3.4 WATER RESOURCES

This section describes the surface water and groundwater resources for the site of the proposed Eagle Rock Enrichment Facility (EREF). It provides data for the site and surrounding area and describes the regional setting of the natural water systems. This information establishes the basis for evaluation of potential facility impacts on surface water, groundwater, aquifers, water use, and water quality. Subsections address surface hydrology, water quality characteristics, pre-existing environmental conditions, water rights and resources, water use, contamination sources, and groundwater characteristics.

Much of the water resources information was obtained from prior studies, including extensive subsurface investigations for the Department of Energy's Idaho National Laboratory (INL), which is located immediately west of the proposed site, as well as regional studies conducted by the U.S. Geologic Survey and the State of Idaho. This information is supplemented by a site specific groundwater monitoring and sampling program initiated in March 2008.

The proposed facility will use groundwater for both process and potable water requirements. No surface water will be used. The collection and storage of runoff from specific site areas will be controlled. As described below, no significant adverse changes are expected for the hydrologic environment as a result of construction and operation of the facility. ER Section 4.4.7, Control of Impacts to Water Quality, addresses the potential impacts to water resources as a result of activities at the proposed facility, including runoff and infiltration changes due to plant construction and fill placement.

3.4.1 Surface Hydrology

The National Oceanic and Atmospheric Administration's (NOAA) Western Regional Climate Center maintains historical climate data for weather stations throughout the western United States. NOAA classifies the climate of the proposed site as semi-arid climate. A detailed description of the local climate is presented in ER Section 3.6, Meteorology, Climatology, and Air Quality. The combination of low annual precipitation, high evaporation and site topography has created a low potential for surface water run-on or run-off for this site.

The proposed EREF site contains no surface water bodies. There are a few small drainage features in the northeastern corner, and the southeastern and southwestern areas of the proposed site. However, the drainages in the northeastern corner are no longer evident in the field because they are within irrigated crop circles when the natural topography has been smoothed to accommodate crop production. The southeastern and southwestern drainage features likely originated from natural erosional processes during spring snowmelt or heavy rains but now primarily conduct minor amounts of water from irrigated agriculture areas. The southeastern drainages terminate as seepage loss into the ground or by evapotranspiration. In the southwestern area, a single natural drainage was identified during field reconnaissance and this ephemeral drainage can convey water off site during episodic melt water and precipitation events or agricultural flooding. The drainage is located in the southwestern corner of the proposed site and runs from the south-central area of the proposed site southward toward Highway 20. The source of the water within the site boundary is likely the westernmost center pivot agricultural irrigation system. The drainage also potentially conveys surface water during large rainfall events. Just to the north of Highway 20, a series of small ponds were used historically to collect and store water from this drainage for agricultural uses, but these ponds are no longer in use and are dry. Highway 20 has a culvert to convey water from this drainage to the south away from the roadway. Based on field observations, this drainage has an incised channel into the soil exposing bedrock in some areas. Figure 3.4-1, Drainage Feature and Location, shows this drainage feature.

Regional and local hydrologic features are shown in Figure 3.4-2, Regional Hydrologic Features Within 80 km (50 mi), and Figure 3.4-3, Local Hydrologic Features Within 8 km (5 mi). An example of typical site drainage morphology is shown in Figure 3.4-4, Photo of Small Drainage Feature.

Most precipitation is contained on site due to infiltration and evapotranspiration. The vegetation on the site is primarily big sagebrush and perennial grasses or crops on approximately 389 ha (962 acres) of the proposed facility. The surface soils are predominantly of an eolian origin having low permeability and high storage, which tends to hold moisture rather than allow rapid infiltration. Water held in storage in the soil is subsequently subject to evapotranspiration by the well rooted xerophyte type and drought resistant plants of this locale.

Twenty subsurface borings were drilled at the site during November 2007. An additional 10 borings were drilled in May 2008. Moisture content by weight of the initial 20 samples ranged from 9.6% to 15.5%. Moisture content by weight of the May 2008 samples ranged from 10.6% to 19.0%. The winter and spring of 2008 were exceptionally moist in terms of snow and rainfall, explaining the higher moisture contents measured in May 2008 compared to those for November 2007.

The groundwater system underlying the Snake River Plain (SRP) in the vicinity of the proposed facility is referred to as the Eastern Snake River Plain (ESRP) Aquifer (Whitehead, 1992). Recharge rates from precipitation can vary significantly from one part of the ESRP to another due to variations in rainfall, timing, surface cover, evaporation rates, vegetation, etc. In the central part of the ESRP recharge rates are reported to range from 0.6 cm/yr (0.2 in/yr) near the EREF site to 9.1 cm/yr (3.6 in/yr) near Craters of the Moon to the west. The higher recharge rates at Craters of the Moon is attributed to higher precipitation, freshly exposed basaltic lava with high permeability, and because soils and vegetation are largely absent (Ackermann, 2006). At INL, recharge rates range from 0.30 cm/yr (0.12 in/yr) to 1.2 cm/yr (0.48 in/yr) or 2% to 5% of mean annual precipitation of 21.3 cm/yr (8.4 in/yr) (Ackermann, 2006). Given the proximity of INL and similarity in terrain, recharge rates to the ESRP Aquifer at the proposed site are also expected to be in the range of 2% to 5% of mean annual precipitation.

3.4.1.1 Facility Withdrawals and/or Discharges to Hydrologic Systems

A summary of annual liquid waste volumes anticipated to accumulate at the EREF is provided in Table 3.4-1, Summary of Potentially Contaminated Liquid Wastes for the Eagle Rock Enrichment Facility. EREF water consumption is provided in Table 3.4-2, Anticipated Normal Plant Water Consumption and Table 3.4-3, Anticipated Peak Plant Water Consumption. Domestic and process water will be withdrawn from one or more on-site wells. The EREF is expected to require approximately 18,800 m^3/yr (4,970,000 gal/yr) in support of plant operations. Of this approximately 1,382 m^3/yr (365,000 gal/yr) will be consumed by plant processes and 17,407 m^3/yr (4,599,000 gal/yr) will be used for potable water.

The EREF design precludes operational process discharges from the plant to surface or groundwater. Liquid wastes are treated and discharged to atmosphere by evaporation via the Liquid Effluent Collection and Treatment System Evaporator. Total effluent discharge to atmosphere by evaporation from the liquid effluent system evaporator are approximately 29,600 L (7,825 gal) annually. The slurry from the evaporator process is expected to be approximately 360 L (95 gal) annually. This waste will be collected and transferred offsite to a low-level waste facility. An engineered basin, the Cylinder Storage Pads Stormwater Retention Basin, will be utilized for the collection and containment of water from stormwater runoff from the Cylinder Storage Pads and daily treated domestic sanitary effluent discharges. The annual treated domestic sanitary effluent discharge to the basin will be approximately 14,600 m^3/yr (3,860,000 gal/yr). The annual stormwater runoff discharge from the Cylinder Storage Pads to the Cylinder Storage Pads Stormwater Retention Basin will be approximately 32,400 m^3/yr (8,560,000 gal/yr). Therefore, the total potential annual discharge to the Cylinder Storage Pads Stormwater Retention Basin will be approximately 47,000 m^3 (12,420,000 gal). The location of the Cylinder Storage Pads Stormwater Retention Basis is shown on Figure 4.4-1, Facility Layout with Stormwater Detention/Retention Basins. Evaporation will provide the only means of liquid disposal from this Cylinder Storage Pads Stormwater Retention Basin. The Cylinder Storage Pads Stormwater Retention Basin will include a single membrane liner, to eliminate infiltration into the ground. Residual dry solids, if any, after evaporation of water, will be impounded within the basin.

The Cylinder Storage Pads Stormwater Retention Basin is designed to contain a volume of approximately 110,087 m^3 (89 acre-ft) maintaining a freeboard of 0.9 m (3.0 ft). Under highly unlikely events, the volume of the basin will contain approximately 113,888 m^3 (92 acre-ft), maintaining a freeboard of 0.3 m (1.0 ft). The area served by the basin includes 12.7 ha (31.4 acres), the total area of the Cylinder Storage Pads. The retention basin is designed to contain runoff for a volume equal to twice that for the 24-hour, 100-year return frequency rain storm, a 5.70-cm (2.24-in) rainfall plus allowances for daily treated sanitary effluent discharges.

A packaged treatment plant is planned to dispose of domestic sanitary wastes at the site. The solid wastes generated by the Domestic Sanitary Sewage Treatment Plant will be temporarily stored in a holding tank for periodic disposal at an off-site location, as described in ER Section 4.1.2, Utilities Impacts. As indicated above, daily treated domestic sanitary effluent from the sewage system will be directed to the lined Cylinder Storage Pads Stormwater Retention Basin.

Residual solids, after evaporation of water from the Cylinder Storage Pads Stormwater Retention Basin, will be removed off site by a licensed contractor. The wastes will be disposed based on their characterization and in accordance with the U.S. EPA and State of Idaho regulatory requirements. The State of Idaho has adopted the U.S. EPA hazardous waste regulations governing the generation, handling, storage, transportation, and disposal of hazardous materials (IDAPA, 2008f). These regulations are found in ER Section 1.3, Applicable Regulatory Requirements, Permits and Required Consultations.

Stormwater runoff from the central, southern, and surrounding runoff diversions will be collected in the Site Stormwater Detention Basin. The Site Stormwater Detention Basin is located at the south side of the proposed site and will collect runoff from various developed parts of the site, including roads, parking areas, and building roofs (see Figure 4.4-1, Facility Layout with Stormwater Detention/Retention Basins). The detention basin will be unlined and will have an outlet structure to control discharges above the design level. Normal discharge will be through evaporation and infiltration into the ground. The detention basin will be designed to contain runoff for a volume equal to the 24-hour, 100-year return frequency rain storm of 5.70 cm (2.24 inch) rainfall. The storage capacity available for maintaining a freeboard of 0.6 m (2.0 ft) is approximately 32,835 m^3 (27 acre-ft). For a highly unlikely storm scenario maintaining a freeboard of 0.3 m (1.0 ft), the basin will have approximately 49,600 m^3 (40 acre-ft) of storage capacity. The area served by the detention basin is about 134 ha (332 acres). It will also be designed to detain post-construction peak flow runoff rates from the outfall that are equal to or less than the pre-construction runoff rates from the site area.

Water balances for the Cylinder Storage Pads Stormwater Retention Basin are presented in Tables 3.4-4 and 3.4-5, Water Balance for the Cylinder Storage Pads Stormwater Retention

Basin (minimum and maximum scenarios, respectively). Similarly, water balances for the Site Stormwater Detention Basin are found in Tables 3.4-6 and 3.4-7, Water Balance for the Site Stormwater Detention Basin (minimum and maximum scenarios, respectively). The water balance tables consider the following components:

- Precipitation runoff
- Direct precipitation
- Treated domestic sanitary effluent to the retention basin
- Infiltration from the detention basin, and
- Evaporation.

The water balances include the following inputs and assumptions in addition to those cited in the table notes:

- The annual minimum and maximum precipitation amounts were distributed by month using the recorded direct and wettest distribution by month. Use of the minimum precipitation amounts provides a minimum discharge scenario. Use of the maximum precipitation amounts provides a maximum discharge scenario. The information conservatively represents what could possibly occur (although highly unlikely) over a very dry or very wet calendar year based on the 53 year period of record.
- No credit is taken for outflows from the Site Stormwater Detention Basin through the discharge outlet. Any such flows will eventually infiltrate, evaporate or evapotranspirate.
- Precipitation inflow to the retention basin is based on 100% impervious surface contribution from the Cylinder Storage Pads.
- Precipitation inflow to the detention basin is based on the proposed developed surface characteristics of impervious areas, gravel areas, lawn and natural areas contributing to the basin. Inflows were calculated using the HydroCAD Stormwater Modeling System computer software. Urban Hydrology for Small Watersheds, TR-55 was used to calculate runoff curve numbers, taking into account the frozen ground conditions during the winter season.

The tables provide the monthly balance (inflow minus outflow). A positive value indicates that the inflow components exceed the outflow components for the respective basin. A negative value indicates that outflow components will dispose of a portion of or the entire monthly inflow for the respective basin. The tables also provide the monthly net in the basin. A non-zero value indicates that the basin will contain standing water.

The results for the Cylinder Storage Pads Stormwater Retention Basin show that basin outflow due to evaporation will exceed inflows for the months of May through October under the minimum discharge scenario. Cumulative basin outflow due to evaporation does not exceed the monthly inflows for this unlikely chain of events during the maximum discharge scenario. However, the storage volume provided is never exceeded even under the cumulative effect of back to back record wettest months. Under this highly unlikely event, freeboard has been reduced to 0.3 m (1.0 ft) for calculating available basin volume. For the more likely scenario, if the monthly mean precipitation is used in this basin model, a freeboard of 2.27 m (7.45 ft) is provided.

The results for the Site Stormwater Detention Basin show that basin outflow due to evaporation and infiltration will exceed all inflows on a monthly basis under both discharge scenarios. Of the amount that infiltrates into the ground, a portion is expected to eventually return to the atmosphere via evapotranspiration by vegetation growing within and in the vicinity of the basin.

As shown in Tables 3.4-6 and 3.4-7, the combination of both potential infiltration and potential evaporation are more than sufficient to dispose of basin inflows on a monthly basis.

In summary, the results demonstrate that even under the maximum scenarios, the capacities of the basins are not exceeded. As stated above, the evaporation rates used in calculating the water balances for the retention and detention basins are based on historic ambient evaporation rates for the site area. Should ambient seasonal air temperatures increase due to global warming and climate change, the evaporation rates would be expected to increase, further reducing infiltration from the detention basin and/or the potential to exceed basin capacities. As a result, the water balance tables are considered conservative.

3.4.2 Water Quality Characteristics

As discussed in ER Section 3.4.1, Surface Hydrology, there are no surface water bodies at the proposed facility and no surface water was present in the drainages during the site field investigations and site visits between November 2007 and July 2008, and October 2008. The vast majority of runoff from precipitation at the site is effectively contained on site by the natural topography where it infiltrates into the shallow soils. There are small linked drainages that likely convey limited seasonal drainage. The heads of these drainages are near the boundary of the facility footprint.

Two agricultural wells (Lava Well-3 and Spud Well) were previously installed at the proposed site. In addition, five deep aquifer monitoring wells (GW-1 through GW-5) and one shallow perched water well (GW-4S) were drilled and installed on the proposed site (see Figure 3.4-5). Standard protocols were followed during all phases of well drilling, installation, completion, development, and sample collection.

Groundwater samples were collected from all of the aquifer monitoring wells; however, a groundwater sample could not be obtained from the shallow perched water well (GW-4S) due to lack of water. GW-4S was installed to determine if a perched groundwater system existed at the site; however, this well has remained dry since completion. The existing agricultural wells were sampled in March 2008, June 2008, and October 2008. The deep monitoring wells GW-1 through GW-5 were sampled as they were completed between May 2008 and July 2008, and sampled a second time in October 2008. Additional sampling and analysis of the on-site monitoring wells is anticipated to be performed in January 2009 and April 2009 to establish seasonal characterization of the on-site groundwater quality. The regional and local groundwater chemistry is described in detail in ER Section 3.4.15.

3.4.3 Pre-Existing Environmental Conditions

Historically, the site has been used for farming and grazing. There is no documentation of manufacturing, storage, or significant use of hazardous chemicals on the subject property. The closest area of large industrial operations is the INL. The eastern boundary of the INL is about 0.8 km (0.5 mi) west of the proposed site. The INL property near the proposed site is undeveloped rangeland. The closest facility on the INL property is the Materials and Fuels Complex located approximately 16 km (10 mi) west of the proposed property boundary. There are no other commercial or industrial facilities within 8 km (5 mi) of the site.

The primary anthropogenic effects on water quality reported for the ESRP Aquifer in the vicinity to the EREF are due to:

- Agricultural practices
- Industrial operations at INL

The major effects of agricultural practices on the ESRP water quality are elevated concentrations of nitrate and other anions and the occasional presence of pesticides. Wells near the eastern boundary of the INL show elevated nitrate and other anion concentrations probably due to agricultural impacts (DOE-ID, 2007a). The elevated nitrate concentrations are indicative of leaching of fertilizers in agricultural areas and transport into the aquifer. The transport to the aquifer reflects irrigation water migrating back to the aquifer with an increase in anions, chloride and sulfate due to evaporation. Agricultural areas upgradient of the EREF site could impact water quality beneath the EREF site.

INL is the closest area of large industrial operations to the proposed EREF site. However, regional groundwater flow directions indicate that INL is cross gradient to the proposed EREF (DOE-ID, 2007a; DOE-ID, 2007b; Ackerman, 2006). Groundwater flow paths determined by delineation of groundwater plumes at the INL indicate that these plumes will not impact the proposed EREF site (DOE-ID, 2007b).

3.4.4 Historical and Current Hydrological Data

The proposed facility is located in an area with no surface water bodies. The predominant regional direction of groundwater flow is from the northeast to southwest (Smith, 2004) (Whitehead, 1992). The closest surface water bodies are the Snake River and the Market Lake Wildlife Management Area (WMA). These two surface water bodies are located about 32 km (20 mi) to the east and northeast of the site, respectively. Each of these features is located within the Idaho Falls watershed (Hydrologic Unit Code [HUC] 17040201) (IDEQ, 2004). Due to the distance of these surface waters bodies from the proposed site, it is unlikely that they will be impacted by the facility from surface water flow. Flow data for the Snake River are presented in ER Section 3.4.13, Freshwater Streams for the Watershed Containing the Site.

3.4.5 Statistical Inferences

With the exception of the calculation and presentation of simple arithmetic means, no statistical parameters are used to provide or interpret surface hydrologic data for the proposed facility.

3.4.6 Water Rights and Resources

The proposed facility will obtain water for operational purposes from groundwater using wells within the property boundary. Water rights and transfers associated with the acquisition of this water are described in the following subsections.

3.4.6.1 Public Water Supply and Water Rights

The ESRP Aquifer has been a designated “sole source aquifer” since 1991. A sole source aquifer is defined by the EPA as an aquifer that supplies at least 50% of the drinking water in the area overlying the aquifer. The EPA definition also requires that the area dependent on the sole source aquifer must have no alternative drinking water sources that could satisfy all of the drinking water in an economical and legal manner (EPA, 2008a). At the current time, the ESRP Aquifer is the sole source of drinking water for the entire population residing in southeast and south-central Idaho.

The largest municipalities located in the ESRP include Idaho Falls in Bonneville County and Pocatello in Bannock County. The City of Idaho Falls operates a system of 19 groundwater wells that produce an average daily usage of about 76,000 m^3/d (20,000,000 gal/d) and maximum usage of 220,000 m^3/d (58,000,000 gal/d). The City of Pocatello obtains drinking water from the ESRP and the tributary Portneuf Aquifer through a system of 21 water supply wells. These wells provide an average of 57,160 m^3/d (15,000,000 gal/d) (IDC, 2008a).

The use of groundwater by the EREF will be covered by a 1961 water right appropriation that will be transferred to the property for use as industrial water. The water transfer will occur concurrently with the purchase of the property by AES and will change the original water use from agriculture to industrial use. The primary point of diversion will be from the existing agricultural well, Lava Well 3, near the center of Section 13, or a replacement well. The water will be assigned to other points of diversion to allow for the use of water from another well if the primary well should happen to fail. The original 1961 appropriation will decrease to approximately 1,713 m^3/day (452,500 gal/day) for industrial use and 147 m^3/day (38,800 gal/day) for seasonal irrigation use. The predicted daily water consumption of the EREF is anticipated to be approximately 51.5 m^3/d (13,600.0 gal/d) and the peak water consumption rate is anticipated to be 43 L/s (689 gpm). The normal annual water usage rate for the EREF will be 18,790,000 L/yr (4,970,000 gal/yr), which is a very small fraction (i.e., about 3%) of the water appropriation value of 625,000,000 L/yr (165,000,000 gal/yr) for industrial use. The peak water usage is developed based on the assumption that all water users are operating simultaneously. Furthermore, the peak water usage assumes that each water user is operating at maximum demand. This combination of assumptions is very unlikely to occur during the lifetime of the EREF. Nevertheless, the peak water usage is used to size the piping system and pumps. Given that the normal annual water usage rate for the EREF is a very small fraction of the appropriation value, momentary usages of water beyond the expected normal water usage rate is expected to be well within the water appropriation value for the EREF.

3.4.6.2 Regional Groundwater Use

The SRP Aquifer is relied upon for drinking water and irrigation throughout southeastern Idaho (Garabedian, 1992)(Lindholm, 1996). A breakdown of the water withdrawals by use from the SRP Aquifer is provided in Table 3.4-8, Total Groundwater Withdrawals from the SRP Aquifer for Irrigation, Public-Supply, and Self-Supplied Industrial Water Uses in 2000. The data in this table indicate that irrigation is the primary use, accounting for 97% of the total withdrawals in 2000 (Maupin, 2005). Public water supply accounts for 3% of the total withdrawals, and industrial uses amount to a fraction of 1% (Maupin, 2005).

At the current time, about 1.2 million ha (3 million ac) of the SRP are irrigated farmlands. About one third of the irrigation water is pumped from the SRP Aquifer and two thirds from surface water diversions (DGI, 2008). Irrigation with groundwater is possible because of high rates of water yield from the basaltic units of the SRP Aquifer.

3.4.6.3 Idaho National Laboratory

The INL is a significant user of groundwater in the general area of the proposed site. The ESRP Aquifer is the source of all the water used at INL. In 2007, the INL pumped 3.97E+06 m^3 (1.05E+09 gal) from a total of 29 production wells at 8 facilities (INL, 2008). The water uses at the INL include drinking water for employees and water for use in chemical processing, facilities operations, wastewater treatment, and environmental remediation (ATSDR, 2004).

3.4.6.4 Site Groundwater Management

The proposed site location is within the Bonneville-Jefferson groundwater management district. According to the Idaho Department of Water Resources (IDWR, 2008a), groundwater districts were defined by the Idaho State Legislature in the "Ground Water District Act" of 1995. This Act allows groundwater users to organize their own Districts that have broader authorities than water measurement districts. The groundwater districts can perform the measurement and reporting functions required by law and levy assessments similar to water measurement districts. Additionally, groundwater districts may represent their members in various water use issues and related legal matters, develop and operate mitigation and recharge plans, and perform other duties. It is unlikely that stipulations of the Bonneville-Jefferson Groundwater Management District will have any impact on the proposed EREF use of ground water.

The proposed site location is not within the service areas of any irrigation companies. It also is not located in established groundwater critical groundwater areas, contamination areas, or groundwater vulnerability areas (IDWR, 2008a).

3.4.7 Quantitative Description of Water Use

The source of water for the proposed facility would come from on-site groundwater wells. Anticipated water use by the facility is shown in Table 3.4-2, Anticipated Normal Plant Water Consumption, and Table 3.4-3, Anticipated Peak Facility Water Consumption. The water supply will be adequate for operation and maintenance of the proposed site.

3.4.8 Non-Consumptive Water Use

The EREF will have a water appropriation of approximately 1,713 m^3/d (452,500 gal/d) for industrial use and 147 m^3/day (38,800 gal/day) for seasonal irrigation use. from an existing water right associated with the property. This water right will transfer to AES with the purchase of the property. Non-consumptive use of water is not planned.

3.4.9 Contaminant Sources

There will be no direct discharges to native groundwater or surface waters from the operations at the proposed facility, other than potential infiltration from the Site Stormwater Detention Basin. There is no history of industrial use at the site. With the exception of agricultural products (fertilizers, pesticides, etc.) used at or near the site, the closest source of known hazardous releases and contaminants to the groundwater system is the INL. However, the INL is hydrologically cross gradient to the proposed site based on predominant flow directions in the ESRP Aquifer (DOE-ID, 2007a; DOE-ID, 2007b; Ackerman, 2006). Agricultural influences are the only potential upgradient impacts. Additional industrial development could occur in the vicinity, but no plans for such operations are known at this time.

Stormwater runoff from the proposed site will be controlled during construction and operation. Appropriate stormwater construction runoff permits for construction activities will be obtained before construction begins. Designs for stormwater runoff controls for the operating plant are described in Section 4.4, Water Resources Impacts. Appropriate routine erosion control measures and best management practices (BMPs) will be implemented as is normally required by such permits.

During operation, stormwater will be collected from appropriate site areas and routed to detention/retention basins. The stormwater plan is described in ER Section 4.4.1, Receiving Waters and shown in Figure 4.4-1, Facility Layout with Stormwater Detention/Retention Basins.

3.4.10 Description of Wetlands

An evaluation of wetlands mapped by the Fish and Wildlife Service determined that the site does not contain jurisdictional wetlands (USFWS, 1980) (USFWS, 2008c).

3.4.11 Federal and State Regulations

ER Section 1.3, Applicable Regulatory Requirements, Permits, and Required Consultations, describes the applicable regulatory requirements and permits for this project. ER Section 4.4, Water Resources Impacts, describes potential site impacts as they relate to environmental permits regarding water use by the proposed EREF (refer to ER Section 1.3.1, Federal Agencies and ER Section 1.3.2, State Agencies).

Applicable regulations for water resources for this proposed site include:

- The Safe Drinking Water Act (SDWA) requirements on a state level: The Idaho Environmental Protection and Health Act (Idaho Code Chapter 1, Title 39) gives the Idaho Department of Environmental Quality (IDEQ) the authority to promulgate rules governing quality and safety of drinking water. The Water Quality Division (WQD) is delegated responsibility to implement the SDWA. Rules governing quality and safety of drinking water in Idaho have been promulgated in IDAPA 58.01.08. Although a permit is not required for a drinking water system serving fewer than 10,000 persons (IDAPA, 2008b), the IDEQ requires a comprehensive treatment plan and licensed plant operator. The drinking water plan for the proposed EREF will include sufficient detail to demonstrate that the proposed project meets applicable criteria. The facility plan generally addresses the overall system-wide plan.
- National Pollution Discharge Elimination System (NPDES): The NPDES permit program includes an industrial stormwater permitting component adopted under Section 402 of the CWA. The NPDES Stormwater Program regulates discharges of stormwater from industrial and commercial facilities to waters of the United States. Since the construction of the proposed EREF would be greater than 0.4 ha (1.0 ac), AES will obtain a NPDES Construction General Permit to establish the provisions for meeting stormwater regulations at the EREF. For operations, AES will obtain a NPDES Multi-Sector General Permit for stormwater discharges. Design, construction, and operational details of facility groundwater systems and stormwater pollution prevention plans will be provided to EPA and IDEQ as part of the Notice of Intent to obtain each permit. Water Well Permit: A permit application to drill a well must be approved by staff of the IDWR. The information required on the application includes the well location, proposed use, and well construction methods. Wells must be drilled by persons holding a driller's license from the IDWR. Wells must also comply with Idaho's well construction standards found at IDAPA 37.03.09 (IDAPA, 2008h). A drilling permit must be obtained before the construction of any well greater than 5.5 m (18.0 ft) in depth. The drilling permit is valid for two months from the approval date for the start of construction.

3.4.12 Surface Water Characteristics for Relevant Water Bodies

No off-site surface water runoff will occur from the proposed facility. One minor, natural erosional drainage exists within the proposed site boundary (described in ER Section 3.4.1, Surface Hydrology). It is located in the southwestern corner of the proposed site and runs from the south-central area of the proposed site southward toward Highway 20. Highway 20 has a culvert to convey water from this drainage to the south, away from the roadway. Precipitation that will fall on the developed areas of the proposed site will be collected in stormwater retention and detention basins where it will be allowed to evaporate or infiltrate into the subsurface in the case of the detention basin.

3.4.12.1 Freshwater Streams, Lakes, Impoundments

The proposed site does not include any freshwater streams or lakes. Retention and detention basins designed to contain stormwater runoff and treated effluent from the Domestic Sanitary Sewage Treatment Plant from the EREF will be constructed as part of the facility. These components are described in ER Section 3.4.1.1, Facility Withdrawals and/or Discharges to Hydrologic Systems.

3.4.12.2 Flood Frequency Distributions, Including Levee Failures

The proposed facility elevation is above the 100-year and the 500-year flood elevation (FEMA, 1981).

3.4.12.3 Flood Control Measures (Reservoirs, Levees, Flood Forecasting)

The proposed facility is not located near any reservoirs, levees or surface waters that could cause flooding of the plant site. In addition, because the proposed facility elevation will be above the 100-year and the 500-year flood elevation - as designated by FEMA (FEMA, 1981), no flood control measures are proposed.

3.4.12.4 Location, Size and Elevation of Outfall

Operations at the proposed facility will not include an outfall to any surface water bodies.

3.4.12.5 Outfall Water Body

The operations at the proposed facility will not include a surface water body outfall.

3.4.12.6 Bathymetry Near Any Outfall

The operations at the proposed facility will not include an outfall to any surface water bodies and, as a result, bathymetry is not necessary.

3.4.12.7 Erosion Characteristics and Sediment Transport

The EREF is designed as a non-discharge facility; therefore erosion and sediment transport are not expected to occur. The operations at the proposed facility will not include an outfall or discharge to any surface water bodies.

3.4.12.8 Floodplain Description

The proposed EREF site elevation is above the 100-year and the 500-year flood elevation (FEMA, 1981). There are no detailed floodplain maps available for the site since it is not located near any floodplains.

3.4.12.9 Design-Basis Flood Elevation

Since the proposed site is not within the 100-year or 500-year floodplain (FEMA, 1981), flooding at the proposed facility is unlikely. The proposed site is contained within the Idaho Falls watershed, HUC 17040201, with gradual average slopes of about 1.4%. The Natural Resources Conservation Service soil survey data summary indicates that soils typically have no potential for ponding (NRCS, 2008a). Any on-site precipitation will be subject to evapotranspiration or infiltration. Minor intermittent drainages originating within the site boundary do not connect to off-site resources or larger drainages. The largest surface water body southwest of the proposed site (along the topographical grade) is Lake Wolcott, approximately 120 km (75 mi) from the proposed site and the Snake River about 32 km (20 mi) east of the site. No special design considerations for local intense precipitation are necessary to prevent flooding at the proposed site other than the stormwater runoff controls described in ER Sections 4.4.1, Receiving Waters, and 4.4.7.1, Mitigations.

3.4.13 Freshwater Streams for the Watershed Containing the Site

The Snake River and some minor tributaries are located in the Idaho Falls watershed, HUC 17040201, where the proposed facility will be located (IDEQ, 2004). No streams on the proposed site flow directly to any tributaries or the Snake River.

3.4.13.1 Drainage Areas

The proposed facility is located in the Idaho Falls watershed, HUC 17040201. The slopes and surface waters generally flow from northeast to southwest. The closest surface water bodies are the Snake River and the Market Lake Wildlife Management Area (WMA), about 32 km (20 mi) to the east and northeast of the site, respectively. Each of these features is located within the Idaho Falls watershed, HUC 17040201 (IDEQ, 2004). As described in ER Section 3.4.1, Surface Hydrology, there are a few small drainage areas within the proposed site boundary.

3.4.13.2 Historical Maximum and Minimum River Flows

There are three USGS streamflow gauging stations for the Snake River located within the Idaho Falls watershed that have historical daily records of streamflow (USGS, 2008b). These are the Snake River near Lewisville, Snake River above Eagle Rock near Idaho Falls, and Snake River near Idaho Falls. Table 3.4-9, Average Flows by Month for the Snake River, shows the average flows by month at these gauge locations along the Snake River. Table 3.4-10, Snake River Gauge Statistics, shows the average annual flow, average daily minimum and maximum flows, and daily minimum and maximum flows for each of these gauges.

A hydrograph depicting the mean daily streamflow over the period of record for the Snake River gauge with the longest historical record is shown in Figure 3.4-6, Snake River above Eagle Rock near Idaho Falls Hydrograph.

3.4.13.3 Historical Drought River Flows

The Palmer Drought Severity Index shows that south-central Idaho has been in a drought since water year 2000 (Skinner, 2007). Average annual flows recorded at USGS gauge 13057155, Snake River above Eagle Rock near Idaho Falls, have been reduced to about 200 m^3/s (7,060 ft^3/s) since this time. Refer to Figure 3.4-7, Annual Flows in the Snake River.

The State of Idaho has published a drought plan to respond to water supply issues during dry periods and has identified critical groundwater management areas, most located in southwestern Idaho, where groundwater has been "overdrafted" to supplement water needs (IDWR, 2001). However, the proposed EREF is located within the Idaho Falls watershed and has enough available water in times of drought to provide for regional needs.

3.4.13.4 Important Short Duration Flows

Annual peak flows for the Snake River above Eagle Rock near Idaho Falls tend to be between two and three times the average flows (Figure 3.4-7, Annual Flows in the Snake River). The greatest flow occurred during a storm in 1997 where the short duration flow reached 1,376 m^3/s (48,600 ft^3/s) (USGS, 2008b).

3.4.14 Water Impoundments

Impoundments to contain stormwater runoff and treated domestic sanitary effluent will be constructed as part of the facility. These features are described in ER Section 3.4.1.1, Facility Withdrawals and/or Discharges to Hydrologic Systems.

3.4.14.1 Elevation-Area-Capacity Curves

Impoundments to contain stormwater runoff and treated domestic sanitary effluent will be constructed as part of the proposed EREF. These features are described in ER Section 3.4.1.1, Facility Withdrawals and/or Discharges to Hydrologic Systems.

The Site Stormwater Detention Basin which will be located at the south side of the site will be designed to contain runoff for a volume equal to a 24-hour, 100-year return frequency rain storm of 5.70 cm (2.24 inch) rainfall. The storage capacity available for maintaining a freeboard of 0.6 m (2.0 ft) is approximately 32,835 m^3 (27 acre-ft). For a highly unlikely storm scenario maintaining a freeboard of 0.3 m (1.0 ft), the basin will have approximately 49,600 m^3 (40 acre-ft) of storage capacity. The area served by the detention basin is 134 ha (332 acres).

The Cylinder Storage Pads Stormwater Retention Basin which will be located northwest of the developed footprint will be designed to contain a volume of approximately 110,087 m^3 (89 acre-ft) maintaining a freeboard of 0.9 m (3.0 ft). Under highly unlikely events, the volume of the basin will contain approximately 113,888 m^3 (92 acre-ft), maintaining a freeboard of 0.3 m (1.0 ft). The area served by the retention basin will be 12.7 ha (31.4 acres). The retention basin will be designed to contain runoff for a volume equal to twice that for the 24-hour, 100-year return frequency rain storm, a 5.70-cm (2.24-in) rainfall plus allowances for treated effluent from the Domestic Sanitary Sewage Treatment Plant.

3.4.14.2 Reservoir Operating Rules

The proposed facility will not make use of any reservoir.

3.4.14.3 Annual Yield and Dependability

The proposed facility will not take or discharge process water to any local water body; thus, it will not affect water storage in any water body.

3.4.14.4 Inflow/Outflow/Storage Variations

The proposed facility will not take or discharge process water to any local water body; thus, it will not affect water storage in any water body.

3.4.14.5 Net Loss, Including Evaporation and Seepage

The proposed facility will not take or discharge process water to any local water body; thus, it will not affect water storage in any water body. Discharge of treated effluent from the Domestic Sanitary Sewage Treatment Plant will be to the Cylinder Storage Pads Stormwater Retention Basin, which will be lined. This retention basin will be designed so that evaporation is the sole discharge route. The annual evaporation potential is 117.73 cm (46.35 in).

3.4.14.6 Current Patterns

The proposed facility will not take or discharge process water to local water bodies or the ground surface; thus, there will be no change in current patterns.

3.4.14.7 Temperature Distribution

The proposed facility will not take or discharge process wastewater or non-contact cooling water to any local water body; thus, it will not affect water temperature in any water body.

3.4.15 Groundwater Characteristics

The groundwater characteristics for the area of the proposed EREF site are discussed in the following sections.

3.4.15.1 Regional Hydrology

The groundwater system underlying the SRP in the vicinity of the proposed facility is referred to as the Eastern Snake River Plain (ESRP) aquifer (Whitehead, 1992). The ESRP Aquifer consists predominantly of flood basalt lava flows with intermittent interbeds of unconsolidated sediments (Whitehead, 1992) (Whitehead, 1994b) as discussed in ER Section 3.3, Geology and Soils. The geologic units comprising the aquifer are primarily lava flows of the Snake River Group basalts (Qb) and the upper part of the Idaho Group (Bruneau Formation) (Ackerman, 2006) (Smith, 2004). The basalt units are variable in thickness and generally discontinuous in lateral extent. Sedimentary interbeds exist between some of the basalts and are of variable thickness and lateral extent (Ackerman, 2006) (Smith, 2004). At the site, the groundwater surface is encountered at depths between 201.5 m (661.1 ft) and 220.0 m (721.9 ft) below ground surface (bgs). The saturated thickness of the ESRP Aquifer is shown on Figure 3.4-8, Saturated Thickness of Pliocene and Younger Basaltic Rocks in the ESRP Aquifer (Whitehead, 1994b).

The ESRP Aquifer covers about 26,000 km^2 (10,039 mi^2) with a thickness up to 400 m (1,312 ft) thick and the water volume in the aquifer is estimated at 100 billion m^3 (3.5E+12 ft^3) (Smith, 2004). The ESRP Aquifer is a major economic resource in southeastern Idaho that is relied upon for both drinking water and irrigation (Garabedian, 1992) (Lindholm, 1996). Wells completed in the top hundred meters or so (few hundred feet) of the Quaternary basaltic units are reported to have specific-capacity values that range from 0.103 m^3/s (3.6 ft^3/s) to 0.207 m^3/s (7.3 ft^3/s) per meter (3.3 ft) of drawdown (Whitehead, 1994b). Based on an analysis of 176 wells in the ESRP Aquifer, Garabedian (Garabedian, 1992) reported median specific yields that range from 0.0008 m^3/s (0.03 ft^3/s) to 0.197 m^3/s (7.0 ft^3/s) per meter (3.3 ft) of drawdown with higher values were the Quaternary basalts are thickest.

The ESRP Aquifer is unconfined over nearly all of its area through locally confined conditions may exist (Garabedian, 1992). The overlying unsaturated zone or vadose zone is spatially heterogeneous and ranges in thickness from 60 m (200 ft) to greater than 300 m (984 ft) (Smith, 2004) and consists of unconsolidated alluvium and Snake River Group basalts (Qb) (Ackerman, 2006). The saturated thickness of the aquifer is greatest in the central part of the ESRP and thins substantially to the west (Whitehead, 1994b). Within the basalts, permeable zones are located mainly in the tops and bottoms of lava flows, which are typically fractured and porous, leading to high horizontal hydraulic conductivity. Vertical joint densities and presence of lower permeability sediment interbeds act to control vertical hydraulic conductivity (Smith, 2004). The interbeds may also act to locally confine limited portions of the aquifer (Whitehead, 1992). Overall, the fractured, porous, and complexly interconnected nature of the basaltic lava flows has resulted in high but heterogeneous and anisotropic horizontal conductivity and much lower vertical conductivity (Nimmo, 2004).

Natural recharge to the aquifer occurs primarily in the Yellowstone Plateau in southeastern Idaho and in the Bitterroot, Lemhi, Lost River, White Knob, and Pioneer mountain ranges adjacent to the northern side of the aquifer (Smith, 2004). A water budget developed in 1980 for the ESRP Aquifer indicated that 60% of the recharge to the aquifer occurs from infiltration of irrigation water. Recharge from groundwater underflow derived from upland areas of the Yellowstone Plateau and mountainous areas on the north side of the ESRP accounts for another 18%. Infiltration of direct precipitation falling on the ESRP provides another 9% of the recharge budget. Contributions from losing stretches of Snake River tributaries and canals accounted for the remaining 13% of the recharge budget (Garabedian, 1992).

The primary discharge area for the aquifer is the Snake River (Ackerman, 2006) (Garabedian, 1992) (Smith, 2004) (Whitehead, 1992). Much of the discharge occurs in a series of springs known as the "Thousand Springs Area", near the City of Twin Falls, Idaho and another area of springs near American Falls Reservoir located about 145 km (90 mi) upstream from Twin Falls, Idaho (Wood, 1988). The rate of discharge to the Snake River and the American Falls Reservoir is approximately 69.4 m^3/s (2,450.8 ft^3/s)(Whitehead, 1994b). Discharge rates at specific springs vary seasonally by up to 34% as a result of seasonal precipitation and irrigation practices (Johnson, 2002). However the total discharge rates to the Snake River are relatively constant on a seasonal basis, although there have been long-term trends in discharge attributable to changes in irrigation practices and climatic fluctuations (Garabedian, 1992) (Lindholm, 1996) (Whitehead, 1994b).

3.4.15.1.1 Groundwater Elevations and Flow Direction

Groundwater elevations in the ESRP Aquifer vary from approximately 1,830 m (6,004 ft) at the northeastern edge to less than approximately 792 m (2,600 ft) at the southwestern edge. The elevation of groundwater drops about 610 m (2,001 ft) over a 320-km (200-mi) flowpath for an average gradient of 1.9 m/km (10.0 ft/mi) (Smith, 2004) (Wood, 1988). Groundwater flowpaths run in a southwestern direction, generally parallel to the Snake River for much of the central portion of ESRP. The Snake River turns northwestward and the groundwater flowpaths discharge to the Snake River (see Figure 3.4-9, Groundwater Elevations and General Direction of Groundwater Movement in the SRP Aquifer) (Ackerman, 2006) (Whitehead, 1994b).

3.4.15.1.2 Groundwater Aquifier Interactions

The ESRP Aquifer is located within a topographic basin formed by geological subsidence relative to surrounding mountain ranges and uplands (Garabedian, 1992). The ESRP Aquifer receives inflows of groundwater as underflow from tributary basins located along its margins, especially along the northern and northwestern boundaries where a series of northwest-trending mountain ranges and valleys terminate on their southern ends in the ESRP (Ackerman, 2006) (Garabedian, 1992) (Lindholm, 1996).

In the “Thousand Springs”, area, the Snake River has incised a deep west-northwest trending channel in the basalt matrix making up the aquifer. In addition, a significant amount of water is withdrawn from the aquifer for irrigation purposes.

Due to the aquifers physical configuration, and the nature of the inflows and outflows, the ESRP Aquifer does not interact with or convey water into other regional aquifer systems.

3.4.15.1.2 Groundwater Velocities

The transmissivities of the basalts comprising the ESRP are very high on average throughout much of the ESRP Aquifer (Ackerman, 2006) (Wood, 1988). As a result, groundwater velocities in the aquifer are relatively fast (Table 3.4-11, Ranges of Hydrologic Properties for the SRP). The average time for water to travel from the recharge areas in the northeast to discharge areas at the Snake River, which is a distance of approximately 320 km (199 mi), is estimated to be about 300 years, yielding an average velocity of 3 m/d (10 ft/d) (Smith, 2004). Determinations of groundwater velocities at the nearby INL, based on chloride-36 and tritium data, range from 0.6 m/d (2.0 ft/d) to 5.5 m/d (18.0 ft/d) (Figure 3.4-10, Groundwater Velocities in the ESRP) (Ackerman, 2006)). Reported velocities on the INL near the border of the proposed site are at the high end of this range at 4.6 m/d (15.1 ft/d) to 5.5 m/d (18.0 ft/d) with flow in a southwesterly direction (Figure 3.4-11, Water Elevations and Flow Directions in the ESRP Aquifer). These rapid flow rates are consistent with studies of stable isotope and tritium levels that have indicated that the water in the ESRP Aquifer is derived from modern meteorological sources in the basin and that recharge from these sources is rapid (Schramke, 1996) (Wood, 1988).

3.4.15.1.3 Regional Soil Properties

Soil cover across the ESRP is generally variable, ranging from non-existent in areas of recent volcanism to tens of meters (feet) to thickest in areas of wind-blown loess accumulation (Hughes, 1999) (Lindholm 1996) (Whitehead, 1994b). Thin soils and basalt outcrops are common in many areas along ridge lines and wind-swept areas. Natural soil development due to vegetation growth and degradation is minimal due to the cold, semi-arid climate.

Soil types in the ESRP fall into six orders of lightly weathered soils characteristic of arid conditions: alfisols, aridisols, entisols, inceptisols, mollisols, and vertisols (Cook, 2007). The textures of most of these soil types are described as falling in the silt-loam textural class with 0% to 27% clay, 55% to 80% silt, and 10% to 35% sand (Nimmo, 2004). The mineralogical composition of the soils reported for INL and likely representative of much of the ESRP include quartz, plagioclase feldspar, potassium feldspar, pyroxene, olivine, calcite, dolomite, and clay minerals (Nimmo, 2004).

Data summarized by Nimmo (Nimmo, 2004) for INL indicate that saturated hydraulic conductivities measured on soil cores range from about 5.0E-04 cm/s (1.6E-05 ft/s) to 1.0E-02 cm/s (3.3E-04 ft/s) although reported ranges in the literature span over six orders of magnitude from 1.1E-08 cm/s (3.6E-10 ft/s) to 1.2E-02 cm/s (3.9E-04 ft/s). The Nimmo (Nimmo, 2004) data show porosities from 0.42 to 0.55 and moisture contents from about 5% to 30%. Measurements of unsaturated properties for surficial soils are also summarized by Nimmo (Nimmo, 2004). These data show drying retention curves with air entry pressures near zero, an abrupt decrease in water content at -10 and -30 kPa (-1.4 and -4.3 psi) and then a nearly flat response in water content to higher pressures.

3.4.15.2 Regional Water Quality

The chemical composition of groundwater in the ESRP has been examined in detail (DOE-ID 2007a; DOE-ID 2007b; Wood, 1988). The geochemical and physical parameter data indicate that there are two major water types in the aquifer (Wood, 1988):

- An upper zone located in predominantly Quaternary basalts and sediment interbeds of the Snake River Group. This upper zone is also called the active portion of the aquifer because it is the fastest moving aquifer water and is the primary portion of the aquifer exploited for irrigation and public water supplies. The upper zone may be potentially impacted by EREF activities.
- A deeper zone of the aquifer often exhibits secondary mineralization and contains low temperature geothermal water located primarily in Tertiary basalts, rhyolites and tuffs. Geothermal water in the ESRP Aquifer is defined as water with a temperature greater than 26.0ºC (78.8ºF). The geothermal groundwater is not a major source for irrigation and public supply. This water would not be expected to be impacted by migration from a surface source located at the EREF.

The shallow part of the Snake River Plain Aquifer is characterized as a calcium-bicarbonate chemical type relatively enriched in silica (DOE-ID, 2007a; DOE-ID, 2007b; Wood, 1988). Solute mass balance calculations indicate that about 80% of the solute load leaving the ESRP is derived from subsurface inflows from surrounding drainage basins (Wood, 1988). The remaining 20% of the solute load is derived from mineral dissolution reactions occurring as groundwater flows through the ESRP and reacts with the bedrock. The major dissolving minerals are magnesium-iron-calcium silicates, pyrite, and anhydrite present in the basalt. Calcium, bicarbonate, and silica are removed from solution by the precipitation of calcite and amorphous silica (Wood, 1988). Detectable but low concentrations of minor elements and trace metals are found throughout the aquifer (Table 3.4-12, Mean Concentrations of Analytes in SRP Shallow Zone Groundwater). The concentrations of minor elements and metals are generally low due to the neutral to slightly alkaline pH and moderately reducing conditions.

3.4.15.3 Site Hydrogeology

3.4.15.3.1 Site Groundwater Investigations

Site-specific hydrogeologic investigations occurred at the proposed EREF site between May and July 2008. Additional groundwater sampling was performed in October 2008. The proposed site is located east of the INL site, which has had numerous subsurface investigations performed for the purpose of delineating and monitoring the subsurface hydrologic conditions. Much of this information is directly pertinent to the proposed site and provides the basis for the regional groundwater information summarized in this ER. In addition, the INL hydrogeologic information was used in planning the site-specific investigations.

The objective of the groundwater field studies was to collect data that can be used to describe the following characteristics for the site:

- Stratigraphy of the bedrock units
- Structure and hydrogeological properties of unsaturated and water saturated geological units
- Depth to saturated groundwater conditions within the site boundaries
- Groundwater elevation trends and flow directions
- Prevalence of perched groundwater systems
- Water quality for groundwater
- Potential for interaction between different aquifers

Field activities included:

- Collection of a continuous core between the ground surface and approximately 12.2 m (40.0 ft) below the static water table,
- Installation of five deep monitoring wells to intercept the regional groundwater,
- Installation of one shallow monitoring well to intercept potentially perched groundwater,
- Down hole geophysical testing in two locations,
- Hydrologic testing in both the saturated and unsaturated zones, and
- Groundwater collection and analyses.

Five deep monitoring wells installed at the proposed site were designated as GW-1, GW-2, GW-3, GW-4, and GW-5. One shallow well (GW-4S) was also completed. The locations of these monitoring wells on the proposed site are shown in Figure 3.4-5, Existing Agricultural and Newly Installed Monitoring Wells, and are distributed to allow monitoring of the ground water elevations, evaluation of regional groundwater flow direction, and water quality at the EREF site. The wells are located in areas that are hydrologically upgradient (GW-5), cross gradient (GW-2 and GW-3), downgradient of the plant footprint (GW-4), and within the downgradient edge of the facility footprint (GW-1). The five deep wells provide adequate site-specific data to define the potentiometric surface of the groundwater, thereby providing data indicative of groundwater flow direction and gradient.

At location GW-1, a 7.6-cm (3.0-in) core was collected from the ground surface to the total depth of the boring prior to installation of a monitoring well. The core was collected using a diamond drill bit designed to produce intact core samples. The recovered core revealed a succession of basalt flows with occasional interlayers of silts and clays ranging in thickness between 1.2 to 2.4 m (4.0 to 8.0 ft). The basalt flows typically were highly fractured and highly vesicular, although there were also intervals up to 3.0 m (9.8 ft) thick or more of competent basalt without fractures or vesicles.

Boreholes GW-1 and GW-4 were geophysically logged prior to their completion as monitoring wells. GW-1 was logged to a depth of 223 m (730 ft), which included approximately 208.6 m (684.3 ft) of unsaturated conditions and approximately 9 m (30 ft) of saturated conditions, below the static water level. Partially completed Well GW-4S was logged to a depth of 168 m (550 ft) bgs in unsaturated conditions. Downhole geophysics included caliper, natural gamma, normal electrical resistivity, point resistance, induction resistivity, and optical tools. Following the geophysical logging of GW-1, eight hydrologic packer tests were conducted that covered the range of observed geologic character (e.g., dense to fractured) observed in the core and geophysical tests. The depth to groundwater in the on-site wells ranges between 201.5 m (661.1 ft) and 220.0 m (721.9 ft) below ground surface (bgs), depending on location.

There are four primary features of the sediments and bedrock underlying the proposed site that can dramatically affect the flow of fluids in the vadose zone and groundwater in the saturated zone (Cecil, 1991):

1. Low permeability sedimentary interbeds
2. Alteration in the baked zones at flow tops
3. Dense, unfractured massive basalt
4. Sedimentary and chemical infilling of fractures

A minimum of three well-developed sedimentary interbeds from 1.2 to 2.4 m (4.0 to 8.0 ft) thick were clearly observed in the core collected from GW-1. Similar sedimentary interbeds in GW-4 were inferred from the geophysical logging of that hole. The drilling log for Lava Well-3 suggested the presence of at least two or possibly three sedimentary interbeds. Sedimentary layers were encountered in the core of GW-1 at 18.3, 59.4, and 122.5 m (60.0, 195.0, and 402.0 ft) bgs, and, in GW-4 the sedimentary interbeds were inferred from the geophysical logs at 19.7, 61.9, and 102.2 m (64.6, 203.0, and 334.4 ft) bgs. The geophysical logging conducted with the acoustic televiewer (OPTV) and natural gamma measurements in GW-1 and GW-4 also revealed the presence of sedimentary interbeds. In addition, these interbeds also were qualitatively identified in the conductivity logs. A cross section of the subsurface stratigraphy is shown in Figure 3.3-17, GW-1 Lithologic Log - Summary.

The sedimentary interbeds represent periods of volcanic quiescence and are likely to be laterally continuous for at least several hundred meters (hundreds to thousands of feet), but may have thin or absent areas at the topographic highs of the paleo-ground surface, similar to what is presently observed for the surface terrain. No evidence of sediment interbeds was observed below about 121.9 m (400.0 ft) to the total depth of GW-1 at 222.5 m (730.0 ft) bgs. Several zones containing scoria, cinder, red oxidation, increased vesicles, and changes in fracturing indicating flow tops were also observed. In GW-1, the individual lava flows increase in thickness with depth from 15.2 m (50.0 ft) near the top to over 91.4 m (300.0 ft) near the bottom. The individual flows were also marked by the presence of sediment infillings (e.g., clay) in the fractures. The zones beneath the flow tops where baking from the overlying lava flows would have occurred in combination with sediment infillings likely have lower permeability than the base of the overlying flows.

Most of the basalt bedrock is fractured to some degree with Rock Quality Data (RQD) values typically ranging between 50% and 100%. Some intervals are completely fractured with RQDs of 0% to 25%. The flow interiors are evident by thick, massive zones of basalt with few or no fractures (RQD at or near 100%). The flow interiors typically contain narrow vertical fractures, whereas the flow tops and bottoms typically contain both large vertical and horizontal fractures. The massive zones observed in GW-1 and GW-4 ranged up to 3 m (10 ft) or more in thickness.

Data on groundwater elevations measured for the site monitoring wells have been compiled into two maps of the potentiometric groundwater surface. Figure 3.4-12, Regional Groundwater Potentiometric Surface Map, shows the site groundwater data in conjunction with data from observation wells located in the vicinity of the EREF. Figure 3.4-13, Site Groundwater Potentiometric Surface Map, shows a closer view of the site groundwater elevation data. The data shown in these figures indicate that the depth to water occurs between 201.5 and 220.2 m (661.1 and 721.9 ft) bgs at the site. Based on these elevations, the direction of groundwater flow across the site is from the northeast to the southwest. This direction is consistent with the regional groundwater flow direction, which is to the southwest toward Thousand Springs, approximately 322 km (200 mi) southwest of the site. Based on ground surface elevations and the depths to water observed in GW-5 and GW-1, the hydraulic gradient likely is about 1.5 m (4.9 ft) of difference in water levels over 2,260 m (7,420 ft) between the two wells. This difference in water levels is equivalent to a gradient of approximately 0.0007 m/m (0.0007 ft/ft).

Two field testing methods were utilized to estimate the horizontal permeability of the subsurface materials: borehole constant head tests (packer tests) and one multi-well aquifer pumping test. Eight packer tests were conducted in borehole GW-1 over 1.5 to 3.0 m (5.0 to 10.0 ft) intervals from 7.6 to 190.5 m (25.0 to 625.0 ft) bgs within the vadose zone. The testing was conducted on intervals of fractured bedrock, massive bedrock, and sedimentary interbeds to estimate the full range of hydraulic conductivities. The results of the packer tests indicated hydraulic conductivities as follows (the values in parentheses indicate the number of tests performed in that rock or sediment type):

- Fractured bedrock (five): greater than 9.0E-04 cm/s (3.0E-05 ft/s)
- Soil layers (two): 2.0E-06 cm/s (6.6E-08 ft/s)
- Massive (relatively unfractured) bedrock (one): 2.0E-08 cm/s (6.6E-10 ft/s)

The tests that were performed in the fractured bedrock provide a measure of the lower bound for the highest hydraulic conductivities in the formation because no head pressure was developed during those tests. No head pressure conditions occur when the formation accepts more water than the test pump can deliver, which is an indication of high hydraulic conductivities. If more water could have been delivered to the packed off interval, then a higher hydraulic conductivity might have been measured. Data for the sedimentary interbeds and intervals of massive basaltic bedrock are indicative of low hydraulic conductivities. The sedimentary interbeds and massive basalt layers will significantly impede water movement or may cause lateral flow below the water table or may cause perching above the water table.

An aquifer pumping test was conducted using the existing agricultural (irrigation) well, Lava Well-3, as the pump well and nearby monitoring well GW-5 as an observation well. Three phases to the pumping test occurred:

1. Pre-test monitoring – three days
2. Constant rate pumping test – three days
3. Recovery test – one day

The test was conducted by pumping the agricultural well, Lava Well-3, and measuring the resulting drawdown and barometric pressure changes in GW-5. The pumping well (Lava Well-3) is a large diameter irrigation well originally installed in the 1970s. The well is currently fitted with a pump capable of pumping 15.9 m^3/min (4,200.0 gal/min). The observation well GW-5 is a 10.2-cm (4.0-inch) PVC monitoring well screened from 215.2 to 227.4 m (706.0 to 746.0 ft) bgs, partially penetrating the aquifer.

The pumping well was in operation prior to the test but was shutdown before the pumping test so that water levels and barometric pressure could be monitored to evaluate antecedent trends in water levels and the barometric efficiency of the aquifer. This pre-test period lasted for three days. Water levels during this period were relatively stable, varying less than 0.05 m (0.15 ft). The variations in water level that did occur appeared to be directly related to barometric pressure changes, which varied up to 1.00 kPa (0.15 psi) (0.52 m (1.70 ft) equivalent). The Barometric Efficiency (BE) of the aquifer, the relationship between changes in water levels and barometric pressure, was estimated from this pre-test data at 22%. The BE was then used to make corrections to the changes in water levels observed during the pumping test so that only changes due to pumping were analyzed (Freeze, 1979).

The pumping test was conducted for 72 hours at a constant pumping rate of 15.9 m^3/min (4,200 gal/min) in Lava Well-3 during which time barometric pressure changes and water levels were recorded in GW-5. The water level in GW-5 dropped rapidly in response to pumping at first, and then more slowly as the cone of depression developed and expanded outward. Total drawdown was less than 0.3 m (1.0 ft), exhibiting a classic aquifer response to pumping (Fetter, 1994). Due to the apparent confined or semi-confined conditions, the pumping test data was corrected for barometric pressure changes and analyzed with the Theis equation for non-equilibrium radial flow for a semi-confined aquifer (Fetter, 1994). This solution utilizes type curves related to transmissivity and storativity based on a log-log plot of drawdown versus elapsed time. The response to pumping observed in GW-5 during the constant rate test resulted in a curve on the log-log plot that fit exactly to the Theis type curve, and indicated a transmissivity of 7,850.0 cm^2/s (8.5 ft^2/s), which is consistent with transmissivity values observed at INL (Whitehead, 1992). The recovery test was also analyzed with the Theis method (Fetter, 1994), which resulted in a transmissivity of 9,476.0 cm^2/s (10.2 ft^2/s) and the Jacob-Straight-Line method, which resulted in a transmissivity of 8,365.0 cm^2/s (9.0 ft^2/s).

Hydraulic conductivity is calculated by dividing transmissivity by the aquifer thickness. The aquifer thickness is based on an interpretation of the hydrostratigraphy observed during drilling. Based on observations in GW-1, the aquifer is estimated to range in thickness from 45.7 to 91.4 m (150.0 to 300.0 ft). The individual basalt flows appear to increase in thickness with depth in GW-1, and it is estimated that a reasonable maximum aquifer thickness is 106.7 m (350.0 ft). Using these data, the hydraulic conductivity is calculated to be 0.007 m/s (0.023 ft/s)). If the aquifer thickness is closer to 60.9 m (200.0 ft) thick, then the hydraulic conductivity would be 0.015 m/s (0.05 ft/s). It is important to note that this is a measure of the hydraulic conductivity of the aquifer as a whole. Individual fractures or void spaces may have hydraulic conductivity values that are orders of magnitude higher, while the massive zones will have hydraulic conductivities orders of magnitude lower (as low as 1E-10 m/s (3.3E-10 ft/s) as measured in the packer tests).

The results of the pumping test indicated a storativity of 0.03. Confined aquifers typically have storativities in the range of 0.005 to 0.00005, while unconfined aquifers typically have a specific yield (S_y) in the range of 0.1 to 0.3 (Fetter, 1994). The storativity value of 0.03 estimated for the aquifer tested at the site suggests that the aquifer is acting as an unconfined or semi-confined aquifer. Regionally, the SRP aquifer is considered to be unconfined (Whitehead, 1992). However, locally confined conditions can exist due to the lower permeability zones existing at the top of the aquifer as described above. The aquifer test results suggest that the aquifer is locally confined, as suggested by the response to barometric pressure and the shape of the first derivative of the log-log drawdown versus elapsed time curve, but becomes unconfined at some distance away from the pumping well. Early-time drawdown data reflect the confined conditions, while later-time data reflect unconfined conditions and/or delayed recharge. The late-time data on the drawdown versus time plot deviates from the type curve (less drawdown) suggesting an additional source of recharge to the cone of depression was reached toward the end of the test. This is likely due to the confining layer (massive bedrock) either pinching out or developing more fractures and unconfined conditions, thus yielding more water from storage.

3.4.15.3.2 Vadose Zone and Perched Groundwater

The vadose zone in the ESRP is spatially heterogeneous, ranges from 60 m (197 ft) to 300 m (984 ft) (Smith, 2004), and consists of unconsolidated alluvium and Snake River Group basalts (Qb). Perching of water above the regional water table requires two things, first, a large contrast between a higher permeability layer with a lower permeability zone below and second, a significant source of water to maintain the perched water body. Perched water zones are common throughout the ESRP, especially near rivers, canals or other sources of surface water because of the high contrasts in permeability common in the basalts and sediments in the area. The presence of lower permeability zones only indicate that zones of perched groundwater could occur if sufficient recharge was available. The development of perched zones on top of confining layers has been a subject of concern at INL (Cecil, 1991).

The first interval that could develop perched groundwater at the proposed site is the sedimentary interbed at approximately 18.3 to 19.8 m (60.0 to 65.0 ft) bgs observed in GW-1 and GW-4, which is underlain by a layer of massive bedrock from 54.9 to 57.9 m (180.0 to 190.0 ft) bgs. Numerous other confining layers that could develop perched zones are present at greater depths.

Perched water was not directly observed during drilling; however, some limited increase in moisture water during drilling of GW-4 was noted. Moist conditions were occasionally observed downhole when drilling started in the morning, but it was not possible to determine whether the down hole moisture was a result of condensation of warm compressed air overnight, draining of perched water into the well, infiltrating wetting fronts, or overnight drainage of drilling circulation fluids from the previous day. The sediment layers that are interfingered with the basalts (described above) could potentially act as a perching layer for infiltrating precipitation. To determine whether a perched layer exists beneath the site, a shallow monitoring well (designated as GW-4S) was installed directly above the uppermost sediment layer. Groundwater was not observed in this well which suggests that although the sediment layers could act as a perching layer for groundwater, there is either insufficient recharge water to form a perched water body or the sediment layers are not continuous enough or impermeable enough to be an effective perching layer.

At the proposed site, drilling occurred soon after the 2008 spring snow melt. However, no perched water zones were observed during drilling GW-1 and no water accumulated in GW-4S. These observations indicate that any perched water dissipates relatively quickly (i.e., within a matter of days or weeks) or that even in an exceedingly wet year recharge is insufficient to form perched water. It is most likely the former.

The primary sources of recharge to the vadose zone and subsequently to the aquifer beneath the site is precipitation in the form of rainfall, snow melt, and irrigation infiltration. An extensive set of wells located around the proposed site are monitored for groundwater elevation on a monthly to yearly basis by the U.S. Geological Survey and Idaho Department of Water Resources (IDWR, 2008b). Data from wells at nearby locations within 1 to 20 km (0.6 to 12.4 mi) of the proposed site show typical seasonal changes in groundwater elevations of less than 1.5 m (5.0 ft) with the highest levels occurring in spring and early summer and lowest levels in late summer and fall. Long-term fluctuations in water levels range up to 15 m (50 ft) for the entire periods of record of 20 to 50 years (IDWR, 2008b) due to meteorological cycles and changes in irrigation practices in the ESRP (Garabedian, 1992)(Lindholm, 1996). It does not appear that seasonal infiltration events play a significant role in area of the proposed site.

3.4.15.4 Site Groundwater Quality

Groundwater was collected and analyzed from the existing agricultural wells on the site in March 2008 and June 2008, and the deep monitoring wells were sampled during installation between May and July 2008 and sampled a second time in October 2008. The shallow perched water well (GW-4S) has remained dry since completion.

The two existing agricultural wells and the newly installed five aquifer monitoring wells at the EREF site were sampled for field measured parameters and inorganic analytes, metals (dissolved and total recoverable including major cations and anions) total organic carbon, volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), polychlorinated biphenyls (PCBs), pesticides, herbicides, and total petroleum hydrocarbons (Table 3.4-13, Chemical Analyses for the EREF Site Groundwater). In addition, samples were analyzed for radiological constituents of tritium, gross alpha, gross beta, gamma spectrometry, thorium isotopes, uranium isotopes and radium isotopes (Table 3.4-14, Radiochemical Analyses for the EREF Site Groundwater). Sampling results are compared to EPA maximum contaminant levels (MCLs) and secondary maximum contaminant levels (SMCLs) (Tables 3.4-13, Chemical Analyses for the EREF Site Groundwater, and Table 3.4-14, Radiochemical Analyses for the EREF Site Groundwater). The regulatory limits represent the EPA Safe Drinking Water Act (SDWA) primary and secondary drinking water standards for potable water supplies (EPA, 2008b). In addition, inorganic data are compared to background values (Figure 3.4-14, Piper Diagram Showing Major Elemental Composition of Groundwater in the ESRP Aquifer).

The analytical results show that the groundwater has concentrations of major ions that are consistent with regional groundwater (Table 3.4-12, Mean Concentrations of Analytes in SRP Shallow Zone Groundwater). The regional groundwater has a predominantly calcium-bicarbonate chemical composition and is of high quality when compared to drinking water standards (DOE-ID, 2007a; DOE-ID, 2007b; Wood, 1988).

The concentrations of dissolved analytes are below their corresponding EPA MCL. Concentrations of minor elements and trace metals found in the aquifer at the EREF are similar to regional background groundwater concentrations (Table 3.4-12, Mean Concentrations of Analytes in SRP Shallow Zone Groundwater, and Tables 3.4-13, Chemical Analyses for the EREF Site Groundwater). With the exception of total recoverable aluminum and iron collected from the two agricultural wells (highlighted in Table 3.4-13, Chemical Analyses for the Eagle Rock Enrichment Site Groundwater), total metals concentrations are less than their EPA MCL. The elevated total recoverable aluminum and iron concentrations detected in the unfiltered samples are probably due to suspended particulates because aluminum is not soluble at the neutral to slightly alkaline pH of the SRP Aquifer, and dissolved concentrations of aluminum and iron do not exceed their MCLs. Also, iron shows variability with the total recoverable concentration exceeding the EPA MCL only for the initial May 2008 samples but not in more recent samples. The concentrations of minor elements and metals are generally low due to the neutral to slightly alkaline pH. Total dissolved solids are approximately 200 to 260 mg/L, which is lower than the EPA limits of 500 mg/L.

No volatile or semi-volatile organic compounds, pesticides, herbicides, or PCBs were detected in the March to July 2008 samples. The October 2008 samples from GW-1, GW-2, and GW-3 contained low concentrations of bis (2-ethylhexyl) phthalate and a single detection of diethylphthalate occurred for GW-5. These two phthalate compounds are used as plasticizers and it is expected that their occurrence is from contact of the samples with plastics during collection and analyses. Trace amounts of chloroform were also detected once (October 2008) in the QA/QC blank sample for Spud Well; however, chloroform was not detected in any other QA/QC or primary or samples. The chloroform result was slightly above the practical quantitation limit (PQL) and was likely the result of laboratory cross contamination. Lube oil was detected at low concentrations in samples from the irrigation well, Lava Well-3, and from well GW-4. Lubricating oil is a known contaminant associated with well drilling and likely explains the occurrence of petroleum in both wells. No other petroleum hydrocarbons were detected in the site groundwater samples.

Most of the radiological analytes were less than their respective minimum detectable concentration (MDC) (Table 3.4-14, Radiochemical Analyses for the EREF Site Groundwater). The gamma spectroscopy analytes, gross alpha and tritium were below their MDCs in all samples. The radiological analytes that occurred most frequently above their MDCs were gross beta, Uranium-234 and Uranium-238 (MDC exceedences are highlighted in Table 3.4-14, Radiochemical Analyses for the EREF Site Groundwater). These analytes are naturally occurring and are similar in concentration to background values observed at the INL (DOE-ID, 2007b). In addition,Thorium-230 was detected just above it's MDC in wells Lava 3-01 and GW-04 and Thorium-232 was detected above its MDC in Lava 3-01 (3/25/08 sample only), Spud-01 (6/19/08 sample only), and well GW-5. Tritium was also detected in GW-3 in the May 20, 2008 sample only. The radiological analytical results were less than MCLs, where applicable.

Some of the radionuclide results given in Table 3.4-14, Radiochemical Analyses for the EREF Site Groundwater, are negative. It is possible to calculate radioanalytical results that are less than zero, although negative radioactivity is physically impossible. This result typically occurs when activity is not present in a sample or is present near background levels. Laboratories occasionally choose not to report negative results or results that are near zero. For the groundwater samples, the negative values are left as reported so as not to censor the results.

TABLES

Table 3.4-1 Summary of Potentially Contaminated Liquid Wastes for the Eagle Rock Enrichment Facility

(Page 1 of 1)

Source/System	Annual Volume: L (Gal)
Laboratory waste, floor washings, miscellaneous condensates	23,140 (6,112)
Degreaser Water	3,710 (980)
Spent Citric Acid	2,720 (719)
Total Treated Plant Effluent[1]	29,600 (7,825)

Notes:

1. Liquid wastes are treated and discharged to atmosphere by evaporation via Liquid Effluent Treatment System evaporator. Total annual liquid effluent is approximately 29,600 L (7,825 gal) of distillate; with uranic input approximately 57 kg (126 lb). Liquid wastes are treated by precipitation, filtration, and evaporation prior to discharge. The anticipated atmospheric distillate release is expected to be <0.0178 g/yr (6.28E-04 oz/yr) of total uranium.

Table 3.4-2 Anticipated Normal Facility Water Consumption
(Page 1 of 1)

Area/Usage	M^3/Yr	L/Day	Gal/Day		L/Year	Gal/Year
Potable Water Average Consumption						
All Shifts – up to 420 people	17,407	47,691	12,600		17,407,215	4,599,000
Summation of Liquid Effluents (excluding utilities)						
Laboratory, Floor washing water, and various condensates	23.14	63	17		23,140	6,114
Degreaser washer	3.71	10	3		3,710	980
Citric acid	2.72	7	2		2,720	719
Laundry	None	None	None		None	None
Hand Wash and Shower Water[1]	Nil	Nil	Nil		Nil	Nil
Total Liquid Effluents	**29.6**	**81**	**21**		**29,570**	**7,812**
DI Water makeup (process, humidification, etc.)	**1,352**	**3,704**	**979**		**1,351,955**	**357,188**
Total Water consumption[2]	**18,800**	**51,500**	**13,600**		**18,790,000**	**4,970,000**

Notes:

1. Testing only. No radiological discharge.
2. Values rounded up.

Table 3.4-3 Anticipated Peak Facility Water Consumption (Page 1 of 2)

Peak Potable Water Consumption	No. of Fixtures	Basis		Flow Rate	
				GPM	L/s
OSB		**Fixture Units**	**Total Fixtures**		
Sinks	10	3	30		
WC	10	5	50		
Urinals	5	4	20		
Showers	10	2	20		
JC	2	3	6		
Total OSB			**126**	**45**	**2.8**
Admin					
Sinks	8	3	24		
WC	8	5	40		
Urinals	5	4	20		
JC	1	3	3		
Total Admin			**87**	**40**	**2.5**
CAB					
Sinks	5	3	12		
WC	4	5	20		
Urinals	3	4	12		
Showers	3	2	6		
JC	1	3	3		
Total CAB			**53**	**30**	**1.9**
Security Bldgs					
Sinks	3	3	9		
WC	3	5	15		
Urinals	2	4	8		
Showers	2	2	4		
JC	1	3	3		
Total Security Bldgs.			**39**	**25**	**1.6**
Gate Houses (2)					
Sinks	2	3	6		
WC	2	5	10		
Urinals	2	4	8		
JC	2	3	6		
Total Gate Houses			**30**	**20**	**1.3**
Visitor Center					
Sinks	4	3	12		
WC	3	5	15		
Urinals	2	4	8		
JC	1	3	3		
Sinks – Kitchen	1	3	3		
Dishwasher – Kitchen	1	1.5	2		
Handwash – Kitchen	1	2	2		
Total visitor Center			**45**	**27**	**1.7**
Warehouses (2)					
Sinks	4	3	12		
WC	4	5	20		
Urinals	2	4	8		
JC	2	3	6		
Total Warehouses			**46**	**27**	**1.7**

Table 3.4-3 Anticipated Peak Facility Water Consumption
(Page 2 of 2)

Peak Potable Water Consumption	No. of Fixtures	Basis		Flow Rate	
				GPM	L/s
Peak Process Water Consumption					
DI Water Make Up				50	3.2
Total Peak Process Water				50	3.2
Fire Protection (Two 680 m3 (180,000 gal) for water tanks				375	23.7
	Total Peak Flow			**689**	**43**

Table 3.4-4 Water Balance for the Cylinder Storage Pads Stormwater Retention Basin (Minimum Scenario) (Page 1 of 1)

Month	Precipitation cm (in)	Total Precipitation Inflow to Basin m^3 (gal)	Treated Sanitary Effluent Inflow to Basin m^3 (gal)	Total Inflow to Basin m^3 (gal)	Evaporation per Month cm (in)	Potential Evaporation Outflow from Basin m^3 (gal)	Balance Inflow-Outflow m^3 (gal)	Net in Basin m^3 (gal)
JAN	0.08 0.03	129 34,097	1,241 327,825	1,370 361,922	0.00 0.00	0 0	1,370 361,922	1,370 361,922
FEB	0.18 0.07	301 79,576	1,121 296,100	1,422 375,676	0.00 0.00	0 0	1,422 375,676	2,792 737,598
MAR	0.00 0.00	0 0	1,241 327,825	1,241 327,825	0.00 0.00	0 0	1,241 327,825	4,033 1,065,423
APR	0.03 0.01	43 11,372	1,201 317,250	1,244 328,622	0.00 0.00	0 0	1,244 328,622	5,277 1,394,045
MAY	0.25 0.10	430 113,656	1,241 327,825	1,671 441,481	13.26 5.22	5,551 1,465,771	-3,880 -1,024,290	1,397 369,756
JUN	0.18 0.07	301 79,542	1,201 317,250	1,502 396,792	15.91 6.27	6,653 1,756,989	-5,151 -1,360,197	0 0
JUL	0.00 0.00	0 0	1,241 327,825	1,241 327,825	18.28 7.20	7,642 2,018,083	-6,401 -1,690,258	0 0
AUG	0.00 0.00	0 0	1,241 327,825	1,241 327,825	16.71 6.58	6,988 1,845,329	-5,747 -1,517,504	0 0
SEP	0.00 0.00	0 0	1,201 317,250	1,201 317,250	11.40 4.49	4,765 1,258,357	-3,564 -941,107	0 0
OCT	0.00 0.00	0 0	1,241 327,825	1,241 327,825	6.85 2.70	2,862 755,800	-1,621 -427,975	0 0
NOV	0.00 0.00	0 0	1,201 317,250	1,201 317,250	0.00 0.00	0 0	1,201 317,250	1,201 317,250
DEC	0.10 0.04	2,781 45,471	1,241 327,825	4,022 362,060	0.00 0.00	0 0	4,022 362,060	5,222 679,310
Totals	0.8 0.3	3,985 363,714	14,600 3,859,875	18,595 4,212,353	82.41 32.45	34,461 9,100,328		

Notes:

1. The annual evaporation rate is 117.73 cm (46.35 in). The pan evaporations are from Aberdeen Experimental Station in Bonneville County. The rates were adjusted by a factor of 0.7 [82.42 cm (32.45 in)] to more closely estimate the evaporation from naturally existing surfaces such as a shallow lake. The months of January, February, March, April, November, and December will have 0.0 cm (0.0 in) evaporation.
2. To be on the conservative side, precipitation for the winter months of December, January, and February will be included as entering the basin from the Cylinder Storage Pads.
3. Available basin storage volume is approximately 110,087 m3 (89 acre-ft) that is based on the maximum available water depth of 1.8 m (6.0 ft) with a free board of 0.9 m (3.0 ft). Therefore, there is no discharge from this basin under this highly unlikely chain of events. For the minimum rainfall scenario, the basin water level will have a freeboard of 2.7 m (8.8 ft).
4. Overall size of the retention basin to top of berm is equivalent to 5.3 ha (13.1 acres)

Source: WRCC, 2008

Table 3.4-5 Water Balance for the Cylinder Storage Pads Stormwater Retention Basin (Maximum Scenario) (Page 1 of 2)

Month	Precipitation cm (in)	Total Precipitation Inflow to Basin m^3 (gal)	Treated Sanitary Effluent Inflow to Basin m^3 (gal)	Total Inflow to Basin m^3 (gal)	Evaporation per Month cm (in)	Potential Evaporation Outflow from Basin m^3 (gal)	Balance Into Basin: Inflow-Outflow m^3 (gal)	Net in Basin m^3 (gal)
JAN	6.93 2.73	11,826 3,123,937	1,241 327,825	13,067 3,451,762	0.00 0.00	0 0	13,067 3,451,762	13,067 3,451,762
FEB	6.02 2.37	10,329 2,728,320	1,121 296,100	11,449 3,024,420	0.00 0.00	0 0	11,449 3,024,420	24,516 6,476,182
MAR	4.47 1.76	7,706 2,035,456	1,241 327,825	8,946 2,363,281	0.00 0.00	0 0	8,946 2,363,281	33,463 8,839,463
APR	6.40 2.52	11,102 2,932,612	1,201 317,250	12,303 3,249,862	0.00 0.00	0 0	12,303 3,249,862	45,766 12,089,325
MAY	11.00 4.33	19,211 5,074,568	1,241 327,825	20,452 5,402,393	13.26 5.22	6,251 1,650,604	14,201 3,751,788	59,967 15,841,113
JUN	7.85 3.09	13,759 3,634,360	1,201 317,250	14,959 3,951,610	15.91 6.27	7,599 2,006,675	7,361 1,944,935	67,327 17,786,048
JUL	4.80 1.89	8,419 2,223,949	1,241 327,825	9,660 2,551,774	18.28 7.20	8,742 2,308,647	918 243,127	68,245 18,029,175
AUG	6.58 2.59	11,564 3,054,616	1,241 327,825	12,805 3,382,441	16.71 6.58	8,061 2,128,759	4,744 1,253,682	72,988 19,282,857
SEP	6.86 2.70	12,100 3,196,131	1,201 317,250	13,300 3,513,381	11.40 4.49	5,571 1,471,212	7,729 2,042,169	80,718 21,325,026
OCT	7.04 2.77	12,474 3,294,971	1,241 327,825	13,715 3,622,796	6.85 2.70	3,405 899,190	10,310 2,723,606	91,027 24,048,632
NOV	6.25 2.46	11,141 2,943,020	1,201 317,250	12,342 3,260,270	0.00 0.00	0 0	12,342 3,260,270	103,369 27,308,901
DEC	5.16 2.03	9,238 2,440,235	1,241 327,825	10,479 2,768,060	0.00 0.00	0 0	10,479 2,768,060	113,848 30,076,961
Totals	79.35 31.24	138,868 36,682,174	14,600 3,859,875	153,478 40,542,049	82.41 32.45	39,629 10,465,088		

Table 3.4-5 Water Balance for the Cylinder Storage Pads Stormwater Retention Basin (Maximum Scenario) (Page 2 of 2)

Notes:

1. The annual evaporation rate is 117.73 cm (46.35 in). The pan evaporations are from Aberdeen Experimental Station in Bonneville County. The rates were adjusted by a factor of 0.7 [82.42 cm (32.45 in)] to more closely estimate the evaporation from naturally existing surfaces such as a shallow lake. The months of January, February, March, April, November, and December will have 0.0 cm (0.0 in) evaporation.
2. To be on the conservative side, precipitation for the winter months of December, January, and February will be included as entering the basin from the Cylinder Storage Pads.
3. Based on the 53 year period of record of highest monthly rainfall, no such event happened for any consecutive months and only once - June and August 1968 – that no more than two wettest months occurred in any one year. Therefore, it is highly unlikely that there will be as severe a cumulative occurrence as shown above nor continuation to the next year.
4. Available basin storage volume with a freeboard of 0.3 m (1.0 ft) is approximately 113,888 m^3 (92 acre-ft). This results in a basin water depth of 2.4 m (8.0 ft). Therefore, there is no discharge from this basin under this highly unlikely chain of events.
5. Overall size of retention basin to top of berm is equivalent to 5.3 ha (13.1 acres).

Source: WRCC, 2008

Table 3.4-6 Water Balance for the Site Stormwater Detention Basin (Minimum Scenario) (Page 1 of 2)

Month	Precipitation cm (in)	Total Precipitation Inflow to Basin m^3 (gal)	Evaporation + Infiltration per Month cm (in)	Potential Evaporation + Potential Infiltration Outflow from Basin per Month m^3 (gal)	Balance Inflow – Outlow m^3 (gal)	Net in Basin m^3 (gal)
JAN	0.08	41	537	285,246	-285,205	0
	0.03	10,844	212	75,362,304	-75,351,460	0
FEB	0.18	96	485	257,642	-257,546	0
	0.07	25,302	191	68,069,177	-68,043,875	0
MAR	0.00	0	537	285,246	-285,246	0
	0.00	0	212	75,362,304	-75,362,304	0
APR	0.03	14	520	276,045	-276,031	0
	0.01	3,614	205	72,931,262	-72,927,648	0
MAY	0.25	137	551	299,326	-299,189	0
	0.10	36,140	217	79,082,091	-79,045,951	0
JUN	0.18	96	536	292,936	-292,841	0
	0.07	25,302	211	77,394,009	-77,368,707	0
JUL	0.00	0	556	304,648	-304,648	0
	0.00	0	219	80,488,230	-80,488,230	0
AUG	0.00	0	554	302,987	-302,987	0
	0.00	0	218	80,049,435	-80,049,435	0
SEP	0.00	0	532	288,143	-288,143	0
	0.00	0	209	76,127,486	-76,127,486	0
OCT	0.00	0	544	292,512	-292,512	0
	0.00	0	214	77,282,033	-77,282,033	0
NOV	0.00	0	520	276,045	-276,045	0
	0.00	0	205	72,931,262	-72,931,262	0
DEC	0.10	55	537	285,246	-285,192	0
	0.04	14,458	212	75,362,304	-75,347,846	0
Totals	0.81	438	6,410			
	0.32	115,660	2,524			

Table 3.4-6 Water Balance for the Site Stormwater Detention Basin (Minimum Scenario) (Page 2 of 2)

Notes:

1. The annual evaporation rate is 117.73 cm (46.35 in). The pan evaporations are from Aberdeen Experimental Station in Bonneville County. The rates were adjusted by a factor of 0.7 [82.42 cm (32.45 in)] to more closely estimate the evaporation from naturally existing surfaces such as a shallow lake. The months of January, February, March, April, November, and December will have 0.0 cm (0.0 in) evaporation.
2. The infiltration rate used is conservatively set at 0.000120 m/min (0.000395 f/min) which is 50% of the low end of the referenced (NRCS, 2008) documented range to account for the effect of the accumulation of sedimentation.
3. Winter Months are December, January, February, where no precipitation enters the basin from the watershed. The only precipitation entering the basin will be from direct snowfall into the basin.
4. Due to the small amount of precipitation of the remainder of the driest months of record, there will be no surface runoff of rain water reaching the basin from the site. The only precipitation entering the basin will be from direct rainfall into the basin.
5. Overall size of the detention basin to top of berm is equivalent to 5.5 ha (13.7 acres).

Sources:

NRCS, 2008d; WRCC, 2008

Table 3.4-7 Water Balance for the Site Stormwater Detention Basin (Maximum Scenario) (Page 1 of 2)

Month	Precipitation cm (in)	Total Precipitation Inflow to Basin m^3 (gal)	Evaporation + Infiltration per Month cm (in)	Potential Evaporation + Potential Infiltration Outflow from Basin per Month m^3 (gal)	Balance Inflow – Outflow m^3 (gal)	Net in Basin m^3 (gal)
JAN	6.93	77,610	537	285,246	-207,637	0
	2.73	20,504,502	212	75,362,304	-54,857,802	0
FEB	6.02	64,356	485	257,642	-193,286	0
	2.37	17,002,902	191	68,069,177	-51,066,275	0
MAR	4.47	13,388	537	285,246	-271,859	0
	1.76	3,537,023	212	75,362,304	-71,825,281	0
APR	6.40	3,897	520	276,045	-272,148	0
	2.52	1,029,478	205	72,931,262	-71,901,784	0
MAY	11.00	21,955	551	299,326	-277,371	0
	4.33	5,800,425	217	79,082,091	-73,281,666	0
JUN	7.85	6,290	536	292,936	-286,646	0
	3.09	1,661,906	211	77,394,009	-75,732,103	0
JUL	4.80	6,949	556	304,648	-297,699	0
	1.89	1,835,995	219	80,488,230	-78,652,235	0
AUG	6.58	5,270	554	302,987	-297,717	0
	2.59	1,392,451	218	80,049,435	-78,656,984	0
SEP	6.86	3,194	532	288,143	-284,949	0
	2.70	843,765	209	76,127,486	-75,283,721	0
OCT	7.04	1,602	544	292,512	-290,911	0
	2.77	423,204	214	77,282,033	-76,858,829	0
NOV	6.25	34,856	520	276,045	-241,189	0
	2.46	9,209,036	205	72,931,262	-63,722,226	0
DEC	5.16	51,795	537	285,246	-233,451	0
	2.03	13,684,374	212	75,362,304	-61,677,930	0
Totals	79.35	291,161	6,410			
	31.24	76,925,061	2,524			

Table 3.4-7 Water Balance for the Site Stormwater Detention Basin (Maximum Scenario) (Page 2 of 2)

Notes:

1. The annual evaporation rate is 117.73 cm (46.35 in). The pan evaporations are from Aberdeen Experimental Station in Bonneville County. The rates were adjusted by a factor of 0.7 [82.42 cm (32.45 in)] to more closely estimate the evaporation from naturally existing surfaces such as a shallow lake. The months of January, February, March, April, November, and December will have 0.0 cm (0.0 in) evaporation.
2. The infiltration rate used is conservatively set at 0.000120 m/min (0.000395 f/min) which is 50% of the low end of the referenced (NRCS, 2008d) documented range to account for the effect of the accumulation of sedimentation.
3. Overall size of detention basin to top of berm is equivalent to 5.5 ha (13.7 acres).

Sources:

NRCS, 2008d; WRCC, 2008

Table 3.4-8 Total Groundwater Withdrawals from the SRP Aquifer for Irrigation, Public-Supply, and Self-Supplied Industrial Water Uses in 2000

(Page 1 of 1)

Use	M^3/s (Ft^3/s)	Percent of Total
Irrigation	110.4 (3,898.7)	97
Public water supply	3.0 (106.3)	3
Self-supplied industrial	0.6 (20.5)	<1
Total withdrawals	114.0 (4,025.5)	100

Table 3.4-9 Average Flows by Month for the Snake River
(Page 1 of 1)

		Average Monthly Streamflow												
	Period of Record	**Units**	**October**	**November**	**December**	**January**	**February**	**March**	**April**	**May**	**June**	**July**	**August**	**September**
Snake River near Lewis-ville	**1978-1983**	m^3/s	83	92	101	106	110	155	242	389	375	249	142	109
		ft^3/s	2,919	3,237	3,562	3,748	3,889	5,471	8,531	13,748	13,249	8,782	5,008	3,845
Snake River above Eagle Rock near Idaho Falls	**1988-2007**	m^3/s	92	96	89	91	108	135	177	295	337	226	176	140
		ft^3/s	3,235	3,391	3,134	3,205	3,804	4,752	6,255	10,405	11,893	7,994	6,230	4,932
Snake River near Idaho Falls	**1983-1987**	m^3/s	152	164	177	188	146	188	326	498	489	298	168	152
		ft^3/s	5,362	5,804	6,242	6,643	5,146	6,633	11,521	17,599	17,252	10,538	5,920	5,356

Table 3.4-10 Snake River Gauge Statistics
(Page 1 of 1)

	Period of Record	Units	Annual Average	Daily Maximum	Average Daily Maximum	Daily Minimum	Average Daily Minimum
Snake River near Lewisville	**1978-1983**	m^3/s	179	691	275	33	113
		ft^3/s	6,332	24,400	9,694	1,160	4,002
Snake River above Eagle Rock near Idaho Falls	**1988-2007**	m^3/s	163	1,356	394	27	83
		ft^3/s	5,769	47,900	13,902	950	2,925
Snake River near Idaho Falls	**1983-1987**	m^3/s	245	818	364	76	129
		ft^3/s	8,668	28,900	12,857	2,670	4,545

Table 3.4-11 Ranges of Hydrologic Properties for the SRP
(Page 1 of 1)

Reference	Area	Porosity	Saturated Hydraulic Conductivity m/s (ft/s)	Groundwater Velocity m/s (ft/s)
Ackerman, 2006*	Eastern Snake River Plain Aquifer	0.05-0.27	3.5E-08 - 8.5E-02 (1.1E-07 - 2.8E-01)	6.9E-07 - 7.1E-05 (2.3E-05 - 2.3E-04)
Garabedian, 1992	Eastern Snake River Plain Aquifer	0.05-0.2	1.6E-06 - 3.4E-02 (5.3E-06 – 1.1E-01)	NA
Smith, 2004	Snake River Plain Aquifer	Up to 0.5	NA	NA
Wood, 1988	Snake River Plain Aquifer	NA	NA	2.3E-05 - 4.6E-05) (7.6E-05 – 1.5E-04)
Stoller, 2007	Snake River Plain Aquifer	NA	NA	1.7E-05 - 7.1E-05 (5.7E-05 - 7.1E-05)
Nimmo, 2004	Sediments at Idaho National Laboratory	NA	1.0E-10 - 1.2E-04 (3.4E-10 - 3.9E-04)	NA
Nimmo, 2004	Basalts at Idaho National Laboratory	NA	3.5E-08 - 1.1E-01 (1.1E-07 - 3.7E-01)	NA
Ackerman, 2006	Hydrogeologic Unit 1** – Younger rocks consisting of thin, densely fractured basalt	0.05-0.27	3.5E-08 - 8.5E-02 (1.1E-07 - 2.8E-01)	NA
Ackerman, 2006	Hydrogeologic Unit 2** – Younger rocks consisting of massive, less densely fractured basalt	0.11	2.3E-05 – 4.9E-03 (7.6E-05 – 1.6E-02)	NA
Ackerman, 2006	Hydrogeologic Unit 3** – Intermediate-age rocks consisting of slightly altered fractured basalt and interbedded sediment**	0.5-0.8	1.2E-06 - 8.5E-02 (3.8E-06 - 2.8E-01)	NA
Ackerman, 2006	Older rocks consisting of intensely altered, fractured basalt and rhyolitic ash-flow tuffs**	<0.09-19	6.9E-09 - 1.0E-04 (2.2E-08 - 3.4E-07)	NA
Ackerman, 2006	Sediment**	0.25-0.73	1.2E-10 - 8.4E-04 (3.8E-10 - 2.8E-03)	NA

NA – Not Available.

*Compilation from a variety of sources.

** Hydrogeologic units as defined by Ackerman (Ackerman, 2006) for Idaho National Laboratory and vicinity.

Table 3.4-12 Mean Concentrations of Analytes in SRP Shallow Zone Groundwater
(Page 1 of 1)

Analyte	Snake River Plain	Eastern Snake River Plain	Western Snake River Plain
Major constituents			
Ca, mg/L	51	51	36
Mg, mg/L	17	18	9.8
Na, mg/L	43	26	46
K, mg/L	5	4	7.4
HCO_3, mg/L	222	220	190
Cl, mg/L	32	28	17
SO_4, mg/L	67	41	52
SiO_2, mg/L	37	31	56
TDS*, mg/L	361	307	318
Minor and trace constituents			
F, mg/L	0.7	0.6	1
NO_3, mg/L	1.5	1.5	1.5
P, mg/L	0.1	0.1	0.09
Al, µg/L	13	13	10
Ba, µg/L	65	69	43
Fe, µg/L	41	36	55
Pb, µg/L	9	8	13
Li, µg/L	36	37	36
Mn, µg/L	22	12	35
Sr, µg/L	254	259	140
Zn, µg/L	100	108	95

*TDS is calculated from the sum of major constituents

Table 3.4-13 Chemical Analyses for the EREF Site Groundwater (Page 1 of 9)

Well Name	Lava Well 3	Spud Well	GW-3	GW-5	Spud Well	Lava Well 3	GW-1	GW-4	GW-2	RL (mg/L, or as noted)	EPA MCL[1] (mg/L, or as noted)
Sample Name	**LAVA 3-01**	**SPUD-1**	**GW-03-01**	**GW-05-01**	**SPUD WELL-01**	**LAVA 3-01**	**GW-01-01**	**GW-4-01**	**GW-2-01**		
Sample Date	**03/25/08**	**03/25/08**	**05/20/08**	**06/19/08**	**06/19/08**	**06/19/08**	**07/07/08**	**07/09/08**	**07/10/08**		
Analyte	**(mg/L, or as noted)**	**(mg/L, or as noted)**	**(mg/L, or as noted)**	**(mg/L, or as noted)**	**(mg/L, or as noted)**	**(mg/L, or as noted)**	**(mg/L, or as noted)**	**(mg/L, or as noted)**	**(mg/L, or as noted)**		
Field Parameters											
pH (s.u.)	6.73	7.8	7.52	7.70	7.94	7.74	7.83	8.43	8.11	-	6.5 to 8.5 [4]
Temp ºC (ºF)	9.4 (48.9)	6.6 (43.9)	12.3 (54.1)	12.7 (54.9)	11.8 (53.2)	12.0 (53.6)	13.1 (55.6)	13.2 (55.8)	13.7 (56.7)	-	NS
Electrical Conductivity µS/cm (µmhos/cm)	NM	NM	358 (358)	350 (350)	425 (425)	345 (345)	302 (302)	294 (294)	285 (285)	-	NS
Depth to water m (ft) (BGS[2])	217.9 (715)	NM	208.9 (685.3)	220.0 (721.9)	NM	NM	208.6 (684.3)	201.5 (661.1)	202.9 (665.7)	-	
Lab Parameters											
Dissolved											
Aluminum	<0.08 [3]	<0.08 [3]	<0.08 [3]	<0.08 [3]	<0.08 [3]	<0.08 [3]	<0.08 [3]	<0.08 [3]	<0.08 [3]	0.08	0.05 - 0.2 [4]
Antimony	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	0.003	0.006
Arsenic	<0.003	<0.003	<0.003	<0.003	0.00303	<0.003	<0.003	<0.003	<0.003	0.003	0.01
Barium	0.0103	0.0149	0.0115	0.0113	0.0138	0.0101	0.0074	0.0098	0.0103	0.002	2
Beryllium	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0.002	0.004
Boron	0.063	0.065	0.061	0.059	0.065	0.061	0.049	0.052	0.044	0.04	NS
Cadmium	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0.002	0.005
Calcium	40.0	49.7	40.6	38.1	46.4	37.2	32.1	32.8	29.2	0.04	NS
Chromium	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	0.006	0.1
Cobalt	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	0.006	NS
Copper	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	1.3 [5]
Iron	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	0.06	0.3 [4]
Lead	<0.0075	<0.0075	<0.0075	<0.0075	<0.0075	<0.0075	<0.0075	<0.0075	<0.0075	0.0075	0.015 [5]
Magnesium	11.4	14.1	11.8	11.3	13.8	11.0	9.44	9.75	8.79	0.06	NS
Manganese	<0.004	0.0075	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	0.0048	0.004	0.05 [4]
Mercury	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	0.0002	0.002
Molybdenum	<0.008	0.0089	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	0.008	NS

Table 3.4-13 Chemical Analyses for the EREFSite Groundwater
(Page 2 of 9)

Well Name	Lava Well 3	Spud Well	GW-3	GW-5	Spud Well	Lava Well 3	GW-1	GW-4	GW-2	RL (mg/L, or as noted)	EPA MCL[1] (mg/L, or as noted)
Sample Name	**LAVA 3-01**	**SPUD-01**	**GW-03-01**	**GW-05-01**	**SPUD WELL-01**	**LAVA 3-01**	**GW-01-01**	**GW-4-01**	**GW-2-01**		
Sample Date	**03/25/08**	**03/25/08**	**05/20/08**	**06/19/08**	**06/19/08**	**06/19/08**	**07/07/08**	**07/09/08**	**07/10/08**		
Analyte	**(mg/L, or as noted)**	**(mg/L, or as noted)**	**(mg/L, or as noted)**	**(mg/L, or as noted)**	**(mg/L, or as noted)**	**(mg/L, or as noted)**	**(mg/L, or as noted)**	**(mg/L, or as noted)**	**(mg/L, or as noted)**		
Lab Parameters											
Dissolved											
Nickel	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	NS
Potassium	3.10	3.47	3.05	3.11	3.42	2.93	2.47	2.70	2.50	0.5	NS
Selenium	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	0.04	0.05
Silica (SiO2)	35.9	34.8	32.5	33.4	32.2	33.9	34.9	35.5	34.0	0.17	NS
Silver	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.005	0.1 [4]
Sodium	16.3	18.5	17.2	17.0	18.2	16.2	14.8	14.0	13.0	0.5	NS
Thallium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.002
Zinc	<0.01	0.457	0.143	0.0528	0.0853	<0.01	0.0871	0.186	0.113	0.01	5 [4]
Total Recoverable											
Aluminum	**0.366**	**0.223**	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	0.08	0.05 - 0.2 [4]
Antimony	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	0.003	0.006
Arsenic	0.0039	0.00434	0.00443	0.00453	0.00599	0.00584	0.00554	0.00503	<0.003	0.003	0.01
Barium	0.0119	0.0171	0.0103	0.0116	0.0149	0.0102	0.0082	0.0103	0.0130	0.002	2
Beryllium	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0.002	0.004
Boron	0.064	0.07	0.058	0.068	0.071	0.068	0.050	0.060	0.057	0.04	NS
Cadmium	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0.002	0.005
Calcium	41.3	51.1	37.3	40.6	49.8	39.2	35.0	35.3	33.5	0.04	NS
Chromium	<0.006	0.0096	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	0.006	0.1
Cobalt	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	0.006	NS
Copper	0.01	0.011	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	1.3 [5]
Iron	**1.19**	**0.515**	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	0.06	0.3 [4]
Lead	<0.0075	0.0104	<0.0075	<0.0075	<0.0075	<0.0075	<0.0075	<0.0075	<0.0075	0.0075	0.015 [5]
Magnesium	12.3	14.5	10.8	11.9	14.5	11.6	10.0	10.4	10.1	0.06	NS

Table 3.4-13 Chemical Analyses for the EREF Site Groundwater (Page 3 of 9)

Well Name	Lava Well 3	Spud Well	GW-3	GW-5	Spud Well	Lava Well 3	GW-1	GW-4	GW-2	RL (mg/L, or as noted)	EPA MCL[1] (mg/L, or as noted)
Sample Name	LAVA 3-01	SPUD-01	GW-03-01	GW-05-01	SPUD WELL-01	LAVA 3-01	GW-01-01	GW-4-01	GW-2-01		
Sample Date	03/25/08	03/25/08	05/20/08	06/19/08	06/19/08	06/19/08	07/07/08	07/09/08	07/10/08		
Analyte	(mg/L, or as noted)	(mg/L, or as noted)	(mg/L, or as noted)	(mg/L, or as noted)	(mg/L, or as noted)	(mg/L, or as noted)	(mg/L, or as noted)	(mg/L, or as noted)	(mg/L, or as noted)		
Total Recoverable											
Manganese	0.0221	0.0058	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	0.0064	0.004	0.05 [4]
Mercury	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	0.0002	0.002
Molybdenum	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	0.008	NS
Nickel	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	NS
Potassium	3.17	3.48	2.89	3.10	3.38	3.01	2.96	2.85	2.84	0.5	NS
Selenium	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	0.04	0.05
Silica (SiO2)	38.7	36.5	32.4	35.9	34.9	35.4	37.0	38.2	38.6	0.17	NS
Silver	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.005	0.1 [4]
Sodium	16.7	18.5	16	16.7	18.0	15.7	15.0	14.5	13.9	0.5	NS
Thallium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.002
Zinc	0.0146	1.03	0.131	0.0629	0.104	<0.01	0.0925	0.202	0.157	0.01	5 [4]
Organics										**PQL (mg/L)**	
Lube Oil	1.23	ND	ND	ND	ND	ND	ND	ND	ND	0.5	NS
Diesel	ND	ND	ND	ND	ND	ND	ND	0.107	ND	0.1	NS
Gasoline	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.1	NS
SVOC	ND	ND	ND	ND	ND	ND	ND	ND	ND	Various	Various
VOC	ND	ND	ND	ND	ND	ND	ND	ND	ND	Various	Various
Pesticides	ND	ND	ND	NA	NA	NA	ND	ND	ND	Various	Various
Herbicides	ND	ND	ND	ND	ND	ND	ND	ND	ND	Various	Various
Polychlorinated biphenyls, PCB	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0002	0.0005
TOC	ND	ND	ND	2.18	6.01	2.60	ND	ND	ND	1	NS

Table 3.4-13 Chemical Analyses for the EREF Site Groundwater (Page 4 of 9)

Well Name	Lava Well 3	Spud Well	GW-3	GW-5	Spud Well	Lava Well 3	GW-1	GW-4	GW-2	RL (mg/L, or as noted)	EPA MCL[1] (mg/L, or as noted)
Sample Name	LAVA 3-01	SPUD-01	GW-03-01	GW-05-01	SPUD WELL-01	LAVA 3-01	GW-01-01	GW-4-01	GW-2-01		
Sample Date	03/25/08	03/25/08	05/20/08	06/19/08	06/19/08	06/19/08	07/07/08	07/09/08	07/10/08		
Analyte	(mg/L, or as noted)	(mg/L, or as noted)	(mg/L, or as noted)	(mg/L, or as noted)	(mg/L, or as noted)	(mg/L, or as noted)	(mg/L, or as noted)	(mg/L, or as noted)	(mg/L, or as noted)		
Inorganic major cations and anions											
Bicarbonate	143	170	142	142	165	140	130	129	126	1	NS
Carbonate	<1	<1	<1	<1	<1	<1	<1	<1	<1	1	NS
Chloride	13.4	16.2	12.9	13.1	16.9	13.9	9.73	9.46	8.50	1.0	250 [4]
Cyanide (free)	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.1	0.2
Fluoride	0.862	0.728	0.8	1.1	0.834	1.09	0.803	0.810	0.801	0.1	2 [4]
Nitrate as N	1.29	1.44	<0.05	1.29	1.48	1.30	1.38	1.46	1.47	0.05	10
Nitrite as N	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.05	1
General Properties[6]											
pH (S.U.)	7.43	7.98	8.12	8.03	8.06	8.05	8.11	8.06	8.19	No RL	6.5 to 8.5 [4]
Specific conductance (umhos/cm)	370	440	460	360	430	350	320	310	270	1	NS
Sulfate as SO4	21.6	33.8	22.7	24.1	35.9	22.7	13.1	12.5	10.4	0.3	250 [4]
Total Alkalinity	143	170	142	142	165	140	130	129	126	1	NS
Total Dissolved Solids	220	260	230	230	260	220	210	200	200	10	500 [4]
Total Organic Carbon	<1.00	<1.00	<1.00	2.18	6.01	2.60	<1.00	<1.00	<1.00	1	NS
Total Suspended Solids	19	13	<5	<5	<5	<5	<5	<5	<5	5	NS

Table 3.4-13 Chemical Analyses for the EREF Site Groundwater (Page 5 of 9)

Well Name	GW-3	Lava Well 3	GW-5	Spud Well	GW-1	GW-4	GW-2	RL (mg/L, or as noted)	EPA MCL[1] (mg/L, or as noted)
Sample Name	GW-03-01	LAVA 03-01	GW-05-01	SPUD WELL-01-01	GW-01-01	GW-04-01	GW-02-01		
Sample Date	9/29/08	9/30/08	9/30/08	9/30/08	9/30/08	10/1/08	10/1/08		
Analyte	(mg/L, or as noted)	(mg/L, or as noted)	(mg/L, or as noted)	(mg/L, or as noted)	(mg/L, or as noted)	(mg/L, or as noted)	(mg/L, or as noted)		
Field Parameters									
pH (s.u.)	7.7	7.9	7.92	7.66	7.84	7.71	7.91	-	6.5 to 8.5 [4]
Temp ºC (ºF)	11.84 (53.31)	15.17 (59.31)	11.9 (53.42)	11.82 (53.28)	13.22 (55.80)	12.68 (54.82)	13.7 (56.66)	-	NS
Electrical Conductivity µS/cm (µmhos/cm)	356 (356)	349 (349)	358 (358)	416 (416)	300 (300)	292 (292)	282 (282)	-	NS
Depth to water m (ft) (BGS[2])	NM	NM	NM	NM	NM	NM	NM	-	
Lab Parameters									
Dissolved									
Aluminum	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	0.08	0.05 - 0.2 [4]
Antimony	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	0.003	0.006
Arsenic	<0.003	<0.003	<0.003	0.00324	<0.003	<0.003	<0.003	0.003	0.01
Barium	0.0098	0.0095	0.0102	0.0139	0.0069	<0.0079	<0.0086	0.002	2
Beryllium	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0.002	0.004
Boron	0.057	0.056	0.056	0.059	0.049	0.048	0.046	0.04	NS
Cadmium	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0.002	0.005
Calcium	36.7	35.5	37	45.3	31.1	30.8	29.3	0.04	NS
Chromium	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	0.006	0.1
Cobalt	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	0.006	NS
Copper	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	1.3 [4,5]
Iron	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	0.06	0.3 [4]
Lead	<0.0075	<0.0075	<0.0075	<0.0075	<0.0075	<0.0075	<0.0075	0.0075	0.015 [5]
Magnesium	10.7	10.3	10.9	13.1	9.16	9.04	8.89	0.06	NS
Manganese	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	0.004	0.05 [4]
Mercury	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	0.0002	0.002
Molybdenum	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	0.008	NS

Table 3.4-13 Chemical Analyses for the EREF Site Groundwater
(Page 6 of 9)

Well Name	GW-3	Lava Well 3	GW-5	Spud Well	GW-1	GW-4	GW-2	RL (mg/L, or as noted)	EPA MCL[1] (mg/L, or as noted)
Sample Name	**GW-03-01**	**LAVA 03-01**	**GW-05-01**	**SPUD WELL-01-01**	**GW-01-01**	**GW-4-01**	**GW-02-01**		
Sample Date	**9/29/08**	**9/29/08**	**9/30/08**	**9/30/08**	**9/30/08**	**10/1/08**	**10/1/08**		
Analyte	**(mg/L, or as noted)**	**(mg/L, or as noted)**	**(mg/L, or as noted)**	**(mg/L, or as noted)**	**(mg/L, or as noted)**	**(mg/L, or as noted)**	**(mg/L, or as noted)**		
Lab Parameters									
Dissolved									
Nickel	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	NS
Potassium	2.86	2.8	2.9	3.16	2.65	2.6	2.64	0.5	NS
Selenium	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	0.04	0.05
Silica (SiO2)	32.8	32.6	33	32.1	33.6	33.9	34.3	0.17	NS
Silver	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.005	0.1 [4]
Sodium	15.9	15.8	16.4	17.4	13.7	13.3	13	0.5	NS
Thallium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.002
Vanadium	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.005	0.005
Zinc	0.0165	<0.01	0.0211	0.0353	<0.01	0.0321	0.0228	0.01	5 [4]
Total Recoverable									
Aluminum	0.175	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	0.08	0.05 - 0.2 [4]
Antimony	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	0.003	0.006
Arsenic	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	0.003	0.01
Barium	0.012	0.011	0.0106	0.014	0.0074	0.0095	0.0091	0.002	2
Beryllium	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0.002	0.004
Boron	0.064	0.065	0.061	0.063	0.051	0.054	0.048	0.04	NS
Cadmium	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0.002	0.005
Calcium	39.6	38	37.4	44.9	31.3	32.4	30.9	0.04	NS
Chromium	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	0.006	0.1
Cobalt	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	0.006	NS
Copper	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	1.3 [4,5]
Iron	0.255	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	0.06	0.3 [4]
Lead	<0.0075	<0.0075	<0.0075	<0.0075	<0.0075	<0.0075	<0.0075	0.0075	0.015 [5]
Magnesium	11.6	11.2	11	13.1	9.16	9.63	9.47	0.06	NS

Table 3.4-13 Chemical Analyses for the EREF Site Groundwater
(Page 7 of 9)

Well Name	GW-3	Lava Well 3	GW-5	Spud Well	GW-1	GW-4	GW-2	RL (mg/L, or as noted)	EPA MCL[1] (mg/L, or as noted)
Sample Name	**GW-03-01**	**LAVA 03-01**	**GW-05-01**	**SPUD WELL-01-01**	**GW-01-01**	**GW-4-01**	**GW-2-01**		
Sample Date	**9/29/08**	**9/29/08**	**9/30/08**	**9/30/08**	**9/30/08**	**10/1/08**	**10/1/08**		
Analyte	**(mg/L, or as noted)**	**(mg/L, or as noted)**	**(mg/L, or as noted)**	**(mg/L, or as noted)**	**(mg/L, or as noted)**	**(mg/L, or as noted)**	**(mg/L, or as noted)**		
Total Recoverable									
Manganese	0.0043	<0.004	<0.004	<0.004	<0.004	<0.004	<0.0044	0.004	0.05 [4]
Mercury	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	0.0002	0.002
Molybdenum	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	0.008	NS
Nickel	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	NS
Potassium	3.02	2.99	2.97	3.18	2.65	2.67	2.7	0.5	NS
Selenium	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	0.04	0.05
Silica (SiO2)	35.2	34.1	35.7	34.1	35.8	35.5	36.1	0.17	NS
Silver	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.005	0.1 [4]
Sodium	17.3	17.4	16.7	17.2	13.6	14	13.8	0.5	NS
Thallium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.002
Vanadium	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.005	0.005
Zinc	0.0669	<0.01	0.0283	0.0377	0.0139	0.0384	0.0536	0.01	5 [4]
Organics								**PQL (mg/L)**	
Lube Oil	ND	0.592	ND	ND	ND	ND	ND	Various	Various
Diesel	ND	ND	ND	ND	ND	ND	ND	0.1	
Gasoline	ND	ND	ND	ND	ND	ND	ND	0.1	
bis(2-Ethylhexyl) Phthalate	1.04	ND	ND	ND	3.1	ND	8.44	0.5	NS
Diethylphthalate	ND	ND	1.62	ND	ND	ND	ND	0.5	NS
Remaining SVOCs	ND	ND	ND	ND	ND	ND	ND	Various	Various
Chloroform	ND	ND	ND	ND	ND	ND	ND	0.5	0.08
Remaining VOCs	ND	ND	ND	ND	ND	ND	ND	Various	Various
Pesticides	ND	ND	ND	ND	ND	ND	ND	Various	Various
Herbicides	ND	ND	ND	ND	ND	ND	ND	Various	Various
Polychlorinated biphenyls, PCB	ND	ND	ND	ND	ND	ND	ND	0.0002	0.0005

Table 3.4-13 Chemical Analyses for the EREF Site Groundwater (Page 8 of 9)

Well Name	GW-3	Lava Well 3	GW-5	Spud Well	GW-1	GW-4	GW-2	RL (mg/L, or as noted)	EPA MCL[1] (mg/L, or as noted)
Sample Name	**GW-03-01**	**LAVA 03-01**	**GW-05-01**	**SPUD WELL-01-01**	**GW-01-01**	**GW-4-01**	**GW-2-01**		
Sample Date	**9/29/08**	**9/29//08**	**9/30/08**	**9/30/08**	**9/30/08**	**10/1/08**	**10/1/08**		
Analyte	**(mg/L, or as noted)**	**(mg/L, or as noted)**	**(mg/L, or as noted)**	**(mg/L, or as noted)**	**(mg/L, or as noted)**	**(mg/L, or as noted)**	**(mg/L, or as noted)**		
TOC	<1	<1	<1	<1	1.07	1.26	1.59	1	NS
Inorganic major cations and anions									
Bicarbonate	147	148	147	168	133	129	126	1	NS
Carbonate	<1	<1	<1	<1	<1	<1	<1	1	NS
Chloride	13.9	14	14.4	14.4	9.92	9.38	8.73	0. 2	250 [4]
Cyanide (free)	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.1	0.2
Fluoride	0.795	0.805	0.797	0.682	0.801	0.783	0.784	0.1	2 [4]
Nitrate as N	1.31	1.32	1.32	1.46	1.38	1.42	1.45	0.05	10
Nitrite as N	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.05	1
General Properties[6]									
pH (S.U.)	8.09	7.91	8.08	8.07	8.13	8.06	8.11	No RL	6.5 to 8.5 [4]
Specific conductance (umhos/cm)	370	370	390	460	330	310	300	1	NS
Sulfate as SO4	22.1	20.9	22.7	32.9	13.3	12.2	10.1	0.3	250 [4]
Total Alkalinity	147	148	147	168	133	129	126	1	NS
Total Dissolved Solids	250	240	230	280	200	180	170	10	500 [4]
Total Organic Carbon	<1	<1	<1	<1	1.07	1.26	1.59	1	NS
Total Suspended Solids	6	<5	<5	<5	<5	<5	<5	5	NS

Table 3.4-13 Chemical Analyses for the EREF Site Groundwater
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NOTES:

Highlighted results exceed EPA MCL

1. EPA, 2006
2. BGS = Below ground surface when well was sampled.
3. Detection limit for aluminum above the lowest value of the secondary standard.
4. EPA secondary maximum contaminant levels (SMCLs) (EPA, 2006)
5. Action level requiring treatment (EPA, 2006)
6. Lab measurement

NA = Not analyzed due to bottle breakage
NM = Not measured
NS = No standard
s.u. = standard units
< Denotes result was less than the lab reporting limit (RL). The RL is the number following the less than sign
ND = Non-detect
VOC = Volatile Organic Compounds
SVOC = Semi-Volatile Organic Compounds
TPH = Total Petroleum Hydrocarbons
TOC = Total Organic Carbon
MCL = Maximum Contaminant Level
RL =Reporting Limit
S.U. = Standard units
PQL = Practical Quantitation Limit (see Organics)

Table 3.4-14 Radiochemical Analyses for the EREF Site Groundwater
(Page 1 of 19)

Well Name	Lava Well 3				Spud Well				
Sample Date	3/25/2008	3/25/2008	3/25/2008	3/25/2008	3/25/2008	3/25/2008	3/25/2008	3/25/2008	
Sample Name	LAVA 3-01	LAVA 3-01	MDC	MDC	SPUD-1	SPUD-1	MDC	MDC	EPA MCL[1]
Analyte	(pCi/L)	(Bq/L)	(pCi/L)	(Bq/L)	(pCi/L)	(Bq/L)	(pCi/L)	(Bq/L)	pCi/L (Bq/L)
Radioactive Constituent									
Gross Alpha	1.3E+00	4.7E-02	2.9E+00	1.1E-01	1.4E+00	5.3E-02	2.8E+00	1.0E-01	15 (0.55)
Gross Beta	**5.7E+00**	**2.1E-01**	3.3E+00	1.2E-01	**4.3E+00**	**1.6E-01**	3.2E+00	1.2E-01	15 (0.55)
Ag-108m	7.1E-01	2.6E-02	1.2E+00	4.4E-02	-1.0E-02	-3.7E-04	7.6E-01	2.8E-02	NS
Ag-110m	-7.7E-01	-2.8E-02	1.9E+00	7.0E-02	4.1E-01	1.5E-02	1.3E+00	4.8E-02	NS
Ba-140	1.1E+00	4.1E-02	8.7E+00	3.2E-01	-1.6E+00	-5.9E-02	6.1E+00	2.3E-01	NS
Be-7	-5.1E+00	-1.9E-01	1.5E+01	5.5E-01	9.0E-01	3.3E-02	1.0E+01	3.7E-01	NS
Ce-141	2.1E+00	7.6E-02	3.1E+00	1.1E-01	1.0E-01	3.7E-03	6.0E+00	2.2E-01	NS
Ce-144	-1.0E-01	-3.7E-03	7.1E+00	2.6E-01	2.4E+00	8.9E-02	5.4E+00	2.0E-01	NS
Co-57	3.8E-01	1.4E-02	1.6E+00	5.9E-02	5.6E-01	2.1E-02	7.0E-01	2.6E-02	NS
Co-58	-2.4E-01	-8.9E-03	1.8E+00	6.7E-02	1.0E-02	3.7E-04	1.2E+00	4.4E-02	NS
Co-60	6.0E-02	2.2E-03	1.5E+00	5.5E-02	2.0E-01	7.4E-03	1.0E+00	3.7E-02	NS
Cr-51	5.1E+00	1.9E-01	1.8E+01	6.7E-01	-4.3E+00	-1.6E-01	1.6E+01	5.9E-01	NS
Cs-134	-1.1E-01	-4.1E-03	1.5E+00	5.5E-02	-4.0E-01	-1.5E-02	1.0E+00	3.7E-02	NS
Cs-137	4.3E-01	1.6E-02	1.2E+00	4.4E-02	3.7E-01	1.4E-02	8.9E-01	3.3E-02	NS
Fe-59	-4.0E-01	-1.5E-02	4.3E+00	1.6E-01	-1.6E+00	-5.9E-02	3.0E+00	1.1E-01	NS
I-131	-2.8E+00	-1.0E-01	1.4E+01	5.2E-01	3.4E+00	1.3E-01	1.3E+01	4.8E-01	NS
K-40	-1.5E+00	-5.5E-02	3.1E+01	1.1E+00	1.4E+01	5.2E-01	3.5E+01	1.3E+00	NS
La-140	1.1E+00	4.1E-02	8.7E+00	3.2E-01	-1.6E+00	-5.9E-02	6.1E+00	2.3E-01	NS
Mn-54	-8.0E-02	-3.0E-03	1.4E+00	5.2E-02	6.0E-02	2.2E-03	9.7E-01	3.6E-02	NS

Table 3.4-14 Radiochemical Analyses for the EREF Site Groundwater (Page 2 of 19)

Well Name	Lava Well 3				Spud Well				
Sample Date	3/25/2008	3/25/2008	3/25/2008	3/25/2008	3/25/2008	3/25/2008	3/25/2008	3/25/2008	
Sample Name	LAVA 3-01	LAVA 3-01	MDC	MDC	SPUD-1	SPUD-1	MDC	MDC	EPA MCL[1]
Analyte	(pCi/L)	(Bq/L)	(pCi/L)	(Bq/L)	(pCi/L)	(Bq/L)	(pCi/L)	(Bq/L)	pCi/L (Bq/L)
Nb-95	-2.1E-01	-7.8E-03	2.3E+00	8.5E-02	9.6E-01	3.6E-02	1.7E+00	6.3E-02	NS
Ru-103	-3.7E-01	-1.4E-02	2.7E+00	1.0E-01	-9.8E-01	-3.6E-02	2.5E+00	9.2E-02	NS
Ru-106	9.0E-01	3.3E-02	1.1E+01	4.1E-01	-5.3E+00	-2.0E-01	9.4E+00	3.5E-01	NS
Sb-124	-2.2E+00	-8.1E-02	5.1E+00	1.9E-01	7.4E-01	2.7E-02	2.9E+00	1.1E-01	NS
Sb-125	-1.0E+00	-3.7E-02	3.6E+00	1.3E-01	6.8E-01	2.5E-02	2.4E+00	8.9E-02	NS
Se-75	-5.6E-01	-2.1E-02	1.7E+00	6.3E-02	-8.9E-01	-3.3E-02	1.3E+00	4.8E-02	NS
Zn-65	6.3E-01	2.3E-02	2.9E+00	1.1E-01	1.4E+00	5.3E-02	2.1E+00	7.8E-02	NS
Zr-95	-8.9E-01	-3.3E-02	3.2E+00	1.2E-01	-4.9E-01	-1.8E-02	2.2E+00	8.1E-02	NS
H-3	1.1E+02	4.1E+00	4.5E+02	1.7E+01	4.0E+01	1.5E+00	4.5E+02	1.7E+01	NS
Ra-224	-1.1E+04	-4.1E+02	6.5E+05	2.4E+04	0.0E+00	0.0E+00	4.5E+05	1.7E+04	NS
Ra-226	-3.7E-02	-1.4E-03	8.5E-01[3]	3.1E-02[3]	3.2E-01	1.2E-02	8.6E-01[3]	3.2E-02[3]	5 (0.18) [Ra-226+Ra-228][2]
Ra-228[4]	**5.1E+00**	**-1.9E-01**	4.2E+00[3]	1.6E-01[3]	-6.5E+00	-2.4E-01	1.1E+01[3]	4.1E-01[3]	5 (0.18) - [Ra-226+Ra-228][2]
Th-228	1.0E-01	3.8E-03	2.9E-01	1.1E-02	1.2E-01	4.5E-03	1.6E-01	5.9E-03	NS
Th-230	**8.5E-01**	**3.1E-02**	4.7E-01	1.7E-02	9.0E-02	3.3E-03	4.1E-01	1.5E-02	NS
Th-232	**2.6E-01**	**9.8E-03**	6.5E-02	2.4E-03	2.0E-02	7.4E-04	5.5E-02	2.0E-03	NS
U-234	**2.0E+00**	**7.5E-02**	3.0E-01	1.1E-02	**1.1E+00**	**3.9E-02**	2.2E-01	8.1E-03	20 (0.74)
U-235	**2.8E-01**	**1.0E-02**	2.5E-01	9.2E-03	2.9E-01	1.1E-02	3.9E-01	1.4E-02	20 (0.74)
U-238	**6.0E-01**	**2.2E-02**	2.7E-01	1.0E-02	**9.5E-01**	**3.5E-02**	3.6E-01	1.3E-02	20 (0.74)

Table 3.4-14 Radiochemical Analyses for the EREF Site Groundwater (Page 3 of 19)

Well Name	GW-3				GW-5				
Sample Name Sample Date	GW-3-01 5/20/2008	GW-3-01 5/20/2008	MDC 5/20/2008	MDC 5/20/2008	GW-5-01 6/19/2008	GW-5-01 6/19/2008	MDC 6/19/2008	MDC 6/19/2008	EPA MCL[1]
Analyte	(pCi/L)	(Bq/L)	(pCi/L)	(Bq/L)	(pCi/L)	(Bq/L)	(pCi/L)	(Bq/L)	pCi/L (Bq/L)
Radioactive Constituent									
Gross Alpha	5.1E-01	1.9E-02	3.50E-00	1.3E-01	-5.4E-01	-2.0E-02	1.9E+00	7.0E-02	15 (0.55)
Gross Beta	**5.8E-00**	**2.1E-01**	3.7E-00	1.4E-01	9.5E-01	3.5E-02	2.8E+00	1.0E-01	15 (0.55)
Ag-108m	-5.0E-02	-1.8E-03	1.7E+00	6.3E-02	1.1E+00	4.1E-02	3.9E+00	1.4E-01	NS
Ag-110m	-8.0E-02	-3.0E-03	2.8E+00	1.0E-01	-1.1E+00	-4.1E-02	6.3E+00	2.3E-01	NS
Ba-140	-1.6E+00	-5.9E-02	7.1E+00	2.6E-01	4.0E+00	1.5E-01	9.4E+00	3.5E-01	NS
Be-7	2.8E+00	1.0E-01	1.8E+01	6.7E-01	-1.3E+01	-4.8E-01	4.4E+01	1.6E+00	NS
Ce-141	1.2E+00	4.6E-02	3.2E+00	1.2E-01	2.9E+00	1.1E-01	7.3E+00	2.7E-01	NS
Ce-144	-4.0E-01	-1.5E-02	8.8E+00	3.3E-01	1.5E+00	5.5E-02	2.7E+01	1.0E+00	NS
Co-57	1.0E-01	3.7E-03	1.1E+00	4.1E-02	2.0E-01	7.4E-03	3.4E+00	1.3E-01	NS
Co-58	-4.3E-01	-1.6E-02	2.4E+00	8.9E-02	1.6E+00	5.9E-02	4.8E+00	1.8E-01	NS
Co-60	1.1E-01	4.1E-03	2.6E+00	9.6E-02	2.1E+00	7.8E-02	5.1E+00	1.9E-01	NS
Cr-51	-7.3E+00	-2.7E-01	2.0E+01	7.4E-01	-2.6E+01	-9.6E-01	5.1E+01	1.9E+00	NS
Cs-134	2.1E-01	7.8E-03	1.9E+00	7.0E-02	2.0E-01	7.4E-03	4.8E+00	1.8E-01	NS
Cs-137	-7.8E-01	-2.9E-02	2.0E+00	7.4E-02	-1.0E-01	-3.7E-03	5.1E+00	1.9E-01	NS
Fe-59	-6.0E-01	-2.2E-02	5.4E+00	2.0E-01	0.0E+00	0.0E+00	1.1E+01	4.1E-01	NS
I-131	-7.0E-01	-2.6E-02	7.3E+00	2.7E-01	-5.9E+00	-2.2E-01	1.2E+01	4.4E-01	NS
K-40	-6.0E+00	-2.2E-01	5.7E+01	2.1E+00	-2.8E+01	-1.0E+00	7.9E+01	2.9E+00	NS
La-140	-1.6E+00	-5.9E-02	7.1E+00	2.6E-01	4.0E+00	1.5E-01	9.4E+00	3.5E-01	NS
Mn-54	-3.9E-01	-1.4E-02	2.1E+00	7.8E-02	3.2E+00	1.2E-01	3.8E+00	1.4E-01	NS
Nb-95	-1.3E+00	-4.7E-02	3.1E+00	1.1E-01	3.0E-01	1.1E-02	5.9E+00	2.2E-01	NS
Ru-103	-2.2E-01	-8.1E-03	3.4E+00	1.3E-01	-5.0E-01	-1.8E-02	5.0E+00	1.8E-01	NS
Ru-106	-1.3E+01	-4.9E-01	1.8E+01	6.7E-01	-2.8E+01	-1.0E+00	4.6E+01	1.7E+00	NS
Sb-124	6.0E-01	2.2E-02	6.7E+00	2.5E-01	-1.2E+00	-4.4E-02	1.3E+01	4.8E-01	NS
Sb-125	-4.0E-01	-1.5E-02	5.1E+00	1.9E-01	1.8E+00	6.7E-02	1.3E+01	4.8E-01	NS
Se-75	-2.4E+00	-8.9E-02	3.6E+00	1.3E-01	-8.0E-01	-3.0E-02	5.6E+00	2.1E-01	NS

Table 3.4-14 Radiochemical Analyses for the EREF Site Groundwater (Page 4 of 19)

Well Name	GW-3				GW-5				
Sample Name Sample Date	GW-3-01 5/20/2008	GW-3-01 5/20/2008	MDC 5/20/2008	MDC 5/20/2008	GW-5-01 6/19/2008	GW-5-01 6/19/2008	MDC 6/19/2008	MDC 6/19/2008	EPA MCL[1]
Analyte	(pCi/L)	(Bq/L)	(pCi/L)	(Bq/L)	(pCi/L)	(Bq/L)	(pCi/L)	(Bq/L)	pCi/L (Bq/L)
Zn-65	7.0E-01	2.6E-02	9.1E+00	3.4E-01	1.9E+00	7.0E-02	1.9E+01	7.0E-01	NS
Zr-95	-4.0E-01	-1.5E-02	4.2E+00	1.6E-01	-7.0E-01	-2.6E-02	8.3E+00	3.1E-01	NS
H-3	**5.3E+02**	**2.0E+01**	4.3E+02	1.6E+01	2.8E+02	1.0E+01	4.3E+02	1.6E+01	NS
Ra-224	0E+00	0E+00	2.7E+05	1E+04	3.5E+02	1.3E+01	9.6E+02	3.6E+01	NS
Ra-226	-1.8E-02	-6.5E-04	1.6E-01 [3]	5.9E-03 [3]	-2.5E-02	-9.3E-04	1.4E-01 [3]	5.2E-03 [3]	5 (0.18) [Ra-226+Ra-228][2]
Ra-228 [4]	8.9E+00	3.3E-01	1.5E+01 [3]	5.6E-01 [3]	-1E+00	-3.7E-02	2.1E+01 [3]	7.8E-01 [3]	5 (0.18) -[Ra-226+Ra-228][2]
Th-228	-2.9E-03	-1.1E-04	2.1E-02	7.8E-04	4.2E-03	1.6E-04	2.2E-02	8.1E-04	NS
Th-230	-2.6E-02	-9.6E-04	3.7E-02	1.4E-03	9.0E-03	3.3E-04	3.8E-02	1.4E-03	NS
Th-232	**1.3E-02**	**4.8E-04**	7.3E-03	2.7E-04	**4.7E-02**	**1.7E-03**	1.0E-02	3.7E-04	NS
U-234	**1.4E+00**	**5.3E-02**	6.6E-03	2.4E-04	**6.5E-02**	**2.4E-03**	2.4E-02	8.9E-04	20 (0.74)
U-235	**3.7E-02**	**1.4E-03**	1.6E-02	5.9E-04	**7.6E-02**	**2.8E-03**	2.3E-02	8.5E-04	20 (0.74)
U-238	**6.4E-01**	**2.4E-02**	2.4E-03	8.9E-05	**6.7E-02**	**2.5E-03**	2.1E-02	7.8E-04	20 (0.74)

Table 3.4-14 Radiochemical Analyses for the EREF Site Groundwater (Page 5 of 19)

Well Name	Spud Well				Lava Well 3				
Sample Name Sample Date	SPUD-01 6/19/2008	SPUD-01 6/19/2008	MDC 6/19/2008	MDC 6/19/2008	LAVA 03-01 6/19/2008	LAVA 03-01 6/19/2008	MDC 6/19/2008	MDC 6/19/2008	EPA MCL[1]
Analyte	(pCi/L)	(Bq/L)	(pCi/L)	(Bq/L)	(pCi/L)	(Bq/L)	(pCi/L)	(Bq/L)	pCi/L (Bq/L)
Radioactive Constituent									
Gross Alpha	0.0E+00	0.0E+00	4.0E+00	1.5E-01	8.0E-01	3.0E-02	3.8E+00	1.4E-01	15 (0.55)
Gross Beta	**5.5E+00**	**2.0E-01**	2.8E+00	1.0E-01	**4.0E+00**	**1.5E-01**	3.3E+00	1.2E-01	15 (0.55)
Ag-108m	-1.5E+00	-5.5E-02	4.6E+00	1.7E-01	-1.2E+00	-4.4E-02	4.6E+00	1.7E-01	NS
Ag-110m	0.0E+00	0.0E+00	7.6E+00	2.8E-01	-7.0E-01	-2.6E-02	7.3E+00	2.7E-01	NS
Ba-140	-8.5E+00	-3.1E-01	1.4E+01	5.2E-01	3.6E+00	1.3E-01	1.0E+01	3.7E-01	NS
Be-7	3.0E+00	1.1E-01	4.6E+01	1.7E+00	-4.0E+00	-1.5E-01	4.2E+01	1.6E+00	NS
Ce-141	-5.2E+00	-1.9E-01	9.2E+00	3.4E-01	-6.5E+00	-2.4E-01	9.4E+00	3.5E-01	NS
Ce-144	5.0E+00	1.8E-01	2.8E+01	1.0E+00	-1.2E+00	-4.4E-02	2.9E+01	1.1E+00	NS
Co-57	-3.0E-01	-1.1E-02	3.6E+00	1.3E-01	0.0E+00	0.0E+00	3.8E+00	1.4E-01	NS
Co-58	5.0E-01	1.8E-02	5.6E+00	2.1E-01	-1.8E+00	-6.7E-02	5.9E+00	2.2E-01	NS
Co-60	-2.3E+00	-8.5E-02	6.5E+00	2.4E-01	1.0E+00	3.7E-02	5.2E+00	1.9E-01	NS
Cr-51	-1.3E+01	-4.8E-01	5.4E+01	2.0E+00	-3.0E+00	-1.1E-01	4.8E+01	1.8E+00	NS
Cs-134	-2.4E+00	-8.9E-02	6.1E+00	2.3E-01	2.4E+00	8.9E-02	4.9E+00	1.8E-01	NS
Cs-137	1.6E+00	5.9E-02	5.0E+00	1.8E-01	-2.9E+00	-1.1E-01	6.0E+00	2.2E-01	NS
Fe-59	4.7E+00	1.7E-01	1.1E+01	4.1E-01	-5.6E+00	-2.1E-01	1.2E+01	4.4E-01	NS
I-131	0.0E+00	0.0E+00	1.2E+01	4.4E-01	3.1E+00	1.1E-01	9.4E+00	3.5E-01	NS
K-40	6.0E+00	2.2E-01	8.3E+01	3.1E+00	-2.5E+01	-9.2E-01	8.2E+01	3.0E+00	NS
La-140	-8.5E+00	-3.1E-01	1.4E+01	5.2E-01	3.6E+00	1.3E-01	1.0E+01	3.7E-01	NS
Mn-54	-1.5E+00	-5.5E-02	5.6E+00	2.1E-01	-4.3E+00	-1.6E-01	6.3E+00	2.3E-01	NS
Nb-95	2.0E-01	7.4E-03	7.6E+00	2.8E-01	4.0E-01	1.5E-02	7.3E+00	2.7E-01	NS
Ru-103	8.0E-01	3.0E-02	6.3E+00	2.3E-01	2.7E+00	1.0E-01	5.6E+00	2.1E-01	NS
Ru-106	-2.3E+01	-8.5E-01	5.2E+01	1.9E+00	-1.8E+01	-6.7E-01	5.4E+01	2.0E+00	NS
Sb-124	-6.0E-01	-2.2E-02	1.3E+01	4.8E-01	2.6E+00	9.6E-02	1.2E+01	4.4E-01	NS
Sb-125	-5.3E+00	-2.0E-01	1.4E+01	5.2E-01	1.0E+00	3.7E-02	1.4E+01	5.2E-01	NS

Table 3.4-14 Radiochemical Analyses for the EREF Site Groundwater (Page 6 of 19)

Well Name	Spud Well				Lava Well 3				
Sample Name / Sample Date	SPUD-01 6/19/2008	SPUD-01 6/19/2008	MDC 6/19/2008	MDC 6/19/2008	LAVA 03-01 6/19/2008	LAVA 03-01 6/19/2008	MDC 6/19/2008	MDC 6/19/2008	EPA MCL[1]
Analyte	(pCi/L)	(Bq/L)	(pCi/L)	(Bq/L)	(pCi/L)	(Bq/L)	(pCi/L)	(Bq/L)	pCi/L (Bq/L)
Se-75	2.9E+00	1.1E-01	6.0E+00	2.2E-01	-2.0E+00	-7.4E-02	6.7E+00	2.5E-01	NS
Zn-65	-1.5E+00	-5.5E-02	2.0E+01	7.4E-01	-4.0E-01	-1.5E-02	1.6E+01	5.9E-01	NS
Zr-95	6.0E-01	2.2E-02	9.9E+00	3.7E-01	-1.5E+00	-5.5E-02	1.0E+01	3.7E-01	NS
H-3	2.4E+02	8.9E+00	4.2E+02	1.6E+01	3.2E+02	1.2E+01	4.3E+02	1.6E+01	NS
Ra-224	0.0E+00	0.0E+00	1.3E+03	4.8E+01	0.0E+00	0.0E+00	9.1E+02	3.4E+02	NS
Ra-226	4.7E-02	1.7E-03	1.5E-01 [3]	5.5E-03 [3]	-1.9E-02	-6.9E-04	1.2E-01[3]	4.4E-03[3]	5 (0.18) [Ra-226+Ra-228][2]
Ra-228 [4]	1.8E+00	6.7E-02	2.2E+01 [3]	8.1E-01 [3]	-3E-01	-1.1E-02	2.3E+01[3]	8.5E-03[3]	5 (0.18) - [Ra-226+Ra-228][2]
Th-228	2.4E-03	8.9E-05	3.0E-02	1.1E-03	3.3E-02	1.2E-03	9.3E-02	3.4E-03	NS
Th-230	**2.9E-01**	**1.1E-02**	4.4E-02	1.6E-03	**1.0E-01**	**3.7E-03**	9.1E-02	3.4E-03	NS
Th-232	**2.3E-02**	**8.4E-04**	1.6E-02	5.9E-04	-5.3E-03	-2.0E-04	3.8E-02	1.4E-03	NS
U-234	**1.6E+00**	**5.8E-02**	1.2E-02	4.4E-04	**1.8E+00**	**6.7E-02**	1.5E-02	5.5E-04	20 (0.74)
U-235	**4.1E-02**	**1.5E-03**	8.6E-03	3.2E-04	**5.6E-02**	**2.1E-03**	1.2E-02	4.4E-04	20 (0.74)
U-238	**7.3E-01**	**2.7E-02**	1.0E-02	3.7E-04	**7.4E-01**	**2.7E-02**	8.4E-02	3.1E-03	20 (0.74)

Table 3.4-14 Radiochemical Analyses for the EREF Site Groundwater
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Well Name	GW-1				GW-4				
Sample Name	GW-01-01	GW-01-01	MDC	MDC	GW-04-01	GW-04-01	MDC	MDC	EPA MCL[1]
Sample Date	7/7/2008	7/7/2008	7/7/2008	7/7/2008	7/9/2008	7/9/2008	7/9/2008	7/9/2008	
Analyte	(pCi/L)	(Bq/L)	(pCi/L)	(Bq/L)	(pCi/L)	(Bq/L)	(pCi/L)	(Bq/L)	pCi/L (Bq/L)
Radioactive Constituent									
Gross Alpha	-2.2E+00	-8.0E-02	3.1E-00	1.1E-01	-2.2E-01	-8.1E-03	3.9E+00	1.4E-01	15 (0.55)
Gross Beta	**3.0E+00**	**1.1E-01**	2.7E+00	1.0E-01	**4.7E+00**	**1.7E-01**	3.4E+00	1.3E-01	15 (0.55)
Ag-108m	-2.0E-01	-7.4E-03	3.5E+00	1.3E-01	-8.6E-01	-3.2E-02	2.9E+00	1.1E-01	NS
Ag-110m	4.6E+00	1.7E-01	5.3E+00	2.0E-01	-2.2E+00	-8.1E-02	5.3E+00	2.0E-01	NS
Ba-140	-1.9E+00	-7.0E-02	9.1E+00	3.4E-01	4.7E+00	1.7E-01	8.2E+00	3.0E-01	NS
Be-7	6.8E+00	2.5E-01	3.3E+01	1.2E+00	-1.7E+01	-6.1E-01	3.3E+01	1.2E+00	NS
Ce-141	1.9E+00	7.0E-02	4.1E+00	1.5E-01	5.0E-01	1.8E-02	7.7E+00	2.8E-01	NS
Ce-144	3.8E+00	1.4E-01	1.9E+01	7.0E-01	-6.7E+00	-2.5E-01	2.4E+01	8.9E-01	NS
Co-57	3.0E-01	1.1E-02	3.5E+00	1.3E-01	4.0E-01	1.5E-02	3.1E+00	1.1E-01	NS
Co-58	-1.7E+00	-6.3E-02	4.4E+00	1.6E-01	-1.4E+00	-5.2E-02	4.1E+00	1.5E-01	NS
Co-60	-5.0E-01	-1.8E-02	5.1E+00	1.9E-01	8.3E-01	3.1E-02	2.5E+00	9.2E-02	NS
Cr-51	-1.0E+00	-3.7E-02	3.6E+01	1.3E+00	-3.0E+00	-1.1E-01	4.0E+01	1.5E+00	NS
Cs-134	2.7E+00	1.0E-01	4.0E+00	1.5E-01	7.4E-01	2.7E-02	3.3E+00	1.2E-01	NS
Cs-137	1.5E+00	5.5E-02	4.0E+00	1.5E-01	-2.0E-02	-7.4E-04	3.5E+00	1.3E-01	NS
Fe-59	-3.0E-01	-1.1E-02	9.3E+00	3.4E-01	2.0E+00	7.4E-02	7.4E+00	2.7E-01	NS
I-131	-3.0E-01	-1.1E-02	7.9E+00	2.9E-01	-2.0E+00	-7.4E-02	1.4E+01	5.2E-01	NS
K-40	-2.9E+01	-1.1E+00	8.8E+01	3.3E+00	2.4E+01	8.9E-01	4.7E+01	1.7E+00	NS
La-140	-1.9E+00	-7.0E-02	9.1E+00	3.4E-01	4.7E+00	1.7E-01	8.2E+00	3.0E-01	NS
Mn-54	-9.1E-01	-3.4E-02	3.7E+00	1.4E-01	-1.6E+00	-5.9E-02	4.1E+00	1.5E-01	NS
Nb-95	0.0E+00	0.0E+00	4.5E+00	1.7E-01	2.0E+00	7.4E-02	4.2E+00	1.6E-01	NS
Ru-103	-2.7E+00	-1.0E-01	4.3E+00	1.6E-01	-1.4E+00	-5.2E-02	4.7E+00	1.7E-01	NS
Ru-106	-2.0E+00	-7.4E-02	3.7E+01	1.4E+00	-3.3E+00	-1.2E-01	3.6E+01	1.3E+00	NS
Sb-124	4.0E-01	1.5E-02	1.1E+01	4.1E-01	-5.0E-01	-1.8E-02	9.6E+00	3.6E-01	NS
Sb-125	-1.4E+00	-5.2E-02	1.1E+01	4.1E-01	2.1E+00	7.8E-02	8.7E+00	3.2E-01	NS

Table 3.4-14 Radiochemical Analyses for the EREF Site Groundwater
(Page 8 of 19)

Well Name	GW-1				GW-4				
Sample Name	GW-01-01	GW-01-01	MDC	MDC	GW-04-01	GW-04-01	MDC	MDC	EPA MCL[1]
Sample Date	7/7/2008	7/7/2008	7/7/2008	7/7/2008	7/9/2008	7/9/2008	7/9/2008	7/9/2008	
Analyte	(pCi/L)	(Bq/L)	(pCi/L)	(Bq/L)	(pCi/L)	(Bq/L)	(pCi/L)	(Bq/L)	pCi/L (Bq/L)
Se-75	2.0E-01	7.4E-03	4.2E+00	1.6E-01	-7.0E-01	-2.6E-02	4.6E+00	1.7E-01	NS
Zn-65	-4.0E+00	-1.5E-01	1.1E+01	4.1E-01	-6.4E+00	-2.4E-01	9.5E+00	3.5E-01	NS
Zr-95	1.1E+00	4.1E-02	7.1E+00	2.6E-01	2.0E-01	7.4E-03	7.0E+00	2.6E-01	NS
H-3	-1.2E+02	-4.4E+00	4.3E+02	1.6E+01	-7.0E+01	-2.6E+00	4.3E+02	1.6E+01	NS
Ra-224	0.0E+00	0.0E+00	6.3E+01	2.3E+00	0.0E+00	0.0E+00	4.7E+02	1.7E+01	NS
Ra-226	4.1E-02	1.5E-03	1.9E-01 [3]	7.0E-03 [3]	1.2E-01	4.4E-03	2.9E-01 [3]	1.1E-02 [3]	5 (0.18) [Ra-226+Ra-228][2]
Ra-228 [4]	1.1E+01	4.1E-01	1.3E+01 [3]	4.8E-01 [3]	1.8E+00	6.7E-02	1.2E+01 [3]	4.4E-02 [3]	5 (0.18) - [Ra-226+Ra-228][2]
Th-228	9.0E-04	3.3E-05	2.2E-02	8.1E-04	-2.7E-02	-1.0E-03	2.0E-01	7.40E-03	NS
Th-230	6.0E-03	2.2E-04	4.1E-02	1.5E-03	**2.4E-01**	**8.9E-03**	1.9E-01	7.03E-03	NS
Th-232	4.9E-03	1.8E-04	1.1E-02	4.1E-04	2E-03	7.4E-05	8.8E-02	3.26E-03	NS
U-234	**1.6E+00**	**6.1E-02**	1.8E-02	6.7E-04	**1.5E-00**	**5.5E-02**	5.3E-02	1.96E-03	20 (0.74)
U-235	**4.2E-02**	**1.5E-03**	2.0E-02	7.4E-04	1.4E-02	5.2E-04	8.0E-02	2.96E-03	20 (0.74)
U-238	**6.8E-01**	**2.5E-02**	1.6E-02	5.9E-04	**5.5E-01**	**2.0E-02**	6.8E-02	2.52E-03	20 (0.74)

Table 3.4-14 Radiochemical Analyses for the EREF Site Groundwater (Page 9 of 19)

Well Name	GW-2				
Sample Name Analyte	GW-02-01 (pCi/L)	GW-02-01 (Bq/L)	MDC (pCi/L)	MDC (Bq/L)	EPA MCL[1] pCi/L (Bq/L)
Sample Date	7/10/2008	7/10/2008	7/10/2008	7/10/2008	
Radioactive Constituent					
Gross Alpha	4.8E-01	1.8E-02	3.7E+00	1.4E-01	15 (0.55)
Gross Beta	**5.0E+00**	**1.9E-01**	3.3E+00	1.2E-01	15 (0.55)
Ag-108m	1.7E-01	6.3E-03	2.3E+00	8.5E-02	NS
Ag-110m	-3.0E-01	-1.1E-02	4.0E+00	1.5E-01	NS
Ba-140	-7.5E+00	-2.8E-01	1.3E+01	4.8E-01	NS
Be-7	-9.6E+00	-3.6E-01	2.9E+01	1.1E+00	NS
Ce-141	4.0E-01	1.5E-02	5.9E+00	2.2E-01	NS
Ce-144	2.1E+00	7.8E-02	1.7E+01	6.3E-01	NS
Co-57	-1.3E-01	-4.8E-03	2.1E+00	7.8E-02	NS
Co-58	-2.0E+00	-7.4E-02	3.6E+00	1.3E-01	NS
Co-60	7.2E-01	2.7E-02	3.3E+00	1.2E-01	NS
Cr-51	-6.0E+00	-2.2E-01	3.5E+01	1.3E+00	NS
Cs-134	6.5E-01	2.4E-02	3.0E+00	1.1E-01	NS
Cs-137	4.6E-01	1.7E-02	3.1E+00	1.1E-01	NS
Fe-59	3.7E+00	1.4E-01	7.5E+00	2.8E-01	NS
I-131	-3.2E+00	-1.2E-01	1.4E+01	5.2E-01	NS
K-40	-4.0E+00	-1.5E-01	4.3E+01	1.6E+00	NS
La-140	-7.5E+00	-2.8E-01	1.3E+01	4.8E-01	NS
Mn-54	-1.6E-01	-5.9E-03	2.8E+00	1.0E-01	NS
Nb-95	2.0E-01	7.4E-03	3.7E+00	1.4E-01	NS
Ru-103	-1.5E+00	-5.5E-02	3.9E+00	1.4E-01	NS
Ru-106	-1.1E+01	-4.0E-01	3.0E+01	1.1E+00	NS
Sb-124	1.2E+00	4.4E-02	8.3E+00	3.1E-01	NS
Sb-125	0.0E+00	0.0E+00	7.4E+00	2.7E-01	NS

Table 3.4-14 Radiochemical Analyses for the EREF Site Groundwater (Page 10 of 19)

Well Name	GW-2				
Sample Name	GW-02-01	GW-02-01	MDC	MDC	EPA MCL[1]
Analyte	(pCi/L)	(Bq/L)	(pCi/L)	(Bq/L)	pCi/L (Bq/L)
Sample Date	7/10/2008	7/10/2008	7/10/2008	7/10/2008	
Se-75	0.0E+00	0.0E+00	3.6E+00	1.3E-01	NS
Zn-65	1.9E+00	7.0E-02	6.5E+00	2.4E-01	NS
Zr-95	2.4E+00	8.9E-02	5.4E+00	2.0E-01	NS
H-3	1.8E+02	7.6E+00	4.3E+02	1.6E+01	NS
Ra-224	1E+01	3.7E-01	8.6E+02	3.18E+01	NS
Ra-226	-3.8E-02	-1.4E-03	2.5E-01 [3]	9.2E-03 [3]	5 (0.18) -[Ra-226+Ra-228][2]
Ra-228 [4]	9E-01	3.3E-02	1.2E+01 [3]	4.4E-01 [3]	5 (0.18) -[Ra-226+Ra-228][2]
Th-228	-2.0E-03	-7.40E-05	9.2E-02	3.40E-03	NS
Th-230	-2.6E-02	-9.62E-04	1.3 E-01	4.81E-03	NS
Th-232	0E+00	0.00E+00	2.8E-02	1.04E-03	NS
U-234	**1.1E+00**	**4.07E-02**	6.7E-02	2.48E-03	20 (0.74)
U-235	2.5E-02	9.25E-04	7.6E-02	2.81E-03	20 (0.74)
U-238	**6.6E-01**	**2.44E-02**	6.4E-02	2.37E-03	20 (0.74)

Table 3.4-14 Radiochemical Analyses for the EREF Site Groundwater
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Well Name	GW-3				Lava Well				
Sample Date	9/29/2008	9/29/2008	9/29/2008	9/29/2008	9/29/2008	9/29/2008	9/29/2008	9/29/2008	
Sample Name	GW-03-01	GW-03-01	MDC	MDC	LAVA 03-01	LAVA 03-01	MDC	MDC	EPA MCL[1]
Analyte	(pCi/L)	(Bq/L)	(pCi/L)	(Bq/L)	(pCi/L)	(Bq/L)	(pCi/L)	(Bq/L)	pCi/L (Bq/L)
Radioactive Constituent									
Gross Alpha	-1.08E+00	-4.00E-02	3.80E+00	1.41E-01	3.90E-01	1.44E-02	4.00E+00	1.48E-01	15 (0.55)
Gross Beta	**4.76E+00**	**1.76E-01**	2.20E+00	8.14E-02	**5.10E+00**	**1.89E-01**	3.40E+00	1.26E-01	15 (0.55)
Ag-108m	0.00E+00	0.00E+00	3.10E+00	1.15E-01	1.48E+00	5.48E-02	2.80E+00	1.04E-01	NS
Ag-110m	7.00E-01	2.59E-02	4.40E+00	1.63E-01	1.20E+00	4.44E-02	4.50E+00	1.66E-01	NS
Ba-140	2.60E+00	9.62E-02	1.20E+01	4.44E-01	-3.10E+00	-1.15E-01	1.20E+01	4.44E-01	NS
Be-7	2.20E+01	8.14E-01	3.30E+01	1.22E+00	6.30E+00	2.33E-01	2.80E+01	1.04E+00	NS
Ce-141	2.00E+00	7.40E-02	6.30E+00	2.33E-01	-3.00E+00	-1.11E-01	7.30E+00	2.70E-01	NS
Ce-144	6.60E+00	2.44E-01	1.80E+01	6.66E-01	1.90E+00	7.03E-02	2.30E+01	8.51E-01	NS
Co-57	-6.20E-01	-2.29E-02	2.40E+00	8.88E-02	-9.90E-01	-3.66E-02	2.90E+00	1.07E-01	NS
Co-58	-2.00E-01	-7.40E-03	4.30E+00	1.59E-01	-1.30E+00	-4.81E-02	3.90E+00	1.44E-01	NS
Co-60	0.00E+00	0.00E+00	4.90E+00	1.81E-01	-3.10E-01	-1.15E-02	3.40E+00	1.26E-01	NS
Cr-51	3.00E+00	1.11E-01	3.60E+01	1.33E+00	9.00E-01	3.33E-02	3.30E+01	1.22E+00	NS
Cs-134	-1.27E+00	-4.70E-02	3.60E+00	1.33E-01	-4.80E-01	-1.78E-02	3.20E+00	1.18E-01	NS
Cs-137	-1.30E+00	-4.81E-02	4.50E+00	1.66E-01	5.60E-01	2.07E-02	3.30E+00	1.22E-01	NS
Fe-59	-1.20E+00	-4.44E-02	1.00E+01	3.70E-01	-4.00E+00	-1.48E-01	8.00E+00	2.96E-01	NS
I-131	1.40E+00	5.18E-02	1.50E+01	5.55E-01	-4.30E+00	-1.59E-01	1.30E+01	4.81E-01	NS
K-40	8.00E+00	2.96E-01	5.30E+01	1.96E+00	-4.00E+00	-1.48E-01	4.80E+01	1.78E+00	NS
La-140	2.60E+00	9.62E-02	1.20E+01	4.44E-01	-3.10E+00	-1.15E-01	1.20E+01	4.44E-01	NS
Mn-54	-1.50E+00	-5.55E-02	4.40E+00	1.63E-01	1.04E+00	3.85E-02	3.10E+00	1.15E-01	NS
Nb-95	0.00E+00	0.00E+00	6.00E+00	2.22E-01	-1.70E+00	-6.29E-02	5.10E+00	1.89E-01	NS
Ru-103	1.00E-01	3.70E-03	4.60E+00	1.70E-01	-1.60E+00	-5.92E-02	4.50E+00	1.66E-01	NS

Table 3.4-14 Radiochemical Analyses for the EREF Site Groundwater
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Well Name	GW-3				Lava Well				
Sample Date	9/29/2008	9/29/2008	9/29/2008	9/29/2008	9/29/2008	9/29/2008	9/29/2008	9/29/2008	
Sample Name	GW-03-01	GW-03-01	MDC	MDC	LAVA 03-01	LAVA 03-01	MDC	MDC	EPA MCL[1]
Analyte	(pCi/L)	(Bq/L)	(pCi/L)	(Bq/L)	(pCi/L)	(Bq/L)	(pCi/L)	(Bq/L)	pCi/L (Bq/L)
Ru-106	1.07E+01	3.96E-01	2.90E+01	1.07E+00	-3.80E+00	-1.41E-01	3.20E+01	1.18E+00	NS
Sb-124	1.90E+00	7.03E-02	1.00E+01	3.70E-01	3.10E+00	1.15E-01	9.00E+00	3.33E-01	NS
Sb-125	-6.00E-01	-2.22E-02	1.00E+01	3.70E-01	1.30E+00	4.81E-02	8.10E+00	3.00E-01	NS
Se-75	2.00E-01	7.40E-03	4.30E+00	1.59E-01	-4.00E-01	-1.48E-02	4.30E+00	1.59E-01	NS
Zn-65	1.90E+00	7.03E-02	8.20E+00	3.03E-01	3.70E+00	1.37E-01	6.30E+00	2.33E-01	NS
Zr-95	7.00E-01	2.59E-02	7.70E+00	2.85E-01	-9.00E-01	-3.33E-02	6.30E+00	2.33E-01	NS
H-3	5.00E+01	1.85E+00	4.30E+02	1.59E+01	-3.00E+01	-1.11E+00	4.30E+02	1.59E+01	NS
Ra-224	**2.06E+02**	**7.62E+00**	1.70E+02	6.29E+00	-9.00E+00	-3.33E-01	1.10E+02	4.07E+00	NS
Ra-226	5.00E-02	1.85E-03	4.70E-01	1.74E-02	6.60E-02	2.44E-03	3.70E-01	1.37E-02	5 (0.18) [Ra-226+Ra-228][2]
Ra-228	1.30E+00	4.81E-02	3.70E+00	1.37E-01	-4.00E+01	1.48E-02	2.90E+00	1.07E-01	5 (0.18) -[Ra-226+Ra-228][2]
Th-228	1.61E-01	5.96E-03	1.70E-01	6.29E-03	1.80E-02	6.66E-04	1.30E-01	4.81E-03	NS
Th-230	1.60E-02	5.92E-04	1.60E-01	5.92E-03	-5.60E-02	-2.07E-03	1.30E-01	4.81E-03	NS
Th-232	2.60E-02	9.62E-04	5.20E-02	1.92E-03	2.80E-02	1.04E-03	4.30E-02	1.59E-03	NS
U-234	**1.54E+00**	**5.70E-02**	2.60E-02	9.62E-04	**1.54E+00**	**5.70E-02**	3.80E-02	1.41E-03	20 (0.74)
U-235	**3.60E-02**	**1.33E-03**	3.20E-02	1.18E-03	**3.80E-02**	**1.41E-03**	3.70E-02	1.37E-03	20 (0.74)
U-238	**6.44E-01**	**2.38E-02**	5.20E-02	1.92E-03	**5.33E-01**	**1.97E-02**	3.60E-02	1.33E-03	20 (0.74)

Table 3.4-14 Radiochemical Analyses for the EREF Site Groundwater
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Well Name	GW-5				Spud Well				
Sample Name Sample Date	GW-05-01 9/30/2008	GW-05-01 9/30/2008	MDC 9/30/2008	MDC 9/30/2008	SPUD WELL-01-01 9/30/2008	SPUD WELL-01-01 9/30/2008	MDC 9/30/2008	MDC 9/30/2008	EPA MCL[1]
Analyte	(pCi/L)	(Bq/L)	(pCi/L)	(Bq/L)	(pCi/L)	(Bq/L)	(pCi/L)	(Bq/L)	pCi/L (Bq/L)
Radioactive Constituent									
Gross Alpha	4.20E-01	1.55E-02	3.10E+00	1.15E-01	-1.18E+00	-4.37E-02	3.80E+00	1.41E-01	15 (0.55)
Gross Beta	**4.22E+00**	**1.56E-01**	2.80E+00	1.04E-01	**4.64E+00**	**1.72E-01**	2.10E+00	7.77E-02	15 (0.55)
Ag-108m	-6.60E-01	-2.44E-02	3.30E+00	1.22E-01	-9.40E-01	-3.48E-02	3.70E+00	1.37E-01	NS
Ag-110m	4.00E-01	1.48E-02	5.70E+00	2.11E-01	1.40E+00	5.18E-02	5.80E+00	2.15E-01	NS
Ba-140	-6.10E+00	-2.26E-01	1.50E+01	5.55E-01	-2.50E+00	-9.25E-02	1.20E+01	4.44E-01	NS
Be-7	-9.70E+00	-3.59E-01	3.50E+01	1.29E+00	-4.00E+00	-1.48E-01	3.90E+01	1.44E+00	NS
Ce-141	2.30E+00	8.51E-02	6.60E+00	2.44E-01	1.50E+00	5.55E-02	6.90E+00	2.55E-01	NS
Ce-144	1.20E+01	4.44E-01	2.10E+01	7.77E-01	8.20E+00	3.03E-01	2.40E+01	8.88E-01	NS
Co-57	-7.40E-01	-2.74E-02	2.70E+00	9.99E-02	1.90E-01	7.03E-03	3.30E+00	1.22E-01	NS
Co-58	-5.00E-01	-1.85E-02	4.40E+00	1.63E-01	8.00E-01	2.96E-02	4.50E+00	1.66E-01	NS
Co-60	-4.00E-01	-1.48E-02	4.70E+00	1.74E-01	-1.00E+00	-3.70E-02	5.90E+00	2.18E-01	NS
Cr-51	1.10E+01	4.07E-01	4.00E+01	1.48E+00	-5.00E+00	-1.85E-01	4.30E+01	1.59E+00	NS
Cs-134	6.30E-01	2.33E-02	3.80E+00	1.41E-01	-1.70E-01	-6.29E-03	4.20E+00	1.55E-01	NS
Cs-137	-8.00E-01	-2.96E-02	3.90E+00	1.44E-01	2.00E-01	7.40E-03	4.10E+00	1.52E-01	NS
Fe-59	8.00E-01	2.96E-02	9.80E+00	3.63E-01	-1.00E+00	-3.70E-02	1.10E+01	4.07E-01	NS
I-131	3.60E+00	1.33E-01	1.20E+01	4.44E-01	-2.90E+00	-1.07E-01	1.40E+01	5.18E-01	NS
K-40	-1.30E+01	-4.81E-01	6.30E+01	2.33E+00	1.30E+01	4.81E-01	6.70E+01	2.48E+00	NS
La-140	-6.10E+00	-2.26E-01	1.50E+01	5.55E-01	-2.50E+00	-9.25E-02	1.20E+01	4.44E-01	NS
Mn-54	-2.00E-01	-7.40E-03	3.80E+00	1.41E-01	-4.00E-01	-1.48E-02	4.80E+00	1.78E-01	NS
Nb-95	1.30E+00	4.81E-02	4.30E+00	1.59E-01	6.00E-01	2.22E-02	5.20E+00	1.92E-01	NS
Ru-103	-2.90E+00	-1.07E-01	5.10E+00	1.89E-01	-1.60E+00	-5.92E-02	5.50E+00	2.03E-01	NS
Ru-106	-7.00E+00	-2.59E-01	4.00E+01	1.48E+00	0.00E+00	0.00E+00	3.40E+01	1.26E+00	NS
Sb-124	3.80E+00	1.41E-01	1.30E+01	4.81E-01	-8.00E-01	-2.96E-02	1.30E+01	4.81E-01	NS
Sb-125	-2.00E+00	-7.40E-02	1.10E+01	4.07E-01	1.10E+00	4.07E-02	1.10E+01	4.07E-01	NS

Table 3.4-14 Radiochemical Analyses for the EREF Site Groundwater
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Well Name	GW-5				Spud Well				
Sample Name Sample Date	GW-05-01 9/30/2008	GW-05-01 9/30/2008	MDC 9/30/2008	MDC 9/30/2008	SPUD WELL-01-01 9/30/2008	SPUD WELL-01-01 9/30/2008	MDC 9/30/2008	MDC 9/30/2008	EPA MCL[1]
Analyte	(pCi/L)	(Bq/L)	(pCi/L)	(Bq/L)	(pCi/L)	(Bq/L)	(pCi/L)	(Bq/L)	pCi/L (Bq/L)
Se-75	1.80E+00	6.66E-02	4.20E+00	1.55E-01	0.00E+00	0.00E+00	5.20E+00	1.92E-01	NS
Zn-65	-2.60E+00	-9.62E-02	9.20E+00	3.40E-01	-2.40E+00	-8.88E-02	1.10E+01	4.07E-01	NS
Zr-95	-1.00E-01	-3.70E-03	8.00E+00	2.96E-01	-5.00E-01	-1.85E-02	9.40E+00	3.48E-01	NS
H-3	-1.60E+02	-5.92E+00	4.30E+02	1.59E+01	-9.00E+01	-3.33E+00	4.30E+02	1.59E+01	NS
Ra-224	2.40E+01	8.88E-01	7.20E+01	2.66E+00	8.10E+01	3.00E+00	1.70E+02	6.29E+00	NS
Ra-226	-1.64E-01	-6.07E-03	4.50E-01	1.66E-02	-9.50E-02	-3.51E-03	4.60E-01	1.70E-02	5 (0.18) [Ra-226+Ra-228][2]
Ra-228	-3.30E-01	-1.22E-02	3.10E+00	1.15E-01	1.60E+00	5.92E-02	3.50E+00	1.29E-01	5 (0.18) - [Ra-226+Ra-228][2]
Th-228	-3.36E-02	-1.24E-03	9.00E-02	3.33E-03	-4.00E-03	-1.48E-04	1.20E-01	4.44E-03	NS
Th-230	-2.30E-02	-8.51E-04	1.30E-01	4.81E-03	8.00E-03	2.96E-04	1.50E-01	5.55E-03	NS
Th-232	9.90E-03	3.66E-04	2.70E-02	9.99E-04	3.20E-02	1.18E-03	6.00E-02	2.22E-03	NS
U-234	**1.85E+00**	**6.84E-02**	4.00E-02	1.48E-03	**1.39E+00**	**5.14E-02**	4.80E-02	1.78E-03	20 (0.74)
U-235	**6.40E-02**	**2.37E-03**	5.90E-02	2.18E-03	3.40E-02	1.26E-03	4.60E-02	1.70E-03	20 (0.74)
U-238	**1.05E+00**	**3.89E-02**	2.50E-02	9.25E-04	**6.98E-01**	**2.58E-02**	4.40E-02	1.63E-03	20 (0.74)

Table 3.4-14 Radiochemical Analyses for the EREF Site Groundwater
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Well Name	GW-1				GW-4				
Sample Name Sample Date	GW-01-01 9/30/08	GW-01-01 9/30/08	MDC 9/30/08	MDC 9/30/08	GW-04-01 10/1/08	GW-04-01 10/1/08	MDC 10/1/08	MDC 10/1/08	EPA MCL[1] pCi/L (Bq/L)
Analyte	(pCi/L)	(Bq/L)	(pCi/L)	(Bq/L)	(pCi/L)	(Bq/L)	(pCi/L)	(Bq/L)	
Radioactive Constituent									
Gross Alpha	-1.89E+00	-6.99E-02	3.30E+00	1.22E-01	**3.40E+00**	**1.26E-01**	3.30E+00	1.22E-01	15 (0.55)
Gross Beta	**3.22E+00**	**1.19E-01**	2.00E+00	7.40E-02	**7.80E+00**	**2.89E-01**	3.40E+00	1.26E-01	15 (0.55)
Ag-108m	1.17E+00	4.33E-02	3.00E+00	1.11E-01	2.00E-01	7.40E-03	3.10E+00	1.15E-01	NS
Ag-110m	-3.00E-01	-1.11E-02	4.80E+00	1.78E-01	-2.00E-01	-7.40E-03	5.30E+00	1.96E-01	NS
Ba-140	5.80E+00	2.15E-01	1.00E+01	3.70E-01	-5.00E-01	-1.85E-02	8.60E+00	3.18E-01	NS
Be-7	1.00E+00	3.70E-02	3.60E+01	1.33E+00	1.01E+01	3.74E-01	2.80E+01	1.04E+00	NS
Ce-141	-1.00E-01	-3.70E-03	6.10E+00	2.26E-01	-4.20E+00	-1.55E-01	8.10E+00	3.00E-01	NS
Ce-144	1.80E+00	6.66E-02	1.80E+01	6.66E-01	6.90E+00	2.55E-01	2.20E+01	8.14E-01	NS
Co-57	5.90E-01	2.18E-02	2.40E+00	8.88E-02	7.10E-01	2.63E-02	2.90E+00	1.07E-01	NS
Co-58	5.00E-01	1.85E-02	4.50E+00	1.66E-01	-1.00E+00	-3.70E-02	4.50E+00	1.66E-01	NS
Co-60	-6.00E-01	-2.22E-02	4.60E+00	1.70E-01	-1.40E+00	-5.18E-02	4.30E+00	1.59E-01	NS
Cr-51	2.00E+00	7.40E-02	3.70E+01	1.37E+00	4.00E+00	1.48E-01	4.00E+01	1.48E+00	NS
Cs-134	-8.10E-01	-3.00E-02	3.40E+00	1.26E-01	-1.03E+00	-3.81E-02	3.80E+00	1.41E-01	NS
Cs-137	1.70E+00	6.29E-02	3.60E+00	1.33E-01	9.00E-02	3.33E-03	3.60E+00	1.33E-01	NS
Fe-59	4.00E-01	1.48E-02	9.50E+00	3.51E-01	-3.90E+00	-1.44E-01	9.40E+00	3.48E-01	NS
I-131	5.90E+00	2.18E-01	1.30E+01	4.81E-01	-4.40E+00	-1.63E-01	1.40E+01	5.18E-01	NS
K-40	-1.10E+01	-4.07E-01	6.50E+01	2.40E+00	-1.60E+01	-5.92E-01	5.70E+01	2.11E+00	NS
La-140	5.80E+00	2.15E-01	1.00E+01	3.70E-01	-5.00E-01	-1.85E-02	8.60E+00	3.18E-01	NS
Mn-54	3.00E-01	1.11E-02	3.70E+00	1.37E-01	-1.00E+00	-3.70E-02	4.20E+00	1.55E-01	NS
Nb-95	9.00E-01	3.33E-02	4.90E+00	1.81E-01	-1.70E+00	-6.29E-02	5.30E+00	1.96E-01	NS
Ru-103	-6.00E-01	-2.22E-02	5.10E+00	1.89E-01	-1.80E+00	-6.66E-02	5.50E+00	2.03E-01	NS
Ru-106	6.10E+00	2.26E-01	3.00E+01	1.11E+00	-2.00E+00	-7.40E-02	3.60E+01	1.33E+00	NS

Table 3.4-14 Radiochemical Analyses for the EREF Site Groundwater (Page 16 of 19)

Well Name	GW-1				GW-4				
Sample Name Sample Date	GW-01-01 9/30/08	GW-01-01 9/30/08	MDC 9/30/08	MDC 9/30/08	GW-04-01 10/1/08	GW-04-01 10/1/08	MDC 10/1/08	MDC 10/1/08	EPA MCL[1] pCi/L (Bq/L)
Analyte	(pCi/L)	(Bq/L)	(pCi/L)	(Bq/L)	(pCi/L)	(Bq/L)	(pCi/L)	(Bq/L)	
Sb-124	-5.20E+00	-1.92E-01	1.50E+01	5.55E-01	-4.90E+00	-1.81E-01	1.30E+01	4.81E-01	NS
Sb-125	3.00E+00	1.11E-01	9.80E+00	3.63E-01	-2.10E+00	-7.77E-02	9.90E+00	3.66E-01	NS
Se-75	1.70E+00	6.29E-02	4.10E+00	1.52E-01	5.00E-01	1.85E-02	5.00E+00	1.85E-01	NS
Zn-65	-1.60E+00	-5.92E-02	8.30E+00	3.07E-01	1.10E+00	4.07E-02	7.80E+00	2.89E-01	NS
Zr-95	-1.90E+00	-7.03E-02	8.90E+00	3.29E-01	-2.20E+00	-8.14E-02	8.30E+00	3.07E-01	NS
H-3	-1.20E+02	-4.44E+00	4.30E+02	1.59E+01	-5.00E+01	-1.85E+00	4.30E+02	1.59E+01	NS
Ra-224	0.00E+00	0.00E+00	1.40E+02	5.18E+00	-3.00E+00	-1.11E-01	1.20E+02	4.44E+00	NS
Ra-226	-6.60E-02	-2.44E-03	4.30E-01	1.59E-02	1.30E-01	4.81E-03	5.30E-01	1.96E-02	5 (0.18) [Ra-226+Ra-228][2]
Ra-228	-1.10E-01	-4.07E-02	2.70E+00	9.99E-02	1.80E+00	6.66E-02	3.00E+00	1.11E-01	5 (0.18) - [Ra-226+Ra-228][2]
Th-228	1.00E-03	3.70E-05	8.40E-02	3.11E-03	1.40E-02	5.18E-04	7.60E-02	2.81E-03	NS
Th-230	0.00E+00	0.00E+00	1.30E-01	4.81E-03	3.30E-02	1.22E-03	1.30E-01	4.81E-03	NS
Th-232	1.70E-02	6.29E-04	4.50E-02	1.66E-03	-1.78E-02	-6.59E-04	7.00E-02	2.59E-03	NS
U-234	**1.84E+00**	**6.81E-02**	5.50E-02	2.03E-03	**1.53E+00**	**5.66E-02**	8.00E-02	2.96E-03	20 (0.74)
U-235	**1.08E-01**	**4.00E-03**	5.50E-02	2.03E-03	8.30E-02	3.07E-03	8.30E-02	3.07E-03	20 (0.74)
U-238	**7.56E-01**	**2.80E-02**	4.20E-02	1.55E-03	**6.09E-01**	**2.25E-02**	7.30E-02	2.70E-03	20 (0.74)

Table 3.4-14 Radiochemical Analyses for the EREF Site Groundwater
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Well Name	GW-2				
Sample Name Analyte	GW-02-01 (pCi/L)	GW-02-01 (Bq/L)	MDC (pCi/L)	MDC (Bq/L)	EPA MCL[1] pCi/L (Bq/L)
Sample Date	10/1/2008	10/1/2008	10/1/2008	10/1/2008	
Radioactive Constituent					
Gross Alpha	1.70E+00	6.29E-02	3.40E+00	1.26E-01	15 (0.55)
Gross Beta	2.44E+00	9.03E-02	3.00E+00	1.11E-01	15 (0.55)
Ag-108m	0.00E+00	0.00E+00	3.20E+00	1.18E-01	NS
Ag-110m	-4.00E-01	-1.48E-02	5.40E+00	2.00E-01	NS
Ba-140	-1.10E+00	-4.07E-02	1.20E+01	4.44E-01	NS
Be-7	-9.10E+00	-3.37E-01	3.70E+01	1.37E+00	NS
Ce-141	-1.10E+00	-4.07E-02	8.50E+00	3.14E-01	NS
Ce-144	1.80E+00	6.66E-02	2.60E+01	9.62E-01	NS
Co-57	-1.90E-01	-7.03E-03	3.40E+00	1.26E-01	NS
Co-58	5.00E-01	1.85E-02	4.00E+00	1.48E-01	NS
Co-60	1.90E+00	7.03E-02	3.90E+00	1.44E-01	NS
Cr-51	-1.30E+01	-4.81E-01	4.70E+01	1.74E+00	NS
Cs-134	4.00E-01	1.48E-02	4.00E+00	1.48E-01	NS
Cs-137	1.10E+00	4.07E-02	3.70E+00	1.37E-01	NS
Fe-59	-5.00E-01	-1.85E-02	9.60E+00	3.55E-01	NS
I-131	8.00E-01	2.96E-02	1.30E+01	4.81E-01	NS
K-40	-1.20E+01	-4.44E-01	6.00E+01	2.22E+00	NS
La-140	-1.10E+00	-4.07E-02	1.20E+01	4.44E-01	NS
Mn-54	1.02E+00	3.77E-02	3.30E+00	1.22E-01	NS
Nb-95	-1.00E-01	-3.70E-03	5.00E+00	1.85E-01	NS
Ru-103	7.00E-01	2.59E-02	5.00E+00	1.85E-01	NS
Ru-106	-1.80E+01	-6.66E-01	4.30E+01	1.59E+00	NS
Sb-124	-3.30E+00	-1.22E-01	1.00E+01	3.70E-01	NS
Sb-125	2.80E+00	1.04E-01	1.00E+01	3.70E-01	NS

Table 3.4-14 Radiochemical Analyses for the EREF Site Groundwater (Page 18 of 19)

Well Name	GW-2				
Sample Name Analyte	GW-02-01 (pCi/L)	GW-02-01 (Bq/L)	MDC (pCi/L)	MDC (Bq/L)	EPA MCL[1] pCi/L (Bq/L)
Sample Date	10/1/2008	10/1/2008	10/1/2008	10/1/2008	
Se-75	-2.00E+00	-7.40E-02	5.70E+00	2.11E-01	NS
Zn-65	3.40E+00	1.26E-01	1.60E+01	5.92E-01	NS
Zr-95	1.40E+00	5.18E-02	6.80E+00	2.52E-01	NS
H-3	-1.40E+02	-5.18E+00	4.30E+02	1.59E+01	NS
Ra-224	-9.80E-01	-3.63E-02	5.20E+01	1.92E+00	NS
Ra-226	5.00E-02	1.85E-03	2.40E-01	8.88E-03	5 (0.18) -[Ra-226+Ra-228][2]
Ra-228	1.30E+00	4.81E-02	2.40E+00	8.88E-02	5 (0.18) -[Ra-226+Ra-228][2]
Th-228	-1.55E-02	-5.73E-04	6.30E-02	2.33E-03	NS
Th-230	-3.30E-02	-1.22E-03	1.20E-01	4.44E-03	NS
Th-232	-8.60E-04	-3.18E-05	3.30E-02	1.22E-03	NS
U-234	**1.42E+00**	**5.25E-02**	4.10E-02	1.52E-03	20 (0.74)
U-235	**1.17E-01**	**4.33E-03**	5.00E-02	1.85E-03	20 (0.74)
U-238	**6.44E-01**	**2.38E-02**	4.80E-02	1.78E-03	20 (0.74)

Table 3.4-14 Radiochemical Analyses for the EREF Site Groundwater
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NOTES:

Highlighted results above minimum detectable concentration (MDC)

1. EPA, 2002.
2. Radium MCL is to be compared against the summed concentrations of Ra-226 and Ra-228.
3. Combined Ra-226 and Ra-228 MDC is greater than combined EPA MCL due to sample size limitations.
4. Radium-228 concentration derived indirectly from a daughter product, Ac-228

NM = Not measured
NS = No standard
NA = No analysis
MCL = Maximum Contaminant Level
MDC = Minimum Detectable Concentration
1 Bq = 27.03 pCi
See ER section 3.4.15.4, Site Groundwater Quality, for explanation of negative radiological values