BC	02/10/09	A090060081	A090060117	Q090710000
GW-307 D	BC	02/10/09	A090060098	A090060117	Q090710000
GW-315	BC	02/17/09	A090060080	A090060116	Q090710004
GW-322	CR	12/16/09	A093200190	A093290069	Q100070025
GW-332	EF	04/28/09	A090850239	A090900095	Q091420052
GW-337	EF	04/28/09	A090850238	A090900095	Q091420052
GW-365	BC	03/02/09	A090060099	A090060123	Q090920030
GW-381	EF	10/19/09	A092670150	A092710318	Q093200289
GW-383	EF	10/14/09	A092670149	A092710319	Q093130088
GW-508	EF	04/20/09	A090850235	A090900098	Q091400117
GW-601	BC	03/02/09	A090060096	A090060123	Q090920030
GW-615	BC	02/18/09	A090060095	A090060115	Q090710004
GW-623	BC	03/03/09	A090060094	A090060122	Q090920030
GW-627	BC	03/05/09	A090060092	A090060120	Q090920034
GW-627	BC	08/06/09	A091820201	A091820190	Q092320152
GW-629	BC	03/05/09	A090060091	A090060120	Q090920034
GW-629	BC	09/09/09	A092510134	A091820182	Q092780599
GW-629	BC	08/06/09	A091820200	A091820190	Q092320155
GW-633	EF	04/28/09	A090850234	A090900094	Q091470000
GW-648	BC	02/09/09	A090060090	A090060118	Q090710000
GW-648	BC	08/05/09	A091820199	A091820191	Q092320148
GW-648 D	BC	02/09/09	A090060109	A090060118	Q090710000
GW-653	BC	03/05/09	A090060108	A090060120	Q090910118
GW-656	EF	05/12/09	A090850233	A090900099	Q091610003
GW-686	EF	05/13/09	A090850232	A090900086	Q091610003
GW-690	EF	05/13/09	A090850231	A090900086	Q091610003
GW-691	EF	05/12/09	A090850230	A090900099	Q091610000
GW-691	EF	10/20/09	A092670169	A092710317	Q093200289
GW-691 D	EF	10/20/09	A092670168	A092710317	Q093200289
GW-692	EF	05/12/09	A090850229	A090900099	Q091610000
GW-698	EF	04/29/09	A090850228	A090900093	Q091470007
GW-698	EF	10/21/09	A092670148	A092710316	Q093230109
GW-698 D	EF	04/29/09	A090850227	A090900093	Q091470007
GW-700	EF	07/28/09	A091820233	A091820195	Q092320136
GW-703	BC	02/26/09	A090060107	A090060124	Q090840133
GW-722-14	EF	09/02/09	A091820232	A091820184	Q092740178
GW-722-17	EF	09/02/09	A091820231	A091820184	Q092740178
GW-722-20	EF	09/02/09	A091820229	A091820184	Q092740178
GW-722-22	EF	09/02/09	A091820228	A091820184	Q092740178
GW-722-33	EF	09/03/09	A091820227	A091820183	Q092740178

APPENDIX G: CY 2009 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-724	BC	02/25/09	A090060106	A090060111	Q090820069
GW-725	BC	02/25/09	A090060105	A090060110	Q090840133
GW-726-04	BC	05/04/09	A090850218	A090900091	Q091470003
GW-726-06	BC	05/04/09	A090850217	A090900090	Q091470003
GW-726-09	BC	05/05/09	A090850216	A090900090	Q091470003
GW-726-12	BC	05/05/09	A090850215	A090900090	Q091470003
GW-726-16	BC	05/06/09	A090850214	A090900089	Q091540178
GW-726-20	BC	05/06/09	A090850213	A090900089	Q091540178
GW-726-23	BC	05/06/09	A090850212	A090900089	Q091540178
GW-735	EF	08/26/09	A091820226	A091820188	Q092670002
GW-738	BC	02/25/09	A090060104	A090060111	Q090820069
GW-740	BC	02/24/09	A090060103	A090060112	Q090820069
GW-744	EF	08/26/09	A091820225	A091820188	Q092670002
GW-747	EF	08/31/09	A091820224	A091820186	Q092720590
GW-750	EF	04/29/09	A090850226	A090900093	Q091470000
GW-763	EF	10/14/09	A092670147	A092710319	Q093130088
GW-765	EF	05/07/09	A090850225	A090900087	Q091540178
GW-769	EF	04/29/09	A090850224	A090900093	Q091470007
GW-775	EF	08/27/09	A091820223	A091820187	Q092670002
GW-776	EF	09/01/09	A091820222	A091820186	Q092720590
GW-779	EF	08/31/09	A091820221	A091820186	Q092720590
GW-781	EF	08/27/09	A091820220	A091820187	Q092670002
GW-782	EF	08/27/09	A091820219	A091820187	Q092670002
GW-783	EF	08/27/09	A091820218	A091820187	Q092670002
GW-791	EF	08/27/09	A091820217	A091820187	Q092670002
GW-816	EF	08/26/09	A091820216	A091820188	Q092670002
GW-820	EF	04/29/09	A090850223	A090900093	Q091470000
GW-959	EF	05/06/09	A090850222	A090900088	Q091540178
GW-960	EF	05/07/09	A090850220	A090900087	Q091540178
Surface water and Springs					
BCK-04.55	BC	08/03/09	A091820213	A091820192	Q092320148
BCK-09.40	BC	08/03/09	A091820212	A091820192	Q092320148
BCK-09.40 D	BC	08/03/09	A091820211	A091820192	Q092320148
BCK-11.97	BC	08/03/09	A091820210	A091820192	Q092320148
GHK2.51WSW	EF	01/29/09	A090060102	A090060119	Q090400144
NPR12.0SW	EF	01/29/09	A090060101	A090060119	Q090400144
NPR23.0SW	EF	01/29/09	A090060100	A090060119	Q090400144
NT-01	BC	08/03/09	A091820198	A091820192	Q092320144
S17	CR	10/12/09	A092670163	A092710321	Q093130084
SCR1.5SW	CR	10/12/09	A092670162	A092710321	Q093130084
SCR2.1SP	CR	05/04/09	A091200196	A090900091	Q091470003
SCR2.1SP	CR	10/12/09	A092670161	A092710321	Q093130084
SCR2.2SP	CR	10/12/09	A092670160	A092710321	Q093130084
SCR3.5SW	CR	10/12/09	A092670159	A092710321	Q093130084
SP-17	EF	08/03/09	A091820215	A091820192	Q092320140
SP-17 D	EF	08/03/09	A091820214	A091820192	Q092320140
SS-4	BC	08/03/09	A091820197	A091820192	Q092320144
SS-5	BC	08/03/09	A091820196	A091820192	Q092320144

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