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Well R-12 Rehabilitation and Conversion Summary Report, Revision 1

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1.0 INTRODUCTION

This report provides a summary of the work performed and the results of rehabilitating and converting well R-12 to a dual-screen well. Plans for R-12 conversion were presented in the “Work Plan for R-Well Rehabilitation and Replacement, Revision 2” (LANL 2007, 098119) that was approved by the New Mexico Environment Department (NMED) on August 20, 2007 (NMED 2007, 098182). This revision 1 was prepared to include the actual date of pump and sampling system installation and an as-built figure of the converted well. This revision also addresses comments made by NMED (NMED 2007, 099501).

The R-12 borehole was drilled to a total depth (TD) of 886 ft by using fluid-assisted air-rotary and conventional mud-rotary techniques and was completed with three screened intervals: screen 1 from 459 to 467.5 ft, screen 2 from 504.5 to 508 ft, and screen 3 from 801 to 839 ft. The top two screens are completed in the vadose zone and screen 3 is completed in the regional aquifer. A dedicated Westbay sampling system was installed in the well after completion.

The results of the well screen analysis for R-12 (LANL 2007, 096330) indicated that after the rehabilitation pilot study (LANL 2007, 095889), screen 1 passed 60%–80% of the assessment tests, screen 2 passed 80%–90% of the assessment tests, and screen 3 passed 80%–90% of the assessment tests. Following Westbay packer deflation and during pilot study rehabilitation activities, a significant volume of screen 2 water was introduced to screen 3. Therefore, the well screen analysis of screen 3 water was deemed to be unrepresentative of screen 3 chemistry. Because of the difficulty of maintaining the integrity of screen 3 water chemistry (large volumes of screen 2 water could not be prevented from entering screen 3, and the volumes were so large that purging was unfeasible), the decision was made to abandon screen 3 and drill a new single-screen well (designated R-36) nearby that would be screened at the same depth in basalt as screen 3 in R-12 (NMED 2007, 095394). Two pumps (one Bennett and one submersible) were installed for long-term sampling of the uppermost screens (screens 1 and 2) at R-12.

2.0 REHABILITATION ACTIVITIES

The activities performed as part of the R-12 rehabilitation and conversion included demolition of the concrete vault around the wellhead, the removal and subsequent replacement of inflatable isolation packers, redevelopment of screen 1 by means of jetting, abandonment of screen 3, hydraulic testing to measure the specific capacity of screen 1, and collection of water samples for laboratory analysis in accordance with the work plan approved by NMED (LANL 2007, 098119; NMED 2007, 095394). Completion of the dedicated sample system installation took place on December 13, 2007. These activities are described in the following subsections.

2.1 Vault Removal

An aboveground reinforced concrete vault previously protected the wellhead at R-12. The vault made service work at R-12 difficult and had served its purpose of protecting the well from flash floods after the Cerro Grande fire. Demolition of the vault was included in this rehabilitation and conversion program. The vault was demolished on October 21, 2007. The concrete surface pad and 10-in. steel protective casing were left in place and undisturbed.

2.2 Inflatable Packers

The dedicated Westbay sampling system in R-12 was removed during the 2006–2007 pilot well rehabilitation study (LANL 2007, 095889) and was not reinstalled. The well screens were left in an isolated state with two inflatable packers to isolate the screen intervals. The packers were deflated and removed from the well on October 23, 2007. After redevelopment, abandonment and testing activities were completed, and a single inflatable packer was temporarily reinstalled between screens 1 and 2 on October 31, 2007. The drop pipe and packers were decontaminated by high-pressure washing and staged at a designated Los Alamos National Laboratory (LANL or the Laboratory) location. The decontamination water was containerized and stored on-site for waste characterization.

No video logging was conducted at R-12 during this time period because logging was conducted during the rehabilitation pilot study (LANL 2007, 095889).

2.3 Redevelopment of Screen 1

Well development of screen 1 consisted of three activities: high velocity jetting, swabbing, and final purge pumping. Jetting was performed before plugging and abandoning screen 3, while swabbing and purging were performed afterward.

High velocity jetting was done through a jetting tool designed with four 1/4-in. horizontal jets for cleaning the screen plus an additional downward-oriented 5/16-in. jet included for balancing the flow and allowing pass-through of any sediment that might be in the piping system. The nozzles in the jetting tool were sized to match the output of the pump while maintaining approximately 200 psi jetting pressure. Jetting consisted of pumping a total of about 4400 gal. of potable water through the jetting tool while raising, lowering, and rotating it within screen 1. The flow rate maintained during the jetting process was approximately 110 to 120 gallons per minute (gal./min), resulting in a jetting velocity of about 130 to 140 ft/s.

During the high velocity jetting process, all three screens in R-12 were open. Because of the substantially lower head in screen 3 and the high capacity of this zone, downward flux within the well carried formation water from screens 1 and 2, along with the potable jetting water, into screen 3 throughout the process. As a result, the composite water level in the open well was located between screens 2 and 3. This effect was hydraulically equivalent to pumping screen 1 at its maximum capacity but without the use of a submersible pump. Thus, high velocity jetting and pumping (by gravity) occurred simultaneously to maximize the development effect on screen 1.

Following plugging and abandonment of screen 3 (section 2.4), screen 1 was swabbed using a surge block built by sandwiching a 4-in. outer diameter nylon disc between two metal plates. The surge block was connected to a heavy weight so that effective swabbing was accomplished in both upward and downward directions. Swabbing consisted of running the tool both upward and downward approximately 75 round trips through screen 1.

Purging was performed using a shrouded 3-in. submersible pump that also was used for test pumping activities. The pump was set and operated at multiple depths in the well to ensure removing the stagnant water above screen 1 as well as water within the sump beneath screen 2. Complete purging of screen 1 was performed before hydraulic testing and sampling. Final purging of screen 2 was deferred until after the screen 1 testing and sampling activities had been completed.

2.4 Screen Abandonment

Abandonment of screen 3 at R-12 was conducted between October 23 and 27, 2007. Details of abandonment materials and placement are presented in Figure 2.4-1. Filter-grade 10/20 silica sand was used as the primary backfill material through the screen interval. The 10/20 sand was installed from the TD of the well at 869 to 779 ft below ground surface (bgs). Finer 20/40 filter-grade silica sand was installed above the 10/20 sand from 746.9 to 779 ft bgs. The finer 20/40 sand serves as a transition interval to keep the cement from flowing into the coarser 10/20 sand. All of the backfill sand was installed with a tremie pipe while running a small volume of potable water to carry the sand into place. A Portland cement seal was installed above the fine transition sand from 736.7 to 746.9 ft bgs. Cement was emplaced using a wireline dump bailer. The dump bailer allowed discrete placement of a calculated volume of cement while minimizing impacts to the well screen by fugitive cement. The cement was allowed to cure overnight (approximately 24 h) before proceeding with the next sand interval. A second interval of 10/20 sand was installed as a buffer above the cement from 542.4 to 736.7 ft bgs.

2.5 Specific Capacity Testing

Hydraulic testing of screen 1 was performed by installing the shrouded 3-in. submersible pump with an underlying inflatable packer for temporary exclusion of the screen 2 water contribution. A pressure transducer was installed between the pump shroud and packer to collect water-level data for specific capacity determination.

A corollary benefit of the effort was collection of a data set that could support hydraulic analysis of the perched zone in which screen 1 is placed. A detailed hydraulic analysis of the data was beyond the scope of the work plan. The current discussion is limited to presenting the specific capacity results. However, the data are archived and will be available for examination if a rigorous analysis of site hydraulics is desired.

The collection of hydraulic pumping data coincided with water-sampling activities at screen 1. Two sampling events were undertaken at screen 1. On October 28, screen 1 was pumped at 2.10 gal./min for 330 min from 1:00 p.m. until 6:30 p.m. The resulting drawdown was 20.0 ft, making the specific capacity 0.105 gal./min/ft of drawdown. On October 29, the zone was pumped at 2.55 gal./min for 630 min from 7:50 a.m. until 6:20 p.m. The resulting drawdown was 24.2 ft, again revealing a specific capacity 0.105 gal./min/ft. These specific capacity results are summarized in Table 2.4-1.

Also shown in the table are the results of specific capacity testing of screen 1 over a year earlier on September 20, 2006. Testing at that time showed a pumping rate of 1.16 gal./min with 12.8 ft of drawdown, for a specific capacity of 0.091 gal./min/ft. The current specific capacity of 0.105 gal./min/ft corresponds to an increase of about 15%, attributable to the redevelopment activities. Of note is that the current tests were performed at nearly double the pumping rate used in 2006. The greater flow rates can induce greater turbulent flow, potentially biasing the specific capacity downward somewhat. Thus, the observed improvement in specific capacity may have been slightly greater if the specific capacity tests had been conducted at the same pumping rate.

Following testing and sampling of screen 1, the packer was deflated and pumping was performed to complete the purge cleanup of screen 2. Water-level data continued to be collected during this task. With both screens 1 and 2 open, the measured discharge rate was 3.45 gal./min with a drawdown of 2.12 ft. The resulting combined specific capacity of the two zones was 1.63 gal./min/ft, as shown in Table 2.4-1.

Based on the specific capacity of screen 1, its estimated contribution during the simultaneous purging of both zones was about 0.22 gal./min. Thus, the yield contribution of screen 2 was 3.45 - 0.22 = 3.23 gal./min. As shown in Table 2.4-1, this made the specific capacity of screen 2 approximately 1.52 gal./min/ft. Testing a year earlier, on October 1, 2006, had shown a specific capacity for screen 2 of 0.99 gal./min/ft. Thus, the current capacity is more than 50% greater than that observed before the rehabilitation work.

Even though specific, deliberate redevelopment procedures were not applied directly to screen 2, it is apparent that the swabbing performed in screen 1 had a beneficial effect on the capacity of screen 2. Raising and lowering the surge block through screen 1 had the effect of forcing water in and out of the screen openings in screen 2, achieving effective development. In fact, the order of magnitude greater yield of screen 2, compared with that of screen 1, meant that swabbing actually caused a greater volume of water to move back and forth through screen 2 than screen 1 throughout the operation.

Because of the downward gradient in R-12, the composite water level has always fallen below both screens 1 and 2 whenever the well was open. This condition precluded any vigorous development of screen 2 in the past. The swabbing action imposed on screen 2 during redevelopment of screen 1 probably represents the first development action ever applied to screen 2 other than simple purging. Thus, the observed increase in screen 2 yield as a result of the rehabilitation procedures is not surprising.

2.6 Sample System Installation and Well Conversion

On December 10, 2007, a custom-made Baski k-packer was installed at a depth of 540.8 to 542.4 ft bgs above the well backfill materials (Figure 2.4-1). This setting provided for a sump space below the lower screen of approximately 32.8 ft. Following k-packer installation, a Baski-fabricated dual pump sampling system was installed between December 11 and December 13, 2007. The dual pump system consists of a Grundfos electrical submersible pump for screen 2 and a Bennett pneumatic piston pump for screen 1. A Baski custom bulkhead double mandrel packer isolates the pumps and sampling intervals; the packer was pressurized at 115 psi. The Grundfos pump intake was set at 501.1 ft bgs, approximately 3.4 ft above the top of the lower screen interval. The discharge pipe for the Grundfos pump consists of 1-in. threaded/coupled schedule 40, Type 304, nonannealed stainless steel that meets the requirements of the American Society for Testing and Material Standard A554. The threaded ends and couplings conform to 1-in. American Petroleum Institute thread design with 10 threads per inch. The Bennett pump intake was set within the upper screen interval at 465.2 ft bgs. The Bennett pump's discharge column and air actuation line are continuous flexible Teflon tubing. Two dedicated 1-in. flush threaded schedule 40 polyvinyl chloride transducer tubes were installed with the sampling system. Both transducer tubes are installed directly above the Bennett pump. The upper transducer tube terminates with a 6-in. machine-slotted screen with 0.010-in. slots. The lower transducer tube terminates with a bottom cap that holds a 0.25-in. nylon tube, which extends through the packer to monitor water levels in the lower screen interval. The transducer tubes, Bennett pump tubing, and Grundfos pump motor electrical cable are banded to the 1-in. stainless pump column at 10-ft intervals with stainless-steel bands.

2.7 Water Quality

Table 2.7-1 shows the sample collection objectives for R-12 screen 1 during the hydraulic testing and the constituents that were measured in the field and laboratory.

2.7.1 Sample Collection, Field Preparation, and Analytical Techniques

A total of 29 groundwater samples were collected during a pumping or aquifer performance test conducted at R-12 screen 1 on October 28 (16 samples) and October 29, 2007 (13 samples). Field parameters consisting of pH, turbidity, dissolved oxygen (DO), temperature, specific conductance (SC), and oxidation-reduction potential (ORP) were measured using a flow-through cell (Geotech) during sample collection. Measurements for the different field parameters recorded during the pumping test are provided in Table 2.7-2. Field pH and temperature were measured using a Beckman (Model 255) meter, and DO was measured using a WTW (Model OXI-330I) DO meter. SC and ORP were measured using a HACH Sension-5 meter and a Thermoelectron Corp. (Russell RL 060P Model) instrument, respectively. Two equipment blanks and one field blank were collected at the beginning of the pumping test. On October 28, 2007, groundwater samples were generally collected every 5 min during the initial 30 min of the pumping test (Table 2.7-1). The frequency of sample collection decreased to every 10 min from 30 to 60 min during the test, every 30 min from 60 to 180 min, and one sample was collected at 240 min (4.0 h). On October 29, 2007, groundwater samples were collected every 60 min during the remainder of the pumping test (9.5 h). Groundwater samples were collected using a submersible pump consisting of a mild-steel discharge pipe equipped with a standard retrofitted submersible pump. The discharge rate varied from 2.13 to 2.90 gal./min during the aquifer performance test.

Twenty-nine groundwater samples (including two duplicates) were filtered before analyses for metals, trace elements, and major cations and anions. Aliquots of samples collected from R-12 screen 1 were filtered through 0.45-µmeter Geotech disposable filters. Twenty-nine nonfiltered samples were also analyzed for sulfide, total organic carbon (TOC), major cations, trace elements, and metals. Samples were acidified with analytical-grade nitric acid to a pH of 2.0 or less for metal and major cation analyses. Nonfiltered samples collected for total sulfide analysis were preserved with a buffer consisting of sodium hydroxide, ethylenediaminetetraacetic acid (EDTA), and ascorbic acid. Samples collected for TOC analysis were not filtered or acidified.

Chemical analyses of screening groundwater samples were performed at the Laboratory's Earth and Environmental Sciences Group 6 (EES-6) laboratory. Groundwater samples were analyzed by EES-6 using techniques specified in the U.S. Environmental Protection Agency SW-846 manual. Total carbonate alkalinity was measured using standard titration techniques. Ion chromatography was the analytical method for bromide, chloride, fluoride, nitrate, nitrite, oxalate, chlorate, perchlorate, phosphate, and sulfate. The instrument detection limits for perchlorate were 0.005, 0.001, and 0.0005 part per million (ppm). Total sulfide was determined by ion-selective electrode (ISE), with a detection limit of 0.006 ppm. Inductively coupled (argon) plasma optical emission spectroscopy (ICPOES) was used for analyses of calcium, magnesium, potassium, silica, and sodium. Aluminum, antimony, arsenic, barium, beryllium, boron, cadmium, cesium, chromium, cobalt, copper, iron, lead, lithium, manganese, mercury, molybdenum, nickel, rubidium, selenium, silver, thallium, thorium, tin, vanadium, uranium, and zinc were analyzed by inductively coupled (argon) plasma mass spectrometry (ICPMS). The precision limits (analytical error) for major ions and trace elements were generally less than ±10% using ICPOES and ICPMS. TOC was measured using a total carbon-organic carbon analyzer.

2.7.2 Field Parameters

Field parameters were measured on 36 groundwater samples, and results are provided in Table 2.7-2 and Table A-1 and are shown in Figure 2.7-1. Field pH varied from 7.72 to 8.31; temperature varied from 14.7 C to 23.2°C during the pumping test conducted at R-12 screen 1. The lowest temperature reading was recorded during the continuation of the pumping test on the morning of October 29, 2007, when the submersible pump was reactivated. (Note the temporary change, or "blip," shown on many figures at this same time.) SC generally increased from 285 to 371 microSiemens per centimeter (µS/cm) and DO increased from 0.19 to 1.41 mg/L. Thirty-three of the 36 turbidity measurements were greater than 5 nephelometric turbidity units (NTUs) (Table 2.7-2, Figure 2.7-1). However, turbidity values generally decreased during pumping (Table 2.7-2, Figure 2.7-1) with the last value as 6.35. As shown in Figure 2.7-2, suspended particles of iron, generated either from the corroded discharge pipe or possibly from the Cerros del Rio basalt, influence turbidity to a greater extent than do total aluminum and zinc, which play a role in turbidity values in some wells. The results presented in Figure 2.7-2 show a slight correlation between turbidity and nonfiltered iron. Noncorrected ORP measurements varied from –232 to +48 millivolts (mV) during the pumping test. Gas bubbles were noted during several ORP measurements, rendering some of the readings not reliable and not indicative of in situ groundwater conditions; however, the overall ORP trends for both days are acceptable. Strongly negative ORP measurements less than –160 mV occurred on the morning of October 29, 2007, as groundwater was initially pumped. The variability in ORP throughout the pumping test suggests that groundwater is weakly poised with respect to reactive reductants and oxidants, inferring ORP values to be qualitative. Field ORP is used along with analytical results (i.e., DO, nitrate, manganese, iron, and sulfate) to determine the redox state of groundwater.

2.7.3 Analytical Results

Analytical results for groundwater samples collected during well screen performance testing at R-12 screen 1 are provided in Appendix A, Table A-1. Charge balance errors for dissolved cations and anions were generally less than ±6%. Figure 2.7-3 shows concentration trends of several solutes and TOC during pumping of the perched intermediate zone (screen 1) at R-12. Calcium is the dominant cation present in the perched intermediate zone at R-12 screen 1 (Table A-2). Dissolved concentrations of calcium exceed the maximum background of 16.5 mg/L for perched intermediate groundwater (LANL 2007, 095817). Dissolved concentrations of calcium increased from 27.1 to 42.3 ppm or mg/L during pumping. Dissolved concentrations of chloride increasing from 21.7 to 33.4 ppm also exceed the maximum background of 6.43 mg/L (LANL 2007, 095817). Dissolved concentrations of calcium and chloride correlate well with each other during the pumping test (Figure 2.7-3). Dissolved concentrations of sodium generally decreased from 33.0 to 18.1 ppm during the pumping test. Sodium exceeds the maximum background for perched intermediate groundwater of 11.1 mg/L (LANL 2007, 095817). Concentrations of total carbonate alkalinity varied from 138 to 156 mg $CaCO_3$/L, exceeding the maximum background of 52 mg $CaCO_3$/L (LANL 2007, 095817). Dissolved concentrations of sulfate varied from 19.1 to 25.9 ppm during the pumping test (Figure 2.7-3, Table A-2), which exceed the maximum background concentration of 4.48 mg/L (LANL 2007, 095817). Concentrations of total sulfide were less than detection (0.006 ppm), suggesting that sulfate reduction was not significant during the pumping test. Noncorrected ORP and DO measurements also suggest that the groundwater is not sufficiently reduced to enhance stability of dissolved sulfide species at R-12 screen 1.

Concentrations of TOC decreased from 36.0 to 1.84 mgC/L during the pumping test (Figure 2.7-3). Because of this declining trend, it appears that the dominant source of TOC is residual EZ-MUD, consisting of a polyacrylamide and polyacrylate high-molecular weight copolymer, used during emplacement of bentonite seals as part of well construction. The addition of EZ-MUD decreases the rate of hydration (coagulation) of bentonite and allowed more control for stabilizing the material above the filter packs for the three screens at R-12. Concentrations of ammonia and total Kjeldahl nitrogen (TKN) measured in groundwater samples collected from screen 1 (Table A-2) also provide evidence for the presence of residual EZ-MUD. Longmire (2002, 072800) provides a discussion on the organic nitrogen functional groups present in EZ-MUD and redox reactions associated with the drilling fluid.

Another plausible but minor source of TOC at R-12 screen 1 consists of soluble organic acids derived from ash associated with the Cerro Grande fire of May 2000. Hydrophobic and hydrophilic organic acids dominate in dissolved organic carbon (5 mgC/L) measured in a groundwater sample collected from screen 1 during 2001 (Longmire 2002, 072800), providing evidence for presence of ash-derived organic carbon. During 2002 and 2003, concentrations of TOC measured at perched intermediate wells completed within the Cerros del Rio basalt at the Los Alamos Canyon low-head weir ranged from 4.5 to 375 mgC/L (Stone et al. 2004, 087379). Concentration increases of calcium, sodium, magnesium, and potassium occurred within the perched intermediate zones at this site after the Cerro Grande fire (Stone et al. 2004, 087379).

Dissolved concentrations of nitrate(N) increased from 1.21 to 3.15 ppm during the pumping test (Figure 2.7-3, Table A-2). Concentrations of nitrate(N) at R-12 screen 1 are considered to be influenced by predrilling site conditions, including migration of treated sewage effluent from Sandia, Los Alamos, and/or Pueblo Canyons. The nitrate(N) concentration in a borehole sample collected during drilling was 5.46 ppm within this perched zone at 464 ft bgs (Broxton et al. 2001, 071252). Drilling fluids were not used during the initial drilling of R-12 when this perched zone was encountered. The average stable isotope ratio of nitrogen-15/nitrogen-14 ($\delta^{15}N$) for the borehole water sample (two analyses) was +21.3 per mil, suggesting that the fractionated nitrate was derived from sewage effluent (Broxton et al. 2001, 071252).

Increasing concentrations of calcium and chloride measured during the pumping test (Figure 2.7-3) suggest that these solutes occur within the Cerros del Rio basalt before drilling and are not due to residual drilling-well completion effects from the dissociation of EZ-MUD copolymer.

The concentration of total carbonate alkalinity in the borehole water sample collected during drilling was 142 ppm $CaCO_3$/L (Broxton et al. 2001, 071252), which is similar to results obtained during this pumping test. Total carbonate alkalinity is associated with treated sewage effluent that occurs in alluvial and perched intermediate groundwater within Sandia and Pueblo Canyons. Dissolved concentrations of calcium, sodium, chloride, and sulfate within the R-12 borehole at 464 ft bgs were 23.5, 186, 197, and 191 ppm, respectively (Broxton et al. 2001, 071252).

Bentonite seals were placed several times in the open borehole across unfractured basalt intervals to test for perching conditions. Water samples were collected from specific saturated zones during this process (Broxton et al. 2001, 071252). It is likely that exchangeable ions (sodium and sulfate) derived from bentonite were initially present in the borehole water sample. Concentrations of calcium, sodium, chloride, and sulfate have decreased since the borehole sampling of R-12 (LANL 2007, 096330). An additional source of sodium and chloride in Sandia and Los Alamos Canyons is from dissolution of road salt characterized by equal equivalents of sodium and chloride in groundwater samples (see Table A-2).

Dissolved concentrations of barium, ranging from 0.036 to 0.047 ppm, at R-12 screen 1 are within background distributions for perched intermediate groundwater (0.0014 to 0.070 mg/L) (LANL 2007, 095817). Dissolved concentrations of uranium range from 0.0022 to 0.0058 ppm (Table A-2), exceeding the maximum background of 0.0006 mg/L (LANL 2007, 095817). Uranium(VI) for the most part is the stable oxidation state of this actinide at R-12 screen 1, based on similar concentrations of uranium in sample pairs for filtered and nonfiltered aliquots. The elevated above-background concentrations of uranium measured during the pumping test are considered to be the result of contaminant migration, possibly from Los Alamos Canyon and not from desorption processes with bentonite. Uranium(VI) complexes including $UO_2(CO_3)_2^{2-}$ and $UO_2(CO_3)_3^{4-}$ are mobile in oxidizing groundwater under basic pH conditions (Langmuir 1997, 056037) characteristic of R-12 screen 1.

Chemical and hydrologic data support a hydrologic connection between the perched intermediate zone within the Cerros del Rio basalt at the low-head weir and R-12 screen 1. Elevated above background concentrations of tritium, uranium, nitrate, and perchlorate at R-12 screen 1 may be derived from past industrial discharges at TA-21 and treated sewage effluent released to Los Alamos and Pueblo Canyons. Hydrologic data indicate that groundwater flow between R-9i and R-12 screen 1 occurs within the Cerros del Rio basalt, based on delayed recharge responses occurring at R-12 screen 1 during snow melt and summer storm events originating within the Los Alamos Canyon watershed (Reid et al. 2006, 099023).

During the October 2007 pumping test, dissolved concentrations of manganese and iron measured in groundwater samples collected from R-12 screen 1 range from 0.069 to 0.148 ppm and from 0.15 to 1.46 ppm (Table A-2), respectively. These two solutes exceed upper background values for manganese (0.016 mg/L) and iron (0.102 mg/L) (LANL 2007, 095817). Iron concentrations in nonfiltered samples are greater than those in filtered samples collected from R-12 screen 1 (Table A-2), resulting either from pipe corrosion early in the sampling (see below) and/or presence of particulate hydrous ferric oxide (HFO) within the perched intermediate zone. Reductive dissolution of manganese dioxide has taken place within the aquifer, based on very similar concentrations of manganese in filtered and nonfiltered samples (Figure 2.7-5, Table A-2). The negative uncorrected ORP measurements provided in Table A-1 support instability of manganese(IV) oxides.

Two rinseate blanks collected from the pump, consisting of hardened steel, and discharge pipe, consisting of mild steel, have concentrations of total manganese and iron of 0.235 and 0.012 ppm and 6.11 and 4.07 ppm, respectively, in nonfiltered samples (Table A-2). Other metals and trace elements detected in the rinseate blanks include aluminum, barium, boron, chromium, copper, lead, nickel, strontium, titanium, vanadium, and zinc (Table A-2). Total concentrations of barium, nickel, strontium, and uranium in the rinseate samples were less than 0.010 ppm. Total concentrations of several metals/trace elements exceeded 0.010 ppm, including aluminum (0.060 and 0.018 ppm), boron (0.013 ppm), copper (0.147 ppm), lead (0.019 ppm), vanadium (0.617 ppm), and zinc (0.617 ppm) (Table A-2).

2.7.4 Well Screen Analysis

Previous Results

Analytical results obtained from sampling of well R-12 screen 1 were evaluated for representativeness and reliability, following geochemical protocols established by the Laboratory (2007, 096330) and approved by NMED (2007, 098182). Groundwater samples were collected from this Westbay-equipped well from 2000 to 2006 during 10 sampling events, and results of the Laboratory well screen analysis are provided in Table B-1. Groundwater samples previously collected from screen 1 have scores ranging from 46% to 67%, with an average score of 60% (LANL 2007, 096330). Groundwater samples collected during well rehabilitation conducted in September 2006 contributed to a test score of 73% (Table B-1) (LANL 2007, 096330). The test scores for the 2000 to 2006 samples generally improved over time with 9 to 14 analytes or general indicators per sampling event failing the geochemical criteria, consisting of 23 to 33 individual tests. Analytes that did not meet the well screen criteria during one or more sampling rounds included pH, ORP, turbidity, magnesium, total carbonate alkalinity, acetone, sulfate, phosphate, TKN, iron, chromium, TOC, ammonia, perchlorate, nitrate(N), strontium, uranium, molybdenum, fluoride, manganese, calcium, and sodium (Table B-1) (LANL 2007, 096330).

Updated Well Screen Analysis

Results of the Laboratory well screen analysis using analytical results obtained during this pumping test are provided in Table B-1. Groundwater samples analyzed from well R-12 screen 1 during the 2007 pumping test have scores ranging from 74% to 89%, consisting of 19 criteria (Table B-1) for 29 samples. The average well screen test score for the 2007 pumping test is 80%, which is an improvement over the previous score achieved during the 2006 pumping test. Negative ORP values (25 measurements), turbidity values greater than 5 NTUs (26 measurements), DO concentrations less than 2 mg/L (29 measurements), excessive concentrations of TOC (29 samples), and dissolved iron and manganese (29 samples) exceeding Laboratory background contributed to samples failing several criteria of the well screen analysis (Table B-1).

Well screen tests for 15 criteria were not applicable in the updated analysis because

- groundwater samples were not analyzed for acetone, TKN, and ammonia;
- selected tests were not applicable due to predrilling conditions (Table B-2);
- dissolved iron and manganese were affected the corroded discharge pipe; and
- perchlorate was not included because of analytical detection limitation.

Analytes considered to be associated with predrilling conditions,and therefore excluded from the well screen analysis, include dissolved calcium, sodium, magnesium, strontium, uranium, nitrate, chloride, total carbonate alkalinity, and sulfate (Table B-2). Well R-12 screen 1 is downgradient of discharges of treated sewage effluent at Technical Area 3 (TA-03) since the early 1950s. Well R-12 screen 1 is crossgradient but possibly hydrologically connected to Los Alamos and Pueblo Canyons that contain industrial and municipal discharges. Based on chemical (source term) and hydrologic data collected in Los Alamos, Pueblo, and Sandia Canyons discussed above, it is likely that elevated above-background concentrations of these solutes result from leachate migration and not from residual drilling affects. Perchlorate was analyzed by using the ion chromatography method, which has a method detection limit greater than 0.001 ppm. Perchlorate, therefore, was not included in the updated well screen analysis. Iron and manganese were not included in the updated well screen analysis because their concentrations were most likely affected by the corroded discharge pipe, as suggested by the elevated concentrations of these constituents in the rinseate blanks, as discussed above.

2.7.5 Geochemical Comparison of Westbay and Pumping Test Samples

A geochemical comparison of selected analytes and pH was performed on the R-12 screen 1 samples to compare samples that were collected by the passive Westbay sampling system and those collected using a submersible pump that allowed active purging. This comparison included analytical results for 10 previous sampling events, conducted from September 18, 2000, to July 11, 2006, using the Westbay system, and two pumping tests conducted on September 29, 2006, and October 28–October 29, 2007. Concentrations of total carbonate alkalinity, TOC, and dissolved calcium, chloride, iron, magnesium, manganese, nitrate(N), sulfate, chromium, nickel, strontium, uranium, vanadium, and zinc were generally lower in samples using Westbay equipment in comparison to those collected during the two pumping tests (Table B-1). Energetic purging or pumping of screen 1 allowed groundwater outside of the filter pack to be sampled, providing more representative groundwater samples. Excess TOC is most likely derived from residual EZ-MUD associated with emplacement of the bentonite seal (Figure 2.7-3).

Figure 2.7-4 shows dissolved concentrations of chloride, sodium, and sulfate during 10 characterization sampling events using Westbay equipment and the two pumping tests. Higher dissolved concentrations of chloride were measured during the 2006 pumping test than during the most recent pumping test. Dissolved concentrations of sodium in samples collected on October 28, 2007, however, exceed those measured during the previous pumping test (Figure 2.7-4). Dissolved concentrations of sulfate were slightly higher in samples collected during the 2006 pumping test than in the most recent samples but were low in samples collected using the Westbay system, suggesting sulfate-reducing conditions during the time of its use. Higher pH values were recorded using Westbay equipment where measurements were taken under atmospheric conditions in comparison to those measured using a flow-through cell during the pumping tests.

Figure 2.7-5 shows concentrations of iron and manganese in filtered and nonfiltered samples collected from R-12 screen 1 during characterization sampling (2000–2005) and the two pumping tests conducted in 2006 and 2007. Higher total and dissolved concentrations of iron were measured during the 2007 pumping test than during the previous test. Dissolved concentrations of iron and an ample source of organic carbon mainly result from partial reductive dissolution of HFO present in the Cerros del Rio basalt, previously measured during characterization sampling from 2000 to 2005 and the 2006 pumping tests. Elevated concentrations of iron measured in the rinseate samples complicate this interpretation for samples collected during the 2007 pumping test. Reductive dissolution of manganese dioxide has taken place within the aquifer, based on very similar concentrations of manganese in filtered and nonfiltered samples collected during the two pumping tests (Table A-2 and Figure 2.7-5). Lower concentrations of sulfate and dissolved iron from Westbay samples point to sulfate-reducing conditions and possible precipitation of sulfide solid phases during those years, maintaining low iron in groundwater to this day.

3.0 DEVIATIONS FROM R-12 REHABILITATION AND CONVERSION WORK PLAN

All activities associated with well rehabilitation and conversion have been completed. There were no deviations from the work plan other than the longer-than-anticipated time for fabrication and installation of the dedicated sampling system.

4.0 CONCLUSIONS

- Screen 3 was isolated from screens 1 and 2 successfully.
- The specific capacity of screen 1 increased by at least 15% over specific capacity measurements during the pilot well rehabilitation study of 2006. The increase may actually have been higher, but in order to make this determination, the same pumping rates would have to have been used for both tests.
- Likewise, the specific capacity of screen 2 increased by at least 50% over that measured in October 2006. Even though no redevelopment techniques were performed at screen 2, it is likely that swabbing at screen 1 during the time that the two screens were in communication had a beneficial effect on screen 2.
- Screen 1 turbidity values stabilized between 4.0 and 6.53 NTUs, with an average of 5.6 NTUs during the last 8 h of pumping. Higher values during the first round of pumping are attributed to particulates in the aquifer that were loosened by the development processes with perhaps some corrosion of the discharge pipe.
- Major cations and anions, such as Ca, Cl, Na, and SO_4, exceed background values established for perched intermediate groundwater (applicable to screen 1); this is partly attributed to natural contributions from the Cerros del Rio basalt and partly to contamination. Increasing concentrations of Ca and Cl measured during the pumping test (Figure 2.7-3) suggest that these solutes occur within the Cerros del Rio basalt before drilling and are not due to residual drilling-well completion effects from the dissociation of EZ-MUD copolymer.
- Taken together, the concentrations of TOC, TKN, and ammonia suggest the lingering presence of EZ-MUD that was used during well construction. TOC concentrations may also reflect the continued presence of recalcitrant organic material remaining from the Cerro Grande fire or may reflect a local elevated background attributed to municipal discharges in the Cerros del Rio basalt.

- Concentrations of nitrate(N) at R-12 screen 1 are considered to be influenced by predrilling site conditions, including migration of treated sewage effluent from Sandia, Los Alamos, and/or Pueblo Canyons.

- The elevated above-background concentrations of uranium measured during the pumping test are considered to be the result of contaminant migration and elevated alkalinity, possibly from Los Alamos Canyon and not from desorption processes with bentonite.

- During the October 2007 pumping test, dissolved concentrations of manganese and iron measured in groundwater samples collected from R-12 screen 1 ranged from 0.069 to 0.148 ppm and from 0.15 to 1.46 ppm (Table A-2), respectively. These two solutes exceed upper background values for manganese (0.016 mg/L) and iron (0.102 mg/L) (LANL 2007, 095817). Iron concentrations in nonfiltered samples are greater than those in filtered samples collected from R-12 screen 1 (Table A-2), resulting mainly from pipe corrosion. Reductive dissolution of manganese dioxide has taken place within the aquifer, based on very similar concentrations of manganese in filtered and nonfiltered samples (Table A-2). The negative uncorrected ORP measurements provided in Table A-1 support instability of manganese(IV) oxides.

- Groundwater samples analyzed from well R-12 screen 1 during the 2007 pumping test have an average well screen analysis score of 80%, ranging from 74% to 89%. This is an improvement over the well screen score for the 2006 pumping test of 73% and an even greater improvement over the analysis score of the 2000–2006 Westbay samples of 47% to 60%. Negative ORP values (25 measurements), turbidity values greater than 5 NTUs (26 measurements), DO concentrations less than 2 mg/L (29 measurements), and excessive concentrations of TOC (29 samples) exceeding Laboratory background contributed to samples failing several criteria of the 2007 well screen analysis.

- Analytes considered to be associated with predrilling or site conditions include dissolved calcium, sodium, magnesium, strontium, uranium, nitrate, chloride, total carbonate alkalinity, and sulfate. Well R-12 screen 1 is downgradient of active sewage discharges in TA-03 released since the early 1950s and crossgradient but is likely hydrologically connected to Los Alamos and Pueblo Canyons containing industrial and municipal discharges.

- Concentrations of total carbonate alkalinity, TOC, and dissolved calcium, chloride, iron, magnesium, manganese, nitrate(N), sulfate, chromium, nickel, strontium, uranium, vanadium, and zinc were generally lower in samples collected by Westbay equipment in comparison to those collected during the two pumping tests conducted in 2006 and 2007. Energetic purging or pumping of screen 1 allowed groundwater outside of the filter pack to be sampled, providing more representative groundwater samples. Excess TOC in the pumped samples is most likely derived from residual EZ-MUD associated with emplacement of the bentonite seal for screen 1.

- The overall conclusion at this time is that redevelopment activities improved the specific capacity at both screens 1 and 2 and the water quality of screen 1 over that of October 2006 and over that of the earlier Westbay samples. For example, the 2007 redevelopment improved the chemistry to the extent that sulfate can now be detected, whereas previously it was not detected because of sulfide-reducing conditions. The effects of redevelopment will not be observed in full for about another 6 months when conditions will have stabilized to a greater extent and when samples are collected with the Baski system that allows purging.

- All planned activities were completed successfully.

5.0 REFERENCES

The following list includes all documents cited in this report. Parenthetical information following each reference provides the author(s), publication date, and ER ID number. This information is also included in text citations. ER ID numbers are assigned by the Environmental Programs Directorate's Records Processing Facility (RPF) and are used to locate the document at the RPF and, where applicable, in the master reference set.

Copies of the master reference set are maintained at the NMED Hazardous Waste Bureau; the U.S. Department of Energy–Los Alamos Site Office; the U.S. Environmental Protection Agency, Region 6; and the Directorate. The set was developed to ensure that the administrative authority has all material needed to review this document, and it is updated with every document submitted to the administrative authority. Documents previously submitted to the administrative authority are not included.

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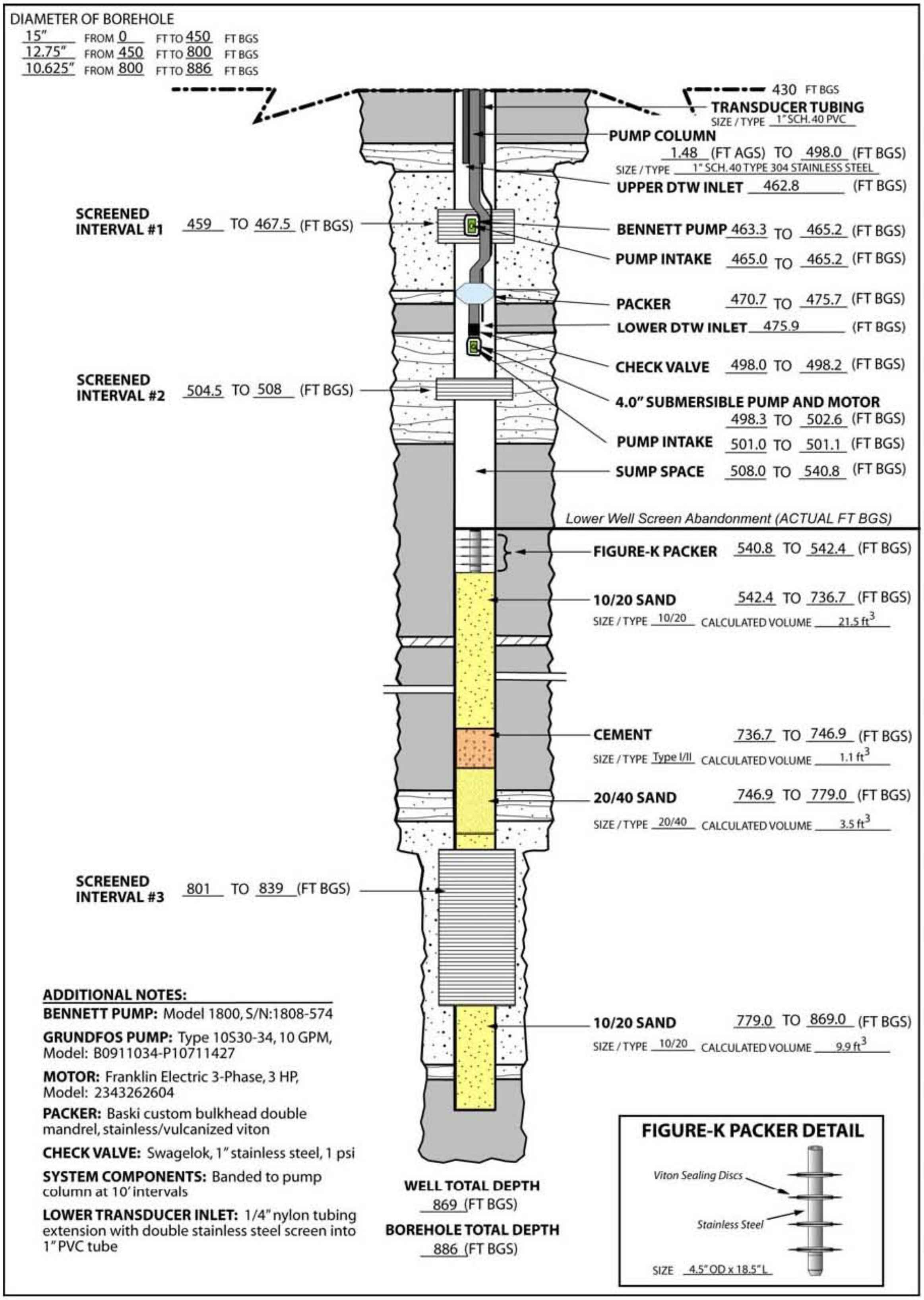

Figure 2.4-1 Abandonment and rehabilitation specifications for regional well R-12

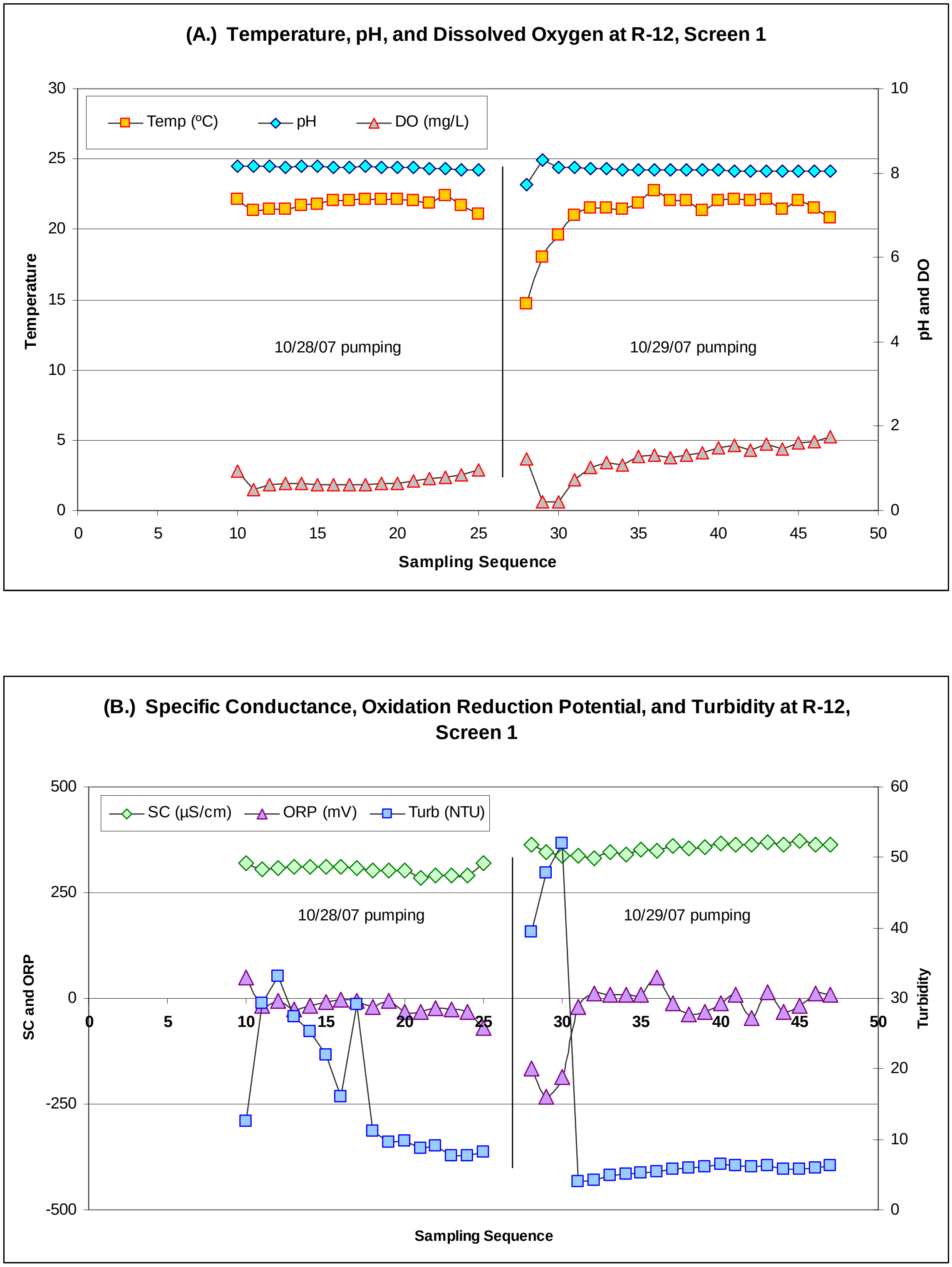

Figure 2.7-1 Field parameters measured at R-12 screen 1 on October 28 and 29, 2007

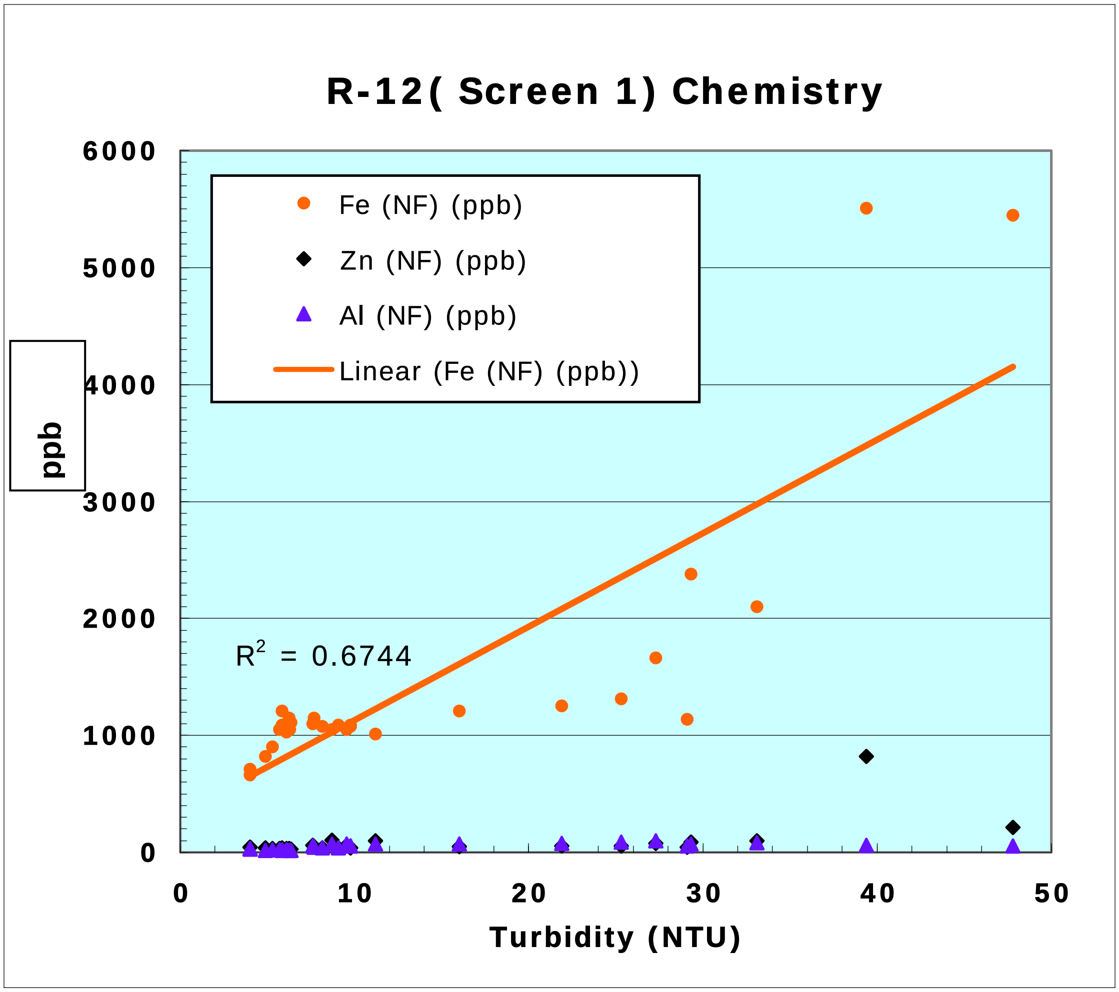

Figure 2.7-2 Turbidity (NTU) versus concentrations of iron (Fe), aluminum (Al), and zinc (Zn) in nonfiltered samples collected at R-12 screen 1 on October 28 and 29, 2007

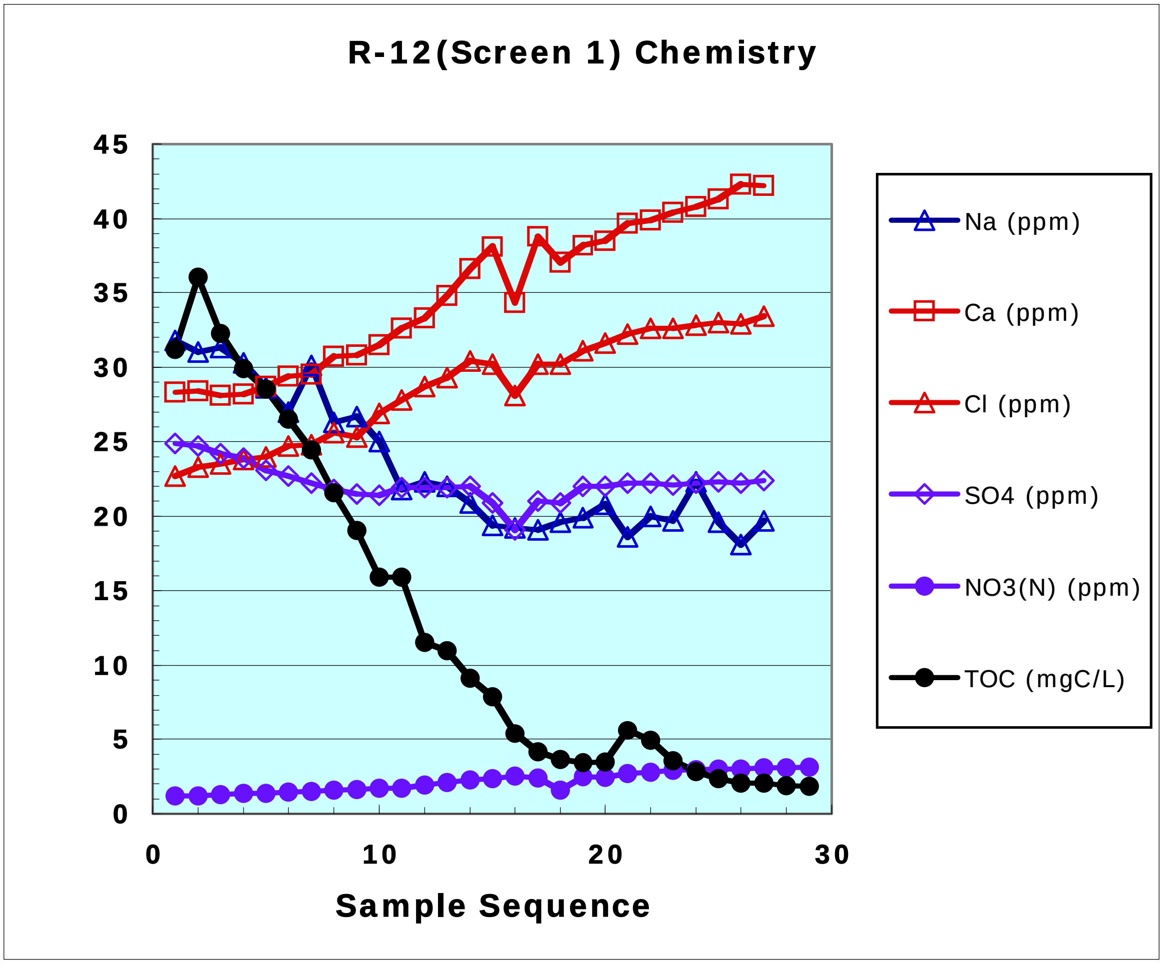

Figure 2.7-3 Sample sequence versus TOC and dissolved concentrations of sodium (Na), calcium (Ca), chloride (Cl), sulfate (SO_4), and nitrate(N) (NO_3-N) at R-12 screen 1 sampled on October 28 and 29, 2007

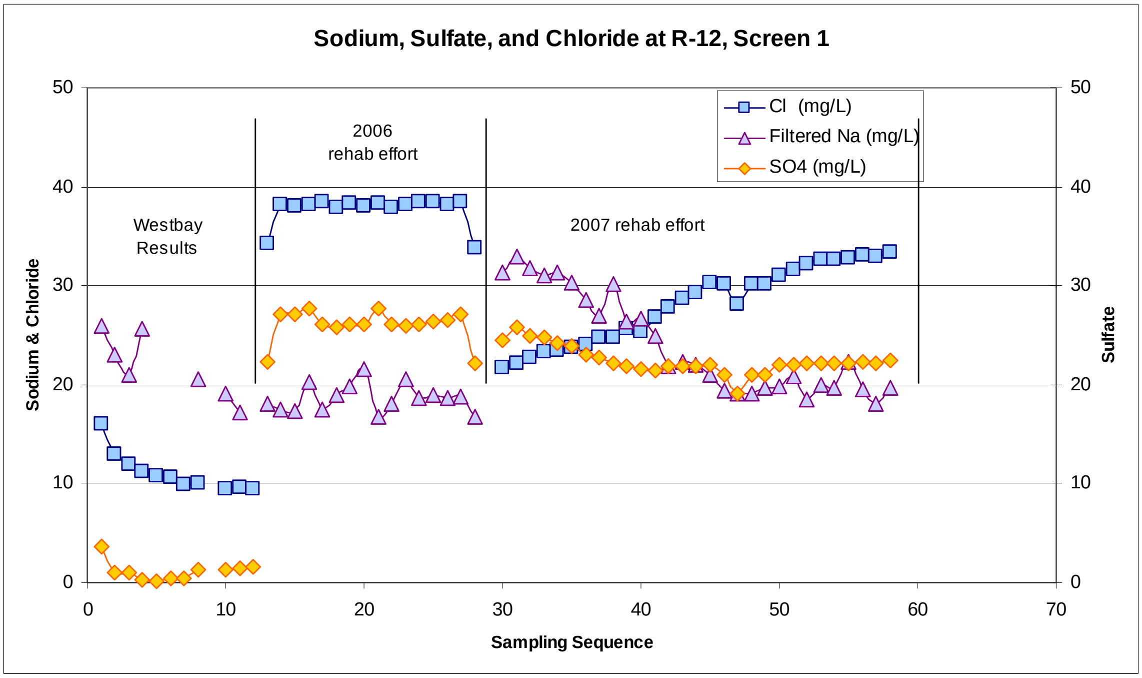

Figure 2.7-4 Sample sequence versus dissolved concentrations of sodium (Na), chloride (Cl), and sulfate (SO_4) during characterization sampling using Westbay equipment and pumping tests conducted in September 2006 and October 2007 at R-12 screen 1

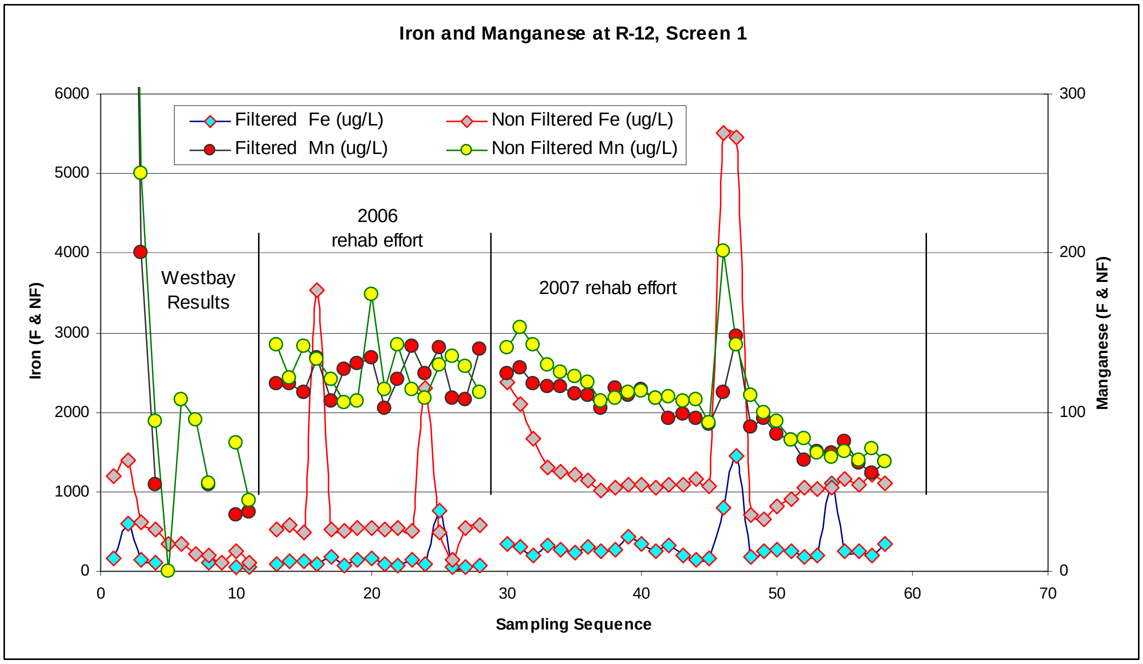

Figure 2.7-5 Sample sequence versus dissolved and total concentrations of iron (Fe) and manganese (Mn) during characterization sampling using Westbay equipment and pumping tests conducted in September 2006 and October 2007 at R-12 screen 1

Table 2.4-1
Specific Capacity Test Data

Date	Zone	Pumping Rate (gal./min)	Drawdown (ft)	Pumping Time (min)	Specific Capacity (gal./min/ft)
Baseline Data from 2006					
9/29/2006	Screen 1	1.16	12.80	720	0.091
10/1/2006	Screen 2	3.3	3.34	720	0.99
Postdevelopment Data from 2007					
10/28/2007	Screen 1	2.10	20.0	330	0.105
10/29/2007	Screen 1	2.55	24.2	630	0.105
10/30/2007	Screens 1 & 2	3.45	2.12	600	1.63
	Screen 1 Share	3.23	2.12	600	1.52
	Screen 2 Share	0.22	2.12	600	0.105

Table 2.7-1
Sampling for the R-12 Well Rehabilitation and Conversion Project

Process/Step	Purpose	Sample Collection	Field Parameters	Frequency/Number of Samples
Remove Packer Isolation String	Prepare well for rehabilitation	None	None	None
Jet Screen #1	Redevelop screen #1	None	None	None
Abandon Screen #3	To isolate and abandon screen #3	None	None	None
Swab Screen #1	Redevelopment	None	None	None
Pump Screen #1 and Evaluate Chemistry	Measure specific capacity and assess water quality during sustained pumping	Performance suite (see definitions below).	pH, ORP, T (temperature), electrical conductivity (EC), DO, turbidity	Every 5 min for first 30 min; 10 min for next 30 min; 30 min for minimum 3 h; each hour until end of specific capacity test (25 samples total).
Install Baski Dual Pump Sample System	Long-term sampling	None	None	None
Performance Measurement, *after* Submersible Pump Installment	Test effects of rehabilitation	Sample 1 month after installation; full suite analysis. Followed by semiannual, per Interim Facility-wide Groundwater Monitoring Plan 2007 requirements and schedule	pH, ORP, T, EC, DO, turbidity	One filtered/nonfiltered pair.
Performance Measurement *after* Submersible Pump Installment	Test effects of rehabilitation	Semiannual per watershed requirements and schedule	pH, ORP, T, EC, DO, turbidity	One filtered/nonfiltered pair.

Notes: Performance suite: Sulfide, TOC, metals, alkalinity, anions (including perchlorate) and cations from the EES-6 laboratory. Full analytical suite: Volatile organic compound, semivolatile organic compound, general inorganic chemicals (including alkalinity), metals, stable isotopes of hydrogen, oxygen, and nitrogen (only during initial and final sampling of each screen).

Table 2.7-2
Field Parameters Measured at R-12 Screen 1 on October 28 and 29, 2007

Time (yr-mo-d-h)	pH (SU)*	Temperature (°C)	SC (µS/cm)	DO (mg/L)	Turbidity (NTU)	ORP (mV)
0710281303	8.16	22.1	320	0.94	12.6	+48
0710281337	8.16	21.3	304	0.49	29.3	-17
0710281342	8.15	21.4	307	0.61	33.1	-6
0710281347	8.14	21.4	310	0.64	27.3	-27
0710281352	8.15	21.7	310	0.64	25.3	-17
0710281357	8.15	21.8	311	0.61	21.9	-8
0710281402	8.14	22.0	310	0.62	16.0	-3
0710281407	8.14	22.0	309	0.61	29.1	-5
0710281417	8.15	22.1	303	0.61	11.2	-19
0710281427	8.14	22.1	301	0.63	9.55	-7
0710281437	8.13	22.1	301	0.64	9.76	-33
0710281510	8.12	22.0	285	0.71	8.67	-32
0710281540	8.11	21.9	292	0.77	9.08	-23
0710281610	8.10	22.4	292	0.78	7.60	-25
0710281640	8.09	21.7	290	0.85	7.68	-33
0710281740	8.08	21.1	320	0.96	8.16	-70
0710290755	7.72	14.7	362	1.21	39.4	-167
0710290825	8.31	18.0	347	0.19	47.8	-232
0710290855	8.14	19.6	337	0.20	52.0	-185
0710290925	8.12	21.0	338	0.73	4.01	-19
0710290955	8.11	21.5	332	1.03	4.21	+12
0710291025	8.10	21.5	345	1.14	4.89	+10
0710291055	8.09	21.4	341	1.07	5.06	+8
0710291125	8.09	21.9	352	1.28	5.29	+9
0710291155	8.09	22.7	350	1.31	5.40	+48
0710291225	8.07	22.0	360	1.24	5.69	-12
0710291255	8.07	22.0	356	1.30	5.94	-38
0710291325	8.08	21.3	359	1.37	6.11	-31
0710291355	8.07	22.0	365	1.50	6.53	-12
0710291425	8.06	22.1	362	1.55	6.27	+10
0710291455	8.06	22.0	363	1.43	6.04	-46
0710291525	8.05	22.1	368	1.57	6.26	+14
0710291555	8.05	21.4	363	1.45	5.76	-31
0710291625	8.05	22.0	371	1.59	5.83	-18
0710291655	8.05	21.5	363	1.63	5.85	+13
0710291725	8.04	20.8	363	1.75	6.35	-10

*SU = Standard unit.

Appendix A

Analytical Data Results

Table A-1
Field Measurments Taken during Hydraulic Testing
at R-12 Screen 1, October 2007

Sampling Sequence	Date	Time	pH	Temp (ºC)	EC (µS/cm)	DO (mg/L)	Turb (NTU)	ORP (mV)	Q (gal/min)	COC ID	Comment
1	10/28/07	8:40								8097	EQB off of pump shroud
2	10/28/07	8:45								8098	EQB off of drop pipe
3	10/28/07	10:30									Pump on
4	10/28/07	10:40					363		2.61		Bottoms up
5	10/28/07	11:10					69.2				Remove bore water
6	10/28/07	11:40					23.2		2.13		Remove bore water
7	10/28/07	12:00					19.6				Remove bore water
8	10/28/07	12:15									Pump off
9	10/28/07	13:00								8157	Collect colloid sample, did not submit
10	10/28/07	13:03	8.16	22.1	320	0.94	12.6	148	2.17		Pump on
11	10/28/07	13:37	8.16	21.3	304	0.49	29.3	-17		8104	
12	10/28/07	13:42	8.15	21.4	307	0.61	33.1	-6		8105	
13	10/28/07	13:47	8.14	21.4	310	0.64	27.3	-27		8106	
14	10/28/07	13:52	8.15	21.7	310	0.64	25.3	-17		8107	
15	10/28/07	13:57	8.15	21.8	311	0.61	21.9	-8		8108	
16	10/28/07	14:02	8.14	22.0	310	0.62	16	-3		8109	
17	10/28/07	14:07	8.14	22.0	309	0.61	29.1	-5		8110	
18	10/28/07	14:17	8.15	22.1	303	0.61	11.2	-19		8111	
19	10/28/07	14:27	8.14	22.1	301	0.63	9.55	-7		8112	
20	10/28/07	14:37	8.13	22.1	301	0.64	9.76	-33		8099	Duplicate
21	10/28/07	15:10	8.12	22.0	285	0.71	8.67	-32		8113	
22	10/28/07	15:40	8.11	21.9	292	0.77	9.08	-23	2.13	8114	
23	10/28/07	16:10	8.10	22.4	292	0.78	7.6	-25		8115	
24	10/28/07	16:40	8.09	21.7	290	0.85	7.68	-33		8116	
25	10/28/07	17:40	8.08	21.1	320	0.96	8.16	-70	2.13	8117	Removed 599 gal. since 13:00 h
26	10/29/07	7:20									Pump on
27	10/29/07	7:50								8157	Collect colloid sample
28	10/29/07	7:55	7.72	14.7	362	1.21	39.4	-167		8118	Companion sample to colloid sample
29	10/29/07	8:25	8.31	18.0	347	0.19	47.8	-232	2.9	8119	
30	10/29/07	8:55	8.14	19.6	337	0.2	52	-185	2.56		
31	10/29/07	9:25	8.12	21.0	338	0.73	4.01	-19		8100	Duplicate
32	10/29/07	9:55	8.11	21.5	332	1.03	4.21	12			
33	10/29/07	10:25	8.10	21.5	345	1.14	4.89	10		8120	
34	10/29/07	10:55	8.09	21.4	341	1.07	5.06	8			
35	10/29/07	11:25	8.09	21.9	352	1.28	5.29	9	2.54	8121	
36	10/29/07	11:55	8.09	22.7	350	1.31	5.4	48			
37	10/29/07	12:25	8.07	22.0	360	1.24	5.69	-12	2.54	8122	
38	10/29/07	12:55	8.07	22.0	356	1.3	5.94	-38	2.54		
39	10/29/07	13:25	8.08	21.3	359	1.37	6.11	-31		8123	
40	10/29/07	13:55	8.07	22.0	365	1.5	6.53	-12			
41	10/29/07	14:25	8.06	22.1	362	1.55	6.27	10		8124	
42	10/29/07	14:55	8.06	22.0	363	1.43	6.04	-46	2.52		
43	10/29/07	15:25	8.05	22.1	368	1.57	6.26	14		8125	
44	10/29/07	15:55	8.05	21.4	363	1.45	5.76	-31			
45	10/29/07	16:25	8.05	22.0	371	1.59	5.83	-18	2.44	8101	Duplicate
46	10/29/07	16:55	8.05	21.5	363	1.63	5.85	13			
47	10/29/07	17:25	8.04	20.8	363	1.75	6.35	10		8126	1466 gal. removed throughout day

Table A-2
Laboratory-Measured Analytical Results

SAMPLE ID	DATE RECEIVED	ER/RRES-WQH	Ag rslt	stdev (Ag)	Al rslt	stdev (Al)	As rslt	stdev (As)	B rslt	stdev (B)	Ba rslt	stdev (Ba)
EU07100G12R101-SSEQB	10/28/2007	WG-08097-EE	0.001		0.060	0.003	0.0002		0.013	0.000	0.008	0.000
EU07100G12R102-SSEQB	10/28/2007	WG-08098-EE	0.001		0.018	0.002	0.0002		0.002	0.000	0.003	0.000
EU07100G12R101-SS-FB	10/28/2007	WG-08099-EE	0.001		0.001		0.0002		0.002		0.001	
EF07100G12R167	10/28/2007	WG-08104-EE	0.001		0.003	0.000	0.0012	0.0000	0.036	0.000	0.034	0.000
EU07100G12R167	10/28/2007	WG-08104-EE	0.001		0.072	0.000	0.0016	0.0000	0.036	0.000	0.039	0.000
EF07100G12R168	10/28/2007	WG-08105-EE	0.001		0.003	0.000	0.0012	0.0000	0.097	0.001	0.034	0.000
EU07100G12R168	10/28/2007	WG-08105-EE	0.001		0.084	0.001	0.0014	0.0001	0.079	0.001	0.039	0.000
EF07100G12R169	10/28/2007	WG-08106-EE	0.001		0.003	0.000	0.0014	0.0000	0.071	0.000	0.035	0.000
EU07100G12R169	10/28/2007	WG-08106-EE	0.001		0.096	0.004	0.0015	0.0000	0.070	0.000	0.040	0.000
EF07100G12R170	10/28/2007	WG-08107-EE	0.001		0.004	0.000	0.0013	0.0001	0.066	0.000	0.036	0.000
EU07100G12R170	10/28/2007	WG-08107-EE	0.001		0.088	0.001	0.0015	0.0000	0.067	0.001	0.040	0.000
EF07100G12R171	10/28/2007	WG-08108-EE	0.001		0.002	0.000	0.0014	0.0000	0.067	0.000	0.037	0.000
EU07100G12R171	10/28/2007	WG-08108-EE	0.001		0.078	0.002	0.0015	0.0000	0.065	0.001	0.040	0.000
EF07100G12R172	10/28/2007	WG-08109-EE	0.001		0.002	0.000	0.0013	0.0000	0.065	0.000	0.036	0.000
EU07100G12R172	10/28/2007	WG-08109-EE	0.001		0.069	0.002	0.0016	0.0000	0.065	0.001	0.039	0.000
EF07100G12R173	10/28/2007	WG-08110-EE	0.001		0.002	0.000	0.0013	0.0000	0.100	0.001	0.036	0.000
EU07100G12R173	10/28/2007	WG-08110-EE	0.001		0.053	0.001	0.0014	0.0000	0.079	0.001	0.040	0.000
EF07100G12R174	10/28/2007	WG-08111-EE	0.001		0.009	0.000	0.0013	0.0000	0.069	0.001	0.035	0.000
EU07100G12R174	10/28/2007	WG-08111-EE	0.001		0.069	0.005	0.0016	0.0001	0.065	0.001	0.037	0.000
EF07100G12R175	10/28/2007	WG-08112-EE	0.001		0.004	0.001	0.0017	0.0003	0.074	0.002	0.040	0.001
EU07100G12R175	10/28/2007	WG-08112-EE	0.001		0.069	0.013	0.0017	0.0003	0.064	0.001	0.038	0.000
EF07100G12R162	10/28/2007	WG-08099-EE	0.001		0.003	0.000	0.0013	0.0000	0.052	0.000	0.038	0.000
EU07100G12R162	10/28/2007	WG-08099-EE	0.001		0.052	0.002	0.0015	0.0000	0.047	0.001	0.040	0.000
EF07100G12R171	10/28/2007	WG-08099-EE	0.001		0.004	0.000	0.0013	0.0000	0.048	0.000	0.039	0.000
EU07100G12R171	10/28/2007	WG-08099-EE	0.001		0.052	0.001	0.0016	0.0000	0.045	0.000	0.041	0.000
EF07100G12R176	10/28/2007	WG-08113-EE	0.001		0.006	0.001	0.0012	0.0000	0.072	0.000	0.041	0.000
EU07100G12R176	10/28/2007	WG-08113-EE	0.001		0.070	0.010	0.0017	0.0003	0.067	0.001	0.041	0.001
EF07100G12R177	10/28/2007	WG-08114-EE	0.001		0.009	0.003	0.0013	0.0003	0.065	0.000	0.037	0.000
EU07100G12R177	10/28/2007	WG-08114-EE	0.001		0.039	0.000	0.0013	0.0000	0.069	0.000	0.043	0.000
EF07100G12R178	10/28/2007	WG-08115-EE	0.001		0.004	0.001	0.0012	0.0002	0.105	0.002	0.039	0.000
EU07100G12R178	10/28/2007	WG-08115-EE	0.001		0.054	0.014	0.0019	0.0006	0.087	0.000	0.043	0.000
EF07100G12R179	10/28/2007	WG-08116-EE	0.001		0.003	0.001	0.0012	0.0002	0.078	0.001	0.041	0.000
EU07100G12R179	10/28/2007	WG-08116-EE	0.001		0.043	0.002	0.0015	0.0000	0.076	0.002	0.047	0.001
EF07100G12R180	10/28/2007	WG-08117-EE	0.001		0.007	0.000	0.0009	0.0000	0.069	0.000	0.042	0.000
EU07100G12R180	10/28/2007	WG-08117-EE	0.001		0.039	0.001	0.0012	0.0000	0.065	0.001	0.044	0.001
EF07100G12R181	10/29/2007	WG-08118-EE	0.001		0.004	0.000	0.0006	0.0000	0.059	0.001	0.041	0.000
EU07100G12R181	10/29/2007	WG-08118-EE	0.001		0.060	0.000	0.0014	0.0000	0.061	0.001	0.053	0.001
EF07100G12R182	10/29/2007	WG-08119-EE	0.001		0.007	0.001	0.0008	0.0000	0.061	0.001	0.044	0.000
EU07100G12R182	10/29/2007	WG-08119-EE	0.001		0.054	0.004	0.0011	0.0000	0.056	0.001	0.056	0.001
EF07100G12R163	10/29/2007	WG-08100-EE	0.001		0.002	0.001	0.0011	0.0000	0.060	0.001	0.044	0.000
EU07100G12R163	10/29/2007	WG-08100-EE	0.001		0.026	0.002	0.0016	0.0001	0.128	0.003	0.054	0.001
EF07100G12R172	10/29/2007	WG-08100-EE	0.001		0.001		0.0013	0.0000	0.087	0.000	0.047	0.000
EU07100G12R172	10/29/2007	WG-08100-EE	0.001		0.031	0.000	0.0015	0.0000	0.081	0.000	0.048	0.000
EF07100G12R183	10/29/2007	WG-08120-EE	0.001		0.002	0.000	0.0011	0.0001	0.065	0.001	0.042	0.000
EU07100G12R183	10/29/2007	WG-08120-EE	0.001		0.019	0.000	0.0013	0.0000	0.062	0.001	0.046	0.000
EF07100G12R184	10/29/2007	WG-08121-EE	0.001		0.002	0.000	0.0009	0.0000	0.058	0.001	0.042	0.000
EU07100G12R184	10/29/2007	WG-08121-EE	0.001		0.021	0.000	0.0011	0.0000	0.053	0.001	0.043	0.001
EF07100G12R185	10/29/2007	WG-08122-EE	0.001		0.002	0.000	0.0010	0.0003	0.045	0.001	0.038	0.001
EU07100G12R185	10/29/2007	WG-08122-EE	0.001		0.020	0.001	0.0012	0.0000	0.057	0.001	0.045	0.000
EF07100G12R186	10/29/2007	WG-08123-EE	0.001		0.002	0.000	0.0009	0.0000	0.053	0.001	0.040	0.000
EU07100G12R186	10/29/2007	WG-08123-EE	0.001		0.022	0.001	0.0012	0.0000	0.049	0.000	0.041	0.000
EF07100G12R187	10/29/2007	WG-08124-EE	0.001		0.017	0.001	0.0011	0.0000	0.053	0.000	0.043	0.000
EU07100G12R187	10/29/2007	WG-08124-EE	0.001		0.016	0.000	0.0011	0.0000	0.114	0.001	0.041	0.000
EF07100G12R188	10/29/2007	WG-08125-EE	0.001		0.003	0.000	0.0010	0.0001	0.118	0.002	0.046	0.001
EU07100G12R188	10/29/2007	WG-08125-EE	0.001		0.019	0.001	0.0013	0.0002	0.099	0.001	0.044	0.000
EF07100G12R164	10/29/2007	WG-08101-EE	0.001		0.003	0.000	0.0009	0.0001	0.093	0.000	0.040	0.000
EU07100G12R164	10/29/2007	WG-08101-EE	0.001		0.022	0.004	0.0016	0.0003	0.089	0.002	0.042	0.001
EF07100G12R173	10/29/2007	WG-08101-EE	0.001		0.005	0.002	0.0014	0.0003	0.080	0.001	0.036	0.001
EU07100G12R173	10/29/2007	WG-08101-EE	0.001		0.015	0.001	0.0011	0.0000	0.096	0.002	0.047	0.001
EF07100G12R189	10/29/2007	WG-08126-EE	0.001		0.002	0.000	0.0009	0.0000	0.087	0.001	0.040	0.000
EU07100G12R189	10/29/2007	WG-08126-EE	0.001		0.016	0.001	0.0011	0.0001	0.087	0.001	0.043	0.000

Table A-2
Laboratory-Measured Analytical Results

Be_rslt	stdev (Be)	Br(-) ppm	Br(-) (U)	TOC rslt	TOC (U)	Ca_rslt	stdev (Ca)	Cd_rslt	stdev (Cd)	Cl(-) ppm	Cl(-) (U)	ClO4(-) ppm	ClO4(-) (U)
0.001		0.01	U	0.58		0.82	0.01	0.001		0.10		0.0005	U
0.001		0.01	U	0.27		0.34	0.01	0.001		0.08		0.0005	U
0.001		0.02		0.20	U	0.01		0.001				0.0005	U
0.001		0.19				27.1	0.1	0.001		21.7		0.005	U
0.001				31.2		27.0	0.1	0.001					
0.001		0.22				27.4	0.2	0.001		22.2		0.005	U
0.001				36.0		27.8	0.0	0.001					
0.001		0.20				28.3	0.1	0.001		22.7		0.005	U
0.001				32.2		28.5	0.2	0.001					
0.001		0.19				28.4	0.3	0.001		23.3		0.005	U
0.001				29.9		28.4	0.2	0.001					
0.001		0.10				28.1	0.1	0.001		23.5		0.005	U
0.001				28.5		28.3	0.2	0.001					
0.001		0.14				28.2	0.1	0.001		23.8		0.005	U
0.001				26.5		28.6	0.2	0.001					
0.001		0.11				28.7	0.2	0.001		24.0		0.005	U
0.001				24.4		28.3	0.1	0.001					
0.001		0.12				29.4	0.0	0.001		24.7		0.005	U
0.001				21.6		29.1	0.0	0.001					
0.001		0.11				29.5	0.1	0.001		24.8		0.005	U
0.001				19.0		29.1	0.1	0.001					
0.001		0.11				30.7	0.2	0.001		25.6		0.001	U
0.001				15.9		30.3	0.1	0.001					
0.001		0.11				30.8	0.1	0.001		25.3		0.001	U
0.001				15.9		30.6	0.1	0.001		0.01			
0.001		0.13				31.5	0.2	0.001		26.9		0.005	U
0.001				11.5		31.3	0.1	0.001					
0.001		0.13				32.6	0.0	0.001		27.8		0.005	U
0.001				11.0		32.7	0.3	0.001					
0.001		0.26				33.3	0.1	0.001		28.7		0.005	U
0.001				9.13		33.7	0.3	0.001					
0.001		0.14				34.8	0.0	0.001		29.3		0.005	U
0.001				7.91		36.6	0.1	0.001					
0.001		0.15				36.6	0.2	0.001		30.4		0.005	U
0.001				5.39		38.3	0.4	0.001					
0.001		0.10				38.1	0.1	0.001		30.2		0.005	U
0.001				4.18		38.2	0.1	0.001					
0.001		0.10				34.3	0.0	0.001		28.1		0.005	U
0.001				3.65		35.0	0.1	0.001					
0.001		0.11				38.8	0.0	0.001		30.2		0.005	U
0.001				3.44		38.1	0.1	0.001					
0.001		0.11				37.0	0.2	0.001		30.2		0.005	U
0.001				3.48		37.1	0.1	0.001					
0.001		0.11				38.2	0.0	0.001		31.1		0.005	U
0.001				5.60		37.9	0.2	0.001					
0.001		0.12				38.5	0.2	0.001		31.6		0.005	U
0.001				4.95		38.9	0.1	0.001					
0.001		0.12				39.7	0.0	0.001		32.2		0.005	U
0.001				3.57		38.8	0.2	0.001					
0.001		0.13				39.9	0.0	0.001		32.6		0.005	U
0.001				2.85		39.4	0.1	0.001					
0.001		0.12				40.4	0.1	0.001		32.6		0.005	U
0.001				2.34		40.6	0.2	0.001					
0.001		0.13				40.8	0.0	0.001		32.8		0.005	U
0.001				2.08		41.6	0.1	0.001					
0.001		0.12				41.3	0.3	0.001		33.0		0.005	U
0.001				2.04		41.9	0.1	0.001					
0.001		0.12				42.3	0.3	0.001		32.9		0.005	U
0.001				1.90		41.6	0.1	0.001					
0.001		0.13				42.2	0.3	0.001		33.4		0.005	U
0.001				1.84		41.8	0.1	0.001					

Table A-2
Laboratory-Measured Analytical Results

Co rslt	stdev (Co)	Alk-CO3 rslt	ALK-CO3 (U)	Cr rslt	stdev (Cr)	Cs rslt	stdev (Cs)	Cu rslt	stdev (Cu)	F(-) ppm	F(-) (U)	Fe rslt	stdev (Fe)
0.001				0.002	0.000	0.001		0.147	0.007	0.01	U	6.11	0.07
0.001				0.001		0.001		0.001		0.01	U	4.07	0.02
0.001		0.8	U	0.001		0.001		0.002	0.000			0.01	
0.002	0.000	0.8	U	0.001	0.000	0.001		0.001	0.000	0.67		0.35	0.00
0.001		0.8	U	0.002	0.000	0.001		0.007	0.000			2.38	0.04
0.001		0.8	U	0.002	0.000	0.001		0.002	0.000	0.72		0.32	0.00
0.001		0.8	U	0.002	0.000	0.001		0.007	0.000			2.10	0.01
0.001		0.8	U	0.002	0.000	0.001		0.001	0.000	0.69		0.21	0.00
0.001		0.8	U	0.003	0.000	0.001		0.006	0.000			1.66	0.02
0.001	0.000	0.8	U	0.002	0.000	0.001		0.001	0.000	0.72		0.32	0.00
0.001		0.8	U	0.002	0.000	0.001		0.004	0.000			1.31	0.01
0.001		0.8	U	0.002	0.000	0.001		0.002	0.000	0.68		0.27	0.00
0.001		0.8	U	0.002	0.000	0.001		0.003	0.000			1.25	0.01
0.001		0.8	U	0.002	0.000	0.001		0.001	0.000	0.70		0.24	0.00
0.001		0.8	U	0.002	0.000	0.001		0.003	0.000			1.21	0.01
0.001		0.8	U	0.002	0.000	0.001		0.001	0.000	0.67		0.31	0.00
0.001		0.8	U	0.002	0.000	0.001		0.003	0.000			1.14	0.02
0.001		0.8	U	0.001	0.000	0.001		0.004	0.000	0.68		0.25	0.00
0.001		0.8	U	0.002	0.000	0.001		0.006	0.000			1.01	0.01
0.001	0.000	0.8	U	0.002	0.001	0.001		0.001	0.000	0.65		0.28	0.00
0.001		0.8	U	0.003	0.001	0.001		0.004	0.001			1.05	0.00
0.001	0.000	0.8	U	0.002	0.000	0.001		0.001		0.65		0.43	0.00
0.001		0.8	U	0.002	0.000	0.001		0.002	0.000			1.08	0.01
0.002	0.000	0.8	U	0.002	0.000	0.001		0.001	0.000	0.64		0.35	0.00
0.001		0.8	U	0.003	0.000	0.001		0.002	0.000	0.01	U	1.09	0.01
0.001		0.8	U	0.002	0.000	0.001		0.003	0.000	0.65		0.25	0.00
0.001		0.8	U	0.003	0.000	0.001		0.007	0.001			1.05	0.01
0.001		0.8	U	0.002	0.001	0.001		0.001	0.000	0.63		0.32	0.00
0.001		0.8	U	0.002	0.000	0.001		0.002	0.000			1.09	0.00
0.001		0.8	U	0.002	0.000	0.001		0.001	0.000	0.65		0.19	0.00
0.001		0.8	U	0.004	0.001	0.001		0.002	0.001			1.10	0.00
0.001		0.8	U	0.002	0.001	0.001		0.001	0.000	0.64		0.15	0.00
0.001		0.8	U	0.002	0.000	0.001		0.003	0.000			1.15	0.02
0.001		0.8	U	0.002	0.000	0.001		0.001		0.63		0.15	0.00
0.001		0.8	U	0.002	0.000	0.001		0.001	0.000			1.08	0.01
0.001		0.8	U	0.002	0.000	0.001		0.001		0.54		0.80	0.01
0.001		0.8	U	0.007	0.000	0.001		0.172	0.002			5.51	0.04
0.001		0.8	U	0.002	0.000	0.001		0.001	0.000	0.53		1.46	0.02
0.001		0.8	U	0.003	0.000	0.001		0.004	0.000			5.45	0.03
0.001		0.8	U	0.001	0.000	0.001		0.001		0.56		0.18	0.00
0.001		0.8	U	0.001	0.000	0.001		0.001	0.000			0.71	0.01
0.001		0.8	U	0.001		0.001		0.001		0.55		0.26	0.00
0.001		0.8	U	0.001	0.000	0.001		0.002	0.000			0.66	0.00
0.001		0.8	U	0.002	0.000	0.001		0.001	0.000	0.56		0.27	0.00
0.001		0.8	U	0.002	0.000	0.001		0.005	0.000			0.82	0.00
0.001		0.8	U	0.002	0.000	0.001		0.001	0.000	0.55		0.25	0.00
0.001		0.8	U	0.002	0.000	0.001		0.003	0.000			0.90	0.01
0.001		0.8	U	0.002	0.000	0.001		0.001	0.000	0.55		0.19	0.00
0.001		0.8	U	0.002	0.000	0.001		0.001	0.000			1.05	0.01
0.002	0.000	0.8	U	0.001	0.000	0.001		0.001		0.60		0.21	0.00
0.001		0.8	U	0.002	0.000	0.001		0.001	0.000			1.03	0.00
0.001		0.8	U	0.002	0.000	0.001		0.001	0.000	0.55		1.11	0.00
0.001		0.8	U	0.002	0.000	0.001		0.002	0.000			1.05	0.01
0.001	0.000	0.8	U	0.002	0.000	0.001		0.001	0.000	0.54		0.26	0.00
0.002	0.000	0.8	U	0.002	0.000	0.001		0.003	0.000			1.15	0.01
0.001		0.8	U	0.002	0.000	0.001		0.001	0.000	0.54		0.26	0.00
0.001		0.8	U	0.003	0.001	0.001		0.002	0.000			1.09	0.01
0.001	0.000	0.8	U	0.004	0.001	0.001		0.005	0.001	0.53		0.19	0.00
0.001		0.8	U	0.002	0.000	0.001		0.001	0.000			1.21	0.01
0.002	0.000	0.8	U	0.002	0.000	0.001		0.001		0.58		0.34	0.00
0.001		0.8	U	0.002	0.000	0.001		0.001	0.000			1.11	0.01

Alk-CO3+HCO3 rslt	ALK-CO3+HCO3 (U)	Hg_rslt	stdev (Hg)	K_rslt	stdev (K)	Li_rslt	stdev (Li)	Mg_rslt	stdev (Mg)	Mn_rslt	stdev (Mn)	Mo_rslt	stdev (Mo)
		0.00005		0.01		0.001		0.07	0.00	0.235	0.003	0.001	
		0.00005		0.01		0.001	0.000	0.04	0.00	0.012	0.000	0.001	
0	U	0.00005		0.01		0.001		0.00		0.000		0.001	
149		0.00005		3.36	0.00	0.034	0.001	7.40	0.01	0.124	0.000	0.002	0.000
149		0.00005		3.45	0.02	0.035	0.001	7.48	0.06	0.141	0.001	0.002	0.000
150		0.00005		3.64	0.00	0.037	0.000	7.44	0.03	0.127	0.000	0.002	0.000
150		0.00005		3.66	0.01	0.035	0.001	7.63	0.03	0.153	0.000	0.002	0.000
150		0.00005		3.54	0.00	0.036	0.001	7.66	0.01	0.118	0.000	0.002	0.000
150		0.00005		3.70	0.02	0.037	0.000	7.83	0.02	0.142	0.001	0.002	0.000
152		0.00005		3.51	0.03	0.033	0.001	7.68	0.04	0.116	0.001	0.002	0.000
152		0.00005		3.64	0.03	0.035	0.000	7.95	0.09	0.130	0.001	0.002	0.000
151		0.00005		3.57	0.01	0.037	0.001	7.93	0.04	0.116	0.001	0.002	0.000
151		0.00005		3.63	0.04	0.036	0.000	7.93	0.06	0.125	0.001	0.002	0.000
148		0.00005		3.53	0.01	0.038	0.001	7.96	0.02	0.112	0.001	0.002	0.000
148		0.00005		3.61	0.05	0.034	0.000	7.97	0.04	0.122	0.001	0.002	0.000
144		0.00005		3.63	0.03	0.037	0.000	7.91	0.04	0.111	0.001	0.002	0.000
144		0.00005		3.70	0.03	0.033	0.001	8.25	0.06	0.119	0.001	0.002	0.000
146		0.00005		3.40	0.04	0.035	0.000	7.76	0.12	0.102	0.001	0.002	0.000
146		0.00005		3.38	0.04	0.041	0.002	7.62	0.03	0.107	0.001	0.002	0.000
144		0.00005		3.87	0.11	0.052	0.010	8.96	0.15	0.116	0.002	0.002	0.000
144		0.00005		3.39	0.03	0.046	0.007	7.85	0.04	0.109	0.000	0.002	0.000
147		0.00005		3.38	0.01	0.039	0.001	8.27	0.01	0.111	0.000	0.002	0.000
147		0.00005		3.37	0.01	0.038	0.001	8.17	0.02	0.112	0.000	0.002	0.000
144		0.00005		3.43	0.02	0.039	0.001	8.45	0.05	0.114	0.000	0.002	0.000
144		0.00005		3.42	0.02	0.039	0.001	8.27	0.03	0.114	0.001	0.002	0.000
147		0.00005		3.57	0.01	0.039	0.003	8.96	0.05	0.108	0.000	0.002	0.000
147		0.00005		3.43	0.05	0.051	0.008	8.50	0.05	0.109	0.001	0.002	0.000
144		0.00005		3.12	0.02	0.049	0.010	8.29	0.05	0.096	0.001	0.002	0.000
144		0.00005		3.39	0.01	0.041	0.002	8.93	0.02	0.109	0.000	0.002	0.000
147		0.00005		3.40	0.03	0.045	0.008	8.91	0.06	0.099	0.001	0.002	0.000
147		0.00005		3.41	0.01	0.058	0.015	9.13	0.04	0.107	0.001	0.002	0.000
148		0.00005		3.26	0.01	0.044	0.007	9.10	0.06	0.096	0.001	0.002	0.000
148		0.00005		3.62	0.09	0.043	0.003	9.96	0.23	0.108	0.003	0.002	0.000
148		0.00005		3.19	0.02	0.040	0.000	9.54	0.04	0.092	0.000	0.002	0.000
148		0.00005		3.19	0.04	0.041	0.000	9.38	0.08	0.094	0.001	0.002	0.000
151		0.00005		3.01	0.04	0.041	0.000	9.37	0.11	0.112	0.001	0.002	0.000
151		0.00005		3.11	0.05	0.038	0.001	9.76	0.13	0.201	0.003	0.002	0.000
138		0.00006	0.00000	3.31	0.05	0.040	0.002	8.99	0.10	0.148	0.002	0.002	0.000
138		0.00005		3.10	0.03	0.034	0.000	8.96	0.08	0.142	0.002	0.002	0.000
152		0.00005		2.96	0.03	0.040	0.000	9.53	0.05	0.090	0.001	0.002	0.000
152		0.00005		3.79	0.08	0.039	0.002	11.19	0.12	0.111	0.002	0.002	0.000
148		0.00005		3.17	0.01	0.036	0.000	9.74	0.04	0.096	0.000	0.002	0.000
148		0.00005		3.19	0.01	0.040	0.001	9.77	0.05	0.099	0.000	0.002	0.000
153		0.00005		3.05	0.01	0.038	0.004	9.90	0.04	0.086	0.001	0.002	0.000
153		0.00005		3.23	0.01	0.039	0.000	10.57	0.05	0.094	0.000	0.002	0.000
155		0.00005		3.16	0.04	0.037	0.001	10.70	0.06	0.083	0.000	0.002	0.000
155		0.00005		3.05	0.04	0.036	0.001	10.36	0.11	0.083	0.001	0.002	0.000
154		0.00005		2.83	0.07	0.046	0.006	9.80	0.16	0.070	0.001	0.002	0.000
154		0.00005		3.20	0.04	0.038	0.001	11.21	0.14	0.083	0.001	0.002	0.000
155		0.00005		3.07	0.02	0.038	0.002	11.01	0.10	0.076	0.000	0.002	0.000
155		0.00005		2.92	0.01	0.040	0.001	10.51	0.02	0.074	0.000	0.002	0.000
155		0.00005		3.07	0.01	0.035	0.000	11.14	0.04	0.074	0.000	0.002	0.000
155		0.00005		3.17	0.02	0.037	0.001	10.42	0.02	0.071	0.000	0.002	0.000
156		0.00005		3.70	0.07	0.043	0.005	12.82	0.16	0.081	0.001	0.002	0.000
156		0.00005		3.36	0.04	0.039	0.004	11.56	0.12	0.075	0.000	0.002	0.000
156		0.00005		3.20	0.01	0.042	0.005	11.38	0.08	0.068	0.000	0.002	0.000
156		0.00005		3.19	0.05	0.050	0.010	11.24	0.14	0.070	0.001	0.002	0.000
155		0.00005		2.93	0.05	0.064	0.018	10.26	0.21	0.061	0.001	0.002	0.000
155		0.00005		3.52	0.04	0.037	0.000	12.36	0.15	0.077	0.001	0.002	0.000
155		0.00005		3.20	0.02	0.037	0.001	11.57	0.10	0.069	0.000	0.002	0.000
155		0.00005		3.18	0.01	0.038	0.000	11.54	0.02	0.069	0.000	0.003	0.000

Table A-2
Laboratory-Measured Analytical Results

Na rslt	stdev (Na)	Ni rslt	stdev (Ni)	NO2(ppm)	NO2-N rslt	NO2-N (U)	NO-3 ppm	NO-3-N rslt	NO-3-N (U)	C2O4 rslt	C2O4 (U)	Pb rslt	stdev (Pb)
0.30	0.01	0.004	0.000	0.04	0.014		0.11	0.024		0.01	U	0.0191	0.0007
0.22	0.00	0.001		0.03	0.009		0.09	0.021		0.01	U	0.0002	
0.00		0.000		0.01	0.003	U	0.01	0.002	U	0.01	U	0.0002	
31.37	0.05	0.003	0.000	0.01	0.003	U	5.34	1.205		0.01	U	0.0002	
31.68	0.15	0.005	0.000									0.0013	0.0000
33.00	0.05	0.004	0.000	0.01	0.003	U	5.38	1.215		0.01	U	0.0002	
33.64	0.15	0.004	0.000									0.0015	0.0001
31.81	0.08	0.003	0.000	0.01	0.003	U	5.71	1.290		0.01	U	0.0002	
33.01	0.25	0.004	0.000									0.0012	0.0001
31.00	0.24	0.004	0.000	0.01	0.003	U	6.05	1.365		0.01	U	0.0002	
31.94	0.29	0.004	0.000									0.0010	0.0000
31.31	0.22	0.004	0.000	0.01	0.003	U	6.14	1.386		0.01	U	0.0002	
31.67	0.34	0.004	0.000									0.0010	0.0000
30.33	0.13	0.004	0.000	0.01	0.003	U	6.38	1.440		0.01	U	0.0002	
30.86	0.32	0.004	0.000									0.0008	0.0000
28.61	0.17	0.004	0.000	0.01	0.003	U	6.61	1.492		0.01	U	0.0002	
30.88	0.40	0.004	0.000									0.0006	0.0000
27.04	0.35	0.014	0.000	0.01	0.003	U	7.02	1.586		0.01	U	0.0026	0.0000
27.13	0.21	0.017	0.001									0.0039	0.0001
30.11	0.52	0.005	0.001	0.01	0.003	U	7.15	1.614		0.01	U	0.0002	
26.33	0.35	0.005	0.001									0.0011	0.0001
26.32	0.02	0.004	0.000	0.01	0.003	U	7.65	1.727		0.01	U	0.0002	
26.44	0.10	0.005	0.000									0.0005	0.0000
26.65	0.07	0.004	0.000	0.01	0.003	U	7.53	1.699		0.01	U	0.0002	
26.48	0.23	0.005	0.000									0.0002	
24.97	0.06	0.008	0.000	0.01	0.003	U	8.55	1.930		0.01	U	0.0012	0.0001
23.99	0.20	0.016	0.002									0.0035	0.0007
21.82	0.18	0.006	0.001	0.01	0.003	U	9.26	2.091		0.01	U	0.0002	
23.64	0.10	0.005	0.000									0.0004	0.0000
22.29	0.06	0.005	0.001	0.01	0.003	U	10.00	2.258		0.01	U	0.0002	
22.80	0.02	0.009	0.002									0.0005	0.0002
22.03	0.01	0.009	0.002	0.01	0.003	U	10.30	2.326		0.01	U	0.0002	
24.30	0.45	0.007	0.000									0.0004	0.0000
20.92	0.12	0.005	0.000	0.01	0.003	U	11.11	2.509		0.01	U	0.0002	
20.91	0.33	0.005	0.000									0.0003	0.0000
19.40	0.28	0.005	0.000	0.01	0.003	U	10.75	2.427		0.01	U	0.0002	
19.95	0.21	0.008	0.000									0.2539	0.0118
19.15	0.12	0.005	0.000	0.55	0.166		7.11	1.605		0.01	U	0.0003	0.0000
18.97	0.24	0.006	0.000									0.0009	0.0000
19.12	0.25	0.005	0.000	0.01	0.003	U	10.99	2.482		0.01	U	0.0002	
22.55	0.28	0.006	0.000									0.0003	0.0000
19.61	0.09	0.005	0.000	0.01	0.003	U	10.94	2.471		0.01	U	0.0002	
19.74	0.15	0.006	0.000									0.0011	0.0000
19.86	0.23	0.005	0.000	0.01	0.003	U	11.89	2.685		0.01	U	0.0002	
21.13	0.04	0.006	0.000									0.0015	0.0000
20.79	0.21	0.005	0.000	0.01	0.003	U	12.39	2.798		0.01	U	0.0002	
20.23	0.20	0.005	0.000									0.0002	
18.58	0.33	0.006	0.001	0.01	0.003	U	12.86	2.905		0.01	U	0.0002	
21.02	0.22	0.005	0.000									0.0002	
20.04	0.10	0.005	0.000	0.01	0.003	U	13.24	2.990		0.01	U	0.0002	
18.95	0.07	0.006	0.000									0.0002	0.0000
19.73	0.05	0.005	0.000	0.01	0.003	U	13.35	3.014		0.01	U	0.0002	0.0000
18.78	0.07	0.006	0.000									0.0003	0.0000
22.33	0.35	0.007	0.001	0.01	0.003	U	13.47	3.042		0.01	U	0.0002	
20.61	0.20	0.006	0.001									0.0004	0.0000
19.60	0.07	0.006	0.000	0.01	0.003	U	13.67	3.087		0.01	U	0.0002	
19.49	0.31	0.009	0.002									0.0002	
18.08	0.29	0.011	0.003	0.01	0.003	U	13.60	3.071		0.01	U	0.0002	
21.54	0.26	0.005	0.000									0.0002	
19.65	0.15	0.006	0.000	0.01	0.003	U	13.94	3.148		0.01	U	0.0002	
19.51	0.05	0.006	0.000									0.0002	

Table A-2
Laboratory-Measured Analytical Results

pH (Lab)	PO4(-3) rslt	PO4(-3) (U)	Rb rslt	stdev (Rb)	S2- rslt	S2- (U)	Sb rslt	stdev (Sb)	Se rslt	stdev (Se)	Si rslt	stdev (Si)	SiO2 rslt
	0.01	U	0.001				0.001		0.001		0.54	0.01	1.17
	0.01	U	0.001				0.001		0.001		0.53	0.00	1.14
5.55	0.01	U	0.001		0.009	U	0.001		0.001		0.01		0.02
8.00	0.02		0.005	0.000			0.001		0.001		23.52	0.12	50.33
8.00			0.005	0.000	0.009	U	0.001		0.001		24.37	0.08	52.14
8.01	0.01	U	0.005	0.000			0.001		0.001		23.54	0.09	50.37
8.01			0.005	0.000	0.009	U	0.001		0.001		24.70	0.17	52.85
8.03	0.02		0.005	0.000			0.001		0.001		24.04	0.09	51.44
8.03			0.005	0.000	0.009	U	0.001		0.001		25.38	0.23	54.32
8.01	0.02		0.005	0.000			0.001		0.001		23.82	0.09	50.98
8.01			0.005	0.000	0.009	U	0.001		0.001		25.21	0.26	53.96
8.03	0.03		0.005	0.000			0.001		0.001		24.45	0.12	52.32
8.03			0.005	0.000	0.009	U	0.001		0.001		24.93	0.30	53.34
8.02	0.02		0.005	0.000			0.001		0.001		24.27	0.09	51.94
8.02			0.005	0.000	0.009	U	0.001		0.001		24.88	0.09	53.25
8.05	0.03		0.005	0.000			0.001		0.001		23.79	0.11	50.92
8.05			0.005	0.000	0.009	U	0.001		0.001		25.54	0.40	54.65
8.04	0.02		0.005	0.000			0.001		0.001		23.40	0.22	50.08
8.04			0.005	0.000	0.009	U	0.001		0.001	0.000	23.20	0.29	49.66
8.06	0.03		0.006	0.001			0.001		0.002	0.001	26.26	0.66	56.20
8.06			0.006	0.001	0.009	U	0.001		0.001	0.000	23.67	0.13	50.66
8.07	0.01	U	0.005	0.000			0.001		0.001		24.23	0.17	51.86
8.07			0.005	0.000	0.009	U	0.001		0.001		24.29	0.05	51.99
8.02	0.02		0.005	0.000			0.001		0.001		24.60	0.24	52.65
8.02			0.005	0.000	0.009	U	0.001		0.001		24.77	0.08	53.00
8.06	0.02		0.005	0.001			0.001		0.001	0.000	24.90	0.01	53.30
8.06			0.007	0.001	0.009	U	0.001		0.002	0.000	24.01	0.35	51.38
8.07	0.02		0.007	0.001			0.001		0.001	0.001	21.90	0.20	46.87
8.07			0.006	0.000	0.009	U	0.001		0.001	0.000	23.98	0.08	51.32
8.06	0.01		0.006	0.001			0.001		0.001	0.000	22.76	0.20	48.71
8.06			0.008	0.003	0.009	U	0.001		0.002	0.001	23.75	0.15	50.83
8.08	0.02		0.006	0.001			0.001		0.001	0.000	22.95	0.05	49.11
8.08			0.006	0.000	0.009	U	0.001		0.001	0.000	25.43	0.57	54.43
8.08	0.01		0.006	0.000			0.001		0.001	0.000	23.10	0.07	49.44
8.08			0.006	0.000	0.009	U	0.001		0.001	0.000	22.94	0.24	49.08
8.02	0.01	U	0.006	0.000			0.001		0.001	0.000	19.09	0.20	40.84
8.02			0.005	0.000	0.009	U	0.001		0.001	0.000	21.49	0.32	45.99
7.95	0.01	U	0.006	0.000			0.001		0.001	0.000	19.79	0.19	42.34
7.95			0.006	0.000	0.009	U	0.001		0.001	0.000	18.88	0.15	40.40
8.05	0.01		0.006	0.000			0.001		0.001	0.000	21.90	0.14	46.87
8.05			0.006	0.000	0.009	U	0.001		0.001	0.000	25.77	0.48	55.14
8.07	0.01		0.006	0.000			0.001		0.001	0.000	22.55	0.01	48.25
8.07			0.006	0.000	0.009	U	0.001		0.001	0.000	22.76	0.18	48.72
7.87	0.01	U	0.005	0.000			0.001		0.001	0.000	22.31	0.22	47.74
7.87			0.006	0.000	0.009	U	0.001		0.001	0.000	23.91	0.13	51.17
7.96	0.01	U	0.006	0.000			0.001		0.001	0.000	23.53	0.14	50.35
7.96			0.005	0.000	0.009	U	0.001		0.001	0.000	22.91	0.18	49.04
8.00	0.01	U	0.007	0.001			0.001		0.002	0.000	21.24	0.47	45.46
8.00			0.006	0.000	0.009	U	0.001		0.001	0.000	24.44	0.44	52.31
8.00	0.01	U	0.006	0.000			0.001		0.001	0.000	23.29	0.16	49.84
8.00			0.006	0.000	0.009	U	0.001		0.001	0.000	22.70	0.05	48.57
8.01	0.01	U	0.006	0.000			0.001		0.001	0.000	23.79	0.12	50.91
8.01			0.006	0.000	0.009	U	0.001		0.001	0.000	22.37	0.15	47.87
8.07	0.01	U	0.007	0.001			0.001		0.002	0.000	26.80	0.45	57.36
8.07			0.006	0.000	0.009	U	0.001		0.001	0.000	24.73	0.07	52.92
8.06	0.01	U	0.006	0.001			0.001		0.002	0.000	23.53	0.12	50.36
8.06			0.008	0.002	0.009	U	0.001		0.002	0.001	23.70	0.24	50.72
8.05	0.01	U	0.010	0.003			0.001		0.003	0.001	21.31	0.43	45.61
8.05			0.006	0.000	0.009	U	0.001		0.001	0.000	25.98	0.20	55.59
8.07	0.01	U	0.006	0.000			0.001		0.001	0.000	23.72	0.18	50.75
8.07			0.006	0.000	0.009	U	0.001		0.001	0.000	24.12	0.12	51.63

Table A-2
Laboratory-Measured Analytical Results

stdev (SiO2)	Sn_rslt	stdev (Sn)	SO4(-2)_rslt	SO4(-2)_(U)	Sr_rslt	stdev (Sr)	Th_rslt	stdev (Th)	Ti_rslt	stdev (Ti)	Tl_rslt	stdev (Tl)	U_rslt
0.02	0.001		0.23		0.003	0.000	0.001		0.003	0.000	0.001		0.0002
0.01	0.001		0.16		0.001	0.000	0.001		0.001	0.000	0.001		0.0002
	0.001		0.05		0.001		0.001		0.002		0.001		0.0002
0.25	0.001		24.5		0.115	0.000	0.001		0.002		0.001		0.0050
0.17	0.001				0.117	0.001	0.001		0.005	0.000	0.001		0.0068
0.19	0.001		25.9		0.116	0.000	0.001		0.002		0.001		0.0050
0.37	0.001				0.118	0.001	0.001		0.006	0.000	0.001		0.0060
0.20	0.001		24.9		0.118	0.000	0.001		0.002		0.001		0.0056
0.50	0.001				0.122	0.001	0.001		0.006	0.000	0.001		0.0067
0.20	0.001		24.7		0.117	0.001	0.001		0.002		0.001		0.0056
0.55	0.001				0.122	0.001	0.001		0.006	0.000	0.001		0.0064
0.26	0.001		24.2		0.122	0.000	0.001		0.002		0.001		0.0058
0.65	0.001				0.122	0.001	0.001		0.006	0.000	0.001		0.0063
0.18	0.001		23.9		0.121	0.001	0.001		0.002		0.001		0.0055
0.19	0.001				0.122	0.001	0.001		0.005	0.000	0.001		0.0060
0.24	0.001		23.1		0.121	0.001	0.001		0.002		0.001		0.0020
0.86	0.001				0.128	0.001	0.001		0.005	0.000	0.001		0.0022
0.46	0.001		22.7		0.121	0.001	0.001		0.002		0.001		0.0022
0.62	0.001				0.119	0.001	0.001		0.004	0.000	0.001		0.0024
1.41	0.001		22.2		0.139	0.002	0.001		0.002		0.001		0.0031
0.28	0.001				0.121	0.001	0.001		0.004	0.000	0.001		0.0029
0.37	0.001		21.8		0.125	0.001	0.001		0.002		0.001		0.0055
0.11	0.001				0.124	0.001	0.001		0.004	0.000	0.001		0.0063
0.52	0.001		21.5		0.128	0.000	0.001		0.002		0.001		0.0060
0.18	0.001				0.126	0.001	0.001		0.004	0.000	0.001		0.0068
0.02	0.001		21.4		0.136	0.000	0.001		0.002		0.001		0.0026
0.75	0.001				0.129	0.002	0.001		0.004	0.001	0.001		0.0032
0.44	0.001		21.9		0.124	0.001	0.001		0.002		0.001		0.0032
0.18	0.001				0.136	0.000	0.001		0.003	0.000	0.001		0.0026
0.42	0.001		21.9		0.135	0.001	0.001		0.002		0.001		0.0031
0.33	0.001				0.140	0.001	0.001		0.004	0.000	0.001		0.0041
0.11	0.001		21.9		0.137	0.001	0.001		0.002		0.001		0.0031
1.21	0.001				0.151	0.004	0.001		0.002		0.001		0.0030
0.15	0.001		22.0		0.143	0.001	0.001		0.002		0.001		0.0028
0.50	0.001				0.140	0.001	0.001		0.002		0.001		0.0029
0.43	0.001		20.9		0.139	0.001	0.001		0.002		0.001		0.0021
0.68	0.002				0.145	0.002	0.001		0.003	0.000	0.001		0.0024
0.41	0.001		19.1		0.138	0.001	0.001		0.002		0.001		0.0020
0.32	0.001				0.140	0.002	0.001		0.002	0.000	0.001		0.0018
0.31	0.001		21.0		0.138	0.001	0.001		0.002		0.001		0.0029
1.03	0.001				0.163	0.002	0.001		0.002		0.001		0.0029
0.03	0.001		20.9		0.143	0.000	0.001		0.002		0.001		0.0028
0.38	0.001				0.143	0.001	0.001		0.002		0.001		0.0028
0.47	0.001		22.0		0.144	0.000	0.001		0.002		0.001		0.0028
0.27	0.001				0.155	0.001	0.001		0.002		0.001		0.0027
0.30	0.001		22.0		0.154	0.002	0.001		0.002		0.001		0.0027
0.38	0.001				0.149	0.001	0.001		0.002		0.001		0.0027
1.00	0.001		22.2		0.141	0.002	0.001		0.002		0.001		0.0033
0.94	0.001				0.160	0.002	0.001		0.002		0.001		0.0029
0.35	0.001		22.2		0.156	0.001	0.001		0.002		0.001		0.0028
0.10	0.001				0.149	0.001	0.001		0.002		0.001		0.0028
0.26	0.001		22.1		0.161	0.001	0.001		0.002		0.001		0.0028
0.32	0.001				0.150	0.001	0.001		0.002		0.001		0.0028
0.96	0.001		22.2		0.183	0.003	0.001		0.002		0.001		0.0032
0.14	0.001				0.168	0.002	0.001		0.002		0.001		0.0031
0.26	0.001		22.3		0.161	0.001	0.001		0.002		0.001		0.0033
0.52	0.001				0.161	0.003	0.001		0.002		0.001		0.0040
0.93	0.001		22.2		0.146	0.003	0.001		0.002		0.001		0.0050
0.43	0.001				0.178	0.002	0.001		0.002		0.001		0.0028
0.38	0.001		22.4		0.164	0.001	0.001		0.002		0.001		0.0028
0.26	0.001				0.166	0.001	0.001		0.002		0.001		0.0028

Table A-2
Laboratory-Measured Analytical Results

stdev (U)	V rslt	stdev (V)	Zn rslt	stdev (Zn)	TDS (ppm)	Cations	Anions	Balance
	0.617	0.015	0.643	0.004	11			
	0.009	0.000	0.009	0.000	6			
	0.001		0.001		1			
0.0002	0.018	0.001	0.018	0.001	323	3.42	3.72	-0.04
0.0001	0.089	0.001	0.089	0.001	275	---	---	---
0.0001	0.018	0.000	0.018	0.000	328	3.52	3.79	-0.04
0.0002	0.098	0.002	0.098	0.002	279	---	---	---
0.0001	0.015	0.000	0.015	0.000	329	3.53	3.78	-0.03
0.0000	0.075	0.002	0.075	0.002	281	---	---	---
0.0001	0.017	0.000	0.017	0.000	330	3.50	3.83	-0.04
0.0000	0.057	0.000	0.057	0.000	280	---	---	---
0.0000	0.015	0.000	0.015	0.000	330	3.52	3.80	-0.04
0.0001	0.054	0.002	0.054	0.002	278	---	---	---
0.0001	0.019	0.005	0.019	0.005	327	3.48	3.77	-0.04
0.0002	0.050	0.000	0.050	0.000	275	---	---	---
0.0000	0.005	0.000	0.016	0.000	319	3.43	3.69	-0.04
0.0000	0.005	0.000	0.043	0.000	272	---	---	---
0.0000	0.004	0.000	0.055	0.001	320	3.38	3.74	-0.05
0.0001	0.006	0.001	0.100	0.006	265	---	---	---
0.0006	0.007	0.001	0.019	0.003	329	3.63	3.70	-0.01
0.0005	0.007	0.001	0.062	0.010	264	---	---	---
0.0001	0.018	0.001	0.018	0.001	325	3.46	3.78	-0.04
0.0000	0.039	0.000	0.039	0.000	270	---	---	---
0.0000	0.016	0.000	0.016	0.000	323	3.49	3.71	-0.03
0.0001	0.040	0.000	0.040	0.000	268	---	---	---
0.0002	0.005	0.000	0.033	0.002	328	3.50	3.82	-0.04
0.0005	0.007	0.001	0.104	0.013	268	---	---	---
0.0007	0.005	0.001	0.021	0.004	318	3.35	3.82	-0.06
0.0001	0.005	0.000	0.041	0.000	267	---	---	---
0.0005	0.006	0.001	0.015	0.002	327	3.47	3.90	-0.06
0.0012	0.008	0.002	0.061	0.018	269	---	---	---
0.0006	0.006	0.001	0.019	0.003	330	3.54	3.94	-0.05
0.0001	0.006	0.000	0.047	0.002	279	---	---	---
0.0000	0.004	0.000	0.010	0.000	334	3.61	3.99	-0.05
0.0000	0.005	0.000	0.039	0.000	272	---	---	---
0.0000	0.002	0.000	0.026	0.000	326	3.61	3.99	-0.05
0.0001	0.005	0.000	0.822	0.010	276	---	---	---
0.0001	0.003	0.000	0.093	0.005	305	3.39	3.64	-0.04
0.0001	0.004	0.000	0.213	0.005	252	---	---	---
0.0001	0.003	0.000	0.020	0.000	334	3.64	4.02	-0.05
0.0001	0.004	0.000	0.043	0.001	285	---	---	---
0.0000	0.003	0.000	0.021	0.000	330	3.59	3.96	-0.05
0.0000	0.004	0.000	0.043	0.001	269	---	---	---
0.0002	0.005	0.000	0.017	0.001	339	3.68	4.09	-0.05
0.0000	0.005	0.000	0.037	0.001	279	---	---	---
0.0003	0.003	0.000	0.013	0.000	346	3.80	4.14	-0.04
0.0000	0.004	0.000	0.032	0.001	278	---	---	---
0.0007	0.004	0.001	0.012	0.002	340	3.68	4.16	-0.06
0.0001	0.004	0.000	0.033	0.001	283	---	---	---
0.0000	0.003	0.000	0.010	0.000	349	3.86	4.20	-0.04
0.0000	0.004	0.000	0.033	0.000	278	---	---	---
0.0001	0.003	0.000	0.029	0.001	352	3.88	4.20	-0.04
0.0000	0.004	0.000	0.029	0.000	278	---	---	---
0.0005	0.003	0.000	0.011	0.001	364	4.17	4.22	-0.01
0.0002	0.004	0.000	0.031	0.002	289	---	---	---
0.0004	0.003	0.000	0.012	0.001	353	3.94	4.23	-0.04
0.0008	0.006	0.001	0.037	0.007	285	---	---	---
0.0016	0.008	0.002	0.018	0.005	345	3.83	4.20	-0.05
0.0001	0.003	0.000	0.026	0.000	292	---	---	---
0.0000	0.003	0.000	0.012	0.000	354	4.01	4.23	-0.03
0.0000	0.004	0.000	0.026	0.000	285	---	---	---

Appendix B

Evaluation of Water Quality Using Well Screen Analysis Methodology

Table B-1
Results of Well Screen Analysis for R-12 (Screen 1)
During the 2007 Pumping Test Conducted on October 28–29, 2007

Well	Port depth (ft)	Scr #	Sample collection date	Event	Tritium (pCi/L)	Modern Water?	3H plume?	Field pH		Low pH?	High pH?	Test Gen-1	Alkalinity (mg/L $CaCO_3$)		Test Gen-2	Test Gen-2	Turbidity (NTU)		Test Gen-3	Acetone (ug/L)		Lab Qual Code	Test B1		NH3-N (mg/L)	Lab Qual Code	Test B2		TKN (mg/L)	Lab Qual Code	Test B3		TOC (mg/L)	Lab Qual Code	Test B4	Ba ug/L		Test D3	Test E1	Ca mg/L		Test E2a	Test E2b	Test E2	Test A2
						pCi/L	pCi/L			SU	SU				mg/L	mg/L			NTU				ug/L				mg/L				mg/L				mg/L			mg/L	mg/L			mg/L	mg/L	Within	mg/L
						>UL	>UL			>LL	<UL				<UL	<UL			<UL				<UL				<UL				<UL				<UL			>LL	<UL			>LL	<UL	range	<UL
						1	17			6.1	8.8				52	52			5				5				0.05				0.35				1.1			1.4	72			4.6	18		18
R-12	468	1	18-Sep-00	1	192	Yes	Yes	8.01		Yes	Yes	P	170	CL	Fail		3.3		P	<	30	U	DL		1.1		Fail		0.91		Fail		7.7		Fail	38.0		P	P	30		Yes	No	Fail	
R-12	468	1	14-Mar-01	2	189	Yes	Yes	6.91		Yes	Yes	P	120	CL	Fail		4.4		P		—		ND		1.6		Fail		2.1		Fail		8.9		Fail	48.0		P	P	15		Yes	Yes	P	
R-12	468	1	13-Jun-01	3	187	Yes	Yes	8.63		Yes	Yes	P	36	Fld	P		—		ND		—		ND		3.1		Fail		3.3		Fail		12		Fail	31.0		P	P	4.8		Yes	Yes	P	
R-12	468	1	7-Sep-01	4	181	Yes	Yes	8.96		Yes	No	Fail	0.053	CL	Err		13		Fail	<	7.2	B	Fail		3.12		Fail		3.9		Fail		9.99		Fail	22.3		P	P	3.0		No	Yes	Fail	
R-12	468	1	31-Jul-02	5	161	Yes	Yes	9.2		Yes	No	Fail	40	Fld	P		3.37		P		—		ND		2.09		Fail		—		ND		8.22		Fail	38.6	UF	P	P	3.8	UF	No	Yes	Fail	
R-12	468	1	2-Feb-04	6	149	Yes	Yes	9.17		Yes	No	Fail	46	CL	P		1.8		P		—		ND		1.66		Fail		—		ND		5.30		Fail	43.3	UF	P	P	3.6	UF	No	Yes	Fail	
R-12	468	1	2-Jun-04	7	–	ND	ND	8.85		Yes	No	Fail	34	CL	P		1.6		P	<	5	U	P		—		ND		—		ND		—		ND	33.7	UF	P	P	3.6	UF	No	Yes	Fail	
R-12	468	1	16-Jun-05	8	–	ND	ND	8.93		Yes	No	Fail	43	CL	P		1.2	FN	P	<	5	U	P		1.40		Fail		1.54		Fail		—		ND	34.0		P	P	4.0		No	Yes	Fail	
R-12	468	1	2-Feb-06	9	121	Yes	Yes	8.96		Yes	No	Fail	34	Fld	P		0.9		P		2.15	J	P		1.37		Fail		1.49		Fail		—		ND	37.5		P	P	3.5		No	Yes	Fail	
R-12	468	1	11-Jul-06	10	105	Yes	Yes	9.03		Yes	No	Fail	40	CL	P		1.1		P		1.59	J	P		1.24		Fail		1.27		Fail		3.50		Fail	37.1		P	P	3.6		No	Yes	Fail	
R-12	468	1	29-Sep-06	11	118	Yes	Yes	7.88		Yes	Yes	P	169	Fld	Fail		1.8		P		8.86		Fail	<	0.039	J	P	<	0.01	U	P		1.21		Fail	46.1		P	P	47.6		Yes	No	Fail	
R-12	468	1	28-Oct-07	67	ND	ND	ND	8.16	Fld	Yes	Yes	P	149	UF	No	Plm	29.3		Fail		ND		ND		ND		ND		ND		ND		31.2	UF	Fail	33.8		P	P	27.1		Yes	No		Plm
R-12	468	1	28-Oct-07	68	ND	ND	ND	8.15	Fld	Yes	Yes	P	150	UF	No	Plm	33.1		Fail		ND		ND		ND		ND		ND		ND		36.0	UF	Fail	33.9		P	P	27.4		Yes	No		Plm
R-12	468	1	28-Oct-07	69	ND	ND	ND	8.14	Fld	Yes	Yes	P	150	UF	No	Plm	27.3		Fail		ND		ND		ND		ND		ND		ND		32.2	UF	Fail	35.5		P	P	28.3		Yes	No		Plm
R-12	468	1	28-Oct-07	70	ND	ND	ND	8.15	Fld	Yes	Yes	P	152	UF	No	Plm	25.3		Fail		ND		ND		ND		ND		ND		ND		29.9	UF	Fail	35.8		P	P	28.4		Yes	No		Plm
R-12	468	1	28-Oct-07	71	ND	ND	ND	8.15	Fld	Yes	Yes	P	151	UF	No	Plm	21.9		Fail		ND		ND		ND		ND		ND		ND		28.5	UF	Fail	36.6		P	P	28.1		Yes	No		Plm
R-12	468	1	28-Oct-07	72	ND	ND	ND	8.14	Fld	Yes	Yes	P	148	UF	No	Plm	16		Fail		ND		ND		ND		ND		ND		ND		26.5	UF	Fail	36.0		P	P	28.2		Yes	No		Plm
R-12	468	1	28-Oct-07	73	ND	ND	ND	8.14	Fld	Yes	Yes	P	144	UF	No	Plm	29.1		Fail		ND		ND		ND		ND		ND		ND		24.4	UF	Fail	36.2		P	P	28.7		Yes	No		Plm
R-12	468	1	28-Oct-07	74	ND	ND	ND	8.15	Fld	Yes	Yes	P	146	UF	No	Plm	11.2		Fail		ND		ND		ND		ND		ND		ND		21.6	UF	Fail	35.3		P	P	29.4		Yes	No		Plm
R-12	468	1	28-Oct-07	75	ND	ND	ND	8.14	Fld	Yes	Yes	P	144	UF	No	Plm	9.55		Fail		ND		ND		ND		ND		ND		ND		19.0	UF	Fail	39.8		P	P	29.5		Yes	No		Plm
R-12	468	1	28-Oct-07	62	ND	ND	ND	8.13	Fld	Yes	Yes	P	147	UF	No	Plm	9.76		Fail		ND		ND		ND		ND		ND		ND		15.9	UF	Fail	38.5		P	P	30.7		Yes	No		Plm
R-12	468	1	28-Oct-07	71	ND	ND	ND	8.13	Fld	Yes	Yes	P	144	UF	No	Plm	9.76		Fail		ND		ND		ND		ND		ND		ND		15.9	UF	Fail	38.9		P	P	30.8		Yes	No		Plm
R-12	468	1	28-Oct-07	76	ND	ND	ND	8.12	Fld	Yes	Yes	P	147	UF	No	Plm	8.67		Fail		ND		ND		ND		ND		ND		ND		11.5	UF	Fail	40.6		P	P	31.5		Yes	No		Plm
R-12	468	1	28-Oct-07	77	ND	ND	ND	8.11	Fld	Yes	Yes	P	144	UF	No	Plm	9.08		Fail		ND		ND		ND		ND		ND		ND		11.0	UF	Fail	37.1		P	P	32.6		Yes	No		Plm
R-12	468	1	28-Oct-07	78	ND	ND	ND	8.10	Fld	Yes	Yes	P	147	UF	No	Plm	7.6		Fail		ND		ND		ND		ND		ND		ND		9.13	UF	Fail	39.3		P	P	33.3		Yes	No		Plm
R-12	468	1	28-Oct-07	79	ND	ND	ND	8.09	Fld	Yes	Yes	P	148	UF	No	Plm	7.68		Fail		ND		ND		ND		ND		ND		ND		7.91	UF	Fail	40.9		P	P	34.8		Yes	No		Plm
R-12	468	1	28-Oct-07	80	ND	ND	ND	8.08	Fld	Yes	Yes	P	148	UF	No	Plm	8.16		Fail		ND		ND		ND		ND		ND		ND		5.39	UF	Fail	42.3		P	P	36.6		Yes	No		Plm
R-12	468	1	29-Oct-07	81	ND	ND	ND	7.72	Fld	Yes	Yes	P	151	UF	No	Plm	39.4		Fail		ND		ND		ND		ND		ND		ND		4.18	UF	Fail	40.7		P	P	38.1		Yes	No		Plm
R-12	468	1	29-Oct-07	82	ND	ND	ND	8.31	Fld	Yes	Yes	P	138	UF	No	Plm	47.8		Fail		ND		ND		ND		ND		ND		ND		3.65	UF	Fail	44.3		P	P	34.3		Yes	No		Plm
R-12	468	1	29-Oct-07	63	ND	ND	ND	8.12	Fld	Yes	Yes	P	152	UF	No	Plm	4.01		P		ND		ND		ND		ND		ND		ND		3.44	UF	Fail	44.5		P	P	38.8		Yes	No		Plm
R-12	468	1	29-Oct-07	72	ND	ND	ND	8.12	Fld	Yes	Yes	P	148	UF	No	Plm	4.21		P		ND		ND		ND		ND		ND		ND		3.48	UF	Fail	46.8		P	P	37.0		Yes	No		Plm
R-12	468	1	29-Oct-07	83	ND	ND	ND	8.10	Fld	Yes	Yes	P	153	UF	No	Plm	4.89		P		ND		ND		ND		ND		ND		ND		5.60	UF	Fail	41.7		P	P	38.2		Yes	No		Plm
R-12	468	1	29-Oct-07	84	ND	ND	ND	8.09	Fld	Yes	Yes	P	155	UF	No	Plm	5.29		Fail		ND		ND		ND		ND		ND		ND		4.95	UF	Fail	42.0		P	P	38.5		Yes	No		Plm
R-12	468	1	29-Oct-07	85	ND	ND	ND	8.07	Fld	Yes	Yes	P	154	UF	No	Plm	5.69		Fail		ND		ND		ND		ND		ND		ND		3.57	UF	Fail	37.5		P	P	39.7		Yes	No		Plm
R-12	468	1	29-Oct-07	86/83?	ND	ND	ND	8.08	Fld	Yes	Yes	P	155	UF	No	Plm	6.11		Fail		ND		ND		ND		ND		ND		ND		2.85	UF	Fail	40.3		P	P	39.9		Yes	No		Plm
R-12	468	1	29-Oct-07	87	ND	ND	ND	8.06	Fld	Yes	Yes	P	155	UF	No	Plm	6.27		Fail		ND		ND		ND		ND		ND		ND		2.34	UF	Fail	42.8		P	P	40.4		Yes	No		Plm
R-12	468	1	29-Oct-07	88	ND	ND	ND	8.05	Fld	Yes	Yes	P	156	UF	No	Plm	6.26		Fail		ND		ND		ND		ND		ND		ND		2.08	UF	Fail	46.5		P	P	40.8		Yes	No		Plm
R-12	468	1	29-Oct-07	64	ND	ND	ND	8.05	Fld	Yes	Yes	P	156	UF	No	Plm	5.83		Fail		ND		ND		ND		ND		ND		ND		2.04	UF	Fail	40.1		P	P	41.3		Yes	No		Plm
R-12	468	1	29-Oct-07	73	ND	ND	ND	8.05	Fld	Yes	Yes	P	155	UF	No	Plm	5.83		Fail		ND		ND		ND		ND		ND		ND		1.90	UF	Fail	36.2		P	P	42.3		Yes	No		Plm
R-12	468	1	29-Oct-07	89	ND	ND	ND	8.04	Fld	Yes	Yes	P	155	UF	No	Plm	6.35		Fail		ND		ND		ND		ND		ND		ND		1.84	UF	Fail	39.6		P	P	42.2		Yes	No		Plm

Table B-1
Results of Well Screen Analysis for R-12 (Screen 1)
During the 2007 Pumping Test Conducted on October 28–29, 2007

Well	Port depth (ft)	Scr #	Sample collection date	Event	Cl mg/L	Test A1		F mg/L	Lab Qual Code	Test A2	Mg mg/L	Test E3	Test E3		NO3-N mg/L	Lab Qual Code	Test Gen-5	Test C10	Test C11	ORP	Comment	Test C3	DO		Test C11		ClO4 ug/L	Lab Qual Code	Test Gen-4	Test C7		PO4-P	Lab Qual Code	UOM	Test A6	Na mg/L	Molar ratio Na/Cl	Test A4		SO4 mg/L	Lab Qual Code	Test C1	Test A5	Sulfide		Test C2
						mg/L				mg/L		mg/L	mg/L					mg/L	mg/L			mV			mg/L					ug/L		Thres			mg/L			mg/L				mg/L	mg/L			mg/L
						<UL				<UL		<UL	<UL				<UL	>LL	<UL			>LL			>LL				<UL	>LL		as			<UL			<UL				>LL	<UL			<UL
						3.6				0.23		6.2	6.2				2.7	0.22	2.7			0			2				0.5	0.22		0.250			0.08			13				1.1	4.3			0.01
R-12	468	1	18-Sep-00	1	16.0	Plm		0.52		Plm	9.0	Fail		<	0.10	U	P	Fail		—		ND	—		ND	<	1.04	U	DL	DL	<	0.05	U		P	26.0	2.5	Plm?		3.6		P	P	—		ND
R-12	468	1	14-Mar-01	2	13.0	Plm		0.68		Plm	4.3	P			0.23		P	P		—		ND	—		ND	<	0.958	U	DL	DL	<	0.05	U		P	23.0	2.7	Plm?	<	1.0	U	Fail	P	—		ND
R-12	468	1	13-Jun-01	3	12.0	Plm		0.51		Plm	1.2	P		<	0.05	U	P	Fail		—		ND	—		ND	<	0.958	U	DL	DL		0.44	N*		Fail	21.0	2.7	Plm?	<	1.0	U	Fail	P	—		ND
R-12	468	1	7-Sep-01	4	11.2	Plm		0.56		Plm	0.6	P			0.03	J	P	Fail		—		ND	—		ND		—		ND	ND		0.44			Fail	25.6	3.5	Plm?		0.3		Fail	P	—		ND
R-12	468	1	31-Jul-02	5	10.8	Plm		0.69		Plm	0.6	P			0.04	J	P	Fail		-152.6		Fail	3.3	FLD	P	<	1.45	U	DL	DL		0.21			Fail	24.9	3.6	Plm?	<	0.2	U	Fail	P	—		ND
R-12	468	1	2-Feb-04	6	9.9	Plm		0.65		Plm	0.5	P		<	0.01	U	P	Fail		—		ND	—		ND	<	4	U	DL	DL		—			ND	20.3	3.2	Plm?		0.4	J	Fail	P	—		ND
R-12	468	1	2-Jun-04	7	10.3	Plm		0.66		Plm	0.5	P		<	0.01	U	P	Fail		—		ND	—		ND	<	0.05	U	P	Fail		—			ND	20.8	3.1	Plm?	<	0.2	U	Fail	P	—		ND
R-12	468	1	16-Jun-05	8	10.1	Plm		0.67		Plm	0.5	P		<	0.003	U	P	Fail		91	WBH	P	4.8	FLD	P	<	0.05	U	P	Fail		0.324			Fail	20.6	3.1	Plm?		1.3		P	P	—		ND
R-12	468	1	2-Feb-06	9	9.5	Plm		0.62		Plm	0.4	P		<	0.017	U	P	Fail		—		ND	3.1	FLD	P	<	0.05	U	P	Fail		0.367			Fail	19.1	3.1	Plm?		1.3		P	P	—		ND
R-12	468	1	11-Jul-06	10	9.5	Plm		0.60		Plm	0.4	P		<	0.014	U	P	Fail		—		ND	—		ND	<	0.05	U	P	Fail		0.194			Fail	17.2	2.8	Plm?		1.6		P	P	—		ND
R-12	468	1	29-Sep-06	11	34.2	Plm		0.34		Plm	13.5	Fail			4.20		Plm	P		134		P	3.5	FLD	P		1.49		Fail	P	<	0.059	J-		P	18.8	0.8	Plm?		22.3		P	Plm	<0.003	E6	P
R-12	468	1	28-Oct-07	67	21.7	Plm		0.67		Plm	7.4		Plm		1.21		No	P	Plm	-17		Fail	0.49		Fail	<	5	U	DL	DL		0.02		mg/L as PO4	P	31.4	2.2	Plm?		24.5		P	Plm	0.009	U	P
R-12	468	1	28-Oct-07	68	22.2	Plm		0.72		Plm	7.4		Plm		1.21		No	P	Plm	-6		Fail	0.61		Fail	<	5	U	DL	DL	<	0.01	U	mg/L as PO4	P	33.0	2.3	Plm?		25.9		P	Plm	0.009	U	P
R-12	468	1	28-Oct-07	69	22.7	Plm		0.69		Plm	7.7		Plm		1.29		No	P	Plm	-27		Fail	0.64		Fail	<	5	U	DL	DL		0.02		mg/L as PO4	P	31.8	2.2	Plm?		24.9		P	Plm	0.009	U	P
R-12	468	1	28-Oct-07	70	23.3	Plm		0.72		Plm	7.7		Plm		1.37		No	P	Plm	-17		Fail	0.64		Fail	<	5	U	DL	DL		0.02		mg/L as PO4	P	31.0	2.0	Plm?		24.7		P	Plm	0.009	U	P
R-12	468	1	28-Oct-07	71	23.5	Plm		0.68		Plm	7.9		Plm		1.39		No	P	Plm	-8		Fail	0.61		Fail	<	5	U	DL	DL		0.03		mg/L as PO4	P	31.3	2.1	Plm?		24.2		P	Plm	0.009	U	P
R-12	468	1	28-Oct-07	72	23.8	Plm		0.70		Plm	8.0		Plm		1.44		No	P	Plm	-3		Fail	0.62		Fail	<	5	U	DL	DL		0.02		mg/L as PO4	P	30.3	2.0	Plm?		23.9		P	Plm	0.009	U	P
R-12	468	1	28-Oct-07	73	24.0	Plm		0.67		Plm	7.9		Plm		1.49		No	P	Plm	-5		Fail	0.61		Fail	<	5	U	DL	DL		0.03		mg/L as PO4	P	28.6	1.8	Plm?		23.1		P	Plm	0.009	U	P
R-12	468	1	28-Oct-07	74	24.7	Plm		0.68		Plm	7.8		Plm		1.59		No	P	Plm	-19		Fail	0.61		Fail	<	5	U	DL	DL		0.02		mg/L as PO4	P	27.0	1.7	Plm?		22.7		P	Plm	0.009	U	P
R-12	468	1	28-Oct-07	75	24.8	Plm		0.65		Plm	9.0		Plm		1.61		No	P	Plm	-7		Fail	0.63		Fail	<	5	U	DL	DL		0.03		mg/L as PO4	P	30.1	1.9	Plm?		22.2		P	Plm	0.009	U	P
R-12	468	1	28-Oct-07	62	25.6	Plm		0.65		Plm	8.3		Plm		1.73		No	P	Plm	-33		Fail	0.64		Fail	<	5	U	DL	DL	<	0.01	U	mg/L as PO4	P	26.3	1.6	Plm?		21.8		P	Plm	0.009	U	P
R-12	468	1	28-Oct-07	71	25.3	Plm		0.64		Plm	8.4		Plm		1.70		No	P	Plm	-33		Fail	0.64		Fail	<	5	U	DL	DL		0.02		mg/L as PO4	P	26.7	1.6	Plm?		21.5		P	Plm	0.009	U	P
R-12	468	1	28-Oct-07	76	26.9	Plm		0.65		Plm	9.0		Plm		1.93		No	P	Plm	-32		Fail	0.71		Fail	<	5	U	DL	DL		0.02		mg/L as PO4	P	25.0	1.4	Plm?		21.4		P	Plm	0.009	U	P
R-12	468	1	28-Oct-07	77	27.8	Plm		0.63		Plm	8.3		Plm		2.09		No	P	Plm	-23		Fail	0.77		Fail	<	5	U	DL	DL		0.02		mg/L as PO4	P	21.8	1.2	Plm?		21.9		P	Plm	0.009	U	P
R-12	468	1	28-Oct-07	78	28.7	Plm		0.65		Plm	8.9		Plm		2.26		No	P	Plm	-25		Fail	0.78		Fail	<	5	U	DL	DL		0.01		mg/L as PO4	P	22.3	1.2	Plm?		21.9		P	Plm	0.009	U	P
R-12	468	1	28-Oct-07	79	29.3	Plm		0.64		Plm	9.1		Plm		2.33		No	P	Plm	-33		Fail	0.85		Fail	<	5	U	DL	DL		0.02		mg/L as PO4	P	22.0	1.2	Plm?		21.9		P	Plm	0.009	U	P
R-12	468	1	28-Oct-07	80	30.4	Plm		0.63		Plm	9.5		Plm		2.51		No	P	Plm	-70		Fail	0.96		Fail	<	5	U	DL	DL		0.01		mg/L as PO4	P	20.9	1.1	Plm?		22.0		P	Plm	0.009	U	P
R-12	468	1	29-Oct-07	81	30.2	Plm		0.54		Plm	9.4		Plm		2.43		No	P	Plm	-167		Fail	1.21		Fail	<	5	U	DL	DL	<	0.01	U	mg/L as PO4	P	19.4	1.0	Plm?		20.9		P	Plm	0.009	U	P
R-12	468	1	29-Oct-07	82	28.1	Plm		0.53		Plm	9.0		Plm		1.60		No	P	Plm	-232		Fail	0.19		Fail	<	5	U	DL	DL	<	0.01	U	mg/L as PO4	P	19.2	1.1	Plm?		19.1		P	Plm	0.009	U	P
R-12	468	1	29-Oct-07	63	30.2	Plm		0.56		Plm	9.5		Plm		2.48		No	P	Plm	-19		Fail	0.73		Fail	<	5	U	DL	DL		0.01		mg/L as PO4	P	19.1	1.0	Plm?		21.0		P	Plm	0.009	U	P
R-12	468	1	29-Oct-07	72	30.2	Plm		0.55		Plm	9.7		Plm		2.47		No	P	Plm	-19		Fail	0.73		Fail	<	5	U	DL	DL		0.01		mg/L as PO4	P	19.6	1.0	Plm?		20.9		P	Plm	0.009	U	P
R-12	468	1	29-Oct-07	83	31.1	Plm		0.56		Plm	9.9		Plm		2.69		No	P	Plm	10		P	1.14		Fail	<	5	U	DL	DL	<	0.01	U	mg/L as PO4	P	19.9	1.0	Plm?		22.0		P	Plm	0.009	U	P
R-12	468	1	29-Oct-07	84	31.6	Plm		0.55		Plm	10.7		Plm		2.80		No	P	Plm	9		P	1.28		Fail	<	5	U	DL	DL	<	0.01	U	mg/L as PO4	P	20.8	1.0	Plm?		22.0		P	Plm	0.009	U	P
R-12	468	1	29-Oct-07	85	32.2	Plm		0.55		Plm	9.8		Plm		2.90		No	P	Plm	-12		Fail	1.24		Fail	<	5	U	DL	DL	<	0.01	U	mg/L as PO4	P	18.6	0.9	Plm?		22.2		P	Plm	0.009	U	P
R-12	468	1	29-Oct-07	86/83?	32.6	Plm		0.60		Plm	11.0		Plm		2.99		No	P	Plm	-31		Fail	1.37		Fail	<	5	U	DL	DL	<	0.01	U	mg/L as PO4	P	20.0	0.9	Plm?		22.2		P	Plm	0.009	U	P
R-12	468	1	29-Oct-07	87	32.6	Plm		0.55		Plm	11.1		Plm		3.01		No	P	Plm	10		P	1.55		Fail	<	5	U	DL	DL	<	0.01	U	mg/L as PO4	P	19.7	0.9	Plm?		22.1		P	Plm	0.009	U	P
R-12	468	1	29-Oct-07	88	32.8	Plm		0.54		Plm	12.8		Plm		3.04		No	P	Plm	14		P	1.57		Fail	<	5	U	DL	DL	<	0.01	U	mg/L as PO4	P	22.3	1.1	Plm?		22.2		P	Plm	0.009	U	P
R-12	468	1	29-Oct-07	64	33.0	Plm		0.54		Plm	11.4		Plm		3.09		No	P	Plm	-18		Fail	1.59		Fail	<	5	U	DL	DL	<	0.01	U	mg/L as PO4	P	19.6	0.9	Plm?		22.3		P	Plm	0.009	U	P
R-12	468	1	29-Oct-07	73	32.9	Plm		0.53		Plm	10.3		Plm		3.07		No	P	Plm	-18		Fail	1.59		Fail	<	5	U	DL	DL	<	0.01	U	mg/L as PO4	P	18.1	0.8	Plm?		22.2		P	Plm	0.009	U	P
R-12	468	1	29-Oct-07	89	33.4	Plm		0.58		Plm	11.6		Plm		3.15		No	P	Plm	-10		Fail	1.75		Fail	<	5	U	DL	DL	<	0.01	U	mg/L as PO4	P	19.7	0.9	Plm?		22.4		P	Plm	0.009	U	P

Table B-1
Results of Well Screen Analysis for R-12 (Screen 1)
During the 2007 Pumping Test Conducted on October 28–29, 2007

Well	Port depth (ft)	Scr #	Sample collection date	Event		B ug/L	Lab Qual Code	Test A1		Cr (F) ug/L	Lab Qual Code		Test Gen-6	Test C9		Cr (NF) ug/L	Lab Qual Code	Test F3	Ratio Cr (NF/F)	Test F4		Fe (F) ug/L	Lab Qual Code		Test C5	Fe (NF) ug/L	Lab Qual Code	Test F1	Ratio Fe(NF/F)	Test F2	Mn (F) ug/L	Lab Qual Code		Test C6		Ni (F) ug/L	Lab Qual Code		Test F5	Sr ug/L		Test D2	Test E3	Test E3		U ug/L	Lab Qual Code	
														ug/L				ug/L		Ratio					ug/L			ug/L		Ratio				ug/L					ug/L			ug/L	ug/L	ug/L				
								<UL					<UL	>LL				<UL		<UL					<UL			<UL		<UL				<UL					<UL			>LL	<UL	<UL				
								16					2.4	0.5				10		5					103			500		10				14					50			19	155	155				
R-12	468	1	18-Sep-00	1		96	B	Plm	<	0.3	U		P	Fail	<	0.33	U	P	1	NA	<	160			Fail	1200		No	7.5	P	860			Fail		5.1	B		P	130		P	P			0.86		
R-12	468	1	14-Mar-01	2	<	110		Plm	<	0.3	U		P	Fail	<	0.34	U	P	1	NA		600			Fail	1400		No	2.3	P	720			Fail		0.91	B		P	71		P	P			0.055	BE	
R-12	468	1	13-Jun-01	3		120		Plm	<	0.2	U		P	Fail	<	2	B	P	10	NA	<	150			Fail	610		No	4.1	P	200			Fail	<	1.9	B		P	25		P	P			0.027	B	
R-12	468	1	7-Sep-01	4		122		Plm	<	0.6	U		P	DL		6.33		P	11	NA		109			Fail	521		No	4.8	P	54.8			Fail		2.34	B		P	13.9		Red	P		<	0.003	U	
R-12	468	1	31-Jul-02	5		108		Plm		1.8		UF	P	P		1.83	B	P	—	NA		350		UF	Fail	350		Yes	—	NA	108		UF	Fail	<	3.35	B	UF	P	16.8	UF	Red	P		<	15.6	U	UF
R-12	468	1	2-Feb-04	6		75.7		Plm		6.0	JN-	UF	UF	P		6.03	JN-	P	—	NA		209		UF	Fail	209		Yes	—	NA	95.2		UF	Fail		4.97	B	UF	P	15.4	UF	Red	P		<	0.157	B	UF
R-12	468	1	2-Jun-04	7		77		Plm		0.5	B	UF	P	P		0.528	B	P	—	NA		205		UF	Fail	205		Yes	—	NA	68.1		UF	Fail	<	2.28	B	UF	P	17.4	UF	Red	P			0.026	B	UF
R-12	468	1	16-Jun-05	8		74		Plm	<	1.0	U		P	DL	<	1	U	P	1	NA		113	*		Fail	107		Yes	0.9	NA	54.3			Fail		1.4	J		P	19.9		P	P		<	0.05	U	
R-12	468	1	2-Feb-06	9		67.6		Plm	<	1.2	J		P	P	<	1	J	P	1	NA		54.1	J		P	260		Yes	4.8	NA	35.8			Fail		1.5	J		P	14.9		Red	P		<	0.065	J	
R-12	468	1	11-Jul-06	10		67.9		Plm	<	1.0	U		P	DL	<	1	U	P	1	NA		58.6	J		P	106		Yes	1.8	NA	37.2			Fail		1.3	J		P	15.2		Red	P		<	0.05	U	
R-12	468	1	29-Sep-06	11		103		Plm	<	1.1	J		P	P	<	4.8		P	4	NA		62.3	J		P	578		No	9.3	P	109			Fail		6.3			P	180		P	Fail			3.4		
R-12	468	1	28-Oct-07	67		36		Plm		1.5			P	P		2.4		P	1.6	NA		351			Rnst Blnk	2382		Rnst Blnk	6.8	NA	124			Rnst Blnk		3.4			P	115		Yes	No	Plm		5.0		
R-12	468	1	28-Oct-07	68		97		Plm		1.5			P	P		2.1		P	1.4	NA		317			Rnst Blnk	2101		Rnst Blnk	6.6	NA	127			Rnst Blnk		3.5			P	116		Yes	No	Plm		5.0		
R-12	468	1	28-Oct-07	69		71		Plm		1.7			P	P		2.5		P	1.5	NA		205			Rnst Blnk	1665		Rnst Blnk	8.1	NA	118			Rnst Blnk		3.4			P	118		Yes	No	Plm		5.6		
R-12	468	1	28-Oct-07	70		66		Plm		1.5			P	P		2.5		P	1.6	NA		325			Rnst Blnk	1308		Rnst Blnk	4.0	NA	116			Rnst Blnk		3.7			P	117		Yes	No	Plm		5.6		
R-12	468	1	28-Oct-07	71		67		Plm		1.7			P	P		2.3		P	1.3	NA		275			Rnst Blnk	1247		Rnst Blnk	4.5	NA	116			Rnst Blnk		3.8			P	122		Yes	No	Plm		5.8		
R-12	468	1	28-Oct-07	72		65		Plm		1.7			P	P		2.4		P	1.4	NA		242			Rnst Blnk	1208		Rnst Blnk	5.0	NA	112			Rnst Blnk		3.8			P	121		Yes	No	Plm		5.5		
R-12	468	1	28-Oct-07	73		100		Plm		1.8			P	P		1.8		P	1.0	NA		307			Rnst Blnk	1140		Rnst Blnk	3.7	NA	111			Rnst Blnk		3.8			P	121		Yes	No	Plm		2.0		
R-12	468	1	28-Oct-07	74		69		Plm		1.4			P	P		2.3		P	1.7	NA		252			Rnst Blnk	1012		Rnst Blnk	4.0	NA	102			Rnst Blnk		13.7			P	121		Yes	No	Plm		2.2		
R-12	468	1	28-Oct-07	75		74		Plm		2.5			Fail	P		2.9		P	1.2	NA		277			Rnst Blnk	1054		Rnst Blnk	3.8	NA	116			Rnst Blnk		5.3			P	139		Yes	No	Plm		3.1		
R-12	468	1	28-Oct-07	62		52		Plm		1.6			P	P		2.2		P	1.4	NA		429			Rnst Blnk	1084		Rnst Blnk	2.5	NA	111			Rnst Blnk		4.4			P	125		Yes	No	Plm		5.5		
R-12	468	1	28-Oct-07	71		48		Plm		1.9			P	P		2.6		P	1.4	NA		351			Rnst Blnk	1094		Rnst Blnk	3.1	NA	114			Rnst Blnk		4.5			P	128		Yes	No	Plm		6.0		
R-12	468	1	28-Oct-07	76		72		Plm		1.8			P	P		2.8		P	1.5	NA		247			Rnst Blnk	1055		Rnst Blnk	4.3	NA	108			Rnst Blnk		7.9			P	136		Yes	No	Plm		2.6		
R-12	468	1	28-Oct-07	77		65		Plm		2.3			P	P		2.3		P	1.0	NA		318			Rnst Blnk	1092		Rnst Blnk	3.4	NA	96			Rnst Blnk		5.6			P	124		Yes	No	Plm		3.2		
R-12	468	1	28-Oct-07	78		105		Plm		2.3			P	P		3.7		P	1.6	NA		191			Rnst Blnk	1095		Rnst Blnk	5.7	NA	99			Rnst Blnk		5.5			P	135		Yes	No	Plm		3.1		
R-12	468	1	28-Oct-07	79		78		Plm		2.4			P	P		2.4		P	1.0	NA		150			Rnst Blnk	1154		Rnst Blnk	7.7	NA	96			Rnst Blnk		8.7			P	137		Yes	No	Plm		3.1		
R-12	468	1	28-Oct-07	80		69		Plm		1.7			P	P		2.4		P	1.4	NA		154			Rnst Blnk	1075		Rnst Blnk	7.0	NA	92			Rnst Blnk		5.2			P	143		Yes	No	Plm		2.8		
R-12	468	1	29-Oct-07	81		59		Plm		1.8			P	P		6.9		P	3.9	NA		795			Rnst Blnk	5512		Rnst Blnk	6.9	NA	112			Rnst Blnk		5.3			P	139		Yes	No	Plm		2.1		
R-12	468	1	29-Oct-07	82		61		Plm		2.0			P	P		2.6		P	1.3	NA		1459			Rnst Blnk	5451		Rnst Blnk	3.7	NA	148			Rnst Blnk		5.3			P	138		Yes	No	Plm		2.0		
R-12	468	1	29-Oct-07	63		60		Plm		1.5			P	P		1.2		P	0.8	NA		179			Rnst Blnk	711		Rnst Blnk	4.0	NA	90			Rnst Blnk		5.3			P	138		Yes	No	Plm		2.9		
R-12	468	1	29-Oct-07	72		87		Plm		1.0			P	P		1.1		P	1.1	NA		260			Rnst Blnk	659		Rnst Blnk	2.5	NA	96			Rnst Blnk		4.6			P	143		Yes	No	Plm		2.8		
R-12	468	1	29-Oct-07	83		65		Plm		2.1			P	P		2.4		P	1.1	NA		271			Rnst Blnk	816		Rnst Blnk	3.0	NA	86			Rnst Blnk		5.3			P	144		Yes	No	Plm		2.8		
R-12	468	1	29-Oct-07	84		58		Plm		1.7			P	P		1.8		P	1.1	NA		253			Rnst Blnk	897		Rnst Blnk	3.6	NA	83			Rnst Blnk		5.4			P	154		Yes	No	Plm		2.7		
R-12	468	1	29-Oct-07	85		45		Plm		2.3			P	P		2.3		P	1.0	NA		189			Rnst Blnk	1051		Rnst Blnk	5.6	NA	70			Rnst Blnk		6.4			P	141		Yes	No	Plm		3.3		
R-12	468	1	29-Oct-07	86/83?		53		Plm		1.4			P	P		1.9		P	1.4	NA		208			Rnst Blnk	1031		Rnst Blnk	4.9	NA	76			Rnst Blnk		5.4			P	156		Yes	No	Plm		2.8		
R-12	468	1	29-Oct-07	87		53		Plm		1.9			P	P		2.0		P	1.1	NA		1110			Rnst Blnk	1053		Rnst Blnk	0.9	NA	74			Rnst Blnk		5.1			P	161		Yes	No	Plm		2.8		
R-12	468	1	29-Oct-07	88		118		Plm		1.9			P	P		2.3		P	1.2	NA		257			Rnst Blnk	1153		Rnst Blnk	4.5	NA	81			Rnst Blnk		6.6			P	183		Yes	No	Plm		3.2		
R-12	468	1	29-Oct-07	64		93		Plm		1.9			P	P		2.9		P	1.5	NA		258			Rnst Blnk	1092		Rnst Blnk	4.2	NA	68			Rnst Blnk		6.1			P	161		Yes	No	Plm		3.3		
R-12	468	1	29-Oct-07	73		80		Plm		4.3			Fail	P		1.8		P	0.4	NA		191			Rnst Blnk	1211		Rnst Blnk	6.3	NA	61			Rnst Blnk		10.8			P	146		Yes	No	Plm		5.0		
R-12	468	1	29-Oct-07	89		87		Plm		1.8			P	P		2.0		P	1.1	NA		341			Rnst Blnk	1109		Rnst Blnk	3.3	NA	69			Rnst Blnk		5.5			P	164		Yes	No	Plm		2.8		

Table B-1
Results of Well Screen Analysis for R-12 (Screen 1)
During the 2007 Pumping Test Conducted on October 28–29, 2007

Well	Port depth (ft)	Scr #	Sample collection date	Event	Test C8	Test D1	Test E5	Test E5		V ug/L	Lab qual code		Test C4		Zn ug/L	Lab Qual Code		Test D4	Tests Passed	Tests Failed	Tests with P/Fail outcome	% Pass	Is 3H detected?	General Indicators	Category A	Category B	Category C								Category D			
					ug/L	ug/L	ug/L	ug/L										ug/L							Residual	Residual		Redox Indicators							Sorption			
					>LL	>LL	<UL	<UL					>LL					>LL							Inorganics	Organics	SO4	Fe/Mn						NO3				
					0.1	0.1	0.72	0.72					0.5					0.5										V	Fe	Mn	ClO4	U	Cr		U	Sr	Ba	Zn
R-12	468	1	18-Sep-00	1	P	P	Fail		<	0.33	U		Fail	<	9.3	B		P	17	12	29	59	Yes	+Alk		NH3, TKN, TOC		V	Fe	Mn			Cr	NO3				
R-12	468	1	14-Mar-01	2	Fail	Red	P		<	0.38	U		Fail		1.6	B		P	18	10	28	64	Yes	+Alk		NH3, TKN, TOC	SO4	V	Fe	Mn		U	Cr					
R-12	468	1	13-Jun-01	3	Fail	Red	P		<	0.38	U		Fail	<	0.39	B		Fail	15	12	27	56	Yes		PO4	NH3, TKN, TOC	SO4	V	Fe	Mn		U	Cr	NO3				Zn
R-12	468	1	7-Sep-01	4	Fail	Red	P			0.49	B		Fail	<	1.76	B		P	12	14	26	46	Yes	+pH, Turb	PO4	Ace, NH3, TKN, TOC	SO4	V	Fe	Mn		U		NO3				
R-12	468	1	31-Jul-02	5	DL	DL	DL			1.23	B	UF	P	<	9.07		UF	UF	14	10	24	58	Yes	+pH	PO4	NH3, TOC	SO4, ORP		Fe	Mn				NO3				
R-12	468	1	2-Feb-04	6	P	P	P		<	0.61	U	UF	Fail	<	3.85	B	UF	UF	14	9	23	61	Yes	+pH		NH3, TOC	SO4	V	Fe	Mn				NO3				
R-12	468	1	2-Jun-04	7	Fail	Red	P		<	0.61	U	UF	Fail	<	4.48	B	UF	UF	15	9	24	63		+pH			SO4	V	Fe	Mn	ClO4	U		NO3				
R-12	468	1	16-Jun-05	8	Fail	Red	P		<	1	U		DL	<	9.2	J*		P	19	10	29	66		+pH	PO4	NH3, TKN			Fe	Mn	ClO4	U		NO3				
R-12	468	1	2-Feb-06	9	Fail	Red	P		<	1	U		DL	<	2	U		DL	18	9	27	67	Yes	+pH	PO4	NH3, TKN				Mn	ClO4	U		NO3				
R-12	468	1	11-Jul-06	10	Fail	Red	P		<	1	U		DL		4.3	J		P	17	10	27	63	Yes	+pH	PO4	NH3, TKN, TOC				Mn	ClO4	U		NO3				
R-12	468	1	29-Sep-06	11	P	P	Fail			3	J		P		53			P	24	9	33	73	Yes	+Alk		Ace, TOC				Mn								
R-12	468	1	28-Oct-07	67	P	P	No	Plm		18.0			P		18			P	15	4	19	79	ND	Turb		TOC	ORP							DO				
R-12	468	1	28-Oct-07	68	P	P	No	Plm		18.5			P		18			P	15	4	19	79	ND	Turb		TOC	ORP							DO				
R-12	468	1	28-Oct-07	69	P	P	No	Plm		14.7			P		15			P	15	4	19	79	ND	Turb		TOC	ORP							DO				
R-12	468	1	28-Oct-07	70	P	P	No	Plm		16.7			P		17			P	15	4	19	79	ND	Turb		TOC	ORP							DO				
R-12	468	1	28-Oct-07	71	P	P	No	Plm		14.6			P		15			P	15	4	19	79	ND	Turb		TOC	ORP							DO				
R-12	468	1	28-Oct-07	72	P	P	No	Plm		18.6			P		19			P	15	4	19	79	ND	Turb		TOC	ORP							DO				
R-12	468	1	28-Oct-07	73	P	P	No	Plm		5.5			P		16			P	15	4	19	79	ND	Turb		TOC	ORP							DO				
R-12	468	1	28-Oct-07	74	P	P	No	Plm		4.4			P		55			P	15	4	19	79	ND	Turb		TOC	ORP							DO				
R-12	468	1	28-Oct-07	75	P	P	No	Plm		7.1			P		19			P	14	5	19	74	ND	Turb		TOC	ORP							DO				
R-12	468	1	28-Oct-07	62	P	P	No	Plm		18.5			P		18			P	15	4	19	79	ND	Turb		TOC	ORP							DO				
R-12	468	1	28-Oct-07	71	P	P	No	Plm		16.4			P		16			P	15	4	19	79	ND	Turb		TOC	ORP							DO				
R-12	468	1	28-Oct-07	76	P	P	No	Plm		5.2			P		33			P	15	4	19	79	ND	Turb		TOC	ORP							DO				
R-12	468	1	28-Oct-07	77	P	P	No	Plm		5.4			P		21			P	15	4	19	79	ND	Turb		TOC	ORP							DO				
R-12	468	1	28-Oct-07	78	P	P	No	Plm		5.8			P		15			P	15	4	19	79	ND	Turb		TOC	ORP							DO				
R-12	468	1	28-Oct-07	79	P	P	No	Plm		5.7			P		19			P	15	4	19	79	ND	Turb		TOC	ORP							DO				
R-12	468	1	28-Oct-07	80	P	P	No	Plm		4.1			P		10			P	15	4	19	79	ND	Turb		TOC	ORP							DO				
R-12	468	1	29-Oct-07	81	P	P	No	Plm		2.2			P		26			P	15	4	19	79	ND	Turb		TOC	ORP							DO				
R-12	468	1	29-Oct-07	82	P	P	No	Plm		2.7			P		93			P	15	4	19	79	ND	Turb		TOC	ORP							DO				
R-12	468	1	29-Oct-07	63	P	P	No	Plm		3.3			P		20			P	16	3	19	84	ND			TOC	ORP							DO				
R-12	468	1	29-Oct-07	72	P	P	No	Plm		3.0			P		21			P	16	3	19	84	ND			TOC	ORP							DO				
R-12	468	1	29-Oct-07	83	P	P	No	Plm		5.1			P		17			P	17	2	19	89	ND			TOC								DO				
R-12	468	1	29-Oct-07	84	P	P	No	Plm		3.5			P		13			P	16	3	19	84	ND	Turb		TOC								DO				
R-12	468	1	29-Oct-07	85	P	P	No	Plm		4.2			P		12			P	15	4	19	79	ND	Turb		TOC	ORP							DO				
R-12	468	1	29-Oct-07	86/83?	P	P	No	Plm		3.0			P		10			P	15	4	19	79	ND	Turb		TOC	ORP							DO				
R-12	468	1	29-Oct-07	87	P	P	No	Plm		3.5			P		29			P	16	3	19	84	ND	Turb		TOC								DO				
R-12	468	1	29-Oct-07	88	P	P	No	Plm		3.5			P		11			P	16	3	19	84	ND	Turb		TOC								DO				
R-12	468	1	29-Oct-07	64	P	P	No	Plm		3.4			P		12			P	15	4	19	79	ND	Turb		TOC	ORP							DO				
R-12	468	1	29-Oct-07	73	P	P	No	Plm		8.4			P		18			P	14	5	19	74	ND	Turb		TOC	ORP							DO				
R-12	468	1	29-Oct-07	89	P	P	No	Plm		3.4			P		12			P	15	4	19	79	ND	Turb		TOC	ORP							DO				

Table B-1
Results of Well Screen Analysis for R-12 (Screen 1)
During the 2007 Pumping Test Conducted on October 28–29, 2007

Well	Port depth (ft)	Scr #	Sample collection date	Event		Category E				Category F	General Indicators							Category A Inorganic Indicators						Category B Organic Indicators				Category C1 Redox (SO4)			Category C2 Redox (Fe/Mn)			
						Carbonate Minerals				Metal Corrosion	Mod water 3H	Gen-1 In pH	Gen-2 Alk	Gen-3 Turb	Gen-4 ClO4	Gen-5 NO3-N	Gen-6 Cr	A1 B	A2 Cl	A3 Na	A4 SO4	A5 F	A6 PO4	B1 Ace	B2 NH3	B3 TKN	B4 TOC	C1 SO4	C2 S	C3 ORP	C4 V	C5 Fe	C6 Mn	C7 ClO4
					Ba	Ca	Mg	Sr	U		UL=17	range	UL=52	UL=5	UL=0.5	UL=2.6	UL=2.4	UL=16	UL=3.6	UL=13	UL=4.	UL=0.23	UL=0.08	5	0.05	0.35	1.1	LL=1.1	UL=0.010	LL=0	LL=0.5	UL=103	UL=14	LL=0.22
R-12	468	1	18-Sep-00	1		+Ca	Mg		U?		Yes	P	Fail	P	DL	P	P	Plm	Plm	Plm?	P	Plm	P	DL	Fail	Fail	Fail	P	-ND-	-ND-	Fail	Fail	Fail	DL
R-12	468	1	14-Mar-01	2							Yes	P	Fail	P	DL	P	P	Plm	Plm	Plm?	P	Plm	P	-ND-	Fail	Fail	Fail	Fail	-ND-	-ND-	Fail	Fail	Fail	DL
R-12	468	1	13-Jun-01	3							Yes	P	P	ND	DL	P	P	Plm	Plm	Plm?	P	Plm	Fail	-ND-	Fail	Fail	Fail	Fail	-ND-	-ND-	Fail	Fail	Fail	DL
R-12	468	1	7-Sep-01	4		−Ca					Yes	Fail	Err	Fail	ND	P	P	Plm	Plm	Plm?	P	Plm	Fail	Fail	Fail	Fail	Fail	Fail	-ND-	-ND-	Fail	Fail	Fail	ND
R-12	468	1	31-Jul-02	5		−Ca					Yes	Fail	P	P	DL	P	P	Plm	Plm	Plm?	P	Plm	Fail	-ND-	Fail	-ND-	Fail	Fail	-ND-	Fail	P	Fail	Fail	DL
R-12	468	1	2-Feb-04	6		−Ca					Yes	Fail	P	P	DL	P	UF	Plm	Plm	Plm?	P	Plm	ND	-ND-	Fail	-ND-	Fail	Fail	-ND-	-ND-	Fail	Fail	Fail	DL
R-12	468	1	2-Jun-04	7		−Ca					-ND-	Fail	P	P	P	P	P	Plm	Plm	Plm?	P	Plm	ND	P	-ND-	-ND-	ND	Fail	-ND-	-ND-	Fail	Fail	Fail	Fail
R-12	468	1	16-Jun-05	8		−Ca					-ND-	Fail	P	P	P	P	P	Plm	Plm	Plm?	P	Plm	Fail	P	Fail	Fail	ND	P	-ND-	P	DL	Fail	Fail	Fail
R-12	468	1	2-Feb-06	9		−Ca					Yes	Fail	P	P	P	P	P	Plm	Plm	Plm?	P	Plm	Fail	P	Fail	Fail	ND	P	-ND-	-ND-	DL	P	Fail	Fail
R-12	468	1	11-Jul-06	10		−Ca					Yes	Fail	P	P	P	P	P	Plm	Plm	Plm?	P	Plm	Fail	P	Fail	Fail	Fail	P	-ND-	-ND-	DL	P	Fail	Fail
R-12	468	1	29-Sep-06	11		+Ca	Mg	Sr	U?		Yes	P	Fail	P	Fail	Fail	P	Plm	Plm	Plm?	Plm	Plm	P	Fail	P	P	Fail	P	P	P	P	P	Fail	P
R-12	468	1	28-Oct-07	67							-ND-	P	Plm	Fail	DL	Plm	P	Plm	Plm	Plm?	Plm	Plm	P	-ND-	-ND-	-ND-	Fail	P	P	Fail	P	NA	NA	DL
R-12	468	1	28-Oct-07	68							-ND-	P	Plm	Fail	DL	Plm	P	Plm	Plm	Plm?	Plm	Plm	P	-ND-	-ND-	-ND-	Fail	P	P	Fail	P	NA	NA	DL
R-12	468	1	28-Oct-07	69							-ND-	P	Plm	Fail	DL	Plm	P	Plm	Plm	Plm?	Plm	Plm	P	-ND-	-ND-	-ND-	Fail	P	P	Fail	P	NA	NA	DL
R-12	468	1	28-Oct-07	70							-ND-	P	Plm	Fail	DL	Plm	P	Plm	Plm	Plm?	Plm	Plm	P	-ND-	-ND-	-ND-	Fail	P	P	Fail	P	NA	NA	DL
R-12	468	1	28-Oct-07	71							-ND-	P	Plm	Fail	DL	Plm	P	Plm	Plm	Plm?	Plm	Plm	P	-ND-	-ND-	-ND-	Fail	P	P	Fail	P	NA	NA	DL
R-12	468	1	28-Oct-07	72							-ND-	P	Plm	Fail	DL	Plm	P	Plm	Plm	Plm?	Plm	Plm	P	-ND-	-ND-	-ND-	Fail	P	P	Fail	P	NA	NA	DL
R-12	468	1	28-Oct-07	73							-ND-	P	Plm	Fail	DL	Plm	P	Plm	Plm	Plm?	Plm	Plm	P	-ND-	-ND-	-ND-	Fail	P	P	Fail	P	NA	NA	DL
R-12	468	1	28-Oct-07	74							-ND-	P	Plm	Fail	DL	Plm	P	Plm	Plm	Plm?	Plm	Plm	P	-ND-	-ND-	-ND-	Fail	P	P	Fail	P	NA	NA	DL
R-12	468	1	28-Oct-07	75							-ND-	P	Plm	Fail	DL	Plm	Fail	Plm	Plm	Plm?	Plm	Plm	P	-ND-	-ND-	-ND-	Fail	P	P	Fail	P	NA	NA	DL
R-12	468	1	28-Oct-07	62							-ND-	P	Plm	Fail	DL	Plm	P	Plm	Plm	Plm?	Plm	Plm	P	-ND-	-ND-	-ND-	Fail	P	P	Fail	P	NA	NA	DL
R-12	468	1	28-Oct-07	71							-ND-	P	Plm	Fail	DL	Plm	P	Plm	Plm	Plm?	Plm	Plm	P	-ND-	-ND-	-ND-	Fail	P	P	Fail	P	NA	NA	DL
R-12	468	1	28-Oct-07	76							-ND-	P	Plm	Fail	DL	Plm	P	Plm	Plm	Plm?	Plm	Plm	P	-ND-	-ND-	-ND-	Fail	P	P	Fail	P	NA	NA	DL
R-12	468	1	28-Oct-07	77							-ND-	P	Plm	Fail	DL	Plm	P	Plm	Plm	Plm?	Plm	Plm	P	-ND-	-ND-	-ND-	Fail	P	P	Fail	P	NA	NA	DL
R-12	468	1	28-Oct-07	78							-ND-	P	Plm	Fail	DL	Plm	P	Plm	Plm	Plm?	Plm	Plm	P	-ND-	-ND-	-ND-	Fail	P	P	Fail	P	NA	NA	DL
R-12	468	1	28-Oct-07	79							-ND-	P	Plm	Fail	DL	Plm	P	Plm	Plm	Plm?	Plm	Plm	P	-ND-	-ND-	-ND-	Fail	P	P	Fail	P	NA	NA	DL
R-12	468	1	28-Oct-07	80							-ND-	P	Plm	Fail	DL	Plm	P	Plm	Plm	Plm?	Plm	Plm	P	-ND-	-ND-	-ND-	Fail	P	P	Fail	P	NA	NA	DL
R-12	468	1	29-Oct-07	81							-ND-	P	Plm	Fail	DL	Plm	P	Plm	Plm	Plm?	Plm	Plm	P	-ND-	-ND-	-ND-	Fail	P	P	Fail	P	NA	NA	DL
R-12	468	1	29-Oct-07	82							-ND-	P	Plm	Fail	DL	Plm	P	Plm	Plm	Plm?	Plm	Plm	P	-ND-	-ND-	-ND-	Fail	P	P	Fail	P	NA	NA	DL
R-12	468	1	29-Oct-07	63							-ND-	P	Plm	P	DL	Plm	P	Plm	Plm	Plm?	Plm	Plm	P	-ND-	-ND-	-ND-	Fail	P	P	Fail	P	NA	NA	DL
R-12	468	1	29-Oct-07	72							-ND-	P	Plm	P	DL	Plm	P	Plm	Plm	Plm?	Plm	Plm	P	-ND-	-ND-	-ND-	Fail	P	P	Fail	P	NA	NA	DL
R-12	468	1	29-Oct-07	83							-ND-	P	Plm	P	DL	Plm	P	Plm	Plm	Plm?	Plm	Plm	P	-ND-	-ND-	-ND-	Fail	P	P	P	P	NA	NA	DL
R-12	468	1	29-Oct-07	84							-ND-	P	Plm	Fail	DL	Plm	P	Plm	Plm	Plm?	Plm	Plm	P	-ND-	-ND-	-ND-	Fail	P	P	P	P	NA	NA	DL
R-12	468	1	29-Oct-07	85							-ND-	P	Plm	Fail	DL	Plm	P	Plm	Plm	Plm?	Plm	Plm	P	-ND-	-ND-	-ND-	Fail	P	P	Fail	P	NA	NA	DL
R-12	468	1	29-Oct-07	86/83?							-ND-	P	Plm	Fail	DL	Plm	P	Plm	Plm	Plm?	Plm	Plm	P	-ND-	-ND-	-ND-	Fail	P	P	Fail	P	NA	NA	DL
R-12	468	1	29-Oct-07	87							-ND-	P	Plm	Fail	DL	Plm	P	Plm	Plm	Plm?	Plm	Plm	P	-ND-	-ND-	-ND-	Fail	P	P	P	P	NA	NA	DL
R-12	468	1	29-Oct-07	88							-ND-	P	Plm	Fail	DL	Plm	P	Plm	Plm	Plm?	Plm	Plm	P	-ND-	-ND-	-ND-	Fail	P	P	P	P	NA	NA	DL
R-12	468	1	29-Oct-07	64							-ND-	P	Plm	Fail	DL	Plm	P	Plm	Plm	Plm?	Plm	Plm	P	-ND-	-ND-	-ND-	Fail	P	P	Fail	P	NA	NA	DL
R-12	468	1	29-Oct-07	73							-ND-	P	Plm	Fail	DL	Plm	Fail	Plm	Plm	Plm?	Plm	Plm	P	-ND-	-ND-	-ND-	Fail	P	P	Fail	P	NA	NA	DL
R-12	468	1	29-Oct-07	89							-ND-	P	Plm	Fail	DL	Plm	P	Plm	Plm	Plm?	Plm	Plm	P	-ND-	-ND-	-ND-	Fail	P	P	Fail	P	NA	NA	DL

Table B-1
Results of Well Screen Analysis for R-12 (Screen 1)
During the 2007 Pumping Test Conducted on October 28–29, 2007

Well	Port depth (ft)	Scr #	Sample collection date	Event			Category C3 Redox (NO3)			Category D Absorption				Category E Carbonate Mineralogy						Category F Metal Corrosion					Categories Under Which Drilling Flags Are to be Assigned					
					C8	C9	C10	C11	D1	D2	D3	D4	E1	E2a	E2b	E2	E3	E4	E5	F1	F2	F3	F4	F5						
					U	Cr	NO3-N	DO	U	Sr	Ba	Zn	Ba	Ca	Ca	Ca	Mg	Sr	U	FeT	FeR	CrT	CrR	Ni	A	B	C	D	E	F
					LL=0.1	LL=0.5	LL=0.22	LL=2	LL=0.1	LL=19	LL=1.	LL=0.5	UL=72	LL=4.6	UL=1	In range	UL=6.2	UL=155	UL=0.72	UL=500	UL=10	UL=10	UL=5	UL=5						
R-12	468	1	18-Sep-00	1	P	Fail	Fail	-ND-	P	P	P	P	P	Yes	No	Fail	Fail	P	Fail	No	P	P	NA	P	–	Organics	Fe	–	+Ca, Mg, U?	–
R-12	468	1	14-Mar-01	2	Fail	Fail	P	-ND-	Red	P	P	P	P	Yes	Yes	P	P	P	P	No	P	P	NA	P	–	Organics	SO4	–	–	–
R-12	468	1	13-Jun-01	3	Fail	Fail	Fail	-ND-	Red	P	P	Fail	P	Yes	Yes	P	P	P	P	No	P	P	NA	P	PO4	Organics	SO4	Zn	–	–
R-12	468	1	7-Sep-01	4	Fail	DL	Fail	-ND-	Red	Red	P	P	P	No	Yes	Fail	P	P	P	No	P	P	NA	P	PO4	Organics	SO4	–	−Ca	–
R-12	468	1	31-Jul-02	5	DL	P	Fail	P	DL	Red	P	UF	P	No	Yes	Fail	P	P	DL	Yes	NA	P	NA	P	PO4	Organics	SO4	–	−Ca	–
R-12	468	1	2-Feb-04	6	P	P	Fail	-ND-	P	Red	P	UF	P	No	Yes	Fail	P	P	P	Yes	NA	P	NA	P	–	Organics	SO4	–	−Ca	–
R-12	468	1	2-Jun-04	7	Fail	P	Fail	-ND-	Red	Red	P	UF	P	No	Yes	Fail	P	P	P	Yes	NA	P	NA	P	–	–	SO4	–	−Ca	–
R-12	468	1	16-Jun-05	8	Fail	DL	Fail	P	Red	P	P	P	P	No	Yes	Fail	P	P	P	Yes	NA	P	NA	P	PO4	Organics	Fe	–	−Ca	–
R-12	468	1	2-Feb-06	9	Fail	P	Fail	P	Red	Red	P	DL	P	No	Yes	Fail	P	P	P	Yes	NA	P	NA	P	PO4	Organics	Mn	–	−Ca	–
R-12	468	1	11-Jul-06	10	Fail	DL	Fail	-ND-	Red	Red	P	P	P	No	Yes	Fail	P	P	P	Yes	NA	P	NA	P	PO4	Organics	Mn	–	−Ca	–
R-12	468	1	29-Sep-06	11	P	P	P	P	P	P	P	P	P	Yes	No	Fail	Fail	Fail	Fail	No	P	P	NA	P	Indeter	Organics	Mn	–	+Ca, Mg, Sr, U?	–
R-12	468	1	28-Oct-07	67	P	P	P	Fail	P	Plm	P	P	P	Yes	No	Plm	Plm	Plm	Plm	NA	NA	P	NA	P	Indeter	Organics	SO4	–	–	–
R-12	468	1	28-Oct-07	68	P	P	P	Fail	P	Plm	P	P	P	Yes	No	Plm	Plm	Plm	Plm	NA	NA	P	NA	P	Indeter	Organics	SO4	–	–	–
R-12	468	1	28-Oct-07	69	P	P	P	Fail	P	Plm	P	P	P	Yes	No	Plm	Plm	Plm	Plm	NA	NA	P	NA	P	Indeter	Organics	SO4	–	–	–
R-12	468	1	28-Oct-07	70	P	P	P	Fail	P	Plm	P	P	P	Yes	No	Plm	Plm	Plm	Plm	NA	NA	P	NA	P	Indeter	Organics	SO4	–	–	–
R-12	468	1	28-Oct-07	71	P	P	P	Fail	P	Plm	P	P	P	Yes	No	Plm	Plm	Plm	Plm	NA	NA	P	NA	P	Indeter	Organics	SO4	–	–	–
R-12	468	1	28-Oct-07	72	P	P	P	Fail	P	Plm	P	P	P	Yes	No	Plm	Plm	Plm	Plm	NA	NA	P	NA	P	Indeter	Organics	SO4	–	–	–
R-12	468	1	28-Oct-07	73	P	P	P	Fail	P	Plm	P	P	P	Yes	No	Plm	Plm	Plm	Plm	NA	NA	P	NA	P	Indeter	Organics	SO4	–	–	–
R-12	468	1	28-Oct-07	74	P	P	P	Fail	P	Plm	P	P	P	Yes	No	Plm	Plm	Plm	Plm	NA	NA	P	NA	P	Indeter	Organics	SO4	–	–	–
R-12	468	1	28-Oct-07	75	P	P	P	Fail	P	Plm	P	P	P	Yes	No	Plm	Plm	Plm	Plm	NA	NA	P	NA	P	Indeter	Organics	SO4	–	–	–
R-12	468	1	28-Oct-07	62	P	P	P	Fail	P	Plm	P	P	P	Yes	No	Plm	Plm	Plm	Plm	NA	NA	P	NA	P	Indeter	Organics	SO4	–	–	–
R-12	468	1	28-Oct-07	71	P	P	P	Fail	P	Plm	P	P	P	Yes	No	Plm	Plm	Plm	Plm	NA	NA	P	NA	P	Indeter	Organics	SO4	–	–	–
R-12	468	1	28-Oct-07	76	P	P	P	Fail	P	Plm	P	P	P	Yes	No	Plm	Plm	Plm	Plm	NA	NA	P	NA	P	Indeter	Organics	SO4	–	–	–
R-12	468	1	28-Oct-07	77	P	P	P	Fail	P	Plm	P	P	P	Yes	No	Plm	Plm	Plm	Plm	NA	NA	P	NA	P	Indeter	Organics	SO4	–	–	–
R-12	468	1	28-Oct-07	78	P	P	P	Fail	P	Plm	P	P	P	Yes	No	Plm	Plm	Plm	Plm	NA	NA	P	NA	P	Indeter	Organics	SO4	–	–	–
R-12	468	1	28-Oct-07	79	P	P	P	Fail	P	Plm	P	P	P	Yes	No	Plm	Plm	Plm	Plm	NA	NA	P	NA	P	Indeter	Organics	SO4	–	–	–
R-12	468	1	28-Oct-07	80	P	P	P	Fail	P	Plm	P	P	P	Yes	No	Plm	Plm	Plm	Plm	NA	NA	P	NA	P	Indeter	Organics	SO4	–	–	–
R-12	468	1	29-Oct-07	81	P	P	P	Fail	P	Plm	P	P	P	Yes	No	Plm	Plm	Plm	Plm	NA	NA	P	NA	P	Indeter	Organics	SO4	–	–	–
R-12	468	1	29-Oct-07	82	P	P	P	Fail	P	Plm	P	P	P	Yes	No	Plm	Plm	Plm	Plm	NA	NA	P	NA	P	Indeter	Organics	SO4	–	–	–
R-12	468	1	29-Oct-07	63	P	P	P	Fail	P	Plm	P	P	P	Yes	No	Plm	Plm	Plm	Plm	NA	NA	P	NA	P	Indeter	Organics	SO4	–	–	–
R-12	468	1	29-Oct-07	72	P	P	P	Fail	P	Plm	P	P	P	Yes	No	Plm	Plm	Plm	Plm	NA	NA	P	NA	P	Indeter	Organics	SO4	–	–	–
R-12	468	1	29-Oct-07	83	P	P	P	Fail	P	Plm	P	P	P	Yes	No	Plm	Plm	Plm	Plm	NA	NA	P	NA	P	Indeter	Organics	Fe	–	–	–
R-12	468	1	29-Oct-07	84	P	P	P	Fail	P	Plm	P	P	P	Yes	No	Plm	Plm	Plm	Plm	NA	NA	P	NA	P	Indeter	Organics	Fe	–	–	–
R-12	468	1	29-Oct-07	85	P	P	P	Fail	P	Plm	P	P	P	Yes	No	Plm	Plm	Plm	Plm	NA	NA	P	NA	P	Indeter	Organics	SO4	–	–	–
R-12	468	1	29-Oct-07	86/83?	P	P	P	Fail	P	Plm	P	P	P	Yes	No	Plm	Plm	Plm	Plm	NA	NA	P	NA	P	Indeter	Organics	SO4	–	–	–
R-12	468	1	29-Oct-07	87	P	P	P	Fail	P	Plm	P	P	P	Yes	No	Plm	Plm	Plm	Plm	NA	NA	P	NA	P	Indeter	Organics	Fe	–	–	–
R-12	468	1	29-Oct-07	88	P	P	P	Fail	P	Plm	P	P	P	Yes	No	Plm	Plm	Plm	Plm	NA	NA	P	NA	P	Indeter	Organics	Fe	–	–	–
R-12	468	1	29-Oct-07	64	P	P	P	Fail	P	Plm	P	P	P	Yes	No	Plm	Plm	Plm	Plm	NA	NA	P	NA	P	Indeter	Organics	SO4	–	–	–
R-12	468	1	29-Oct-07	73	P	P	P	Fail	P	Plm	P	P	P	Yes	No	Plm	Plm	Plm	Plm	NA	NA	P	NA	P	Indeter	Organics	SO4	–	–	–
R-12	468	1	29-Oct-07	89	P	P	P	Fail	P	Plm	P	P	P	Yes	No	Plm	Plm	Plm	Plm	NA	NA	P	NA	P	Indeter	Organics	SO4	–	–	–

Table B-2
Constituents of Contaminant Plumes Present in LANL Monitoring Wells

									Plume Constituents															
Scr ID	Sat Zone	Well	Port depth (ft)	Scr #	Watershed	Modern water present	Upgradient source for contaminated	Plume present?	Tritium	B	Cl	F	Na	ClO4	Cr	NO3	SO4	U	Ca	Mg	Ni	TOC	Other
33	IP	R-12	468	1	Sandia	Yes	SWSS, Power Plant	X	X	X	X	X	X	X	—	X	X	X	X	X	—	—	—
34	IP	R-12	507	2	Sandia	Yes	SWSS, Power Plant	X	X	X	X	X	—	X	—	X	X	—	—	—	—	—	—
35	RT	R-12	811	3	Sandia	Yes	SWSS, Power Plant	X	X	X	X	—	—	X	—	X	X	—	—	—	—	—	—

IP = intermediate perched aquifer
RT = Regional aquifer (top)

X = Yes (present)
— = Not known with certainty to be present
? = Likely to be present, but not certain due to inadequate data record

					B	Ba	TOC		Ca	Cl	ClO4		Cr	F		Fe	Alk	Mg	Mn	Na	Ni	NO3-N		PO4		S		SO4	Sr	U	V	Zn	
Original row	**Sequence of collection**	**Truncated ID**	**F/UF**	**SAMPLE ID**	**B rslt**	**Ba rslt**	**TOC rslt**	**TOC (U)**	**Ca rslt**	**Cl(-) ppm**	**ClO4(-) ppm**	**ClO4(-) (U)**	**Cr rslt**	**F(-) ppm**	**F(-) (U)**	**Fe rslt**	**Alk-CO_3+HCO_3 rslt**	**Mg rslt**	**Mn rslt**	**Na rslt**	**Ni rslt**	**NO-3-N rslt**	**NO-3-N (U)**	**PO4(-3) rslt**	**PO4(-3) (U)**	**S2- rslt**	**S2- (U)**	**SO4(-2) rslt**	**Sr rslt**	**U rslt**	**V rslt**	**Zn rslt**	**Status**
1	na	na	UF	EU07100G12R101-S	0.013	0.008	0.58		0.82	0.10	0.0005	U	0.002	0.01	U	6.11		0.07	0.235	0.30	0.004	0.024		0.01	U			0.23	0.003	0.0002	0.617	0.643	
2	na	na	UF	EU07100G12R102-S	0.002	0.003	0.27		0.34	0.08	0.0005	U	0.001	0.01	U	4.07		0.04	0.012	0.22	0.001	0.021		0.01	U			0.16	0.001	0.0002	0.009	0.009	
3	na	na	UF	EU07100G12R101-S	0.002	0.001	0.20	U	0.01		0.0005	U	0.001			0.01	0	0.00	0.000	0.00	0.000	0.002	U	0.01	U	0.009	U	0.05	0.001	0.0002	0.001	0.001	
4	1	67	F	EF07100G12R167	0.036	0.034			27.1	21.7	0.005	U	0.001	0.67		0.35	149	7.40	0.124	31.37	0.003	1.205		0.02				24.5	0.115	0.0050	0.018	0.018	
6	2	68	F	EF07100G12R168	0.097	0.034			27.4	22.2	0.005	U	0.002	0.72		0.32	149	7.44	0.127	33.00	0.004	1.215		0.01	U			25.9	0.116	0.0050	0.018	0.018	
8	3	69	F	EF07100G12R169	0.071	0.035			28.3	22.7	0.005	U	0.002	0.69		0.21	149	7.66	0.118	31.81	0.003	1.290		0.02				24.9	0.118	0.0056	0.015	0.015	
10	4	70	F	EF07100G12R170	0.066	0.036			28.4	23.3	0.005	U	0.002	0.72		0.32	149	7.68	0.116	31.00	0.004	1.365		0.02				24.7	0.117	0.0056	0.017	0.017	
12	5	71	F	EF07100G12R171	0.067	0.037			28.1	23.5	0.005	U	0.002	0.68		0.27	149	7.93	0.116	31.31	0.004	1.386		0.03				24.2	0.122	0.0058	0.015	0.015	
14	6	72	F	EF07100G12R172	0.065	0.036			28.2	23.8	0.005	U	0.002	0.70		0.24	149	7.96	0.112	30.33	0.004	1.440		0.02				23.9	0.121	0.0055	0.019	0.019	
16	7	73	F	EF07100G12R173	0.100	0.036			28.7	24.0	0.005	U	0.002	0.67		0.31	149	7.91	0.111	28.61	0.004	1.492		0.03				23.1	0.121	0.0020	0.005	0.016	
18	8	74	F	EF07100G12R174	0.069	0.035			29.4	24.7	0.005	U	0.001	0.68		0.25	149	7.76	0.102	27.04	0.014	1.586		0.02				22.7	0.121	0.0022	0.004	0.055	
20	9	75	F	EF07100G12R175	0.074	0.040			29.5	24.8	0.005	U	0.002	0.65		0.28	149	8.96	0.116	30.11	0.005	1.614		0.03				22.2	0.139	0.0031	0.007	0.019	
22	10	62	F	EF07100G12R162	0.052	0.038			30.7	25.6	0.001	U	0.002	0.65		0.43	149	8.27	0.111	26.32	0.004	1.727		0.01	U			21.8	0.125	0.0055	0.018	0.018	
24	11	71	F	EF07100G12R171	0.048	0.039			30.8	25.3	0.001	U	0.002	0.64		0.35	149	8.45	0.114	26.65	0.004	1.699		0.02				21.5	0.128	0.0060	0.016	0.016	
26	12	76	F	EF07100G12R176	0.072	0.041			31.5	26.9	0.005	U	0.002	0.65		0.25	149	8.96	0.108	24.97	0.008	1.930		0.02				21.4	0.136	0.0026	0.005	0.033	
28	13	77	F	EF07100G12R177	0.065	0.037			32.6	27.8	0.005	U	0.002	0.63		0.32	149	8.29	0.096	21.82	0.006	2.091		0.02				21.9	0.124	0.0032	0.005	0.021	
30	14	78	F	EF07100G12R178	0.105	0.039			33.3	28.7	0.005	U	0.002	0.65		0.19	149	8.91	0.099	22.29	0.005	2.258		0.01				21.9	0.135	0.0031	0.006	0.015	
32	15	79	F	EF07100G12R179	0.078	0.041			34.8	29.3	0.005	U	0.002	0.64		0.15	149	9.10	0.096	22.03	0.009	2.326		0.02				21.9	0.137	0.0031	0.006	0.019	
34	16	80	F	EF07100G12R180	0.069	0.042			36.6	30.4	0.005	U	0.002	0.63		0.15	149	9.54	0.092	20.92	0.005	2.509		0.01				22.0	0.143	0.0028	0.004	0.010	
36	17	81	F	EF07100G12R181	0.059	0.041			38.1	30.2	0.005	U	0.002	0.54		0.80	149	9.37	0.112	19.40	0.005	2.427		0.01	U			20.9	0.139	0.0021	0.002	0.026	
38	18	82	F	EF07100G12R182	0.061	0.044			34.3	28.1	0.005	U	0.002	0.53		1.46	149	8.99	0.148	19.15	0.005	1.605		0.01	U			19.1	0.138	0.0020	0.003	0.093	
40	19	63	F	EF07100G12R163	0.060	0.044			38.8	30.2	0.005	U	0.001	0.56		0.18	149	9.53	0.090	19.12	0.005	2.482		0.01				21.0	0.138	0.0029	0.003	0.020	
42	20	72	F	EF07100G12R172	0.087	0.047			37.0	30.2	0.005	U	0.001	0.55		0.26	149	9.74	0.096	19.61	0.005	2.471		0.01				20.9	0.143	0.0028	0.003	0.021	
44	21	83	F	EF07100G12R183	0.065	0.042			38.2	31.1	0.005	U	0.002	0.56		0.27	149	9.90	0.086	19.86	0.005	2.685		0.01	U			22.0	0.144	0.0028	0.005	0.017	
46	22	84	F	EF07100G12R184	0.058	0.042			38.5	31.6	0.005	U	0.002	0.55		0.25	149	10.70	0.083	20.79	0.005	2.798		0.01	U			22.0	0.154	0.0027	0.003	0.013	
48	23	85	F	EF07100G12R185	0.045	0.038			39.7	32.2	0.005	U	0.002	0.55		0.19	149	9.80	0.070	18.58	0.006	2.905		0.01	U			22.2	0.141	0.0033	0.004	0.012	
50	24	86	F	EF07100G12R186	0.053	0.040			39.9	32.6	0.005	U	0.001	0.60		0.21	149	11.01	0.076	20.04	0.005	2.990		0.01	U			22.2	0.156	0.0028	0.003	0.010	
52	25	87	F	EF07100G12R187	0.053	0.043			40.4	32.6	0.005	U	0.002	0.55		1.11	149	11.14	0.074	19.73	0.005	3.014		0.01	U			22.1	0.161	0.0028	0.003	0.029	
54	26	88	F	EF07100G12R188	0.118	0.046			40.8	32.8	0.005	U	0.002	0.54		0.26	149	12.82	0.081	22.33	0.007	3.042		0.01	U			22.2	0.183	0.0032	0.003	0.011	
56	27	64	F	EF07100G12R164	0.093	0.040			41.3	33.0	0.005	U	0.002	0.54		0.26	149	11.38	0.068	19.60	0.006	3.087		0.01	U			22.3	0.161	0.0033	0.003	0.012	
58	28	73	F	EF07100G12R173	0.080	0.036			42.3	32.9	0.005	U	0.004	0.53		0.19	149	10.26	0.061	18.08	0.011	3.071		0.01	U			22.2	0.146	0.0050	0.008	0.018	
60	29	89	F	EF07100G12R189	0.087	0.040			42.2	33.4	0.005	U	0.002	0.58		0.34	149	11.57	0.069	19.65	0.006	3.148		0.01	U			22.4	0.164	0.0028	0.003	0.012	
5	1	67	UF	EU07100G12R167	0.036	0.039	31.2		27.0				0.002			2.38	149	7.48	0.141	31.68	0.005					0.009	U		0.117	0.0068	0.089	0.089	
7	2	68	UF	EU07100G12R168	0.079	0.039	36.0		27.8				0.002			2.10	150	7.63	0.153	33.64	0.004					0.009	U		0.118	0.0060	0.098	0.098	
9	3	69	UF	EU07100G12R169	0.070	0.040	32.2		28.5				0.003			1.66	150	7.83	0.142	33.01	0.004					0.009	U		0.122	0.0067	0.075	0.075	
11	4	70	UF	EU07100G12R170	0.067	0.040	29.9		28.4				0.002			1.31	152	7.95	0.130	31.94	0.004					0.009	U		0.122	0.0064	0.057	0.057	
13	5	71	UF	EU07100G12R171	0.065	0.040	28.5		28.3				0.002			1.25	151	7.93	0.125	31.67	0.004					0.009	U		0.122	0.0063	0.054	0.054	
15	6	72	UF	EU07100G12R172	0.065	0.039	26.5		28.6				0.002			1.21	148	7.97	0.122	30.86	0.004					0.009	U		0.122	0.0060	0.050	0.050	
17	7	73	UF	EU07100G12R173	0.079	0.040	24.4		28.3				0.002			1.14	144	8.25	0.119	30.88	0.004					0.009	U		0.128	0.0022	0.005	0.043	
19	8	74	UF	EU07100G12R174	0.065	0.037	21.6		29.1				0.002			1.01	146	7.62	0.107	27.13	0.017					0.009	U		0.119	0.0024	0.006	0.100	
21	9	75	UF	EU07100G12R175	0.064	0.038	19.0		29.1				0.003			1.05	144	7.85	0.109	26.33	0.005					0.009	U		0.121	0.0029	0.007	0.062	
23	10	62	UF	EU07100G12R162	0.047	0.040	15.9		30.3				0.002			1.08	147	8.17	0.112	26.44	0.005					0.009	U		0.124	0.0063	0.039	0.039	
25	11	71	UF	EU07100G12R171	0.045	0.041	15.9		30.6	0.01			0.003	0.01	U	1.09	144	8.27	0.114	26.48	0.005					0.009	U		0.126	0.0068	0.040	0.040	
27	12	76	UF	EU07100G12R176	0.067	0.041	11.5		31.3				0.003			1.05	147	8.50	0.109	23.99	0.016					0.009	U		0.129	0.0032	0.007	0.104	
29	13	77	UF	EU07100G12R177	0.069	0.043	11.0		32.7				0.002			1.09	144	8.93	0.109	23.64	0.005					0.009	U		0.136	0.0026	0.005	0.041	
31	14	78	UF	EU07100G12R178	0.087	0.043	9.13		33.7				0.004			1.10	147	9.13	0.107	22.80	0.009					0.009	U		0.140	0.0041	0.008	0.061	
33	15	79	UF	EU07100G12R179	0.076	0.047	7.91		36.6				0.002			1.15	148	9.96	0.108	24.30	0.007					0.009	U		0.151	0.0030	0.006	0.047	
35	16	80	UF	EU07100G12R180	0.065	0.044	5.39		38.3				0.002			1.08	148	9.38	0.094	20.91	0.005					0.009	U		0.140	0.0029	0.005	0.039	
37	17	81	UF	EU07100G12R181	0.061	0.053	4.18		38.2				0.007			5.51	151	9.76	0.201	19.95	0.008					0.009	U		0.145	0.0024	0.005	0.822	
39	18	82	UF	EU07100G12R182	0.056	0.056	3.65		35.0				0.003			5.45	138	8.96	0.142	18.97	0.006					0.009	U		0.140	0.0018	0.004	0.213	
41	19	63	UF	EU07100G12R163	0.128	0.054	3.44		38.1				0.001			0.71	152	11.19	0.111	22.55	0.006					0.009	U		0.163	0.0029	0.004	0.043	
43	20	72	UF	EU07100G12R172	0.081	0.048	3.48		37.1				0.001			0.66	148	9.77	0.099	19.74	0.006					0.009	U		0.143	0.0028	0.004	0.043	
45	21	83	UF	EU07100G12R183	0.062	0.046	5.60		37.9				0.002			0.82	153	10.57	0.094	21.13	0.006					0.009	U		0.155	0.0027	0.005	0.037	
47	22	84	UF	EU07100G12R184	0.053	0.043	4.95		38.9				0.002			0.90	155	10.36	0.083	20.23	0.005					0.009	U		0.149	0.0027	0.004	0.032	
49	23	85	UF	EU07100G12R185	0.057	0.045	3.57		38.8				0.002			1.05	154	11.21	0.083	21.02	0.005					0.009	U		0.160	0.0029	0.004	0.033	
51	24	86	UF	EU07100G12R186	0.049	0.041	2.85		39.4				0.002			1.03	155	10.51	0.074	18.95	0.006					0.009	U		0.149	0.0028	0.004	0.033	
53	25	87	UF	EU07100G12R187	0.114	0.041	2.34		40.6				0.002			1.05	155	10.42	0.071	18.78	0.006					0.009	U		0.150	0.0028	0.004	0.029	
55	26	88	UF	EU07100G12R188	0.099	0.044	2.08		41.6				0.002			1.15	156	11.56	0.075	20.61	0.006					0.009	U		0.168	0.0031	0.004	0.031	
57	27	64	UF	EU07100G12R164	0.089	0.042	2.04		41.9				0.003			1.09	156	11.24	0.070	19.49	0.009					0.009	U		0.161	0.0040	0.006	0.037	
59	28	73	UF	EU07100G12R173	0.096	0.047	1.90		41.6				0.002			1.21	155	12.36	0.077	21.54	0.005					0.009	U		0.178	0.0028	0.003	0.026	
61	29	89	UF	EU07100G12R189	0.087	0.043	1.84		41.8				0.002			1.11	155	11.54	0.069	19.51	0.006					0.009	U		0.166	0.0028	0.004	0.026	