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Well Screen Analysis Report, Revision 1

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Responsible program manager:

Ardyth Simmons	Stan Dewart for AS	Program Manager	Environmental Programs LWSP	2/20/07
Printed Name	Signature	Title	Organization	Date

Responsible LANS representative:

Andrew Phelps	[signature]	Associate Director	Environmental Programs	2/16/07
Printed Name	Signature	Title	Organization	Date

Responsible DOE representative:

David Gregory	[signature] for	Federal Project Director	DOE-LASO	2/16/07
Printed Name	Signature	Title	Organization	Date

EXECUTIVE SUMMARY

From 1998 through 2006, 42 wells have been drilled, completed and sampled for hydrogeologic characterization beneath the Pajarito Plateau, either as part of the “Hydrogeologic Workplan” or as part of corrective measures. Concerns about the reliability or representativeness of the groundwater quality data obtained from these wells stem from the potential for residual drilling fluids and additives to mask the present and future detection of contaminants. This report is Revision 1 of the ”Well Screen Analysis Report,” which provided results of a preliminary geochemical evaluation of well screens in the 33 wells that had been completed and sampled as of August 2005. This revision incorporates comments and recommendations of the New Mexico Environment Department as well as suggestions from other reviewers. This revision also presents the evaluation of a complete suite of characterization samples from all of the characterization wells, including several completed and sampled since August 2005.

The primary purpose of this report is to evaluate whether screens in characterization wells are capable of producing data that are reliable and representative of the intermediate-depth groundwater and the regional aquifer. In so doing, this report first establishes a set of geochemical criteria against which to compare the water chemistry measured at each screen. This comparison results in a quantitative estimate of the extent to which the data are judged to be reliable or representative of predrilling groundwater geochemistry. Ratings for the most recent samples from each screen, as of December 2006, are used to determine screens that produce reliable water-quality data at this time and those for which data are potentially compromised by residual drilling artifacts. Of the impacted screens, the report identifies those that appear to be cleaning up over time and those that are the most problematic. It also establishes a technical basis for real-time screening of new data for reliability. In addition, Revision 1 compares screen evaluation results to those presented in Revision 0, identifies apparent differences and trends in groundwater chemistry, and offers potential explanations for them.

This report is being used as one basis for prioritizing the wells and screens that may require rehabilitation. This report also establishes a technical framework for evaluating historic and new water-quality data for representativeness. Details of the evaluation approach, such as indicator species, associated test thresholds, and the list of chemicals that may be affected by residual drilling effects, are likely to continue to be modified in the future. However, the basic framework and the philosophy that underlie the approach are not expected to change.

This report provides a snapshot of water-quality (geochemical) data for samples collected from deep (>200 ft) wells as of December 2006. The wells evaluated in this report include 38 wells constructed under the auspices of the “Hydrogeologic Workplan,” as well as 4 wells installed as part of a corrective measures study in Cañon de Valle. Within the 42 wells are 95 individual screens. Of these screens, 80 were functional and 15 were dry or plugged at the time that this analysis was conducted. Each of the functional screens was analyzed independently for this report.

The screen evaluation addresses only the potential geochemical impacts of products used in drilling. Drilling products are defined as the primary drilling fluids (polymer-based fluids and bentonite mud) and associated drilling additives placed or circulated in the borehole during drilling operations. Drilling and construction of monitoring wells within perched intermediate zones at depths greater than 100 ft or within the regional aquifer require the use of drilling fluids to ensure borehole stability and lubricity. Revision 1 of this report presents a comprehensive picture of drilling fluid use in the evaluated wells (Table 4-19 and Figure 4-1). It is outside the scope of this report to address questions concerning the need for, or the appropriateness of, specific drilling methods and fluids. It is also outside the scope of this report to evaluate any changes to the physical integrity of the well screens and casings resulting from drilling, construction, or development activities.

This report does not examine whether the use of drilling fluids impacted achievement of the characterization objectives of the "Hydrogeologic Workplan," nor whether these wells are suitable for use as monitoring wells under the March 1, 2005, Compliance Order on Consent (Consent Order). Plans for rehabilitation of wells are discussed elsewhere and the results of the pilot rehabilitation study at wells R-12, R-16, and R-20 will be discussed in a separate report.

The initial motivation for preparation of Revision 1 was to address comments of the NMED. A reanalysis of the geochemical data set used in Revision 0, augmented by a more comprehensive data set and additional screens, was performed using additional geochemical indicators for residual drilling effects. The usefulness and limitations of each indicator are discussed. Details of sampling methods and their relevance to sample reliability and representativeness are provided. Although metal corrosion of well screens and casings is not relevant as a potential impact of drilling fluids, corrosion influences water quality; therefore, indicators of well corrosion have been added to the analysis. The principal component statistical analysis has been expanded to clarify details of the data that were used and the numerical outcomes of the analysis. The most significant change in the evaluation protocol used in Revision 1 is a consolidation of the separate components of the tiered geochemical approach used in the original report, in which the application of criteria was determined based upon which primary drilling fluid was used in the screen interval. The revised approach integrates the potential residual effects of both bentonite and organic drilling fluids into a single set of test criteria that are applied to all screens, regardless of the drilling fluid actually used.

The evaluation in Revision 1 used revised background values from an expanded set of 30 background locations, as reported in the "Groundwater Background Investigation Report, Revision 2." Use of revised background values, along with their detailed statistical characterization, allowed for fine-tuning of test threshold values for geochemical indicators. Overall, the use of these revised threshold values actually increased the number of tests passed for many indicator analytes as well as improving the internal consistency among test outcomes.

Many of the findings of Revision 0 are still true in Revision 1:

- The most common drilling artifact is the presence of reducing conditions.
- Single-screen wells show the least impact from residual drilling fluids.
- The majority of the screens in multiple-screen wells appear to be impacted by residual drilling fluids, although nearly all multiple-screen wells have at least one screen interval rated as Good or Very Good.
- About one-third of the most recent water-quality samples from the evaluated screens are ranked as Very Good with respect to providing technically defensible water-quality data.

The two revisions depart from one another with respect to the proportion of screens rated as Fair to Poor for providing reliable water-quality samples. In Revision 0, 23% of the screens were rated Poor; in Revision 1, the proportion rated Poor drops by nearly half, to 12.5%, for the most recent water sample.

A preliminary conclusion in Revision 0 was that some screens appeared to be improving over time. This overall trend is not only confirmed by the outcomes of the evaluation protocol presented in Revision 1 but also made more apparent because of the improved assessment methodology, inclusion of a greatly expanded database, and the passage of time. Nearly 25% of the screens improved over the period covered by this report, whereas previously the number of sampling events available for many of these screens had been too few to establish definitive trends for them.

The enhanced methodology, database and passage of time may also be responsible for revealing another significant trend that was not apparent in Revision 0. Figure ES-1 shows that the distribution of rankings in Revision 1 is somewhat bimodal for the most recent sample, insofar as 65% of the samples are split evenly between Very Good and Fair. This distribution of ratings largely parallels that of the prevailing reducing/oxidizing conditions in the screens. Oxidizing conditions characterize those screens rated Very Good whereas iron-reducing conditions dominate among those screens rated Fair. The bimodal distribution most likely reflects buffering of groundwater geochemistry by mineral phases in the vicinity of the screen, particularly iron-bearing minerals. Thus the emergence of this pattern may have implications for the time that will be required for the most impacted screens to recover to predrilling conditions.

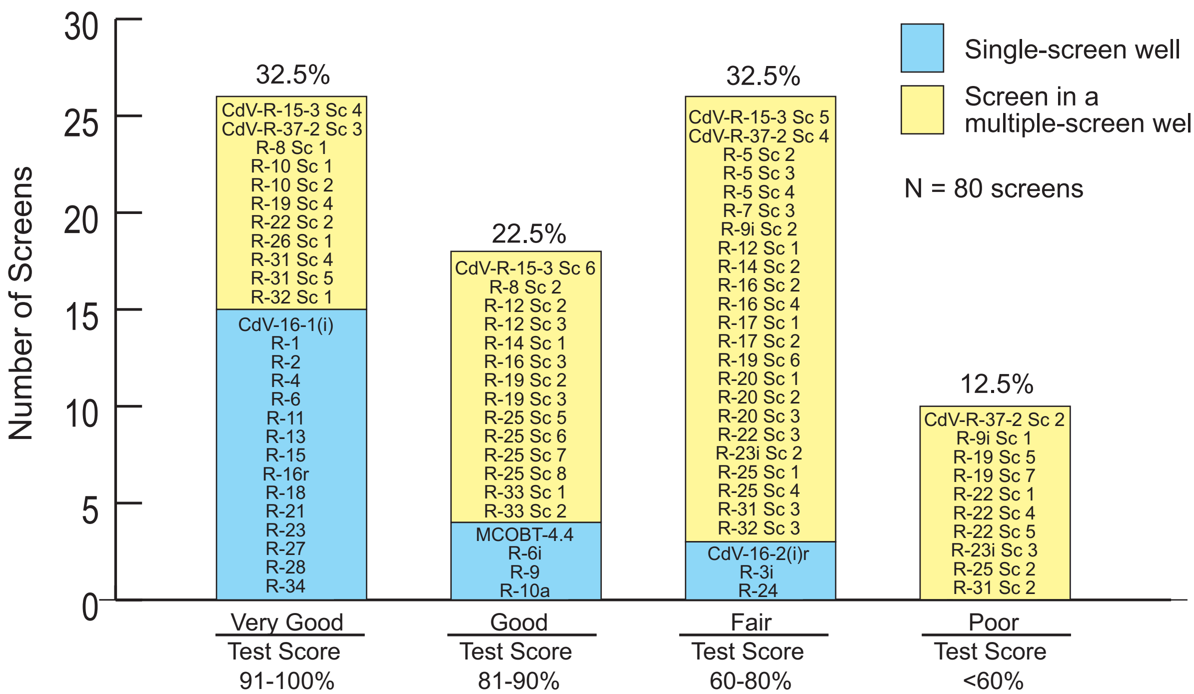

Figure ES-1. Qualitative rating for most recent sample (as of December 31, 2006)

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Acronyms and Abbreviations

AE	alcohol ethoxylate
AES	alcohol ethoxylate sulfate
AOC	area of concern
ASTM	American Society for Testing and Materials
ATSDR	Agency for Toxic Substances and Disease Registry
CA	cluster analysis
CAS	Chemical Abstracts Service
Consent Order	Compliance Order on Consent
COPC	chemical of potential concern

CRDL	contract-required detection limit
DL	detection limit
DNX	hexahydro-1,3-nitroso-5-nitro-1,3,5-triazine
DO	dissolved oxygen
DOC	dissolved organic carbon
DOE	Department of Energy (U.S.)
DQO	data quality objective
DRO	diesel-range organic
ECR	Environmental Characterization and Remediation Group (former LANL group)
EES	Earth and Environmental Sciences (LANL division)
EES-6	Hydrology, Geochemistry, and Geology (an EES group)
EFDB	Environmental Fate Data Base
Eh	oxidation-reduction potential
ECR	Environmental Characterization and Remediation (former LANL group)
ENV	Environmental Stewardship (former LANL division)
EP	Environmental Programs (LANL directorate)
EPA	Environmental Protection Agency (U.S.)
ERDB	Environmental Restoration [Project] database (LANL database)
ER ID	Environmental Restoration [Project] identifier
ERS	Environmental Remediation and Surveillance Program (former LANL program)
ERSS	Environment and Remediation Support Services (LANL division)
ES-PPP	Environmental Stewardship-Pathways Protection Program (LANL)
ESP	Environmental Surveillance Program (LANL)
EXTOXNET	Extension Toxicology Network
F	filtered (sample)
GC-MS	gas chromatography-mass spectrometry
GGRL	Geochemistry and Geomaterials Research Laboratory (LANL)
GSWSED	Groundwater, Surface Water, and Sediment Monitoring Program
HCA	hierarchical cluster analysis
HE	high explosive(s)
HEXP	high explosive degradation products
HMX	high-melting explosive
HSDB	Hazardous Substances Data Bank
ICP	inductively coupled plasma
IDL	instrument detection limit
IFWGMP	interim facility-wide groundwater monitoring plan
LANL	Los Alamos National Laboratory
K_d	distribution coefficient

KMC	K-means cluster
K_{OC}	organic carbon partition coefficient
MDA	material disposal area
MDA	minimum detectable activity
MDL	method detection limit
MGA	modified granular acid
MS	mass spectrometry
MSDS	material safety data sheet
NMED	New Mexico Environment Department
NMED-OB	New Mexico Environment Department DOE Oversight Bureau
NNMCAB	Northern New Mexico Citizen's Advisory Board
NPL	National Priority List
NTU	nephelometric turbidity unit
OPPT	Office of Pollution Prevention and Toxicity (EPA)
ORP	oxidation-reduction potential
PAH	polynuclear aromatic hydrocarbon
PC	principal component
PCA	principal component analysis
PCB	polychlorinated biphenyl
PCOC	potential contaminant of concern
PETN	pentaerythriotol tetranitrate
PIP	Pesticide Information Profile
pH	negative log of the hydrogen concentration in a solution
PM	Pajarito Mesa
PHPA	partially hydrolyzed polyacrylamide/polyacrylate
pzc	point of zero charge
QA	quality assurance
QAP	Quality Assurance Program
QC	quality control
QP	quality procedure
R	regional (characterization well identifier)
R	rejected (when referring to data qualification code)
RCRA	Resource Conservation and Recovery Act
RDX	research department explosive (cyclonite)
redox	oxidation reduction
RN	registry number
RPF	Records Processing Facility (LANL)
RRES	Risk Reduction and Environmental Stewardship (former LANL division)

SOP	standard operating procedure
SOW	statement of work
SRC	Syracuse Research Corporation
SU	standard units
SVOC	semivolatile organic compound
SWMU	solid waste management unit
TA	technical area
TDS	total dissolved solids
TKN	total Kjeldahl nitrogen
TNT	trinitrotoluene
TOC	total organic carbon
TOXNET	Toxicology Data Network
TPH	total petroleum hydrocarbon
TR	timed release
U	undetected (when referring to data qualification code)
UF	nonfiltered (sample)
USGS	United States Geological Survey
VOC	volatile organic compound
WQDB	Water Quality Database
WQH	Water Quality & Hydrology (former LANL group)
WRC	White Rock Canyon
WWW	World Wide Web

Elemental and Chemical Nomenclature

Americium	Am	Neptunium	Np
Ammonia (as Nitrogen)	NH_3-N	Nickel	Ni
Antimony	Sb	Nitrate (as Nitrogen)	NO_3-N
Arsenic	As	Nitrite (as Nitrogen)	NO_2-N
Barium	Ba	Nitrogen	N
Beryllium	Be	Oxygen	O
Bicarbonate	HCO_3	Phosphorus	P
Boron	B	Phosphate (as Phosphorus)	PO_4-P
Bromine	Br	Plutonium	Pu
Cadmium	Cd	Potassium	K
Calcium	Ca	Radium	Ra
Calcium carbonate	$CaCO_3$	Selenium	Se
Carbon	C	Silicon	Si
Cerium	Ce	Silver	Ag
Cesium	Cs	Sodium	Na
Chlorine	Cl	Strontium	Sr
Chromium	Cr	Sulfate	SO_4
Cobalt	Co	Sulfur	S
Copper	Cu	Technetium	Tc
Carbonate	CO_3	Thallium	Tl
Europium	Eu	Thorium	Th
Hydrogen	H	Tin	Sn
Iron	Fe	Tritium	^3H
Lanthanum	La	Uranium	U
Lead	Pb	Vanadium	V
Lithium	Li	Zinc	Zn
Magnesium	Mg		
Manganese	Mn		
Mercury	Hg		
Molybdenum	Mo		
Neodymium	Nd		

1.0 INTRODUCTION

From 1998 through 2006, 42 wells have been drilled and completed for hydrogeologic characterization beneath the Pajarito Plateau as part of the Los Alamos National Laboratory (LANL or the Laboratory) "Hydrogeologic Workplan" (LANL 1998, 059599) or as part of corrective measures. Of the 42 wells, 7 have been completed in perched intermediate zones, 25 have screens in the regional aquifer, and the remaining 10 have screens in both perched intermediate zones and the regional aquifer. Concerns about the reliability or representativeness of the groundwater quality data obtained from these wells stem from the potential for residual drilling fluids and additives to mask the present and future detection of contaminants, as discussed in characterization well geochemistry reports (listed in section 7.3) and by Gilkeson (Gilkeson 2004, 088728). LANL responded to the concerns raised by Gilkeson by presenting hydrogeological and geochemical data collected at selected wells (LANL 2004, 088420). The U.S. Department of Energy (DOE) then requested LANL to provide an in-depth analysis of all screens in wells constructed under the "Hydrogeologic Workplan" that were completed within intermediate perched zones or in the regional aquifer. The U.S. Environmental Protection Agency (EPA) reviewed the criteria selected by the Laboratory for its approach to evaluating the representativeness of water quality data (EPA 2005, 090545). The current document is Revision 1 of the 2005 "Well Screen Analysis Report" (LANL 2005, 091121), which responded to DOE's request by providing results of a geochemical evaluation of well screens in the 33 wells that had been completed and sampled as of August 2005. In addition to updating the report to include wells completed since 2005, this revision also incorporates comments and recommendations of the New Mexico Environment Department (NMED 2006, 094373). This revision also reflects an evolution in the process of evaluating well screens.

This response contains data on radioactive materials, including source, special nuclear, and byproduct material. Information on radioactive materials and radionuclides, including the results of sampling and analysis of radioactive constituents, is voluntarily provided to NMED in accordance with U.S. Department of Energy policy.

1.1 Purpose

The primary purpose of this report is the evaluation of whether screens in characterization wells are capable of producing data that are reliable and representative of the predrilling conditions within intermediate-depth groundwater and the regional aquifer. In so doing, this report first establishes a set of geochemical criteria against which to compare the water chemistry measured at each screen. This comparison results in a quantitative estimate of the extent to which the data are judged as being reliable or representative of predrilling groundwater geochemistry. Ratings for the most recent samples from each screen as of December 2006 are used to define screens that produce reliable water-quality data and those for which data are potentially compromised by residual drilling artifacts. Of the impacted screens, the report identifies those that appear to be cleaning up over time and those that are the most problematic.

The results of this report are being used as the basis of prioritization of wells and screens that may require rehabilitation, if selected for monitoring (LANL 2006, 092535). This report also provides a technical framework for evaluating historic and new water-quality data for representativeness.

1.2 Scope

This report provides a snapshot of water-quality (geochemical) data for samples collected from deep wells as of December 31, 2006. Figure 1-1 shows locations of wells and springs in the Los Alamos area that are the focus of this report. The wells evaluated in this report include 38 wells constructed under the auspices of the "Hydrogeologic Workplan" (LANL 1998, 059599), as well as four wells installed as part of a corrective measures study in Cañon de Valle associated with solid waste management unit (SWMU) 16-021(c), the 260 outfall. Within the 42 wells are 95 individual screens. Of these screens, 80 were functional and 15 were dry, plugged, or had not yet been sampled at the time that this analysis was conducted. Each of the functional screens was analyzed independently for this report.

The screen evaluation primarily addresses the impacts of fluids used in drilling. Drilling fluids can be defined as fluids—and associated drilling additives—placed or circulated in the drilled hole during drilling operations. Drilling and construction of monitoring wells within perched intermediate zones at depths greater than 100 ft or within the regional aquifer require the use of drilling fluids to ensure borehole stability and lubricity. Drilling fluids perform functions that include cleaning cuttings off of the bit and the bottom of the borehole, transporting cuttings to the surface, providing borehole stability, cooling the bit, and lubricating the drill string. Rotary drilling to these depths is not possible without the use of drilling fluids, without incurring substantial risk to the successful completion of the boreholes and installation of the wells. This is particularly true for the complex hydrogeology of the Pajarito Plateau. In addition to chemical products used during drilling, this report also considers effects of chemical products used during well construction and development. It is outside the scope of this report to address questions concerning the need for, or the appropriateness of, specific drilling methods and fluids.

Finally, this revision also evaluates water-quality samples for effects from metal corrosion of well casings and screens.

1.2.1 Revision 1 Modifications

Revision 1 has been prepared to address comments from the NMED (NMED 2006, 094373) and to make other improvements. A reanalysis of the data used in the original report—as well as analysis of new data acquired after that report was prepared—was performed using additional geochemical indicators for groups of analytes. The usefulness and limitations of the indicators are discussed. Details of sampling methods and their relevance to sample outcome are provided. Although well corrosion is not relevant to the potential impact of drilling fluids, corrosion influences water quality; therefore, indicators of well corrosion have been added to the analysis. The principal component analysis performed in section 5 has been expanded to provide additional clarification. Although not related to an NMED comment, the most significant change in Revision 1 is the abandonment of the original report's tiered geochemical approach which focused on evaluating water-quality samples for residual inorganic constituents from bentonite mud, residual organic constituents from drilling polymers, and development of reducing conditions from biodegradation of the organic drilling products. In Revision 1, development of a single systematic set of evaluation criteria recognizes the potential effects of drilling products commonly used in concert with the primary drilling fluids. This efficiency allows for improved automation of the approach. Revision 1 implements an automation algorithm developed in the past year specifically to evaluate historic and current groundwater-quality data with respect to representativeness and to assign qualification flags to samples in LANL's Water Quality Database (WQDB) to indicate those with potential drilling fluid effects.

Revision 1 evaluates a more extensive data set than the original report. Many new data have been collected since the data cutoff of August 2005 for Revision 0. Several new variables have also been added to this revision. Consequently, one cannot easily assess whether a screen's change in rating between revisions 0 and 1 is attributable to a true change in conditions or if it is due solely to the refinement of indicators and modification of approach implemented in this revision.

1.2.2 Topics Outside the Scope of This Report

This report does not examine whether the use of drilling fluids affected the achievement of the characterization objectives of the "Hydrogeologic Workplan," nor whether these wells are suitable for use as monitoring wells under the March 1, 2005, Compliance Order on Consent (Consent Order) signed by the NMED, the DOE, and the University of California.

Other related issues that lie outside the scope of this report include

- specifying actions to be taken for analytes judged as unreliable or not representative of predrilling conditions,
- predicting when an impacted screen may be able to provide chemical data that are reliable and representative of predrilling conditions,
- specifying corrective actions to be taken if a screen is judged as unlikely to produce reliable or representative water-quality samples in the foreseeable future,
- discussing methods for rehabilitating impacted well screens, which is the subject of a separate evaluation, and
- discussing additional factors that may contribute to well screen performance, such as well construction methods and permeability of the geologic formation.

1.3 Organization of the Report

Section 2 describes the methodology and sources used to locate and compile information needed to conduct this analysis, including the development of a list of relevant analytes and their chemical characteristics, well-drilling histories and screen-construction details, and background water-quality parameters that define predrilling groundwater conditions.

Section 3 presents the assumptions used in developing and applying the geochemical criteria used to evaluate water-quality data for individual screens.

Section 4 presents the detailed technical basis of the evaluation process. As a preface for the discussion of the evaluation criteria, section 4.1 summarizes the well drilling, construction, and development methods that were used, and section 4.2 describes groundwater sampling suites, sampling protocols, and sampling frequencies. Sections 4.3 through 4.9 present the methodologies used in the screen evaluation and the analysis of the 80 functioning well screens placed in saturated zones. Section 4.10 provides additional assessment considerations.

Section 5 presents the results of a separately conducted, multivariate statistical approach to evaluating water-quality data through a principal component analysis.

Finally, section 6 summarizes the well screen analysis, conclusions of this report, lessons learned, and potential next steps.

Supporting data and information used to compile this report are provided in the following appendixes:

- Appendix A—chemical characteristics for the analytes and drilling products considered relevant to this analysis, along with chemicals of potential concern (COPCs).
- Appendix B—well and screen characteristics, including timelines for drilling, and development.

- Appendix C—available water-quality data for the geochemical indicator species. The original report included the last three eligible samples (as of August 2005) from each screen. Revision 1 extends that original data set to include new sample data available as of December 2006.
- Appendix D—plots that compare the screen data from Appendix C to each of the geochemical test criteria.
- Appendix E—results of the screen assessment results for 393 samples from the 80 screens and an average score for each screen, as well as for the most recent sample from each screen. These tables are used to prepare the summary figures and to identify trends discussed in section 6.
- Appendix F—details of the principal component analysis, including correlation matrices, factor loadings, and a list of stations used for comparison with the characterization wells.

1.4 Quality Assurance

This evaluation uses validated data that are acquired and reviewed following formal, EPA/LANL-approved quality assurance (QA) procedures as outlined in this section. All groundwater monitoring is conducted as an integrated activity that uses the same personnel, standard operating procedures (SOP)s, laboratory analysis contracts, and data-management systems (LANL 2006, 094147). Monitoring is conducted under procedures that implement the requirements of the program-specific QA project plan ("Quality Assurance Project Plan for the Groundwater, Surface Water, and Sediment Monitoring Program," RRES-WQH-QAPP-GSWSED, R1, located at http://erinternal.lanl.gov/procedures/WQH/QAPP_GSWSED.pdf)

LANL field procedures generally follow guidelines of U.S. Geological Survey (USGS) water-sample collection methods and industrial standards common to environmental sample collection and field measurements, including the collection of field blanks and field duplicates and use of trip blanks. Sample collection, preservation, and measurement of field parameters for groundwater are conducted according to SOPs and quality procedures (QPs) (current versions listed in section 7.4). Field data protocols are discussed in section 4.2.1. Field data have inherent uncertainties, regardless of compliance, particularly with dissolved oxygen (DO), oxidation-reduction potential (ORP), and sulfide. However, it is assumed that these field data are reliable qualitative indicators of oxidation reduction (redox), even if they have quantitative uncertainties (see section 3.0).

Chemical analyses of water samples use commonly accepted analytical methods required under federal regulations such as the Clean Water Act and approved by EPA. Statements of work (SOWs) for contract analytical services that support monitoring activities specify QA guidelines for the contract laboratories, including specific requirements and guidelines for analyzing groundwater samples.

Chemical data are posted on LANL's publicly accessible WQDB web site (http://wqdbworld.lanl.gov) after receipt. These data undergo several stages of review for validation and verification, with their current review status indicated by preliminary and provisional flags in the WQDB. Data verification evaluates the completeness, correctness, consistency, and compliance of a laboratory analytical data package against specific documentation protocols or contract requirements; data validation involves a standardized review of the analytical data against a set of criteria (QP-5.13, R0, Analytical Data Verification/Validation Process). (Note that this procedure was replaced by an Environmental Programs [EP] Environment and Remediation Support Services [ERSS] SOP [EP-ERSS-SOP-5013] on 2/9/2007.) These criteria are tailored to specific analytical suites and techniques, based on national guidelines for data review (EPA 1994, 048639; EPA 1999, 066649), and augmented with other guidance in the case of radionuclides (as referenced in Environmental Stewardship (ENV) Environmental Characterization and Remediation (ECR)

SOP-15.06, Routine Validation of Gamma Spectroscopy Data). SOPs are used to identify the need to apply specific qualifier flags and reason codes to the reported results.

2.0 DATA INPUTS

2.1 Well Drilling and Screen Construction Information

Information about drilling methods and associated fluids or additives potentially present in individual well screen intervals was extracted from well completion reports (listed in section 7.2). In some cases, drilling logbooks were also consulted to verify or augment information in the reports. Extracted information about drilling and screen characteristics has been tabulated and is shown in Appendix B (Tables B-1, B-2, B-4, and B-5). Table B-3 describes drilling product characteristics and the quantities that are typically used, based on technical specifications, material safety data sheets (MSDSs), and other publicly available product-marketing literature.

2.2 Groundwater Chemistry Data for Screens

Groundwater data used in this report (see Appendix C) were extracted from Environmental Programs (EP) Directorate databases and field notes. The primary electronic data archive and source is the WQDB (http://wqdbworld.lanl.gov/), a publicly accessible repository of water-chemistry data obtained as part of characterization, investigation, surveillance, and monitoring of LANL on-site operations. The WQDB only reports data qualifiers for data received from external analytical laboratories. Field data are not amenable to the same level of qualification, beyond verification of instrument calibrations and checks.

Before water samples are collected from single-screen wells for analysis, the screen interval is purged and field parameters are monitored (e.g., pH, turbidity, DO) until they have adequately stabilized so as to minimize effects of screen construction materials on the water. These pre-sampling field data are recorded in field notebooks and on forms. Westbay systems in multiple-screen wells are not capable of purging because there is no internal screen volume to be purged; the sampling port accesses groundwater in the inner annulus between the screen and the sampling system. In lieu of purging, however, the sample collector records field parameters for every sample "pull," of which there may be five or more per sampling event. For a short period of time, these sets of pre-sampling field measurements were entered into an electronic EP database maintained separately from the WQDB. Some field data not yet available in the WQDB were taken from this secondary source, as noted in Appendix C. Section 4.2 provides a more detailed discussion of these field data.

Not all field data are available in electronic format. Purge volumes are recorded in the field, but are not entered into an electronic database. The purge volumes listed in Appendix C were taken from the original field data sheets.

2.3 Background Groundwater Chemistry

The evaluation process used in this report compares selected geochemical indicators for each individual screen against the range of background concentrations that are assumed to encompass predrilling conditions at that screen. Water-quality data that fall outside the range, and that cannot be attributed to the presence of a contaminant plume (see section 2.4), may then be identified as potentially unreliable or not representative of predrilling conditions. The list of indicators used for this comparison—about 30—is neither exhaustive nor comprehensive. The evaluation process is not intended to replace detailed geochemical evaluations such as those presented in characterization well geochemistry reports (listed in section 7.3), but to provide a reasonably simple, efficient, transparent, and consistent process for identifying analytical data that may be unreliable or not representative of predrilling conditions. Consequently, the evaluation method has been constructed by selecting key indicator analytes and parameters to test for the presence or absence of specific geochemical conditions that are known to affect water quality.

Background concentrations used for this comparison have been taken from the “Groundwater Background Investigation Report, Revision 2” (LANL 2007, 094856). The Laboratory updated its determination of the range of background concentrations of inorganic and selected organic compounds and radionuclides within alluvial and perched intermediate groundwater and the regional aquifer. The report provides analytical results and statistical distributions for 30 background stations that were sampled multiple times. The sampling stations consisted of springs discharging within the Sierra de los Valles and White Rock Canyon, supply wells, and monitoring wells completed within the regional aquifer and perched intermediate groundwater zones. Tables 4-3a and 4-3b of this report list ranges and mean background values for key indicator species used in this report.

The ideal approach to determining representative water quality would be to compare water-chemistry data for each screen against background concentrations specific to the formation lithology in which the screen is located. However, this level of distinction for background groundwater chemistry does not exist and is unlikely to ever exist at this level of detail. Consequently, in this report, the range of background concentrations is limited to that defined in the “Groundwater Background Investigation Report, Revision 2” (LANL 2007, 094856) for the regional aquifer and perched intermediate zones.

The applicability of specific geochemical indicator tests may be limited if a contaminant plume is present at the sampled location because a constituent in the plume may mask the condition of concern, producing a biased, misleading, or apparently inconsistent outcome. This caveat is particularly relevant for mobile contaminants that are also used as indicator species (e.g., nitrate, chloride, perchlorate, sulfate, and chromate). Table 2-1 tabulates characterization wells where a contaminant plume is believed to be present and identifies indicator tests that may consequently have limited applicability at those locations.

2.4 Contaminant Plumes

The presence of a contaminant plume at a screen has a potential effect on the reliability of an indicator’s test outcome for a water sample from that screen. Several of the indicators used in this report are also common constituents of contaminant plumes: chloride, perchlorate, chromium, nitrate, and sulfate. Table 2-1 tabulates some of the indicators that may have limited applicability to evaluation of water samples from specific screens due to the known presence of a contaminant plume containing that species. The compilation of this list focused solely on identifying plume constituents detected at concentrations that could change test outcomes. If the test outcome would be the same irrespective of whether the constituent was present or absent from the plume, then it was not addressed.

Compiled information relevant to the delineation of plume locations and constituents is found in well completion reports, well geochemistry reports, the annual “Environmental Surveillance Report,” corrective measures studies reports, specific investigation reports (e.g., chromium investigation), and records of discharges from past and present sewage treatment plants. Confirmatory data is sometimes available from upgradient wells. Table 2-1 lists an indicator as present in the plume at the screen if the following conditions are met:

- The constituent exceeds background levels established for local groundwater
- A credible source for the constituent is present in the watershed, upgradient of the screen
- The constituent is expected to be mobile in local groundwater

- Other geochemical indicators of the plume are also present
- There is an overall high level of confidence that the constituent is present in the plume

Largely beyond the scope of this activity, although a significant consideration, is the identification of constituents that may not be present in the plume at its point of origin, but which attain elevated concentrations along the flowpath due to geochemical interactions between the plume and the formation minerals. An example of this scenario would be the dissolution of carbonate minerals by an acidic discharge, which could result in down-gradient increases in carbonate alkalinity, calcium, barium, and strontium, even if none of these constituents was present in the original discharge.

2.5 Determination of Relevant Analytes

Table 2-2 lists LANL-relevant contaminants for each well according to the watershed in which the well is located, based on operational histories, disposal practices, and site-specific investigations. More comprehensive lists of relevant analytes and COPCs, organized by analyte suite, are presented in Appendix A (Tables A-1 through A-8). The list of analytes is intended to be conservatively broad to ensure the inclusion of key indicator species as well as COPCs across the facility. Thus, the analyte list includes some or all of the following:

- general chemical analytes that are commonly used to characterize groundwater quality,
- analytes that are covered by regulatory standards and that have been detected consistently in sediments or water (including alluvial groundwater, springs, and surface water base flow) in watersheds affected by LANL operations,
- analytes identified by the evaluation of Laboratory SWMUs, areas of concern (AOCs), or other considerations,
- analytes that are covered by regulatory standards and for which analysis has not been previously conducted or for which data are insufficient, and
- analytes specifically identified in the Consent Order.

The median groundwater composition of the regional aquifer was used as input for speciation calculations, using the computer code MINTEQA2 (Allison et al. 1991, 049930), for the inorganic analytes selected as relevant to this report. The speciation results are provided in Appendix A, Tables A-1 (general inorganic analytes), A-2 (metal analytes), and A-3 (radionuclides). These speciation calculations serve as the basis for determining which analytes could be impacted by drilling artifacts and under what conditions, as described in greater detail throughout section 4.

2.6 Chemical Characteristics of Analytes and Drilling Fluids

Information on analyte characteristics tabulated in Appendix A, such as adsorption and aqueous speciation, was retrieved from a systematic search of online databases publicly accessible through the World Wide Web (WWW), as well as standard reference documents. The user can generally search these databases by chemical or other name, chemical name fragment, Chemical Abstracts Service (CAS) registry number (RN), and subject terms. The following databases were searched to compile the bulk of the analyte characteristics required for this report:

- The Hazardous Substances Data Bank (HSDB) provides comprehensive, peer-reviewed toxicology data for about 5000 potentially hazardous chemicals, and is one of a cluster of actively maintained chemical databases on the National Library of Medicine's Toxicology Data Network (TOXNET) (http://toxnet.nlm.nih.gov/).

- The Environmental Fate Data Base (EFDB) is provided by the Syracuse Research Corporation (SRC). CHEMFATE (http://www.syrres.com/esc/efdb.htm) is part of EFDB and provides systematic tabulations of available data for up to 25 categories of environmental fate and physical/chemical properties of individual chemical compounds.
- The Extension Toxicology Network (EXTOXNET) Infobase (http://extoxnet.orst.edu/) develops and makes available pesticide information profiles (PIPs), which include over 170 insecticides, herbicides, fungicides, and other classes of pesticides.
- The Agency for Toxic Substances and Disease Registry (ATSDR 2005, 090525) has developed toxicological profile information sheets (http://www.atsdr.cdc.gov/toxprofiles/) for over 250 hazardous substances found at National Priority List (NPL) sites as well as for other substances related to federal sites.

Searches were also augmented by obtaining review articles or research results provided in peer-reviewed publications. For example, the databases listed above do not always contain quantitative information for some of the less common organic analytes or high-explosive (HE) degradation products. Also, specific publications often contain information or data that are more directly relevant to the water-quality effects of drilling fluids. In particular, laboratory and field investigations related to the design and performance of geologic repositories have resulted in a huge data set on the adsorption behavior of metals and radionuclides in subsurface waters, much of it specific to their adsorption onto bentonite clay (e.g., see data sources for Tables A-9, A-11, and A-12).

Physical and chemical characteristics of drilling products are provided in Appendix A, Tables A-9 through A-13. These tables address

- the mineralogical composition and adsorption characteristics of bentonite clay,
- water-soluble constituents of 12 commonly used well-drilling and development products, and
- chemical structures of constituents in the two primary organic drilling products used during drilling of the characterization wells.

3.0 ASSUMPTIONS

The following assumptions underlie this evaluation of the screen water-quality data:

- Groundwater within perched intermediate zones and the regional aquifer is overall aerobic (i.e., DO is present). Figure 3-1 presents a schematic of the conceptual model of natural groundwater chemistry for the Laboratory and surrounding areas. Supporting information for the assumption of oxidizing predrilling groundwater conditions comes from “Los Alamos National Laboratory's Hydrogeologic Studies of the Pajarito Plateau: A Synthesis of Hydrogeologic Workplan Activities (1998–2004)” (Collins et al. 2005, 092028):
    - the ubiquitous presence of oxidized forms of dissolved nitrogen (nitrate), sulfur (sulfate), and DO
    - the presence of manganese dioxide and ferric (oxy)hydroxide in borehole geologic samples
    - the absence of sulfides
    - low dissolved concentrations of iron and manganese (generally less than 0.1 mg/L)

  - ♦ oxidizing conditions measured in groundwater samples collected within areas of recharge (Sierra de los Valles), along groundwater flow paths (Pajarito Plateau), and from part of the discharge zone (White Rock Canyon springs)
  - ♦ detection of contaminants stable in oxidized forms, including nitrate, perchlorate, chromate, molybdate, sulfate, and uranium(VI), in groundwater at the Laboratory

- Review of three or more characterization and surveillance sample events for a screen yields a screen assessment outcome with a high level of confidence. This means that the outcome of the assessment is approximately the same for all of the most recent sample events, or that the outcomes define a consistent trend over time.
- The level of confidence in the outcome of the assessment is indicated as low or moderate if one or more of the following conditions exist: (a) data are available for less than three sampling events; (b) some key data are not available for the assessment; (c) data for the most recent sampling event were obtained over a year ago; or (d) results from the assessment are internally inconsistent, e.g., with respect to apparent reducing-oxidizing condtions.
- The suite of positively charged organic analytes that adsorb onto bentonite also adsorb onto iron and manganese (oxy)hydroxides and vice versa, depending on pH and the adsorbent's point of zero charge (pzc).
- Neutral organic compounds are assumed not to adsorb onto iron and manganese (oxy)hydroxides that possess either a net negative or net positive surface charge.
- Residual bentonite mud used for drilling contains about 0.4% solid organic carbon (Table A-9). This assumption is made for the purpose of evaluating adsorption sites for organic contaminants.
- The effective distribution coefficient (K_d) for an organic species adsorbing onto bentonite can be estimated from the species' organic carbon partition coefficient (K_{oc}) by multiplying K_{oc} by the fraction of organic carbon in the bentonite (0.004).
- All organic analytes can be potentially impacted if reducing conditions develop in the vicinity of the screen as a direct or indirect result of residual drilling fluids. Organic chemicals undergo oxidation-reduction reactions under a wide range of conditions, including aerobic (oxygen present) and anaerobic (oxygen-absent) conditions. This assumption may be overly stringent because degradation kinetic rates can be extremely slow for some organic analytes in the absence of appropriate microbial populations. The residence time of an organic analyte in an impacted zone is generally expected to be short relative to its biodegradation half-life.
- Field-based measurements of DO, sulfide, and ORP provide reliable qualitative indicators for the presence of reducing conditions, although not necessarily of the absence of such conditions unless appropriate precautions are taken to prevent exposure of the sample to the atmosphere. This assumption is a consequence of the logical expectation that, under reducing conditions, a low to moderate concentration of dissolved oxygen in a bailed or pumped water sample can only be increased—not decreased—upon exposure to the atmosphere, and that the concentration of dissolved sulfide can only decrease (by outgassing or by its oxidation to sulfate), not increase. The same assumption applies to ORP measurements, i.e., that the ORP measured in a reducing water sample can only increase upon exposure to the atmosphere. Consequently, low to moderate ORP and DO values are interpreted as upper limits for actual in situ conditions, and the measured sulfide concentration is considered *a lower limit. Note:* Although one would be wrong to conclude that reducing conditions are absent if these field-based redox indicators passed their associated tests, it is important to recognize that this limitation—that a drilling effect is absent if one of the associated indicator passes its test—applies to all indicators. This limitation is the

primary reason for examining multiple indicators for the same condition and should not be taken as a reason to remove a less-than-perfect indicator from consideration.

4.0 DATA QUALIFICATION PROCESS TO IDENTIFY IMPACTED SCREENS

4.1 Drilling Methods and Impacts

4.1.1 Well Drilling and Construction Methods

A general familiarity with well drilling and construction methods and products is necessary in order to develop and implement a reliable protocol for detecting whether or not groundwater chemistry has been impacted by these activities. LANL has adopted a graded approach for its drilling operations, with the objective of minimizing the introduction of fluids and materials downhole to those needed to complete drilling operations in a timely and effective manner. The use of some type of drilling fluid is generally necessary to cool the drillbit and to lift cuttings from the hole. Two common drilling methods are used at LANL: mud rotary and air rotary (Figure 4-1). The mud-rotary method uses a water-based slurry of bentonite mud, to which soda ash (sodium carbonate) is usually added to increase the fluid pH and to suppress flocculation of the clay particles by calcium. At deeper depths, or if borehole walls become unstable and subject to sloughing or cave-ins, then an organic polymer such as EZ-MUD is added. The polymer serves several purposes, the primary one being to help build the wall cake in order to reduce filtrate loss into the formation. Polymer also coats the clay particles so as to minimize flocculation and clumping.

An air-rotary method uses air as the primary component of the drilling fluid. For shallow boreholes, e.g., depths of 30 ft or less, air alone may be adequate for this purpose. For deeper depths, a fluid with better lift capability is needed, and mixing air with water extends the fluid's effective working depth to about a hundred feet. To lift cuttings from depths up to a few hundred feet, a surfactant such as QUIK-FOAM may be added to the air-water mix to stiffen it. Finally, at greater depths, or if borehole walls are unstable, then a polymer such as EZ-MUD may be added to the air-foam mix. It forms a thin polymeric film coating on the borehole walls that acts to minimize fluid loss to the formation and thereby improves the fluid's lift capability.

A variety of other drilling products is often needed to advance the borehole and to prevent sticking and other problems (Figure 4-1). Chief among these products are lost circulation materials (used to plug openings in the borehole wall and minimize loss of drilling fluids into the formation) and casing lubricant such as TORKease. The significance of the fact that a variety of drilling products are often introduced into a borehole besides bentonite and polymers is made more apparent in sections 4.4 and 4.5 when this information is used to identify potentially useful indicators of residual drilling products.

In wells constructed prior to 2002, a solution of EZ-MUD was used to transport the annular bentonite fill through the tremie pipe. Adding the polymer delayed the swelling of the clay. During this same period of the drilling program, PEL-PLUG was used.

Appendix B, Table B-1, tabulates well drilling, construction, and development histories for the wells evaluated in this report. Table B-2 briefly describes the drilling methods and materials used in each well. The earliest wells were drilled using air-rotary drilling methods with casing advance and the minimal use of fluids other than air. Because of significant problems associated with stuck casing, unstable boreholes, and lost circulation, drilling fluids were used to improve lubricity, borehole stabilization, and cuttings circulation. Continuing drilling problems made total reliance on air-rotary drilling with casing advance impractical for meeting drilling objectives. It became apparent that the depth of the wells and the difficult drilling environment, including substantial heterogeneity in physical rock properties, required that additional drilling techniques be employed in order to penetrate and respond to the complex hydrogeologic conditions that characterize the Pajarito Plateau. All of the drilling methods used by LANL are in accordance with standard industry practice and are described by the American Society for Testing and Materials (ASTM). The drilling methods used by LANL are also among those specified in the Consent Order.

As indicated in Appendix B, Table B-2, all of the wells used some type of downhole material to assist in drilling. Organic fluids, primarily EZ-MUD and QUIK-FOAM, were used in all but two wells. In addition, sodium-bentonite drilling mud was used in twelve well-screen intervals. A variety of other materials was also added to many of the wells (Table B-2). A description of these products, their uses, and the typical amount added per 100 gal. of injection water is provided in Table B-3.

4.1.2 Well Development Methods

Well development is the combination of processes used to mitigate aquifer damage, including that of the borehole wall during well drilling, and to remove suspended sediments. Well development removes fluids used during drilling and can restore or improve porosity and permeability of the formation materials around the well screen. A secondary function of well development is to settle the annular fill to a stable position. Ultimately the well, when fully developed, will yield groundwater samples that are representative of predrilling conditions. Well-development procedures at LANL are consistent with industry standards and with the Consent Order. As of July 2000, the Laboratory defined an upper limit of 2 mg/L of total organic carbon as one of the performance criteria for satisfactory well development.

SOPs and/or drilling workplans prescribe the development process to be followed and specify water quality parameters as performance criteria. To monitor the effectiveness of well development, a suite of groundwater parameters is measured throughout the development process.

> *The primary objective of well development is to remove suspended sediment from the water until turbidity is less than 5 nephelometric turbidity units (NTUs) for three consecutive samples. Additional water quality parameters to be measured during development include pH, temperature, specific conductance, and total organic carbon (TOC). If the NTU standard isn't attainable, an alternate standard of stabilization of pH, temperature, and conductivity, and TOC levels less than 2.0 ppm must be achieved before termination of development procedures. Water samples will be collected daily in 40-ml septum vials and 250-ml poly bottles and transferred to the Earth and Environmental Science Division's Hydrology, Geochemistry, and Geology (EES-6) Group for TOC and anion analyses. Samples will be submitted unfiltered and without acid preservatives.*
> (Kleinfelder 2005, 094909, p. 9)

Groundwater samples are collected immediately after well development and analyzed for the full suite of inorganic constituents and organic constituents, including acetate and formate, which are breakdown products of EZ-MUD. Additional analyses are performed by external laboratories for isopropyl alcohol, the primary constituent in QUIK-FOAM, and/or acetone (initial oxidation product of isopropyl alcohol).

As the drilling program progressed, the tendency was to use rod-based slotted screens in preference to pipe-based slotted screens. Rod-based screens allow more effective development of the screen interval because they have twice as much open area and less of a tendency to allow pockets of drilling fluid to collect behind the screen.

New well development procedures were implemented in 2002, based on recommendations made by Powell and Schafer (2002, 090523). The new procedures emphasize development immediately following well installation to remove the wall cake from the borehole. As described in characterization well completion reports (listed in section 7.2), additional development techniques involved

- initial surging with a bailer during well construction to settle filter pack around the screen,
- using packers to isolate screens to pump directly from that interval in the multiple-screened well installations,
- using standard development chemicals to break down the additives used during drilling,
- jetting at well R-16, and
- removing significantly large volumes of groundwater during the pumping phase of well development. An average of 135% or more groundwater was removed than was added in the multiple-screened wells drilled in 2002 and later.

These new development procedures have been conducted under the drilling contractor's internal field procedure and not under a LANL procedure. The formal documentation of development procedures for a given well is reported in the drilling workplan (e.g., Kleinfelder 2005, 094909 for R-10 and R-10a). The well completion reports (listed in section 7.2) also document the procedure that is followed, along with any deviations from the workplan, and present the monitoring data for field parameters. To assess the effectiveness of the improved development protocol, data for the final measurements of turbidity and TOC following development are tabulated for each screen in Table 4-1. Also on that table are listed data for these parameters as measured for the most recent sampling event in Table C-3. This comparison reveals that desired target values for turbidity (<5 NTU) and TOC (<2 mg/L) have not always been attained by the end of development. For example, R-2, for which development was completed in December 2003, had a final turbidity of 11 NTU and TOC of 2.2 mg/L.

The influence of well development protocols on present-day screen conditions was examined by tabulating water-quality ratings and redox conditions for the most recent sample from each screen as a function of three surrogate measures for the effectiveness of development in removing residual drilling fluids from a screen. The surrogates are the TOC attained by the end of development (Figure 4-2a), the year in which development was completed (Figure 4-2b), and the elapsed time between completion of drilling and end of well development (Figure 4-2c). Figure 4-2a shows that slightly less than one-half of the 80 screens included in this report had achieved TOC <2 mg/L by the end of development. (Note that the majority of these screens were developed prior to establishment of the TOC monitoring guideline.) However, from this plot there appears to be little correlation between the level of TOC achieved and the present-day reliability of the water-quality samples from that screen. The most striking trend is observed when current screen conditions are mapped against the year in which development was completed (Figure 4-2b). Screens in which development was completed in 2003 or later show an improved track record as compared with screens developed prior to 2003. This apparent improvement is attributed to the cumulative effect of multiple factors: implementing additional development criteria, modifying drilling practices to minimize fluid use and loss into the formation, switching to rod-based screens, and—perhaps most importantly—switching to a much higher proportion of single-screen and dual-screen wells rather than multiple-screen wells.

The lack of correlation between ending TOC and present conditions in a screen implies that a significant inventory of residual organic drilling fluid component may remain in a screen interval even after development, and yet not be directly detectable from groundwater samples. This conceptual model, which is described later in section 4.5, assumes that some proportion of the organic constituents used in a borehole adsorb or partition strongly onto geologic material, and that they may not be detected in water-quality samples simply because they have been immobilized or t rapped and are only negligibly soluble.

However, their presence can be inferred from the subsequent development of reducing conditions and lingering elevated concentrations of biodegradation products, as discussed in section 4.5.

Polymer-based fluids, such as EZ-MUD and TORKease, have been used in nearly all of the characterization wells within the scope of this report to provide lubrication between the casing advance system and the borehole wall, stiffen the air-foam mix, or enhance the bentonite-based drilling fluid. Downhole drilling products are analyzed for inorganic chemicals to evaluate their potential to impact groundwater chemistry. Results of this characterization and evaluation are presented in section 4.4 (for inorganic constituents) and section 4.5 (for organic constituents). Once the regional water table was encountered, the use of additives was greatly reduced so as to minimize the impact on groundwater chemistry. Well-development methods were further revised to address the use of bentonite-based drilling fluids. Additional time and effort were spent in removing residual bentonite and minimizing adverse impacts to groundwater chemistry and formation properties.

4.2 Groundwater Sample Collection

4.2.1 Collection Protocol

SOPs for sampling groundwater have undergone multiple revisions to reflect technical and Laboratory organizational changes during the period of record addressed in this report. A list of applicable procedures governing the collection of groundwater samples is presented in section 7.4. This section briefly reviews how the sample collection protocol has evolved over time. Table B-5 lists which of the methods described below were used to collect each of the water-quality samples evaluated in this report.

<u>Single-screen wells</u>

One aspect of sample collection that has been revised over the past decade is the conditions by which the field sampling team determines when the screen interval has been adequately purged. In characterization wells that use submersible pumps to retrieve water samples from intermediate or regional groundwater (16 wells, identified in Tables B-5 and C-2), purging and sampling has been previously performed in accordance with the procedure ENV-ECR SOP-6.01, Purging and Sampling Methods for Single Completion Wells, prepared in 1992. Prior to the collection of groundwater samples, three conditions had to be met: (1) a minimum of three casing volumes of water must be purged; (2) field chemical parameters must stabilize; and (3) turbidity must be stable or less than 5 NTU. Field parameters are considered stabilized when pH varies by less than 0.2 units or the variation in the other parameters over a series of four readings is within ten percent.

In 2004, the Risk Reduction and Environmental Stewardship (RRES) Division's Water Quality & Hydrology (WQH) Group, in a procedure titled "Groundwater Sampling Using Submersible Pumps" (RRES-WQH-SOP-049), adopted the purging criteria of (1) a minimum of three casing volumes of water extracted at a low flow rate; or (2) after purging one casing volume withdrawn at a low flow rate, drawdown, turbidity (and dissolved oxygen, if measured) have stabilized. The effective date of RRES-WQH-SOP-049 is July 21, 2004; however, the draft SOP was implemented prior to document finalization. Depending on the sampling date and well-specific field parameter conditions, from one to three casing volumes of water may have been purged prior to the collection of groundwater samples. Under special conditions (e.g., where field parameters have not stabilized after purging three casing volumes of water or low flow conditions limit the volume available for purging), sample collection has deviated from the SOP and has occurred as directed by the leader of the project for which the samples were intended. Such deviations can be seen in the purge volumes documented in Table C-2. For example, MCOBT-4.4, which is sampled using a submersible pump, was purged of 3 casing volumes of water for the samples collected in 2003, but only 1 casing volume or less in subsequent years The cause for this deviation was the dropping water level in this perched intermediate aquifer; in June 2005, the volume of water obtained was insufficient even to submit for all of the desired analyses.

Specific governing SOPs and volumes of water purged prior to each sampling event covered by this report are presented in Table C-2.

The standards and procedures for measuring field parameters are presented in ENV-DO-203, Field Water Quality Analyses, which became effective July 2005, superseding both RRES-WQH-SOP-054.1 and ENV-ECR-SOP-6.02, Field Water Quality Analyses System. The use of flow-through cells (a closed chamber that allows the continuous flow of water over measurement probes while preventing atmospheric influence) has occurred historically, but not consistently, for the measurement of field parameters at single-screen wells that are sampled using submersible pumps. Beginning with sampling rounds conducted in late 2003 to early 2004, the use of flow-through cells for the collection of field parameter data at wells using submersible pumps became routine.

Multiple-screen wells

Wells equipped with a Westbay system (identified in Table B-1) have been historically sampled in accordance with ENV-ECR-SOP-6.32, Multi-Level Groundwater Sampling of Monitoring Wells—Westbay MP System, and ENV-WQH-SOP-050, Groundwater Sampling Using Westbay System, which are similar procedures prepared by Laboratory groups RRES-ECR and ENV-WQH, respectively. Water samples from Westbay systems have been collected in accordance with ENV-WQH-SOP-050.3 since December 2005.

As described in ENV-WQH-SOP-050, fifteen steps are involved in taking samples with the Westbay sampler: (1) surface function tests are performed; (2) the sampler probe is placed on the well head and the surface function tests are documented (in all steps, documentation occurs on the Groundwater Sampling Field Data Sheet); (3) air is evacuated from stainless-steel sample bottles with a vacuum pump to 2–4 psi and the pressure is documented; (4) the sampler probe and bottles are tripped in using a casing log and table as a reference; (5) the sampler probe is landed at the desired port, the location and pressure inside the casing is documented; (6) the sampler probe is attached to the monitoring port and the zone pressure is recorded; (7) the water sample is collected at the port by opening the sampler valve; when the pressure stabilizes, the zone pressure with the valve open is recorded; (8) the sampling valve is closed and the shoe is retracted, the internal pressure is recorded; (9) the sampler probe is raised and the landing arm is retracted, the sampler probe and stainless-steel sample bottles are tripped out; (10) the sample bottles are disconnected from the sample probe, excess pressure can be vented from the last bottle in the string; (11) the water is transferred to sample containers and the volume of sample water retrieved is recorded; (12) the samples collected for volatile organic compound analysis have several sub-steps to ensure the absence of bubbles in the sample bottle; (13) steps 1–12 are repeated as needed to collect the appropriate volume of water for sampling requirements from each port; (14) samples are collected using a 0.45 µm pore size filter; and (15) field chemistry measurements or field parameters are collected on each run, the information is recorded, and the water used for field measurements is discarded upon completion.

R-33 is an exception to this standardized description of sample collection from multiple-screen wells. R-33 is sampled using a BARCAD system that applies pressurized gas in cycles to push and extract the water column into a sampling chamber. Bore volumes are not removed from R-33 prior to sampling. BARCAD sampling is performed per a draft SOP.

<u>Comparison of field parameters obtained during sampling</u>

To evaluate how these different sampling protocols might affect the reliability of water-quality data, field parameter data obtained during purging of two single-completion wells are compared to field data obtained for each consecutive “sample pull” from two BARCAD screens and two Westbay screens (Figures 4-3a and 4-3b). The samples selected for this comparison are evaluated in detail later in this report. The ending field parameter values are listed in Table C-3, and other water-quality data (post-purging in the case of R-2, R-33, and MCOBT-4.4) are listed in Tables C-4, C-5, and C-6.

An important question is the extent to which purging before sampling affects the quality or reliability of the water-quality data. To address this question, field data are plotted in Figure 4-3b for two sampling events at MCOBT-4.4, both involving purging using a submersible pump. The purge volume for the March 2005 sample was 48 gal., equivalent to 2.2 casing volumes, while that for the June 2005 sample was only 6 gal. (0.3 casing volumes). Figure 4-3b shows that pH, DO, temperature, turbidity, and conductivity were monitored for over 50 minutes before collection of a water-quality sample for analysis. ORP data are available throughout the purging period for the June 2005 event, but are only available for the first 10 minutes for the March 2005 event. Approximate lengths of time involved for stabilization of the individual field parameters are:

- Conductivity, 5 minutes, following which it remains relatively invariant for the remainder of the purge time
- pH, 35 minutes
- ORP, 45 minutes for the June 2005 event
- temperature and turbidity, indeterminate

Overall, however, no systematic difference is obvious when field data from the two sampling events are compared. Any differences in water quality parameters that might arise due to differences in purging volumes or rates are presumably largely masked by natural variability induced by the dropping water levels in this perched water system.

The other five samples examined are all collected from the regional aquifer and are plotted together on Figure 4-3a. The purge volume for R-2, which is sampled with a submersible pump, was 108 gal. for the August 2005 event, equivalent to 2.9 casing volumes. Field data are shown on the same plots for two BARCAD screens (R-33, Screens 1 and 2), and two Westbay screens (R-22, Screen 2 and 4), for sample events in June and July 2005. Again, no systematic difference is readily apparent when field data from these different sampling systems are compared.

4.2.2 Analytical Suites

Once a well is completed and developed, it initially undergoes characterization sampling. Analytes for characterization sampling are designed to detect changes in ambient water chemistry or the presence of Laboratory contaminants, and therefore involve generally comprehensive analytical suites. Following completion of the two to four characterization rounds, ongoing sampling is conducted in accordance with an approved monitoring plan. Analytical suites for surveillance monitoring are generally much less extensive than those analyzed during characterization sampling. Analytes are specified in the monitoring plan for each well based on possible source terms from the Laboratory. The need to monitor for a broad range of analytes is driven by detecting changes in ambient conditions, monitoring movement of environmental constituents of interest, regulatory requirements monitoring, and monitoring to assess the effectiveness of remedial actions. The frequency of sampling is also specified in the monitoring plan, and may range from quarterly to annually or even triennially.

The analytical suites for groundwater samples are periodically updated in response to information gained from site investigations and from changes in regulatory requirements. The suites currently defined in the WQDB are the following:

- Dioxins and furans
- Diesel-range organics (DRO)
- General parameters and inorganic species
- Herbicides
- HE and HE degradation products (HEXP)
- Metals
- Organochlorine pesticides and polychlorinated biphenyls (PCBs)
- Radionuclides
- Semivolatile organic compounds (SVOCs)
- Volatile organic compounds (VOCs)

SVOC and VOC suites overlap with one another, as do the DRO compounds and herbicide suites. Several analytes are measured or reported under more than one description, e.g., as an individual chemical as well as part of a total concentration for a particular category. Thus, even though a sample might not have been submitted for analysis of a particular analytical suite, analytes from that suite may still have been measured.

4.3 Water-Quality Assessment Methodology

4.3.1 General Evaluation Protocol

The original version of this report used a tiered geochemical approach that applied sets of evaluation criteria to each screen depending upon whether or not it was drilled using bentonite mud, organic polymers, or both. The current report establishes the groundwork for a future, more thorough, systematic, consistent, and transparent approach that automates the first step of the data qualification process. Figure 4-4 shows the sequence of steps envisioned for the qualification process. Once a water sample is selected for evaluation of drilling impacts through implementation of the WQDB's in-progress Data Qualification Module (step 1 in Figure 4-4), the next step will be automated application of the full set of water-quality test criteria for which suitable data are available in the WQDB.

The automated portion of the evaluation process (step 2 in Figure 4-4) relies upon the data qualifier codes reported by the analytical laboratory to determine whether to consider the analyte as detected or not detected. In the first stage of the well screen evaluation process, validation codes assigned through the data verification/validation process are not taken into consideration. This approach ensures that all water-quality data are treated on an equal basis by being taken at face value, as received from the analytical laboratory. The analytes that are most affected by this approach of not using verification/ validation codes are the trace metals, especially zinc, but also chromium and molybdenum.

Subsequent to the automated initial screening, manual checks are conducted to ensure the validity of the automated test outcomes (step 3 in Figure 4-4).

If a local contaminant plume is present, or if the previous steps identify the potential for residual drilling effects, then a more in-depth technical review of the evaluation outcomes is almost always warranted (step 4 in Figure 4-4):

- checking for internal consistency among the test outcomes (e.g., indicators of redox conditions, indicators of residual drilling products)
- taking into account site-specific factors that may limit the applicability of a particular test criterion to a water sample
- identifying geochemical conditions that negate an underlying assumption for one or more test criteria.

Once the test criteria outcomes have been satisfactorily reviewed for a water sample such that residual drilling effects can be specified with confidence (step 5 in Figure 4-4), the final step in the data assessment protocol is to identify analytes for which the reported data are potentially unreliable as a result of the drilling effects. This aspect is also automated for producing the initial list of potentially affected analytes (step 6 in Figure 4-4). Following another review for correctness, the affected analytes are then assigned a flag in the WQDB indicating the reported data have a high probability of not being representative of predrilling groundwater conditions due to residual drilling effects.

4.3.2 Categories of Drilling Effects

One of the main objectives of this revised report is to establish and document the technical basis for the methodology used to evaluate groundwater chemistry data for representativeness relative to background and/or predrilling conditions. As a convenient framework, the effects of drilling fluids and development fluids on water chemistry in the vicinity of a well screen are classified as follows throughout this report (Figure 4-5 and Table 4-2), as well as throughout Appendixes A through E:

- Category A—Residual water-soluble inorganic components (section 4.4)
- Category B—Residual organic components (section 4.5)
- Category C—Modification of in situ redox conditions (section 4.6)
- Category D—Modification of surface-active mineral surfaces (section 4.7)
- Category E—Changes in carbonate mineral stability (section 4.8)
- Category F—Corrosion of stainless steel well components (section 4.9)

A set of questions and test criteria have been developed to determine whether specific groundwater samples collected from single and multiple-screen wells are representative of predrilling conditions. The ability of a given well to detect the presence of contaminants, without interference from residual drilling or development fluids, is also an essential end point to this analysis. The remainder of this section discusses each of the different categories of drilling-derived effects in detail. Conceptual models are presented for the initial cause and evolution of each condition over time. Indicator species are selected based on characterization data or geochemical relationships well-established in the scientific literature. The last subsection for each category summarizes the results when the test criteria for that category are applied to the water-quality data from the 80 screens included in this report.

Section 4.10 summarizes the geochemical impacts of each individual drilling fluid, reiterates the geochemical indicators selected to identify when those impacts are present in a water sample, and identifies limitations or conditions under which the reliability of a particular indicator could be in question.

4.3.3 Considerations for Selection of Indicators

Ideally, test questions and indicator species should possess the following qualities:

- Transparency. The underlying logic for the indicator's selection should be quickly evident to users.
- Simplicity. Measured data should be directly comparable to a numerical threshold without any intermediate calculation required.
- Data availability. The data should be available for the majority of sampling events, past and present.
- Reliability. The measured data should have a high degree of reliability relative to whether they are above or below the specified threshold level. For indicators of residual drilling products, this aspect requires taking into account the extent to which the product is typically diluted when it is used.
- Specificity. The test questions for a condition should be sufficiently specific that they can be applied to all samples regardless of the type of drilling fluid used, with minimal risk of falsely identifying conditions that are "known" to be absent because a particular drilling fluid was not used at that location.

No single indicator can embody all of the above desired qualities. The last quality—specificity—is the most difficult to ensure because multiple factors usually affect the concentration of an analyte. Consequently, a concerted effort has been made to include multiple indicators for each condition so that an outcome is not overly reliant upon a single indicator. In addition, outcomes for a sample may require a closer review by a subject-matter expert under the following conditions, in order to determine the applicability of specific tests and their default threshold values:

- the sample's pH or alkalinity lies outside the normal range of background groundwaters,
- the sample's test outcomes appear internally inconsistent, or
- one of the indicator species is suspected of being present in a local contaminant plume, and could be biasing the test outcome.

The threshold values for each test condition are based primarily on background concentrations of inorganic, radionuclide, and natural organic solutes characteristic of perched intermediate zones and the regional aquifer (Tables 4-3a and 4-3b). If geochemical evidence indicates that one or more of the above drilling-related conditions was present when a sample was collected, then the automated data qualification module will assign data-quality flags (such as those listed in Table 4-4) to groundwater constituents that are likely impacted by the presence of those conditions. The purpose of these flags is to indicate to the data user which analyte concentrations may not be representative of predrilling conditions due to residual drilling fluid effects.

If a sample passes all test criteria, and if no strong evidence is found for drilling-fluid effects, then the screen assessment for that sample is completed, and no further evaluation is needed of that particular sample.

4.3.4 Organization and Presentation of Data and Test Outcomes

The data qualification process is documented at several levels of detail in this report, by both tabular and graphical means. The raw water-quality data used for the assessment of the 80 screens covered by this report are listed in Appendix C:

- Table C-3 for general water quality indicators (tritium, pH, alkalinity, and turbidty)
- Table C-4 for organic indicators
- Table C-5 for general inorganic indicators, other than trace metals, and
- Table C-6 for trace metal indicators.

The data listed in these tables are also shown on separate plots for each indicator in Appendix D, in alphabetical order by analyte name. These plots make it easier for the user to judge the credibility of the test itself as well as that of the threshold values, for example, whether the threshold values may be overly stringent or overly lax to define a pass/fail condition with confidence. These plots are also useful for conducting a quick visual check for correlations among indicators, so as to test some aspect of a conceptual model.

Tables C-3 to C-6 also list the outcome for each test applied to each sample: pass, fail, indeterminate, or not applicable. Table C-7 summarizes the number of tests passed and failed for each sample, so as to provide the basis for assigning a qualitative rating to each water sample based on the proportion of tests that were passed. Failed criteria for each individual water sample are also tabulated in Table C-7, according to the category to which the test is assigned. This tabulation provides a convenient means by which one can scan the outcomes for correlations among indicators.

Table E-1 consolidates the individual test outcomes, omitting the raw data and showing only the pass/fail outcomes grouped by category so as to provide another way to visually recognize correlations among indicator outcomes. By examining such tables for common relationships, one develops a sense for the level of confidence to assign to each outcome.

The most condensed summary of sample outcomes is provided in Table E-2, which calculates a composite score for each screen based on all the sample events included in this report. A comparison between the composite score and the score for the most recent sample provides the basis for characterizing each screen's evaluation in terms of four ratings, which are described in more detail in the introductory text for Appendix E:

- an overall composite score that expresses the percent of the applicable criteria met by the screen's water samples;
- the classification of the screen with respect to its ability to provide reliable and representative water-quality samples (very good, good, fair, or poor);
- the trend in the screen's condition with respect to water-quality impacts of residual drilling fluids (stable, improving, worsening, variable, or indeterminate); and
- the level of confidence in the outcome of the evaluation (high, moderate, or low).

4.4 Category A—Residual Water-Soluble Inorganic Constituents

4.4.1 Conceptual Model

This section first outlines how inorganic water-soluble constituents in drilling, construction, and development fluids may affect water quality. The primary drilling products that release water-soluble inorganic constituents to groundwater during use are not only bentonite drilling muds, but also acids, polymers in organic drilling fluids, soda ash, and lost-circulation materials. These materials are combined into a single class because:

- multiple products are often used in the same borehole interval, as illustrated by the variety of organic and inorganic drilling chemicals used in several screen intervals that were drilled using bentonite mud (Table 4-5), and
- based on simple laboratory leaching tests, discussed in subsection 4.4.2, these products share many of the same indicator species such that it would be difficult to determine which particular product was responsible for an anomalous chemical signal. For example, sodium and sulfate are indicator species for several drilling or development products other than bentonite mud.

Figure 4-6 depicts the geochemical conceptual model for the impacts of bentonite mud on water quality. Attention is focused on bentonite mud because this product is used in the largest quantity and initially dominates the water chemistry near the screen. The two major processes of interest are (1) desorption (leaching) of soluble inorganic constituents associated with bentonite, and (2) adsorption of metals, radionuclides, and organic compounds to the bentonite. (This second aspect is covered later in section 4.7.) The bentonite mud used to drill LANL wells, and in fact used for the majority of wells throughout the United States, is derived from Wyoming bentonite, which contains about 75% montmorillonite clay (Table A-9). Wyoming bentonite has a large specific surface area on the order of 600 m^2/g and a cation exchange capacity of about 80 milliequivalents (meq) per 100 g (Lajudie et al. 1995, 090542; Langmuir 1997, 056037). Over half of the ion-exchange sites are occupied by sodium cations (Table A-9). When this bentonite is mixed with water to form the drilling mud, large quantities of sodium and other soluble mineral impurities such as sulfate, nitrate, and chloride are leached into solution (Table A-9). Assuming a make-up rate of 25 lb of bentonite per 100 gal. of water (Table B-3), the initial concentration of total dissolved solids in the mud mix would be on the order of 77,500 mg/L (calculated from data for QUIK-GEL in Table 4-6), which is more than 500 times greater than the median total dissolved solids (TDS) of groundwater in the regional aquifer (145 mg/L calculated from data in Table 4.2-3 of LANL 2007, 094856). One of the objectives of well development is to retrieve as much of these solutes as possible from the saturated zone.

4.4.2 Selection of Indicator Species and Test Criteria

The water-soluble inorganic constituents of several drilling fluids used to drill LANL boreholes were characterized by staff at the LANL Geological and Geochemical Research Laboratory (GGRL) by diluting or leaching each with deionized water, and then analyzing the filtered solutions (Table 4-6). Table A-10 presents a more complete listing of the GGRL leaching data, including some drilling products not included in Table 4-6. These analytical results then provided the basis for estimating initial concentrations in the drilling solution used downhole, assuming each drilling fluid was diluted with an appropriate volume of local groundwater (Table 4-7). The two-fold objective of these calculations is (a) to identify analytes whose concentrations could be significantly increased by the presence of residual drilling fluid at the end of well development, and (b) to identify a set of key indicator species for these residual drilling fluids. The last row of Table 4-7 summarizes the results of this evaluation, identifying several soluble inorganic ions as indicator species based on the predicted magnitude of the increases in groundwater concentration. For example:

- QUIK-GEL and AQUA-GEL Gold Seal bentonite drilling muds—Na, alkalinity, SO_4, F, and NO_3
- PAC-L, a cellulose polymer often added to drilling mud to minimize loss into the formation—Na, alkalinity, Cl, F, and PO_4

The presence of such analytes above background levels for local groundwater provides evidence of desorption processes taking place with residual drilling products, provided that these constituents are not present at a given well site as a result of local contaminant plumes. Sodium, phosphate, sulfate, fluoride, and chloride are commonly present in plumes local to Los Alamos. The selection and application of multiple indicators is one of the main strategies used to minimize the potential for misinterpreting an anomalous geochemical signal, or the potential for an indicator's presence to be masked or ambiguous due to natural variability in background levels or due to inadequate development of a screen interval to remove residual chemicals. Based on estimated concentrations in Table 4-7, for example, calculated initial concentrations for sodium and sulfate in the drilling mud exceed median concentrations in the regional aquifer, on average, by factors of 40 (sodium) and 300 (sulfate).

Such increases above background concentrations are illustrated by the geochemical trend plots for calcium, chloride, fluoride, sulfate, sodium, phosphate, alkalinity, and pH in Screens 2, 3, and 4 of characterization well R-16 (Figure 4-7). This multiple-screen well was drilled with bentonite mud, as well as drilling fluid additives and post-drilling chemicals including Liqui-Trol, Magma Fiber, N-Seal, PAC-L, and soda ash (Table B-2). Concentrations that plot above the grey-shaded regions for each indicator in Figure 4-7 are above background levels for the native groundwater, and are interpreted as residual constituents of drilling fluids not completely removed from the screen interval. Concentrations at background levels in Screen 2 (blue squares in Figure 4-7) indicate that the water-soluble constituents leached from these drilling products were mostly removed from this screen during well development. Screen 4 (red squares) shows greatly elevated concentrations of calcium, sulfate, sodium, and phosphate, which are slowly returning to background values, although at very different rates because of dilution and other geochemical processes. Screen 3 (black squares) appears to be intermediate between these two extremes. The last two samples plotted are data for samples collected in November and December 2006, showing the effectiveness of the recent screen rehabilitation pilot project in expediting a return to predrilling water-quality conditions. The dramatic increase in phosphate and alkalinity in Screen 4 immediately after the rehabilitation activities suggests that the bulk of the residual drilling fluids left in R-16 resided in the vicinity of this screen.

4.4.3 Application of Criteria to Water-Quality Samples

Screening questions, assessment criteria, and test outcomes for this category are presented in Table 4-8. Water-quality data from all of the screens included in this report were compared against the criteria listed in Table 4-8. Measured concentrations in samples from 80 screens are plotted in Appendix D. The details of this comparison are tabulated in Appendixes C and E.

Figure 4-8 summarizes the results of this analysis. Key findings for the most recent sample event include the following:

- The 5 selected indicators for residual inorganic constituents (chloride, fluoride, sulfate, sodium, phosphate), along with alkalinity and pH, are within background levels for 40% (32) of the 80 well screens, indicating the probable absence of significant residual inorganic drilling constituents from these screens.
- Among the 22 single-screen wells, 12 (55%) passed all tests for residual inorganic constituents of drilling fluids, including pH and alkalinity. Among the 58 screens in multiple-screen wells, the proportion of screens passing all tests was only 34% (20 screens).
- Of the 52% (42) of the screens that failed at least 1 of the 5 indicators, 22 (52% of 42) only fail 1 indicator, 11 (26% of 42) fail 2 indicators, 6 (14% of 42) fail 3 indicators, and 3 fail 4–5 indicators.

- From the bottom histogram of Figure 4-8, the most frequent indicator failed is chloride (20 screens, which comprises 48% of the 42 screens that failed 1 or more tests).
- The next 3 most frequently failed tests are those for fluoride (19 screens, 45% of 42), sodium (15 screens), and sulfate (11 screens).
- The test with the fewest number of failed samples is phosphate (9 screens, 21% of 42), possibly reflecting its limited presence in the most commonly used downhole drilling products.

The above outcomes take into account that a test may not be applicable if the constituent is known to be present in a contaminant plume intercepted by the screen. However, some of the remaining instances of elevated concentrations may also be attributed to the presence of an unknown plume or—more likely—to the unknown presence of a constitutuent in a known plume. This caveat is particularly likely to apply to some of the cases of elevated alkalinity, chloride, fluoride, and sodium concentrations.

4.5 Category B—Residual Organic Components of Drilling Fluids and Additives

In parallel with Category A for residual inorganic constituents of drilling fluids, Category B addresses the presence of residual organic constituents. The two dominant organic-based drilling fluids used in LANL wells are EZ-MUD and QUIK-FOAM. The main active ingredients in QUIK-FOAM belong to a class of anionic surfactants known as alcohol ethoxylate sulfates (AES). These molecules are moderately long carbon chains (ranging from 11 to 18 carbon atoms) bonded to several ethoxylate groups and ending with a negatively charged sulfate group (Pojana et al. 2004, 094487). The charge-balancing cation associated with the sulfate group is usually sodium, magnesium, or ammonium. Active ingredients in EZ-MUD are extremely long carbon chains of repeating sequences of polyacrylamide and acrylic acid units.

Several other organic drilling products are also routinely used in drilling—such as Liqui-Trol, N-Seal, PAC-L, SDI defoamer, and TORKease—as well as organic components in largely inorganic products. For example, QUIK-GEL bentonite drilling mud is coated with polyacrylate polymer (Wisconsin Department of Natural Resources 2006, 094912).

4.5.1 Conceptual Model

Figure 4-9 shows an idealized geochemical conceptual model for the water-quality impacts of organic polymer-based drilling fluid. Biodegradation of these compounds cause elevated concentrations of organic carbon and ammonia. The general sequence for biodegradation of AES chemicals is well known because of their widespread use in commercial products such as shampoos and detergents, and numerous studies of their environmental fate in surface waters (Scott and Jones 2000, 094913). Ultimately, the organic parts of these molecules are broken down and oxidized to carbon dioxide. However, the biological half-lives for the initial compounds or their derivatives range from a few hours to several years. Although well characterized for surface environments, biodegradation rates for these products in groundwater are poorly known and extremely sensitive to site-specific conditions (Scott and Jones 2000, 094913). Key factors which affect the rate include the types of microbes already present at the site, the extent to which the various microbial populations are acclimated to their food sources, and particularly whether the microbes require aerobic conditions to actively degrade the organic molecule. While acetone and isopropyl alcohol generally biodegrade fairly quickly to concentrations that are below detection (e.g., within 1 yr), EZ-MUD and EZ-MUD PLUS undergo slow natural degradation on the order of 2 to 3 yr (Simpson 2001, 094859). Under anaerobic (reducing) conditions, the biodegradation rate for surfactants is likely to be significantly slower (Scott and Jones 2000, 094913). Hence, if residual surfactants remain in a screen interval, biodegradation of residual surfactants may not progress significantly until oxidizing conditions are restored.

To envision a typical sequence for biodegradation, schematic sketches of the major QUIK-FOAM and EZ-MUD organic components are presented in Figures 4-10 and 4-11. The precise structure of the QUIK-FOAM surfactant is not known, but it is undoubtedly similar to that shown in Figure 4-10 for another anionic surfactant, sodium laureth sulfate, a common ingredient in hair shampoo (Robison 2006, 094883). An important characteristic of this molecule that has major consequences for its effects on water chemistry is the fact that it has an uncharged hydrophobic end, a hydrophilic negatively-charged end, and a positively-charged cation (NH_4^+ in Figure 4-10) to balance the molecule's negative charge. The first and immediate effect on water quality is leaching of the counterion (NH_4^+). The second step is detachment of the long hydrophobic hydrocarbon chain from the other half of the molecule (step a1 in Figure 4-10). This initial carbon-bonding breaking requires microbial activity and occurs rapidly (on the order of several days) under aerobic conditions (Pojana et al. 2004, 094487; Ying 2006, 094486). Biodegradation of the residual hydrophilic group proceeds more slowly. Eventually, microbes break up the long molecule into ever-smaller segments. Its ultimate breakdown products are inorganic carbon and sulfate. However, this process probably takes several years to go to completion if reducing conditions are present.

The different parts of the surfactant molecule can be expected to biodegrade at very different rates, and possibly not simultaneously. Although microbes often live in symbiotic colonies, each targeting a different species for its food source, they can also be antagonistic toward one another, incapable of coexistence. Microbial activity is also generally sensitive to other geochemical conditions. For example, one of the microbial species that converts the sulfonate group to sulfate requires dissolved oxygen to be present, and so is inactive under reducing conditions.

Figure 4-11 depicts an isolated segment of the repetitive structure of the polyacrylamide that constitutes the main ingredient in EZ-MUD and EZ-MUD PLUS. This extremely long polymer has a molecular weight on the order of 4,000,000–6,000,000 for EZ-MUD and 15,000,000 for EZ-MUD PLUS (Simpson 2001, 094859). Such a large size makes it unlikely that this molecule will penetrate very far into a formation during drilling, except in lost circulation zones or in formations with high porosity or that are fractured. Its ultimate biodegradation products are ammonia, inorganic carbon, and water but, like the QUIK-FOAM surfactant, its degradation rate is not expected necessarily to proceed rapidly in groundwater.

Figure 4-12 shows some of the potential interactions between anionic surfactants, such as those in QUIK-FOAM, and constituents in groundwater. The most significant of these interactions, relative to their potential effects on the transport characteristics of analytes of concern, are discussed below.

- Positively charged metal and radionuclide cations may bind to the negatively charged end of the surfactant, thereby potentially increasing the mobility of these cations.
- Hydrophobic organic species, such as aromatic hydrocarbons and pesticides, may associate with the hydrophobic end of the surfactant molecule, also modifying their mobility.
- Although AES surfactants are not expected to adsorb onto organic-free clays, soils or sediments, they may adsorb onto geologic materials that contain organic carbon (Cano and Dorn 1996, 094860; Cano and Dorn 1996, 094899; Salloum et al. 2000, 094896; Ying 2006, 094486). Partition coefficients reported for adsorption of 1 mg/L of nonionic alcohol ethoxylates (AE) onto natural geologic media containing 0.3 to 2.2% organic carbon ranged up to 2100 mL/g, attaining equilibrium within a few hours (Cano and Dorn 1996, 094860).
- Surfactant molecules may adsorb onto stable metal oxides and modify the mineral's surface characteristics (Cserháti et al. 2002, 094904). For example, the surfactant may create an organic film that can adsorb other organic species, or provide a platform for a microbial population.

- The surfactant molecule may adsorb onto organic surfaces, including microbes, rendering the molecule immobile such that its presence is not directly detectable in a groundwater sample. It presence may either enhance or suppress microbial activity.
- At concentrations on the order of tens to hundreds of mg/L, anionic surfactants may form a spherical aggregate similar to micelles, also called *surfactant colloids* or *solloids* (Cserháti et al. 2002, 094904; Salloum et al. 2000, 094896; Ying 2006, 094486). The concentration at which this occurs is known as the "critical micelle concentration," and is characteristic of that specific surfactant. In water, the hydrophobic part of the molecules turns inward, towards the center of the solloid. Other hydrophobic organic compounds may then partition into the center of the solloid, thereby enhancing the solubility of sparingly soluble organic compounds in water, as well as affecting biodegradation rates of these hydrophobic compounds (Valsaraj and Thibodeaux 1989, 094895).
- The solloid may clog pore openings, reducing hydraulic conductivity and creating micro-environments with redox and geochemical characteristics significantly different from that of the bulk groundwater.
- Until they finally break down altogether, organic molecules may serve as low but constant in situ sources of organic nitrogen (TKN), ammonia, and organic and inorganic carbon to the groundwater.

Also shown in Figure 4-9 are the effects of residual organic drilling fluids on the redox state of the groundwater and on the characteristics of surface-active minerals in the vicinity of the well. These aspects are covered separately in section 4.6 (redox) and section 4.7 (mineral surfaces).

4.5.2 Selection of Indicator Species and Test Threshold Values

EZ-MUD PLUS consists of a high molecular-weight copolymer made up of a carbon framework containing nitrogen functional groups (Longmire 2002, 072800), suspended in a solution of long-chain hydrocarbons (Larson 2006, 094892; Robison 2006, 094891) (Table 4-9). It serves as a flocculating aid for precipitation of suspended solids from the drilling solution. QUIK-FOAM consists of AES, surfactants that serve as a high-expansion foaming agent. The surfactants are dissolved in an aqueous solution containing isopropyl alcohol, acetone, and ethanol (Larson 2006, 094892; Robison 2006, 094891) (Table 4-9). Acetone is also an oxidation product of isopropyl alcohol and is routinely analyzed as part of VOC analysis using gas chromatography-mass spectrometry (GC-MS). Characterization data in Tables 4-9 and 4-10 confirm that the best organic indicators for residual organic drilling components are dissolved organic carbon (DOC), TOC, total Kjeldahl nitrogen (TKN), and ammonia. These same indicators are also suitable for the organic components of inorganic products such as bentonite drilling muds (Table 4-10). Acetone is a good indicator to monitor the effectiveness of well development, and to assess the prevailing biodegradation conditions based on the acetone's rate of disappearance.

The effectiveness of the first three indicators is demonstrated in Figure 4-13, again using the example of R-16. Like Figure 4-7, these plots also start with the first characterization sample in March 2004 and track each indicator's concentration up through mid-October 2006, the most recent sampling event for which analyses of these indicators are available. As a result of its short biodegradation half-life and the ease with which it is removed from a formation during well development, acetone is below detection in all 3 screens even at the time of the first characterization sample, which occurred more than a year after development was completed in December 2002. Other than slightly elevated TOC concentrations, water samples from Screen 2 (blue points) pass nearly all of the tests for all of the events and also show significant improvement following the pilot rehabilitation activities. At the other extreme, water samples from Screen 4 (red points) fail all tests except acetone, and remain slightly elevated in TOC and ammonia concentrations even after the rehabilitation activities. The most dramatic shift is observed in water samples from Screen 3 (black points), which initially show the highest concentrations of TKN and ammonia, but these concentrations approach background levels within 15 months in this screen. TOC, TKN and ammonia remain steadily elevated in screen 4 (red points) for over two years until finally being brought under control by corrective measures taken under the pilot rehabilitation effort in July/August 2006.

4.5.3 Application of Criteria to Water-Quality Samples

Screening questions, assessment criteria, and consequence of response for this category are presented in Table 4-11. Water-quality data from all of the screens included in this report were compared against the criteria listed in Table 4-11. The details of this comparison are tabulated in Tables C-4 and E-1. Measured concentrations for the 80 screens are plotted in Appendix D. Figure 4-14 summarizes the results of this analysis. Key findings for the most recent sample event for which data are available for each indicator include the following:

- The four selected indicators (TOC, TKN, ammonia, and acetone) for residual organic drilling fluids are below the test thresholds for 52% (42) of the 80 well screens, indicating the likely absence of significant residual organic drilling constituents from these screens.
- Among the 22 single-screen wells, 15 (68%) passed all tests for residual organic constituents of drilling fluids. Among the 58 screens in multiple-screen wells, the proportion passing all residual organic tests was 47% (27 screens).
- Of the 38 screens that failed at least 1 indicator, 28 (74% of 38) only fail 1 indicator, 8 (21% of 38) fail 2 indicators, and 8 (21% of 38) fail 3 indicators.
- From the bottom histogram of Figure 4-14, the most frequent indicators failed are TOC (24 screens) and ammonia (22 screens), which comprise 63% and 58%, respectively, of the 38 screens that failed one or more tests.
- Of the 38 screens that failed at least one test, 8 screens (21% of 38) failed TKN.
- The test with the fewest number of failed samples is acetone (3 screens, 8% of 38), reflecting the effectiveness of its removal during well development and the quick biodegradation of any residual concentrations in the screen interval.

4.6 Category C—Modification of In situ Redox Conditions

The residual organic drilling fluids provide a rich source of food for small but ubiquitous native microbial populations in the aquifer. The activities of these sub-micron organisms have dramatic and long-term effects on the water chemistry and mineralogy in the vicinity of the well. As depicted in Figure 4-9, their feasting results in the sequential reduction of dissolved oxygen, nitrate, manganese(IV), chromium(VI), iron(III), uranium(VI), and sulfate and creates anaerobic conditions around the well.

4.6.1 Conceptual Model

Table 4-12 provides information on selected theoretical redox couples that are relevant to the screen assessment, either as indicator species (e.g., dissolved oxygen, nitrate, manganese, iron, sulfate, and bicarbonate) of in situ conditions, or as COPCs that are redox-sensitive. Table 4-13 classifies inorganic and organic solutes according to the type of reducing condition that would affect their concentrations. Strongly reducing conditions, such as those observed during sulfate reduction to hydrogen sulfide, affect a greater number of inorganic and organic analyte suites, whereas aerobic conditions (oxygen present) representative of natural and site conditions have the least impact on analyte suites.

The following discussion focuses on redox processes that both occur naturally and in the presence of residual organic drilling constituents. Redox reactions provide essential information on evaluating geochemical and biochemical impacts from residual drilling fluids on groundwater chemistry and aquifer mineralogy. Determining and monitoring redox chemistry provides important insights as to the extent that groundwater is approaching its predrilling conditions.

Plausible oxidation-reduction reactions occurring under natural conditions and during the breakdown or oxidation of residual organic species are shown in Figure 4-15, and redox criteria for assessing screens are shown in Figure 4-16. Overall oxidizing conditions are characterized by positive Eh values and overall reducing conditions are characterized by negative Eh values. Dissolved oxygen, nitrate, manganese, iron, and sulfate are naturally occurring solutes that undergo reduction in the presence of in situ aerobic and anaerobic microbes and different forms of dissolved and suspended organic carbon. The solubility of naturally occurring minerals present in aquifer material, including manganese dioxide and ferric (oxy)hydroxide, increases under reducing conditions in the presence of organic carbon (Figure 4-9). As in situ microbes consume residual organic drilling constituents such as hydrocarbons, alcohols, QUIK-FOAM surfactants, or EZ-MUD or other polymers that serve as a food source, the following sequence of highly generalized geochemical events is initiated:

- Initially, DO is reduced to water.
- Nitrate is reduced to nitrogen gas (denitrification).
- Manganese dioxide is reduced to dissolved manganese(II).
- Chromate is reduced to chromium(III) and chromium hydroxide [$Cr(OH)_3$]
- Ferric (oxy)hydroxide is reduced to dissolved iron(II).
- Finally, sulfate is reduced to dissolved sulfide (in the forms of hydrogen sulfide and hydrogen bisulfide, depending on the pH).

This conceptual model is illustrated by the geochemical trends plotted in Figure 4-17 for wells R-18 and R-20 Screens 1 and 3. Well R-18 illustrates conditions typical for a well providing reliable and representative water-quality samples free of any residual effects from drilling and construction or of a contaminant plume. Samples from this well show iron, nitrate, and sulfate concentrations that are consistent with oxidizing conditions in the regional aquifer; R-18 passes all of the tests in Category B for residual organics for which data are available (Tables C-3), indicating that no residual organic fluids remain in the formation to initiate reducing conditions. In contrast, Well R-20 Screens 1 and 3 both demonstrate variable degrees of reducing conditions during their first 4 sampling events, evidenced by low nitrate (Figure 4-16c), elevated iron (Figure 4-17), and, in the case of Screen 3, negligibly low sulfate (Figure 4-17). Reduction of iron(III), nitrate, and sulfate has taken place because of the presence of residual organic drilling fluids in these intervals of well R-20. Prior to the start of pilot rehabilitation activities at this well in June 2006, ammonia and TOC concentrations still exceeded the upper threshold limits in all 3 of the screens in R-20, despite the fact that 3-1/2 years had passed since the completion of well development (December 2002).

Molybdenum concentrations are expected to wax and wane as groundwater passes through increasingly negative redox stages. Under oxidizing conditions (DO present), molybdenum (VI) forms stable and soluble molybdate (MoO_4^{2-}) anions. In the regional aquifer, molybdate is present only at low concentrations, often below the detection limit (median 1 µg/L, maximum 4 µg/L, 49% nondetects, Table 4-3a). Molybdenum concentrations may rise sharply when iron (III) is reduced to iron (II) (about

14 mV, Table 4-12), thereby releasing into solution those metal ions (including molybdenum) adsorbed onto ferric (oxy)hydroxides. Molybdate (MoO_4^{2-}) is reduced to molybdenum (IV) at about -203 mV (Table 4-12). Finally, when sulfate is reduced to sulfide (about -217 mV), concentrations of molybdenum once again drop to negligibly low values when it precipitates or co-precipitates with iron to form reduced iron or sulfide minerals. This conceptual model for geochemical interrelationships among molybdenum, iron, and sulfate as reducing conditions evolve is supported by geochemical trends in dissolved metals, sulfate, and sulfide for water-quality samples from screen 3 in R-20 as well as from other screens. Such trends may provide a means for identifying those screens in which iron-and sulfate-reducing conditions have resulted in significant transformation of reactive-phase iron minerals adjacent to an impacted well screen (EPA 2006, 094894).

Sulfate reduction represents the strongest reducing conditions observed in wells impacted by organic drilling fluid. Under this condition, nearly all of the analyte suites (general chemistry, metals, radionuclides, HE compounds, and other organic suites) are significantly impacted (Table 4-13). The list of affected analytes is slightly shortened under the less severe condition of iron and manganese reduction (Table 4-13). Nitrate and dissolved oxygen reduction have most analyte suites not impacted by residual organic drilling fluid, excluding part of the general inorganic suite and all SVOC and VOC suites. A completely restored well produces water with measurable dissolved oxygen (>2 mg/L), dissolved iron and manganese concentrations near or below the detection limit, and nitrate and sulfate concentrations within the range of background or representative of site conditions. Under these aerobic conditions, none of the various analyte suites are expected to be compromised by any residual organic drilling fluid (Table 4-13).

Organic components of drilling products eventually oxidize to carbon dioxide and water, producing elevated alkalinity. Field measurements of dissolved oxygen and analyses of total carbonate alkalinity, dissolved nitrate, manganese, uranium, iron, and sulfate support the sequence of these redox reactions. These various indicators provide direct and quantitative evidence for the breakdown of organic-based drilling fluid and the well's progress toward restoring its predrilling geochemical conditions. Total carbonate alkalinity is denoted as alkalinity in this report.

Analytical results for organic contaminants, such as chlorinated solvents, aromatic hydrocarbons, HE compounds, aliphatic hydrocarbons, and PAHs, that may undergo biological transformations induced by residual drilling fluid may not provide representative results (Table 4-13). Native microbes use residual organic carbon from drilling fluids as a substrate or food source, in the form of an electron donor, and anthropogenic organic compounds listed above can serve as terminal electron acceptors. The electron acceptors become reduced as the residual organic drilling fluid oxidizes to carbonate alkalinity. These include chlorinated aliphatic hydrocarbons and HE compounds.

In situ microbes also consume organic contaminants directly, in which the organic compounds eventually oxidize to total carbonate alkalinity and water. These include PAHs, benzene, toluene, xylene isomers, and ethylbenzene. Organic contaminants affected by biodegradation induced by residual organic drilling fluid would decrease in concentration over time. Predrilling conditions occur when mobile organic contaminants and carbonate alkalinity show consistent trends in groundwater.

4.6.2 Selection of Indicator Species and Test Threshold Values

Redox indicators for water samples are selected based on theoretical calculations as well as practical concerns (see Table 4-12). As shown in Figure 4-16, selected indicators include ten that participate in or respond directly to redox reactions (dissolved oxygen, nitrate, manganese, iron, uranium, perchlorate, chromium, sulfate, sulfide, and ORP), as well as two indicators (nickel and molybdenum) which reflect redox conditions through their take-up and release from Fe- or Mn-bearing minerals dissolved or transformed by shifting redox conditions (e.g., Davranche and Bollinger 2000, 094906; Davranche and

Bollinger 2000, 094908). These species were added in order to be able to detect iron-reducing conditions in situations where that reduction results in a change in mineralogy—such as formation of iron sulfides or iron carbonates—instead of increasing dissolved iron concentrations (EPA 2006, 094894). The addition of molybdenum in particular was suggested by the statistical association between its concentrations and those of iron and manganese in the multivariate statistical analysis presented in section 5 and interpreted in section 5.4.

Although field measurements of DO and ORP are assumed to be uncertain and potentially biased on the high (oxidizing) side relative to in situ conditions, nonetheless these data provide a backup method for detecting sulfate-reducing or nitrate-reducing conditions in a water sample when such conditions may be obscured by the presence of a contaminant plume.

4.6.3 Application of Criteria to Water-Quality Samples

Screening questions, assessment criteria, and the consequence of response for redox conditions are provided in Table 4-14. Water-quality data from all of the screens included in this report were compared against the criteria listed in Table 4-14. The details of this comparison are tabulated in Tables C-5 and C-6, and summarized in Tables C-7 and E-1. Measured data for samples from the 80 screens are plotted in Appendix D.

Figure 4-18 summarizes the results of this analysis, prior to thorough review of the applicability and validity of test criteria for all of the screens and samples. Key observations for this preliminary view of redox test outcomes for the most recent sample event are provided below:

- No indicators of reducing conditions are observed in the most recent sample from 28 (35%) of the 80 screens, indicating the presence of oxidizing conditions in these screens. Twelve of these are single-screen wells, and sixteen are screens in multiple-screen wells.
- Fifty-two (65%) of the 80 screens failed at least one redox test, including ten single-screen wells.
- Thirteen (16%) of the 80 screens failed at least one of the three tests for sulfate-reducing conditions. Two new single-screen wells failed solely on the basis of field parameters (sulfide in R-3i and ORP in R-24).
- Twenty-eight (35%) of the 80 screens failed the test for iron-reducing conditions, based solely on elevated iron concentrations. One is a single-screen well (R-6i) and the remainder are screens in multiple-screen wells.
- Thirty-one (39%) of the 80 screens failed the test for manganese-reducing conditions, based solely on elevated manganese concentrations. Two of these are single-screen wells (R-6 and R-9).
- Nine screens (11%) failed the test for perchlorate-reducing conditions. One is a single-screen well (R-3i) and the rest are screens in multiple-screen wells.
- Fourteen (17.5%) of the 80 screens failed the test for uranium-reducing conditions. All are screens in multiple-screen wells.
- Twenty (25%) of the 80 screens failed at least one of the two tests for nitrate-reducing conditions. All are screens in multiple-screen wells. One screen (R-20, screen 3) failed solely on the basis of low DO.
- Thirteen (16%) of the 80 screens had elevated concentrations of nickel, and thirteen (16%) had elevated concentrations of molybdenum. The conceptual model proposes that these metals are released into solution when oxidized iron or manganese minerals dissolve or convert to reduced

mineral phases including sulfides or carbonates. However, elevated molybdenum concentrations could also result from its presence in a contaminant plume or as an impurity leached from bentonite drilling mud (Table A-10).

At first glance, some of these results appear internally inconsistent because the number of screens showing nitrate-reducing conditions should be at least as great as, if not greater than, the proportions showing sulfate-, iron-, or manganese-reducing conditions. This apparent discrepancy is a consequence of several factors, for example,

- nitrate-reducing conditions may be obscured by the presence of a nitrate contaminant plume at several locations;
- the test threshold for nitrate-reducing conditions does not capture those screens in which this condition is in early (developing) or late (recovering) stages; or
- there could be other sources or geochemical reactions involving sulfide, iron, or manganese which the current conceptual model does not adequately take into account.

Figure 4-18b classifies the most recent samples included in this report according to the redox state that is most consistent with the analytical data, using expert judgment to place heavier reliance on those indicators which are considered most reliable, and to discount those indicators which are likely being affected by other factors (as discussed in section 4.10), including the effects of a contaminant plume. This qualitative evaluation results in the following snapshot of redox conditions in the 80 screens as of December 2006:

- Forty-four (55%) of the 80 screens are fully oxidizing. This total includes 20 of the 22 single-screen wells and 24 of the screens in the multiple-screen wells.
- Only 10 (12.5%) of the 80 screens appear to be squarely in the nitrate-reducing and manganese-reducing categories, in the broad Eh zone between fully oxidizing conditions and iron-reducing conditions. Apparently, this redox state is relatively unstable, and geochemical conditions tend to evolve either to more oxic or more reducing conditions. This distribution probably reflects the prominent role of iron-bearing minerals in controlling the water's redox chemistry.
- Sixteen (20%) of the 80 screens are iron-reducing. All are screens in multiple-screen wells.
- Ten (12.5%) of the 80 screens are sulfate-reducing. This total includes one single-screen well (R-24), which shows elevated manganese and molybdenum levels as well as other signs of reducing conditions. As in the case of nitrate-reducing and manganese-reducing conditions, the sulfate-reducing state may also be unstable, and once the available sulfate is depleted, iron-bearing minerals then establish the water's more stable redox chemistry.

4.7 Category D—Modification of Surface-Active Mineral Surfaces

Surface-active minerals have charged surfaces that attract and retain oppositely-charged metal counter-ions. In the saturated zones beneath the Parajito Plateau, the most common surface-active minerals are native calcium carbonate, clays, and iron (oxy)hydroxides. Analytes adsorb onto a specific mineral surface by ion exchange or formation of a surface complex. In the case of many organic species, retention by a mineral surface may simply be a consequence of the organic compound's hydrophobic characteristic. Under some conditions, adsorption is reversible; in other cases, it is essentially permanent.

Drilling fluids can alter the type, quantity, and distribution of surface-active minerals directly as through the injection of bentonite clays during drilling, or indirectly by initiating the alteration, dissolution, or precipitation of mineral phases. The category of effects addressed by this section is limited to aluminosilicate minerals, and focuses primarily on bentonite drilling clay. Residual drilling effects on iron/manganese-bearing mineral phases are incorporated into Category C as redox effects (section 4.6), and changes in carbonate mineral stabilities due to drilling fluids are addressed in section 4.8 (Category E).

4.7.1 Conceptual Model

In addition to providing a source of inorganic species to the groundwater, as discussed in section 4.4, bentonite drilling mud also affects groundwater quality by removing solutes from solution through adsorption (Figure 4-6). Bentonite is negatively charged at pH >2. Anions adsorb poorly onto bentonite at neutral pHs. Cationic metals that adsorb onto bentonite include aluminum, beryllium, cadmium, chromium(III), cobalt, copper, iron, lead, manganese, mercury, nickel, silver, strontium, and zinc. Many organic constituents also adsorb strongly onto bentonite or partition onto the small but significant fraction of organic carbon compounds that commonly coat parts of the clay surface. Table 4-15 summarizes information on the adsorptive behavior of inorganic and organic adsorbates onto sodium bentonite drilling mud. An adsorbate having a K_d less than 1 mL/g is considered as not adsorbing onto bentonite and as not impacted by its presence in the screen interval. At the other extreme, an adsorbate having a K_d greater than 1000 is considered to be very strongly adsorbed.

4.7.2 Selection of Indicator Species and Test Threshold Values

The high adsorption capacity of bentonite for cations is addressed in Table 4-16, which considers uranium, strontium, and barium as key analytes for evaluating the adsorption capacity of bentonite for inorganic (cationic) chemicals that are present in local groundwaters. Concentrations of analytes that are less than their respective minimum background levels for predrilling conditions may suggest that adsorption processes have taken place with residual bentonite.

Zinc was selected as a conceptually conservative analogue for evaluating the adsorption of cesium-137 onto residual bentonite, based on a literature-derived mean K_d of 2400 mL/g for zinc and 1900 mL/g for cesium (Table A-11) (Sheppard and Thibault 1990, 090541). Zinc is stable as Zn^{2+}, which adsorbs to a greater extent than monovalent cations, including Cs^{+}. These adsorption data were compiled for clay-rich soil. Zinc is typically analyzed using inductively coupled plasma (argon)-mass spectrometry (ICP-MS), and this analyte is detected in groundwater samples. If dissolved zinc is detected in groundwater and it adsorbs more strongly than cesium, based on literature-derived K_d values, then it is reasonable to assume that a nondetect of cesium-137 is reliable and not attributable to removal from solution because of adsorption onto residual bentonite. Cesium also adsorbs onto naturally occurring clay minerals present in aquifer material; however, this process is not included in the conceptual model in order to place conservatism in the analysis.

The compilation of K_d values by Sheppard and Thibault (1990, 090541, Table 3) suggests that cobalt may sorb more strongly onto loam and agricultural soils than does zinc. However, the geochemical conditions under which this occurs are not representative of groundwater beneath the Pajarito Plateau. The more appropriate reference for local conditions is Bradbury and Baeyens (2005, 094905), which shows that zinc sorbs more strongly than cobalt onto montmorillonite in a neutral pH, low-TDS solution.

Radionuclides, including americium-241, cerium-139/141/144, plutonium-238/239/240, and radium-226/228 strongly adsorb onto bentonite (Table A-12). However, these radionuclides—as well as their candidate natural analogues (e.g., lanthanides [Bradbury and Baeyens 2005, 094905; Coppin et al. 2002, 094907])—also adsorb very strongly onto clay minerals and iron (oxy)hydroxides that occur naturally along active flow paths in most host rocks that underlie the Pajarito Plateau. Consequently, it cannot be distinguished whether the absence of a strongly sorbing species from a water sample is attributable to its true absence, to adsorption onto residual bentonite drilling mud, or to adsorption onto native minerals in the formation.

The propensity for HE compounds and degradation products to adsorb or partition onto residual bentonite is based on their estimated K_d values. Compounds with K_d values greater than 1 mL/g are considered to adsorb onto residual bentonite, assuming that the organic carbon content associated with bentonite is 0.4% or higher. Table 4-15 shows that HE compounds with K_d values >1 mL/g are high-melting explosive (HMX), pentaerythriotol tetranitrate (PETN), tetryl, and trinitrotoluene (TNT). Solid organic carbon is considered to be the dominant adsorbent for these hydrophobic compounds. Appendix A, Table A-4 tabulates K_{OC} and K_d values for HE compounds and related degradation products.

The same approach is used to estimate the adsorption or partitioning tendencies of organic analytes: herbicides, pesticides, PCBs, dioxins, furans, VOCs, SVOCs, long-chain aliphatic hydrocarbons, aromatic compounds, and polynuclear aromatic compounds. Appendix A, Table A-5, provides information on K_{OC} and K_d values for dioxins, furans, pesticides, and PCBs and shows that all of these have K_d values >1 mL/g and are considered to be possibly impacted by residual bentonite through adsorption processes.

Most herbicides are not considered to adsorb or partition onto solid organic carbon or bentonite, based on literature-derived K_d values (<1 mL/g) provided in Appendix A, Table A-6. These constituents generally are not impacted by residual bentonite through adsorption processes. Glyphosate, paraquat, picloram, T[2,4,5-], and TP[2,4,5-], however, have calculated K_d values >1 mL/g, and adsorption onto solid organic carbon and bentonite is a conservative assumption.

Constituents of diesel fuel, including long-chain aliphatics and polynuclear aromatic hydrocarbons (PAHs), are considered to adsorb or partition onto both solid organic carbon and bentonite, based on literature-derived K_d values provided in Appendix A, Table A-7. These constituents are potentially impacted by residual bentonite through adsorption processes. The hydrocarbon solution in which EZ-MUD copolymers are suspended falls into this category, as may some of the intermediate breakdown products of QUIK-FOAM surfactants.

Adsorption parameters (K_{OC} and K_d) for VOCs and SVOCs are provided in Appendix A, Table A-8. Most of these organic compounds are characterized by K_d values <1 mL/g, and adsorption onto residual bentonite is not significant. Acetone, isopropyl alcohol, and ethanol are in this category; these three are the VOC constituents of the aqueous solution containing QUIK-FOAM surfactants. Several compounds, including meta-dichlorobenzene[1,3-], para-dichlorobenzene[1,4-], trichlorobenzene[1,2,3 and 1,2,4-], benzidine, bis(2-ethylhexyl)phthalate, butylbenzylphthalate, carbazole, chloronaphalene[2-], and other organic compounds, however, have K_d values >1 mL/g. These compounds are predicted to adsorb onto solid organic carbon and bentonite.

4.7.3 Application of Criteria to Water-Quality Samples

Water-quality data from sampling events in the 12 screens drilled primarily using bentonite mud were compared against the four Category D criteria listed in Table 4-16. Data for these four indicators are plotted for all 80 screens in Appendix D. Details of this comparison are tabulated in Tables C-5 (for barium) and C-6 (for strontium, uranium, and zinc), and are summarized in Table C-7.

In the previous version of this report, tests for adsorption were only applied to water samples from screen intervals in which bentonite drilling mud was known to have been used. Table B-2 documents that bentonite mud was used to drill 3 single-screen wells (R-2, R-4, and R-6), and 10 screen intervals in 4 multiple-screen wells (R-14 screens 1 and 2, R-16 screens 1 to 3, R-20 screens 1 to 3, and R-32 screens 1 and 3). Bentonite-rich annular fill was also inadvertently emplaced in close proximity to the screen in R-13 and to screen 5 in CdV-R-15-3. These 15 screens would have the greatest likelihood of showing any geochemical effects of adsorption onto residual bentonite clays, if present. Key observations for the most recent sample events from these 15 screens include the following:

- One hundred percent of the 15 screens listed above (4 single-screen wells, 11 screens in multiple-screen wells) provide reliable detections of strontium. Therefore, strontium-90, if present, should also be reliably detected.
- One hundred percent of the 15 well screens provide reliable detections of barium and hence data for those metals for which barium can be considered a suitable analogue should also be reliably detected, if present.
- One hundred percent of the 15 well screens provide reliable detections of zinc and hence data for those metals and radionuclides for which zinc can be considered a suitable analogue should also be reliably detected, if present.
- Seventy-three percent (11) of the 15 well screens (4 single-screen wells, 7 screens in multiple-screen wells) provide reliable detections of uranium. Uranium is below detection in water samples from the remaining 4 screens (all in multiple-screen wells), but this condition is attributed to the very reducing environments that have developed at these screens.

Because of the absence of a suitable analogue, it was not possible to evaluate the well-screen intervals drilled using bentonite for detections of strongly adsorbing radionuclides or organic species.

If adsorption onto residual bentonite mud were a significant mechanism for the above detection rate for uranium, then one might expect a higher detection frequency for uranium in water samples from screens in which the drilling mud was not used. This hypothesis was tested by applying the same four test criteria to the 65 screens that were not drilled with bentonite mud. Key observations for the most recent sample event include the following:

- Ninety-two percent of the screens (18 single-screen, 42 of the 47 screens in multiple-screen wells) provide reliable detection of strontium and therefore, strontium-90, if present, should be detected. The detection rate was 100% for the screens drilled using bentonite mud.
- All but one of the 65 well screens provide reliable detections of barium and hence also of those metals for which barium can be considered a suitable analogue. The detection rate was 100% for the screens drilled with bentonite.
- One hundred percent of the well screens provide reliable detections of those metals for which zinc can be considered a suitable analogue. The detection rate was also 100% for the screens drilled with bentonite.
- Eighty percent of the wells (18 single-screen, 34 of the 47 screens in multiple-screen wells) provide reliable detections of uranium. For 12 of the 13 screens that did not provide detections of uranium, this condition is attributed to the reducing environments that have developed at these screens. The detection rate was 73% for the screens in which residual bentonite may have been present.

This comparison of test outcomes for adsorption indicators demonstrates residual bentonite most likely has a negligible effect on concentrations of these particular adsorbing species in regional groundwater. Other geochemical processes, not adsorption onto bentonite, are the dominant controls for dissolved concentrations of these species: specifically, reducing conditions and carbonate alkalinity. The first aspect was discussed in section 4.6, and the second is discussed in the following section.

4.8 Category E—Changes in Carbonate Mineral Stability

4.8.1 Conceptual Model

Barium, alkalinity, and strontium span a large range of concentrations in the screens included in this report, extending to very highly elevated levels (Appendix D). A comprehensive conceptual model that accounts for the major sources for these species and the geochemical processes that control their distribution in an impacted screen interval has not yet been fully developed. Nonetheless it is important to develop a better understanding of these controls because of the dominating role of carbonate species in controlling aquifer mineralogy, groundwater geochemistry, and transport characteristics of COPCs.

The multivariate statistical analysis presented in section 5 and interpreted in section 5.4 reveals a strong statistical association among barium, strontium, and alkalinity, together with boron, calcium, chloride, and magnesium. Relative contributions from several potential sources need to be considered:

- To what extent could association of the cations be explained as a consequence of being leached or dissolved from drilling products (e.g., see leach results for these species in Table A-10)?
- To what extent could association of these species be explained as a consequence of being desorbed or dissolved from the geological formation as a result of a drilling fluid?
- Could the elevated concentrations be an artifact of using soda ash in an interval?
- To what extent could carbon dioxide generated by biodegradation of residual organic drilling fluids contribute to elevated alkalinities in the screen intervals?

4.8.2 Selection of Indicator Species and Test Threshold Values

Indicator species for changes in carbonate mineral stability (barium, calcium, magnesium, strontium, alkalinity, and pH) were selected based upon their statistical association, which is also apparent in plots showing their relative distributions in the 80 screens covered by this report. Uranium was added to this category of indicators because of the importance of alkalinity and pH in controlling its speciation and, hence, transport characteristics. Test criteria for barium, magnesium, strontium, and alkalinity are whether the concentrations measured in a water sample are below the upper limits for these species in background groundwater. The criteria for calcium and pH are whether measured concentrations in a water sample fall within the range established for regional background groundwater (Table 4-17).

4.8.3 Application of Criteria to Water-Quality Samples

A comparison against the limits of background concentrations for these indicators is tabulated in Tables C-3 through C-5. Measured data for samples from the 80 screens are plotted in Appendix D figures. The following trends are notable:

- Low pH is seldom observed. Only 25 (6%) occurrences are noted among the 389 sample events (tallied at the bottom of Table C-3 and plotted on Figure D-20). Only in two screens does a low pH appear possibly to be a persistent condition.
- pH above background levels from local groundwater occurs in 38 (10%) of the full sample set.
- Over 30% of the alkalinity data exceed the upper limit for local groundwater (tallied at the bottom of Table C-3 and plotted in Figure D-2). It is unclear the extent to which these excursions are attributable to residual drilling effects, including biodegradation processes, non-representative bounds on natural variability in groundwater alkalinity, or alkalinity data that are not representative of in situ conditions.

Among the four divalent cations (barium, calcium, magnesium, and strontium), based on results tallied at the bottom of Tables C-5 and C-6:

- Calcium shows the largest total proportion of excursions outside the background range (139 out of 379 samples, 37%), most of which are above background limits (103 out of 379, 27%) rather than below them (38 out of 379, 10%).
- Strontium mimics calcium distributions, with its 35% rate of excursions (134 out of 383 samples) dominated by concentrations above (96 out of 383, 25%) the upper limits of its range in local groundwater rather than below (38 out of 383, 10%) its lower limits.
- Barium shows the most frequent excursions above background limits (114 out of 383, 30%). Low barium is rarely observed, with only one occurrence noted among the 383 samples (<0.3%).
- Magnesium shows the smallest (63 out of 381, 17%) proportion of excursions above its range in native groundwaters.

4.9 Category F—Corrosion of Stainless-Steel Well Components

4.9.1 Conceptual Model

Below the depth of the surface casing, all R wells are constructed with stainless steel well casing. The term “stainless steel” refers to iron-based alloys that contain at least 12% chromium. The high chromium content results in the formation of a passive layer on the surface of the steel that resists oxidation. Stainless steel is known for its inertness even under extreme chemical conditions. However, the properties of this metal under physically stressed conditions can be quite different from those when it is not stressed. Corrosion tends to start in the form of pits or microcracks where the metal was subjected to the greatest stress, and grows along intergranular boundaries. The iron in the steel begins to dissolve into solution as the metallic iron species, and is immediately oxidized to ferric hydroxide if dissolved oxygen is present. The iron hydroxide precipitates, removing it from solution (although it may remain suspended in colloidal form), which allows more iron metal to dissolve. This process continues as long as the supply of DO is continually renewed.

As the iron matrix dissolves, other metal components of the stainless steel are also released. The dominant species (after iron) are chromium, nickel, and manganese. Under oxidizing conditions, the oxidized forms of chromium and nickel are highly soluble, whereas manganese, like iron, forms an insoluble oxide phase. Other metal components which could be released if present in a particular type of steel include boron, molybdenum, phosphorous, sulfur, vanadium, titanium, niobium, and tungsten.

Beyond the depth of the surface casing, the deeper casing for all of the wells evaluated in this report is composed of Type 304 stainless steel. Its approximate composition is described below (Herting et al. 2006, 094898):

- Chromium % 18
- Nickel % 9.0
- Manganese % 1.1
- Silicon % 0.3
- Molybdenum % 0.3
- Carbon % 0.05
- Phosphorus % 0.03

- Sulfur % 0.002
- Iron % 71

The major corrosion products, in order of decreasing total concentrations, are iron, chromium, and nickel (Herting et al. 2005, 094897). Two general observations made by corrosion researchers is that iron is preferentially released relative to its proportion in the alloy, and that the release rate for each element is higher early in the corrosion process and then decreases with subsequent exposure time to the fluid (Herting, et al. 2006, 094898).

4.9.2 Selection of Indicator Species and Test Threshold Values

Indicator species for stainless steel corrosion are highly elevated total concentrations of iron, chromium, and nickel. To distinguish the effects of stainless steel corrosion from those of iron-reducing conditions, additional test criteria must also be specified. The test indicators and threshold values are presented in Table 4-18. Stainless steel corrosion is concluded as being present if any of the following combinations of conditions are met:

- Total iron above 0.5 mg/L *and* a ratio of total to dissolved iron greater than 10,
- Total chromium above the maximum concentration for background groundwater *and* a ratio of total to dissolved chromium greater than 5, and/or
- Dissolved nickel concentration greater than 0.05 mg/L.

Turbidity greater than 5 NTU is an additional test criterion that is neither required nor sufficient to conclude the presence of corrosion, but which establishes the level of confidence that one should have in the outcome of the other test criteria.

4.9.3 Application of Criteria to Water-Quality Samples

Water-quality data are compared against these 6 test criteria in Appendixes C and D:

- Total iron, and the ratio of total iron to dissolved iron (Table C-6 and Appendix D)
- Total chromium, and the ratio of total chromium to dissolved chromium (Table C-6 and Appendix D)
- Dissolved nickel (Table C-6 and Appendix D)
- Turbidity (Table C-3 and Appendix D)

Test outcomes are tabulated in Table C-7, in the far right-hand column labeled “Category F, Metal Corrosion.” In order for the second set of tests to be applicable, the sample must first show that it meets at least one of the qualifying conditions (i.e., it must fail at least one of these tests) (Figure 4-4). Among the most recent samples from each screen, 18 of the 80 screens meet at least one qualifying condition. Of those 18 screens, five show indications of possible stainless steel corrosion:

- CdV-16-2(i)r—high iron ratio
- R-19 Screen 7—high total/dissolved iron ratio and high total/dissolved chromium ratio
- R-22 Screen 1—high total/dissolved chromium ratio
- R-25 Screen 1—high total/dissolved iron ratio, high total/dissolved chromium ratio
- R-25 Screen 2—high total/dissolved chromium ratio, high dissolved nickel concentration

The water samples from two of these five screens (R-22 Screen 1 and R-25 Screen 2) also show definite signs of sulfate-reducing conditions, counter to the conceptual model presented in section 4.9.1. These are also the only screens among the set of five with iron ratios that are less than the test threshold. This indicates the need to fine-tune the conceptual model, such as by geochemical modeling of the corrosion environment so as to minimize the potential to misinterpret geochemical conditions.

4.10 Caveats and Limitations on the Applicability of Indicators

The overall approach to identifying the residual effects of drilling materials has undergone a substantial redesign to reflect the shift in focus away from identifying impacts from specific drilling products and more towards identifying categories of effects, regardless of which specific product or mix of products was primarily responsible for those effects. The restructured approach establishes a better foundation for incorporating future adjustments to the indicators, their test thresholds, and their implications for affected analytes. Table 4-20 presents the full list of indicator species and test threshold values that have been described in this section.

However, just as individual drilling products share many of the same indicators, so do the indicators cross over into more than one category of effects. Their usefulness as an indicator targeting a category of effects may be substantially less reliable if other drilling-related effects are present. Table 4-21 presents a matrix that summarizes such cross-linkages of cause and effect for each indicator, and that identifies some critical qualifications and limitations that affect the applicability or reliability of a particular indicator for a particular condition. This list of qualifications will doubtless grow as experience and knowledge is gained. It is intended that these considerations will be incorporated into the review protocol for data adequacy evaluations.

Finally, one of the more significant factors of which the data reviewer needs to remain cognizant is the potential effect of a contaminant plume on the reliability of an indicator's test outcome. Several of the selected indicators are also common constituents of contaminant plumes: chloride, perchlorate, chromium, nitrate, sulfate, and possibly alkalinity. Table 2-1 tabulates some of the indicator tests that may have limited applicability to evaluation of water samples from specific screens because of the known presence of a contaminant plume containing that species or including constituents that could affect it.

5.0 MULTIVARIATE STATISTICAL ANALYSIS TO IDENTIFY IMPACTED SCREENS

Groundwaters commonly inherit chemical signatures from hydrogeological materials with which they react. In wells that have just been developed, additional changes to the chemistry may occur temporarily as a result of the presence of residual drilling fluids, drilling additives, or "skin effects" from physical and chemical damage to the penetrated rock. In some newly drilled wells, drilling-related effects on water chemistry may be more pronounced than natural chemical variability.

An exploratory use of multivariate statistical methods was made in 2005 to determine if the wells showing residual drilling effects could be identified. Differences in chemical signatures were investigated between the characterization wells and springs and long-established water supply and test wells in Los Alamos County, using a suite of 9 major ions and 11 metals/trace elements. Multivariate statistical methods, specifically principal component analysis (PCA) and cluster analysis (CA), were used to reduce large amounts of geochemical data in order to elucidate patterns within the data which otherwise might not have been observed.

5.1 Data Set Used in the Analyses

Selected regional aquifer water-quality data for the years 2000–2005 were retrieved from the WQDB. The retrieval comprised data for samples from 28 regional (R) characterization wells, 16 White Rock Canyon springs, and 15 long-established wells. These wells included 10 municipal supply wells (the Guaje Canyon series and the Pajarito Mesa [PM] series) and 5 regional aquifer test wells (TW-3, TW-8, DT-5a, DT-9, and DT-10). Of the 28 R wells used in the data set of 2005, 11 are single-screened, and 17 are equipped with multiple screens. In total, R-well results from 49 discrete screens were considered. All but four of the R wells had been sampled more than once; many had four complete rounds of chemical characterization data. To capture the full extent of water-quality variability in the wells, data from all the rounds were used in the statistical analysis.

Results from the White Rock Canyon springs, municipal water-supply wells, and test wells help in the identification of wells that contain residual drilling fluids. A list of these reference stations is provided in Table F-11. All the spring data are from filtered samples and represent regional aquifer quality unaffected by drilling. The test wells were installed in the early 1960s without drilling muds using cable-tool casing-advance methods. Only major ion chemistry results from the test wells were used in the statistical analyses because the metals data are suspect as a result of oxidation and partial dissolution of casing materials used (hardened steel). The municipal water supply wells were installed in the 1970s and 1980s with drilling muds. Because of the age of the supply wells and large pumpage volumes, however, there should be minimal or no residual drilling effects apparent in these wells. All data from the test and water-supply wells were from nonfiltered samples with turbidity levels below 2 NTUs. Because of the low turbidity and developed nature of the wells, those data were treated as comparable to filtered data (assuming that submicron colloids are absent) and added to the filtered results from the R wells and springs.

The analytes selected for the statistical analyses were limited to those that were routinely tested for in both the R wells and the reference stations. This eliminated some potentially useful identifiers of well construction impacts, such as TOC or TKN, because they were only occasionally analyzed in samples from the R wells and rarely in waters from the reference stations. The principal component analysis requires a fully populated data matrix and samples with missing results would have been excluded from the statistical analysis. Radionuclides also were not included in the exploratory analysis because they are not routinely detected in regional aquifer samples.

Statistical analyses were initially performed on four independent groups of data, distinguished by analytical suite and field preparation:

- Dissolved metal/trace-element concentrations—172 filtered (F) samples
- Total metal/trace-element concentrations—201 nonfiltered (UF) samples
- Dissolved major ion concentrations—166 F samples
- Total major ion concentrations—79 UF samples

These initial analyses were performed with the objective of determining if wells with residual drilling impacts could be identified, along with the analytes that best reflected such impacts. After it was demonstrated that the statistical approach was viable, other analyses were performed using merged data sets that included metals/trace elements as well as major ions. The objectives of the latter phase of analysis were to examine the interrelationships between the metals and major ions, and to examine trends in uranium concentrations.

Analytes with below instrument-detection-limit (IDL) concentrations in more than half of the samples were removed from statistical analysis. Below-detection-limit concentration values were replaced with values equal to half the IDL. The metals/trace elements included in the analyses were boron, barium, chromium, iron, manganese, molybdenum, strontium, vanadium, and zinc. The major ions included in the analyses were calcium, magnesium, sodium, potassium, chloride, sulfate, fluoride, nitrate, and total carbonate alkalinity. All of these constituents could be affected to varying extents by the presence of residual drilling fluids.

5.2 Statistical Analysis

Principal component analysis is a multivariate statistical technique for data reduction and for deciphering patterns with large sets of data (Stetzenbach et al. 2001, 090565). These data are not required to be normally distributed for the analysis. In using PCA, a large data matrix can be reduced to two smaller matrices, one consisting of principal component (PC) scores and the other containing the loadings. The scores help define the chemical signatures for each sample in the data set. The loading identifies the analytes that cause the greatest variance in the data set.

After the principal component scores were calculated, they served as input into CAs to group the results and identify groundwaters that have similar chemical signatures. PCA scores, weighted by their respective loadings, were input into the CA. Principal components with eigenvectors (scaling factors) usually larger than 1 were input into the CA. At a minimum, at least three components were carried forward into the CA. The K-means cluster (KMC) or hierarchical algorithms were used to identify similar clusters of results. For most analyses, it was empirically determined that six or seven clusters adequately represented the spread of data. The statistical software package “Statistica for Windows 7.1” (StatSoft, Inc.) was used for all PCA and CA.

5.3 Key Analytes Identified Through the Analysis

Summary results of the PCA are provided in Table 5-1. Appendix F provides detailed correlation matrices and factor loading matrices for all the separate PCA analyses performed. From the nine major ions and nine metals, the PCA identified the constituents that varied the most in concentration within each of the data sets. For each PCA analysis, the nine major ions were reduced to three PCs (groups of analytes). The nine metals/trace elements also were reduced to three PCs. From 65 to 72 percent of the variance in the data sets was explained by the three factors. The key analytes are identified in Table 5-1, along with the proportional amount of variation in the data set that is explained by the three or four principal components listed in that table. There were considerable similarities between the key analytes identified for the nonfiltered and filtered samples. For metals and trace elements, the key analytes included iron, manganese, barium and strontium.

5.4 Interpretation of the Statistical Analyses

An initial review of the water-quality data sets showed a larger range in chemical concentrations in the R wells than is typically found in the springs or long-established wells. The higher concentrations were associated with the R wells and probably reflect the presence or effects of residual drilling fluids or of local contaminant plumes.

Wells with possible drilling impacts were identified by examining chemical signatures established by the statistical analyses. R wells that are compositionally similar (cluster) to the White Rock Canyon springs or the long-established wells are interpreted to have minimal residual drilling impacts. R wells that are placed in other clusters were interpreted to have possible residual drilling effects.

Figures 5-1 through 5-4 present plots of the first three PCs for each metals or major ions analysis. These three PCs account for the majority of variability in the original data. The PCA scores for each water sample are plotted, and groundwaters that are compositionally similar are shown in the plots as clusters (C1, C2, etc.) identified by the KMC method. Highlighted on the plots are selected wells that reflect the most anomalous chemistry. The top plot in each figure shows the PCA scores grouped according to the type of groundwater source: multiple-screen R wells, single-screen R wells, municipal water-supply wells, White Rock Canyon springs, or test wells.

The interrelationships between metals and major ions in the R wells were examined by merging metals and major ions data sets and by analysis using the hierarchical cluster analysis (HCA) method. The results are shown in tree diagrams, or dendograms, in Figures 5-5 and 5-6. The HCA analysis identified the same highly impacted well screens as did the KMC analyses. The resulting dendogram was interpreted upon visual examination to have classified the nonfiltered recent water samples into four subgroups and the filtered samples into five subgroups (clusters) using 19 parameters (Figures 5-5, 5-6). This is a subjective breakdown but the subgroups serve to further examine the characteristics of the most impacted wells.

Tables 5-2 and 5-3 show the means for each of the parameters produced by the HCA analysis. Both the non-filtered and filtered data sets produced similar sub-groups with comparable compositions. Cluster 1 contains elevated concentrations of carbonate minerals (Ba, Ca, Sr), reducing conditions (elevated Fe, Mn), and elevated sodium. This is consistent with categories A (leachable drilling fluids), C (reducing conditions), and E (precipitation or dissolution of carbonate minerals) of residual drilling fluid effects (Table 4-2). Cluster 2 contains significantly reducing conditions but relatively low concentrations of the carbonate minerals. This is consistent with Category C. All of the well screens assigned by HCA to Clusters 1 or 2 showed Poor or Fair scores in the 2005 well screen analysis described in section 4. Clusters 1 and 2 also correspond well to PCs 1 and 2 of the factor loadings matrices.

PC 4 in the factor loading matrix for nonfiltered samples highlights elevated sodium and sulfate and likely reflects the presence of residual bentonite. The differences between the remaining clusters identified in HCA are more subtle and are interpreted to show minimal to moderate impacts from drilling fluids. There is a good correspondence between spatial locations and statistical groups for Clusters 3, 4, and 5. For example, many of the filtered samples from springs and wells within the central portion of the Pajarito Plateau are assigned to Cluster 3 and those from the southern portion are assigned to Cluster 5 (Figure 5-6).

5.5 Interpretation of Uranium Correlations

A major result from PCA is that anomalous chemical concentrations can be identified. This is true for concentrations that are either unusually elevated or unusually low. Thus, if significant removal of uranium from solution is occurring in some R wells, the PCA would identify abnormally low uranium concentrations as a key component of variance in the data set.

A review of the factor loadings matrices (Appendix F) shows that uranium concentrations are correlated with other constituents sensitive to oxidation/reduction. Uranium correlates positively with vanadium and nitrate concentrations, and inversely to iron and manganese concentrations. Abnormally low concentrations of uranium, if present, are statistically associated with elevated iron and manganese concentrations. However, uranium is not significantly associated with any other factors in the PCA. Uranium is not expected to adsorb onto bentonite because it forms anionic or neutrally charged carbonate complexes and is rarely present as a cation. The PCA is consistent with this. If sorption were a dominant mechanism controlling the concentration of uranium, sorption would have been identified as a different component, separate from oxidation/reduction in the factor loadings matrix.

5.6 Key Findings from Statistical Analyses

The chemical signatures of most of the water-supply wells are consistent with those of the test wells and White Rock Canyon springs. This indicates that the water-supply wells reflect the regional aquifer water quality and show no discernible residual effects from drilling fluids. Taken together, results from the springs, test wells, and water-supply wells represent the regional aquifer “baseline” water quality (as distinguished from “background” because it includes normal effects from aging wells).

- In many cases, the single-screen wells are compositionally similar to the baseline stations. There is indication of slightly higher iron or manganese concentrations in some of the single-screen wells. Overall, the analysis indicates that there is minimal to slight residual impacts from drilling in the single-screen wells.
- The multiple-screen R- wells show considerable residual drilling impacts. Significant impacts are seen in the multiple-screen wells in all metals and major ion data sets analyzed. The well screens showing the most impacts include R-20 (screen 2), CdV-R-37-2 (screen 2), R-22 (screen 1), R-22 (screen 4), and R-31 (screen 2).
- The magnitude of drilling impacts was assessed by considering the similarity in chemical signatures to the “baseline” stations—the springs, test wells, and water-supply wells. Table 5-4 summarizes the preliminary interpretation of the results for the most recent data from each site.

5.7 Comparison of PCA Results with Data Qualification Test Outcomes

The two independent approaches largely produce consistent results but differ in a number of aspects. The differences include

- method objectives,
- the number of screens included in the analysis,
- the type of data used in the analysis,
- the period of coverage for samples from each screen,
- the collection dates of samples that represent the “most current” sample, and
- assumptions that underlie interpretation of the results.

Regarding method objectives, the PCA was designed primarily to test whether the screens had chemical characteristics that differed significantly from those shown by local springs and water-supply wells. The latter are assumed to represent relevant background conditions. In contrast, the well screen analysis approach described in section 4 was designed to test whether the screens produced water samples that were reliable and representative of predrilling concentrations for a number of specific categories of analytes of concern, many of which are not detected in background waters.

The two methods use a similar number of inorganic indicator species: about 21 for the well screen analysis method presented in Section 4 and 18 for the PCA method. Notably absent from the PCA input data are organic species and field-based parameters other than alkalinity. Organic-based drilling fluids, if used during drilling of supply wells, have been removed during several decades of pumping. Neither method includes any radionuclides as indicators.

Table 5-5 provides a qualitative comparison of the outcomes of both methods. The methods overlapped in coverage for 51 screens. Screens that were included in the well screen analysis but excluded from the PCA method for the most part were either newly completed wells that only produced water-quality data in the past couple of months, after the PCA study had already been conducted (in June 2005), or older wells for which water-quality data had not yet been transferred into the WQDB from the Environmental Restoration Database (ERDB).

In Table 5-5, shaded cells indicate those 45 screens (88%) for which both methods produced qualitatively comparable results. The two methods differed for 6 screens. The differences are traceable, for the most part, to just a few reasons:

- absence of consideration of organic analytes by the PCA method
- absence of consideration of most field-based data by the PCA method
- differences in the date of the sample considered “most current”
- the specification of background ranges by the well screen analysis approach that may not reflect the full range of conditions that actually occur
- the treatment of partial data sets for which key analytes are not available (included by the screen analysis method, excluded from the PCA method which requires full data sets)

6.0 SUMMARY AND CONCLUSIONS

6.1 Summary

In addition to the sampling events examined in the initial version of this report, all new characterization (i.e., post screening), surveillance, and special-study water samples were evaluated from 42 wells up to December 31, 2006. These included a total of 95 screens, of which 80 were functional: 22 screens in single-screen wells and 58 screens in multiple-screen wells. This is an addition of 9 wells and 14 screens to the list of those evaluated in Revision 0, for a total of about 390 individual sampling events, nearly doubling the original set of 200 samples.

The evaluation in Revision 1 used revised background values from an expanded set of 30 background locations, approved by NMED and reported in the “Groundwater Background Investigation Report, Revision 2” (LANL 2007, 094856). Use of revised background values along with their detailed statistical characterization allowed for fine-tuning of test threshold values for geochemical indicators. Overall, the use of these revised threshold values increased the number of tests passed for many indicator analytes as well as improving the internal consistency among test outcomes.

A major shift in philosophy in Revision 1 is the implementation of a single, comprehensive approach to examining geochemical data for the presence of impacts from any drilling fluids, rather than the separate, tailored evaluations of organic-based and bentonite drilling fluids used in the initial report. The rationale for the single approach is that bentonite drilling fluids still contain minor amounts of organic polymers, and bentonite and organic additives are used in well construction to fill in the annular space between the casing and the formation so as to isolate the screen interval. In other words, individual indicators cannot be linked to just one type of primary drilling fluid. This approach is justified by a vastly improved knowledge of the compositions and uses of drilling fluids and additives and more refined conceptual models about their effects on groundwater and mineral geochemistries. The single approach also allows for more efficient automation of the evaluation protocol, which requires well-defined conditions and boundaries for determining which tests are applicable to a sample and whether an indicator passes or fails a test.

In Revision 1, boron was dropped because it was found not to be a reliable indicator of leaching from bentonite mud (data in Table A-10). However, the following eight new indicators were added to the 18 remaining indicators that were used in Revision 0: barium, chromium, magnesium, molybdenum, nickel, perchlorate, phosphate, and turbidity. The ratio of total to dissolved iron and the ratio of total to dissolved chromium were also added to provide indicators of stainless-steel corrosion. Some were added based on the results of leaching tests of drilling products (Table A-10); others were added based on statistical correlations revealed by the PCA analysis (section 5 and Appendix F); and still others were recommended by the EPA (EPA 2005, 090545; EPA 2006, 094894), NMED (NMED 2006, 094373), and other reviewers.

Revision 1 deals more explicitly than Revision 0 with screens in which the presence of a contaminant plume interfered with the validity of the screen analysis. As an example, the presence of nitrate or sulfate in a contaminant plume can obscure drilling fluid-induced reducing conditions that are otherwise chiefly revealed by negligibly low concentrations of these two species. This potential for reducing conditions to be masked is one primary reason that field parameters—sulfide, dissolved oxygen, and oxidation-reduction potential—are important to include in the evaluation, despite their known limitations. Conversely, elevated chloride in a water sample in which chloride is present in a contaminant plume can be misinterpreted as an indication of the persistent presence of water-soluble drilling-fluid constituents.

As indicated by Table 6-2a, the ranking outcome for the well screens collectively improved considerably between Revision 0 and Revision 1. There are several reasons for this, including having more data, adding more test indicator species, and having statistically based indicator thresholds.

6.2 Conclusions

Any comparison between the well-screen ratings in Revision 0 and the ratings in Revision 1 must take into account several factors:

- Both the criteria and the evaluation protocol have been substantially overhauled in Revision 1.
- Revision 0 limited its examination to the three most recent samples as of August 31, 2005. In contrast, Revision 1 extended its evaluation of these water-quality data to include the large number of characterization and surveillance samples collected since August 2005, up through December 31, 2006.
- Water quality in nine screens from three wells (R-12, R-16, and R-20) has been significantly affected by pilot rehabilitation activities that postdated Revision 0.

The first two factors lead to a greater degree of confidence in the Revision 1 ratings than in Revision 0. However, because all three aspects introduce multiple variables, an interpretation of the screen rating changes is much more complicated than if only one of these situations had been changed. The conclusions must be viewed with this caveat in mind.

Many of the findings of Revision 0 are still true in Revision 1:

- The most common drilling artifact is the presence of reducing conditions.
- Single-screen wells show the least impact from residual drilling fluids.
- The majority of the screens in multiple-screen wells appear to be impacted by residual drilling fluids, although nearly all multiple-screen wells have at least one screen interval rated as Good or Very Good.

The two revisions depart from one another with respect to the proportion of screens rated as Fair to Poor for providing reliable water-quality samples. In Revision 0, 23% of the screens were rated Poor; in Revision 1, the proportion rated Poor drops by nearly half, to 12.5%, for the most recent water sample.

A preliminary conclusion in Revision 0 was that some screens appeared to be improving over time. This overall trend is not only confirmed by the outcomes of the evaluation protocol presented in Revision 1 but also made more apparent because of the improved assessment methodology, inclusion of a greatly expanded database, the passage of time, and early effects of pilot rehabilitation activities. Nearly 25% of the screens improved over the period covered by this report (Table 6-4), whereas previously the number of sampling events available for many of these screens had been too few to establish definitive trends for them.

6.2.1 Observations

The results of the water-quality evaluations documented in this report underscore the importance of examining short-term and long-term trends when assessing the reliability and representativeness of water-quality data for a screen. It is not always sufficient to look at the current geochemical characteristics of a water sample, but one must also often consider the geochemical path that it followed to arrive at that point. Whether an indicator's concentration is rising, falling, or stable is an important trend to establish because such a trend may be a distinguishing characteristic between a residual drilling effect and an effect arising from a local contaminant plume. Factoring in the effects of a local contaminant plume is one of the major challenges for the development and implementation of a data-qualification protocol for residual drilling effects.

Subject to the above caveats, Figure 6-1(a) and Table 6-1 summarize the frequency with which residual drilling effects appear to be present in the most recent sample from the 80 well screens evaluated in this report.

- No residual drilling effects are detected in 20 of the 80 screens. Twelve of these are single-screen wells, and eight are screens in multi-screen wells.
- Among those screens in which residual drilling effects are indicated, the most frequently observed effect (45% of the screens) is the presence of reducing conditions that presumably arise from biodegradation of residual organic drilling products.
- A close second category of observed effects (42% of the screens) are shifts in carbonate mineral stabilities, which have major implications for chemical transport because of the high degree with which trace metals complex with carbonate species in groundwater.
- The third most frequently detected effects (39% of the screens) are indicators of residual organic drilling materials.
- Less frequently detected (26% of the screens) are indicators of residual inorganic drilling fluids; this lower rate may simply reflect the fact that these indicators are not evaluated if they are known to be present in a local contaminant plume.
- The conditions detected with the lowest frequencies are indicators for enhanced adsorption (9% of the screens) and indicators of stainless steel corrosion (6% of the screens).

Several observations are made about each of the six categories of effects, and the indicators used to detect those effects:

- Category A—Among all indicators of residual inorganic species derived from drilling fluids, the most frequently observed are elevated concentrations of alkalinity (31% of screens) and chloride

(25%), with fluoride a close third (24%) (Figure 4-8b). Characterization data for drilling products (Tables 4-7 and A-10) indicate that a number of these could be contributing to the elevated concentrations of these indicators.

- Category B—Among indicators of residual organic drilling fluids, ammonia (28% of the screens) and TOC (30% of the screens) are by far the most commonly detected above their threshold values (Figure 4-14b). Because natural background levels of these species are negligible, these organic indicators also show an obvious decrease as a screen improves over time.
- Category C—“Fully oxidizing” (i.e., aerobic) conditions exist at 55% of the screens (Figure 4-18). In the reducing category, 33% are in the range of more reducing (i.e., iron or sulfate reducing), whereas only 12% are more mildly reducing (reduction of manganese and nitrate). Time will tell whether the more reducing conditions in the screens will improve toward more oxidizing, but the distribution of conditions is clearly bimodal, whereas the preferred outcome would have been to observe a higher percent in the mildly reducing and oxidizing categories. The dearth of screens showing mildly reducing conditions may reflect the effectiveness with which redox conditions in the groundwater are buffered by reactive minerals in the formation, particularly iron-bearing minerals. Some mineralogy altered by drilling fluids is likely to remain unchanged for long periods of time. For example, severely altered iron mineralogy is inferred as being present in well CdV-R-37-2 screen 2, because dissolved iron remained highly elevated (>10,000 µg/L) for all six of the sampling events included in this report, which span a year and a half.
- Category D—All screens in single-screen wells are able to detect indicators of adsorbing species, to the extent that reliable surrogates for these species could be identified. The results for single-screen wells are identical for wells drilled with and without bentonite mud (section 4.7.3). Multiple-screen wells showed some variation between outcomes for wells drilled with and without bentonite mud; but in either case, a vast majority of the screens were able to detect strontium, barium, and zinc. In contrast, only 82% of the screens were able to detect uranium. In this case, however, the nondetects are attributed to the presence of reducing conditions, and not to adsorption onto residual bentonite.
- One observation that has not changed between Revision 0 and Revision 1 of this report is that no good surrogate has been found to evaluate the ability of a screen to provide reliable data for highly sorbing radionuclides such as plutonium-239, which is routinely measured (but not detected) in Laboratory groundwater samples. Analyses of lanthanides have occasionally been conducted but these are also only rarely detected, just as one would expect based on their highly adsorptive characteristics.
- Category E—Calcium, strontium and barium manifest very similar proportions of excursions outside the background range (37%, 35%, and 30%, respectively) as does alkalinity (31% of the 80 screens). Similar to the case of the alteration of iron minerals under extended reducing conditions, the long period of time (more than four years) over which carbonate alkalinity, barium, and strontium concentrations have remained very high in screens 1, 4 and 5 in well R-22 is also likely to have led to significant changes in carbonate mineralogy in the vicinity of the screen.
- Category F—The presence of steel corrosion indicators (Table 6-1) identifies four screens in three wells which may not provide reliable or representative data for trace metals and adsorbing species.

Figure 6-1(b) and Table 6-3 summarize the implications of the inferred residual drilling effects for the ability of the screens to provide reliable and representative water quality data. A few examples are given here:

- Tritium and research department explosive (RDX) can be detected reliably in 100% of the screens because none of the residual drilling effects can alter the concentrations or transport behaviors of these two species.
- Sr-90 can be detected 91% of the time. The few exceptions are all screens in multiple-screen wells.
- Fifty-five percent of the screens can product reliable and representative data for zinc and chromium. The other 45% manifest one or more of the following conditions that affect both of these trace metals: iron or sulfate-reducing conditions, altered iron mineralogy in the screen interval, or stainless-steel corrosion.
- A slightly higher proportion of the screens (58%) can reliably detect perchlorate, which is only affected by the presence of reducing conditions and not by adsorption.
- Like perchlorate, the detection of nitrate is also unreliable in the presence of reducing conditions. However, because nitrate is also leached from some drilling products, the proportion of the screens that can provide reliable and representative nitrate data is much lower (46%) than that for perchlorate.
- Water-quality data for many of the organic species may not be reliable or representative of predrilling water quality if reducing conditions are present that could affect biodegradation rates. If residual organic drilling fluids are present, concentrations of organic species could be modified if they partition into the reservoir of residual organic matter or intermediate biodegradation byproducts.

Two aspects that received attention in this revision are the effects of well development and purging protocols on the reliability of water-quality data from a screen. The influence of well development protocols on present-day screen conditions was examined in section 4.2.1 by tabulating water-quality ratings and redox conditions for the most recent sample from each screen as a function of three surrogate measures for the effectiveness of development in removing residual drilling fluids from a screen. The surrogates were the TOC attained by the end of development, the year in which development was completed, and the elapsed time between completion of drilling and end of well development. The most striking trend was observed when current screen conditions were mapped against the year in which development was completed. Development that completed in 2003 or later shows an improved track record as compared with screens that were developed prior to 2003. This apparent improvement is attributed to the cumulative effect of multiple factors: implementing additional development criteria, modifying drilling practices to minimize fluid use and loss into the formation, switching to rod-based screens, and—perhaps most importantly—switching to a much higher proportion of single-screen and dual-screen wells rather than multiple-screen wells.

The effects of purging on water-quality reliability were also examined in a cursory manner, by plotting trends for field parameters that are monitored prior to sample collection. No systematic difference was revealed by this exercise. It is concluded that no systematic difference is readily apparent when field data from different sampling systems are compared because site-specific factors dominate. For example, any differences in water quality parameters that might arise due to differences in purging volumes or rates are presumably largely masked by natural variability induced by changes in water levels for water-samples from perched intermediate aquifers.

6.2.2 Rankings

The overhaul of the data-evaluation protocol and near-doubling of the sampling events to which this protocol has been applied instills an increased level of confidence in the outcomes as compared to those in the original report. One aspect that has remained the same between the two reports is the delineation of the categories to which outcomes are assigned based on their scores; i.e., 91–100% of tests passed is assigned a ranking of Very Good; 81–90% is Good; 60–80% is Fair, and <60% is Poor. However, it is important to appreciate that, due to the significant changes that have been made, the rankings in this report are not strictly comparable to those in the original report. With this caveat in mind, outcomes from the two revisions of this report are compared below with the objective of sorting out similarities and differences that are meaningful from those which are merely artifacts of changing methodologies and datasets.

Table 6-2a compares the outcomes for the most recent samples that were assessed in Revision 0 (i.e., most recent as of August 2005) to the most recent samples assessed in this revision (i.e., as of December 2006). On average, where the two reports overlap in coverage, samples receive higher ratings in Revision 1 than in the previous one. This is most apparent in the proportion of samples assigned to the Poor category: 23% in Revision 0 as compared to 12.5% in Revision 1. Tables 6-2b through 6-2e are used to evaluate the extent to which this systematic shift in ratings is attributable to improvements in data quality as opposed to changes in the evaluation protocol.

To address the first question, Table 6-2b compares ratings for identical sets of samples (the most recent sample as of August 2005) when these are evaluated using the two different methodologies. The table shows that 36 screens (56% out of 64) maintained the same rank, 14 screens (21%) moved up to a higher rank, and 13 screens (20% of 64) downgraded in rank. Thus, there is general agreement in the qualitative ratings assigned to the same sample by the two approaches, and no systematic bias towards either higher or lower ratings.

To clarify the effects of changes in the evaluation protocol, Tables 6-2c through 6-2e compare outcomes for the presence or absence of specific residual drilling effects.

- Table 6-2c compares the outcomes for identifying the presence or absence of residual inorganic drilling fluids. The two revisions reach the same conclusions for seven samples, but differ on five others. This apparent difference arises primarily because this revision uses more appropriate indicators for this condition, and because threshold values are established based on statistically-derived background values rather than extremes of the background distribution. Another point underscored by this table is the consequence of the decision to extend tests for residual inorganic drilling fluids to all water samples, regardless of the drilling method used in an interval. Of the 52 screens to which this test was not applied in Revision 0 (because they were drilled with organic drilling fluids and not bentonite mud), Revision 1 concludes that residual inorganic drilling fluids are present in 22 (43%).
- Table 6-2d compares outcomes for identifying the presence or absence of residual organic drilling fluids. The two revisions reach the same conclusions for 52 (81%) of the 64 samples. Revision 1 concluded residual organic drilling fluids were present in 12 (19%) of the 64 samples in which Revision 0 had concluded they were absent. The only difference between the two methodologies is the application of lower thresholds in Revision 1 than were used in Revision 0.
- Table 6-2e compares the apparent redox condition for the most recent sample (again, as of August 2005) as concluded by the two methodologies. The outcomes are consistent for only about half of the samples. The differences are mostly due to the use of improved threshold values

adopted from the "Groundwater Background Investigation Report, Revision 2" (LANL 2007, 094856).

As shown in Figure 6-2, the distribution of rankings is somewhat bimodal for both the most recent sample as well as for the composite rankings, with the bimodal distribution somewhat more pronounced observed for the most recent sample. In the most recent sample (Figure 6-2b), almost the same percent of screens ranked Very Good (30%) as ranked Fair (32%) and the same ranked Good as ranked Poor (19%). For the composite ranking, slightly more screens ranked Good (21%) and Fair (36%). The percentage of screens ranking Fair represents an increase of 11% over Poor to Fair between Revision 0 and Revision 1 of the report. Still, it must be borne in mind that Revision 1 considered many more samples and used a much different assessment approach, so the comparisons are not one-for-one.

The improved methodology, larger database and passage of time may also be responsible for revealing another significant trend that was not apparent in Revision 0. Figure 6-2a shows that the distribution of rankings in Revision 1 is somewhat bimodal for the composite sample outcomes; and this effect is even more pronounced for the most recent sample, insofar as 65% of the samples are split evenly between Very Good and Fair and the proportion of screens in the Poor category has significantly decreased. This distribution of ratings largely parallels that of the prevailing reducing/oxidizing conditions in these screens. Oxidizing conditions characterize all screens rated Very Good whereas iron-reducing conditions dominate in those screens rated Fair. The bimodal distribution most likely reflects buffering of groundwater geochemistry by mineral phases in the vicinity of the screen, particularly iron-bearing minerals. Thus the emergence of this pattern may have implications for the time that will be required for the most impacted screens to recover to predrilling conditions.

6.3 Limitations or Uncertainties

The protocol described in this report provides a significant step forward in establishing a comprehensive technical framework and protocol for evaluating the residual drilling effects that would compromise the reliability and representativeness of water-quality data produced by a screen. The protocol inevitably still has limitations, of which the user must remain cognizant. None of the outcomes using these indicator species is infallible. The common shortcomings of field measurements such as dissolved oxygen are already well recognized among the user community. However, the limitations of other indicators are not as readily apparent or explained. For instance, detection of tritium is generally assumed to indicate the presence of a component of modern water, such that the absence of measurable tritium would appear to rule out the presence of a groundwater contaminant plume as being unlikely. However, as shown in Table 6-1, there are screens—such as in wells R-10a and R-23—in which modern contamination is obviously present but in which tritium is below detection.

Multiple interfering conditions created by different constituents in drilling fluids makes it challenging to determine a single responsible indicator for a well screen condition. A change in iron mineralogy, for example, can not be observed directly but can only be inferred from water-quality data. More than one cause could give rise to the identical symptom, but the different causes may have very different long-term prognoses. This ambiguity makes it difficult to predict when or if conditions might change such that the altered mineralogy in the vicinity of a screen will begin to transition back to predrilling conditions.

Three additional categories of residual drilling effects are addressed in this revision: transformation of iron mineral phases, changes in carbonate mineral stabilities, and corrosion of stainless steel components. The described protocol identifies those screens in which these effects appear to be present. However, further progress on interpreting the causes and effects of these geochemical shifts outside the range of background conditions requires better knowledge of the co-evolution of geochemical species, and the ability to incorporate consideration of kinetic rates. For example, zinc may be more mobile than assumed in this evaluation as a result of site-specific chemical conditions such as elevated sulfate, carbonate, and phosphate.

Although closely related, several aspects nonetheless lie outside the scope of this report:

- specifying actions to be taken for analytes judged as unreliable or not representative of predrilling conditions,
- predicting when an impacted screen may be able to provide chemical data that are reliable and representative of pre-drilling conditions,
- specifying corrective actions to be taken if a screen is judged as unlikely to produce reliable or representative water-quality samples in the foreseeable future, and
- discussing methods for rehabilitating impacted well screens, which is the subject of a separate evaluation.

6.4 Next Steps

Data adequacy determination relies on multiple lines of evidence. Implementation of a data adequacy protocol will evolve as insights are gained from testing and modeling. The screen assessment establishes a technically defensible foundation for follow-on tasks:

- Selection and prioritization of screens for rehabilitation or other corrective action
- Revision of sample collection protocols
- Assignment of data qualifiers in WQDB for past, present, and future water-quality data
- Establishment of additional data quality objectives for monitoring network

The only "corrective action" that can be confidently stated an as initial requirement in response to data flagged as unreliable or not representative of predrilling groundwater chemistry is to reassess the screen's data quality objectives (DQOs). DQOs define the type and quality of data to be collected from each screen. These data needs may be affected to varying degrees by residual drilling fluids, requiring a screen-specific analysis of impacts. Some data needs, such as piezometric data, are totally unaffected by drilling fluids, while others could be significantly affected. Consequently, it is not a simple or straightforward matter to specify the next corrective action step because this decision requires a level of detailed evaluation that is far beyond the scope of the evaluation of water-quality data. For example, the selection of an appropriate corrective action requires consideration of

- the significance of the screen's location relative to contaminant pathways;
- whether the screen is needed for a monitoring program;
- whether the screen meets its DQOs as specified for the characterization program;
- whether other screens in the area satisfy any or all of the monitoring needs;
- the long-term prognosis for the screen's recovery to predrilling conditions;
- how many screens in the multiple-screen well are providing reliable water-quality data;
- whether the screen is capable of providing reliable water-quality data for the specific suite of COPCs that could credibly be present;
- whether the screened interval is located in a formation that is too tight to be adequately developed, or to allow adequate purging, so as to attain a high degree of confidence for all water-quality parameters.

7.0 REFERENCES

7.1 Documents Cited in Main Body of Report

The following list includes all documents cited in this report, except for Appendixes A and B. Parenthetical information following each reference provides the author(s), publication date, and Environmental Restoration (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.

Allison, J.D., D.S. Brown, and K.J. Novo-Gradac, March 1991. "MINTEQA2/PRODEFA2, A Geochemical Assessment Model for Environmental Systems: Version 3.0 User's Manual," EPA/600/3-91/021, Office of Research and Development, Athens, Georgia. (Allison et al. 1991, 049930)

ATSDR (Agency for Toxic Substances and Disease Registry), October 25, 2005. "Toxicological Profile Information Sheet," http://www.astdr.cdc.gov/toxprofiles/. (ATSDR 2005, 090525)

Bradbury, M.H., and B. Baeyens, 2005. "Experimental Measurements and Modeling of Sorption Competition on Montmorillonite," *Geochimica et Cosmochimica Acta.,* Vol. 69, No. 17, pp. 4187-4197. (Bradbury and Baeyers 2005, 094905)

Cano, M.L., and P.B. Dorn, 1996. "Sorption of an Alcohol Ethoxylate Surfactant to Natural Sediments," *Environmental Toxicology and Chemistry,* Vol. 15, No. 5, pp. 684-690. (Cano and Dorn 1996, 094860)

Cano, M.L., and P.B. Dorn, 1996. "Sorption of Two Model Alcohol Ethoxylate Surfactants to Sediments," *Chemosphere,* Vol. 33, No. 6, pp. 981-994. (Cano and Dorn 1996, 094899)

Collins, K.A., A.M. Simmons, B.A. Robinson, and C.I. Nylander (Eds.), December 2005. "Los Alamos National Laboratory's Hydrogeologic Studies of the Pajarito Plateau: A Synthesis of Hydrogeologic Workplan Activities (1998–2004)," Los Alamos National Laboratory report LA-14623-MS, Los Alamos, New Mexico. (Collins et al. 2005, 092028)

Coppin, F., G. Berger, A. Bauer, S. Castet, and M. Loubet, 2002. "Sorption of Lanthanides on Smectite and Kaolinite," *Chemical Geology,* Vol. 182, pp. 57-68. (Coppin et al. 2002, 094907)

Cserháti, T., E. Forgács, and G. Oros, 2002. "Biological Activity and Environmental Impact of Anionic Surfactants," *Environment International,* Vol. 28, pp. 337-348. (Cserháti et al. 2002, 094904)

Davranche, M., and J.-C. Bollinger, 2000. "Heavy Metals Desorption from Synthesized and Natural Iron and Manganese Oxyhydroxides: Effect of Reductive Conditions," *Journal of Colloid and Interface Science,* Vol. 227, pp. 531-539. (Davranche and Bollinger 2000, 094906)

Davranche, M., and J.-C. Bollinger, 2000. "Release of Metals from Iron Oxyhydroxides under Reductive Conditions: Effect of Metal/Solid Interaction," *Journal of Colloid and Interface Science,* Vol. 232, pp. 165-173. (Davranche and Bollinger 2000, 094908)

EPA (U.S. Environmental Protection Agency), February 1994. "USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review," EPA-540/R-94-013, Office of Solid Waste and Emergency Response, Washington, D.C. (EPA 1994, 048639)

EPA (U.S. Environmental Protection Agency), October 1, 1999. "USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review," EPA540/R-99/008, Office of Solid Waste and Emergency Response, Washington, D.C. (EPA 1999, 066649)

EPA (Environmental Protection Agency), September 30, 2005. "Los Alamos National Laboratory, Los Alamos, New Mexico (01RC06-001) Impacts of Well Construction Practices," Environmental Protection Agency memorandum to R. Mayer (EPA/Region 6) from R. Ford (EPA/NRMRL), S.D. Acree (EPA/NRMRL), and R.R. Ross (EPA/NRMRL), Office of Research and Development, Ada, Oklahoma. (EPA 2005, 090545)

EPA (Environmental Protection Agency), February 10, 2006. "Los Alamos National Laboratory, Los Alamos, New Mexico (05RC06-001), Impacts of Hydrogeologic Characterization Well Construction Practices," Environmental Protection Agency memorandum to R. Mayer (EPA/Region 6) from R. Ford (EPA/NRMRL), S.D. Acree (EPA/NRMRL), and R.R. Ross (EPA/NRMRL), Office of Research and Development, Ada, Oklahoma. (EPA 2006, 094894)

EXTOXNET (Extension Toxicology Network), November 7, 2005. EXTOXNET Infobase search results, http://extoxnet.orst.edu/. (EXTOXNET 2005, 090526)

Gilkeson, R.H., July 13, 2004. "Groundwater Contamination in the Regional Aquifer beneath the Los Alamos National Laboratory," Version of July 13, 2004, Los Alamos, New Mexico. (Gilkeson 2004, 088728)

Herting, G., I. Odnevall Wallinder, and C. Leygraf, 2005. "A Comparison of Release Rates of Cr, Ni, and Fe from Stainless Steel Alloys and the Pure Metals Exposed to Simulated Rain Events," *Journal of the Electrochemical Society,* Vol. 152, No. 1, pp. B23-B29. (Herting et al. 2005, 094897)

Herting, G., I. Odnevall Wallinder, and C. Leygraf, 2006. "Factors that Influence the Release of Metals from Stainless Steels Exposed to Physiological Media," *Corrosion Science,* Vol. 48, pp. 2120-2132. (Herting et al. 2006, 094898)

Kleinfelder, July 6, 2005. "Kleinfelder Drilling Work Plan for Characterization Wells R-10 and R-10a," report prepared for Los Alamos National Laboratory, Project No. 49436, Albuquerque, New Mexico. (Kleinfelder 2005, 094909)

Lajudie, A., J. Raynal, J.C. Petit, and P. Toulhoat, 1995. "Clay-Based Materials for Engineered Barriers: A Review," Materials Research Society Symposium Proceedings, Vol. 353, Pittsburgh, Pennsylvania, pp. 221-230. (Lajudie et al. 1995, 090542)

Langmuir, D., 1997. *Aqueous Environmental Geochemistry*, Prentice Hall, Inc., Upper Saddle River, New Jersey. (Langmuir 1997, 056037)

LANL (Los Alamos National Laboratory), May 22, 1998. "Hydrogeologic Workplan," Los Alamos National Laboratory document LA-UR-01-6511, Los Alamos, New Mexico. (LANL 1998, 059599)

LANL (Los Alamos National Laboratory), June 2003. "Characterization Well R-14 Completion Report," Los Alamos National Laboratory document LA-UR-03-1664, Los Alamos, New Mexico. (LANL 2003, 076062)

LANL (Los Alamos National Laboratory), June 2003. "Characterization Well R-16 Completion Report," Los Alamos National Laboratory document LA-UR-03-1841, Los Alamos, New Mexico. (LANL 2003, 076061)

LANL (Los Alamos National Laboratory), June 2003. "Characterization Well R-20 Completion Report," Los Alamos National Laboratory document LA-UR-03-1839, Los Alamos, New Mexico. (LANL 2003, 079600)

LANL (Los Alamos National Laboratory), June 2003. "Characterization Well R-32 Completion Report," Los Alamos National Laboratory document LA-UR-03-3984, Los Alamos, New Mexico. (LANL 2003, 079602)

LANL (Los Alamos National Laboratory), September 2004. "Response to Concerns About Selected Regional Aquifer Wells at Los Alamos National Laboratory," Los Alamos National Laboratory document LA-UR-04-6777, Los Alamos, New Mexico. (LANL 2004, 088420)

LANL (Los Alamos National Laboratory), June 1, 2005. "Groundwater Background Investigation Report," Los Alamos National Laboratory document LA-UR-05-2295, Los Alamos, New Mexico. (LANL 2005, 090580)

LANL (Los Alamos National Laboratory), May 2005. "Interim Facility-Wide Groundwater Monitoring Plan," Los Alamos National Laboratory document LA-UR-05-3443, Los Alamos, New Mexico. (LANL 2005, 088789)

LANL (Los Alamos National Laboratory), November 1, 2005. "Well Screen Analysis Report," Los Alamos National Laboratory document LA-UR-05-8615, Los Alamos, New Mexico. (LANL 2005, 091121)

LANL (Los Alamos National Laboratory), July 2006. "2006 Integrated Groundwater Monitoring Plan for Los Alamos National Laboratory," Los Alamos National Laboratory document LA-UR-06-4429, Los Alamos, New Mexico. (LANL 2006, 094147)

LANL (Los Alamos National Laboratory), June 2006. "Workplan for R-Well Rehabilitation and Replacement," Los Alamos National Laboratory document LA-UR-06-3687, Los Alamos, New Mexico. (LANL 2006, 092535)

LANL (Los Alamos National Laboratory), February 2007. "Groundwater Background Investigation Report, Revision 2," Los Alamos National Laboratory document LA-UR-07-0755, Los Alamos, New Mexico. (LANL 2007, 094856)

Larson, T., October 30, 2006. "Drilling Fluid Characterization," Los Alamos National Laboratory memorandum to J. Fabryka-Martin (EES-6) from T. Larson (EES-6), Los Alamos, New Mexico. (Larson 2006, 094892)

Longmire, P., June 2002. "Characterization Well R-12 Geochemistry Report," Los Alamos National Laboratory report LA-13952-MS, Los Alamos, New Mexico. (Longmire 2002, 072800)

National Library of Medicine, November 7, 2005. "Hazardous Substances Data Bank," on TOXNET (Toxicology Data Network), http://toxnet.nlm.nih.gov/. (National Library of Medicine 2005, 090524)

NMED (New Mexico Environment Department), September 18, 2006. “Notice of Disapproval, Well Screen Analysis Report, Los Alamos National Laboratory, EPA ID #NM0890010515 HWB-LANL-05-022,” New Mexico Environment Department letter to M. Johansen (DOE LASO) and D. McInroy (LANL) from J.P. Bearzi (NMED HWB), Santa Fe, New Mexico. (NMED 2006, 094373)

Pojana, G., G. Cassini, and A. Marcomini, 2004. “Determination, Aerobic Biodegradation and Environmental Occurrence of Aliphatic Alcohol Polyethoxylate Sulfates,” *International Journal of Environmental Analytical Chemistry,* Vol. 84, No. 10, pp. 729-738. (Pojana et al. 2004, 094487)

Powell, R.M., and D.C. Schafer, February 8, 2002. “Assessment of Regional Aquifer Well-Development Techniques at the Los Alamos National Laboratory and Impacts on Sampling,” report prepared for Los Alamos National Laboratory by Powell and Associates and David Schafer and Associates. (Powell and Schafer 2002, 090523)

Robison, T., December 6, 2006. “Characterization of EZ-Mud (Draft for review and comment),” Los Alamos National Laboratory memorandum to J. Fabryka-Martin (EES-6) from T. Robison (C-CSE), Los Alamos, New Mexico. (Robison 2006, 094891)

Robison, T., November 6, 2006. “Characterization of Quik-Foam (Draft for review and comment),” Los Alamos National Laboratory memorandum to J. Fabryka-Martin (EES-6) from T. Robison (C-CSE), Los Alamos, New Mexico. (Robison 2006, 094883)

Salloum, M.J., M.J. Dudas, W.B. McGill, and S.M. Murphy, 2000. “Surfactant Sorption to Soil and Geologic Samples with Varying Mineralogical and Chemical Properties,” *Environmental Toxicology and Chemistry,* Vol. 19, No. 10, pp. 2436-2442. (Salloum et al. 2000, 094896)

Scott, M.J., and M.N. Jones, 2000. “The Biodegradation of Surfactants in the Environment,” *Biochimica et Biophysical Acta,* Vol. 1508, pp. 235-251. (Scott and Jones 2000, 094913)

Sheppard, M.I., and D.H. Thibault, 1990. “Default Soil Solid/Liquid Partition Coefficients, K_ds, for Four Major Soil Types: A Compendium,” *Health Physics,* Vol. 59, No. 4, pp. 471-482. (Sheppard and Thibault 1990, 090541)

Simpson, G., May 31, 2001. FAX transmittal to J. Eddy, and M. Klahn, pertaining to Drilling Fluids Table and Recommendations. (Simpson 2001, 094859)

Stetzenbach, K.J., V.F. Hodge, C. Guo, I.M. Farnham, and K.H. Johannesson, March 2001. “Geochemical and Statistical Evidence of Deep Carbonate Groundwater within Overlying Volcanic Rock Aquifers/Aquitards of Southern Nevada, USA,” *Journal of Hydrology,* Vol. 243, No. 3-4, pp. 254-271. (Stetzenbach et al. 2001, 090565)

Syracuse Research Corporation, November 7, 2005. CHEMFATE database search results, http://www.syrres.com/esc/chemfate.htm. (Syracuse Research Corporation 2005, 090573)

Valsaraj, K.T., and L.J. Thibodeaux, 1989. “Relationships between Micelle-Water and Octanol-Water Partition Constants for Hydrophobic Organics of Environmental Interest,” *Water Research,* Vol. 23, No. 2, pp. 183-189. (Valsaraj and Thibodeaux 1989, 094895)

Wisconsin Department of Natural Resources, accessed December 20, 2006. “List of Approved Drilling, Grouting, Rehabilitation & Abandonment Products (DNR Bureau of Drinking Water & Groundwater),” http://www.dnr.state.wi.us/org/water/dwg/tvrdrill06.pdf. (Wisconsin Department of Natural Resources 2006, 094912)

Ying, G.-G., April 2006. "Fate, Behavior, and Effects of Surfactants and their Degradation Products in the Environment," *Environment International,* Vol. 32, No. 3, pp. 417-431. (Ying 2006, 094486)

7.2 Characterization Well Completion Reports

Ball, T., M. Everett, P. Longmire, D. Vaniman, W. Stone, D. Larssen, K. Greene, N. Clayton, and S. McLin (Los Alamos National Laboratory), February 2002. "Characterization Well R-22 Completion Report," Los Alamos National Laboratory report LA-13893-MS, Los Alamos, New Mexico. (LANL 2002, 071471)

Broxton, D., R. Warren, A. Crowder, M. Everett, R. Gilkeson, P. Longmire, and J. Marin, May 2001. "Characterization Well R-12 Completion Report," Los Alamos National Laboratory report LA-13822-MS, Los Alamos, New Mexico. (Broxton et al. 2001, 071252)

Broxton, D., R. Gilkeson, P. Longmire, J. Marin, R. Warren, D. Vaniman, A. Crowder, B. Newman, B. Lowry, D. Rogers, W. Stone, S. McLin, G. WoldeGabriel, D. Daymon, and D. Wycoff, May 2001. "Characterization Well R-9 Completion Report," Los Alamos National Laboratory report LA-13742-MS, Los Alamos, New Mexico. (Broxton et al. 2001, 071250)

Broxton, D., D. Vaniman, W. Stone, S. McLin, M. Everett, and A. Crowder, May 2001. "Characterization Well R-9i Completion Report," Los Alamos National Laboratory report LA-13821-MS, Los Alamos, New Mexico. (Broxton et al. 2001, 071251)

Broxton, D., D. Vaniman, W. Stone, S. McLin, J. Marin, R. Koch, R. Warren, P. Longmire, D. Rogers, and N. Tapia, May 2001. "Characterization Well R-19 Completion Report," Los Alamos National Laboratory report LA-13823-MS, Los Alamos, New Mexico. (Broxton et al. 2001, 071254)

Broxton, D., R. Warren, P. Longmire, R. Gilkeson, S. Johnson, D. Rogers, W. Stone, B. Newman, M. Everett, D. Vaniman, S. McLin, J. Skalski, and D. Larssen, March 2002. "Characterization Well R-25 Completion Report," Los Alamos National Laboratory report LA-13909-MS, Los Alamos, New Mexico. (Broxton et al. 2002, 072640)

Broxton, D., D. Vaniman, P. Longmire, B. Newman, W. Stone, A. Crowder, P. Schuh, R. Lawrence, E. Tow, M. Everett, R. Warren, N. Clayton, D. Counce, E. Kluk, and D. Bergfeld, December 2002. "Characterization Well MCOBT-4.4 and Borehole MCOBT-8.5 Completion Report," Los Alamos National Laboratory report LA-13933-MS, Los Alamos, New Mexico. (Broxton et al. 2002, 076006)

Kleinfelder, June 6, 2003. "Characterization Well R-21 Completion Report," report prepared for Los Alamos National Laboratory, Albuquerque, New Mexico. (Kleinfelder 2003, 090047)

Kleinfelder, May 7, 2004. "Final Well CdV-16-1(i) Completion Report," report prepared for Los Alamos National Laboratory, Project No. 37151/9.12, Albuquerque, New Mexico. (Kleinfelder 2004, 087844)

Kleinfelder, November 2004. "Final Completion Report, Characterization Well R-34," report prepared for Los Alamos National Laboratory, Project No. 37151, Albuquerque, New Mexico. (Kleinfelder 2004, 092199)

Kleinfelder, Inc., January 14, 2005. "Revision 1 Final Completion Report Characterization Well R-4 Los Alamos National Laboratory Los Alamos, New Mexico Project No. 37151/7.12," Albuquerque, New Mexico. (Kleinfelder 2005, 094903)

Kleinfelder, January 25, 2005. “Final Well R-26 Completion Report,” Revision No. 1, report prepared for Los Alamos National Laboratory, Project No. 37151, Albuquerque, New Mexico. (Kleinfelder 2005, 087846)

Kleinfelder, February 2, 2005. “Revision 1, Well R-2 Completion Report,” report prepared for Los Alamos National Laboratory, Project No. 37151/TASK 6.12, Albuquerque, New Mexico. (Kleinfelder 2005, 094900)

Kleinfelder, February 3, 2005. “Revision 1, Well R-1 Completion Report,” report prepared for Los Alamos National Laboratory, Project No. 37151/17.12, Albuquerque, New Mexico. (Kleinfelder 2005, 090045)

Kleinfelder, February 9, 2005. “Revision 1, Well R-28 Completion Report,” report prepared for Los Alamos National Laboratory, Project No. 37151/16.12, Albuquerque, New Mexico. (Kleinfelder 2005, 094042)

Kleinfelder, February 2005. “Final Completion Report, Characterization Well R-11,” report prepared for Los Alamos National Laboratory, Project No. 37151, Albuquerque, New Mexico. (Kleinfelder 2005, 090044)

Kleinfelder, February 2005. “Final Completion Report, Characterization Well R-33,” report prepared for Los Alamos National Laboratory, Project No. 37151, Albuquerque, New Mexico. (Kleinfelder 2005, 094041)

Kleinfelder, April 2005. “Final Completion Report, Characterization Wells R-6/R-6i,” report prepared for Los Alamos National Laboratory, Project No. 37151, Albuquerque, New Mexico. (Kleinfelder 2005, 091693)

Kleinfelder, April 2005. “Final Completion Report, Characterization Well R-18,” report prepared for Los Alamos National Laboratory, Project No. 37151, Albuquerque, New Mexico. (Kleinfelder 2005, 092415)

Kleinfelder, November 2005. “Final Completion Report, Characterization Well CdV-16-2(i)r,” report prepared for Los Alamos National Laboratory, Project No. 49436, Albuquerque, New Mexico. (Kleinfelder 2005, 093665)

Kleinfelder, January 2006. “Final Completion Report, Characterization Wells R-10a/R-10,” report prepared for Los Alamos National Laboratory, Project No. 49436, Albuquerque, New Mexico. (Kleinfelder 2006, 092491)

Kleinfelder, January 2006. “Final Completion Report, Characterization Well R-24,” report prepared for Los Alamos National Laboratory, Project No. 49436, Albuquerque, New Mexico. (Kleinfelder 2006, 092489)

Kleinfelder, February 2006. “Final Completion Report, Characterization Well R-16r,” report prepared for Los Alamos National Laboratory, Project No. 49436, Albuquerque, New Mexico. (Kleinfelder 2006, 094131)

Kleinfelder, March 2006. “Final Completion Report, Intermediate Well R-23i,” report prepared for Los Alamos National Laboratory, Project No. 49436, Albuquerque, New Mexico. (Kleinfelder 2006, 092495)

Kleinfelder, March 2006. "Final Completion Report, Characterization Well R-27," report prepared for Los Alamos National Laboratory, Project No. 49436, Albuquerque, New Mexico. (Kleinfelder 2006, 092488)

Kleinfelder, May 2006. "Final Completion Report, Characterization Well R-17," report prepared for Los Alamos National Laboratory, Project No. 49436, Albuquerque, New Mexico. (Kleinfelder 2006, 092493)

Kleinfelder, January 2007. "Draft, Completion Report, Intermediate Well R-3i," report prepared for Los Alamos National Laboratory, Project No. 49436, Albuquerque, New Mexico. (Kleinfelder 2007, 094910)

Kopp, B., A. Crowder, M. Everett, D. Vaniman, D. Hickmott, W. Stone, N. Clayton, S. Pearson, and D. Larssen, April 2002. "Well CdV-R-15-3 Completion Report," Los Alamos National Laboratory report LA-13906-MS, Los Alamos, New Mexico. (Kopp et al. 2002, 073179)

Kopp, B., M. Everett, J.R. Lawrence, G. WoldeGabriel, D. Vaniman, J. Heikoop, W. Stone, S. McLin, N. Clayton, and D. Larssen, April 2003. "Well CdV-R-37-2 Completion Report," Los Alamos National Laboratory report LA-14023-MS, Los Alamos, New Mexico. (Kopp et al. 2003, 088803)

LANL (Los Alamos National Laboratory), June 2003. "Characterization Well R-5 Completion Report," Los Alamos National Laboratory document LA-UR-03-1600, Los Alamos, New Mexico. (LANL 2003, 080925)

LANL (Los Alamos National Laboratory), June 2003. "Characterization Well R-8 Completion Report," Los Alamos National Laboratory document LA-UR-03-1162, Los Alamos, New Mexico. (LANL 2003, 079594)

LANL (Los Alamos National Laboratory), June 2003. "Characterization Well R-13 Completion Report," Los Alamos National Laboratory document LA-UR-03-1373, Los Alamos, New Mexico. (LANL 2003, 076060)

LANL (Los Alamos National Laboratory), June 2003. "Characterization Well R-14 Completion Report," Los Alamos National Laboratory document LA-UR-03-1664, Los Alamos, New Mexico. (LANL 2003, 076062)

LANL (Los Alamos National Laboratory), June 2003. "Characterization Well R-16 Completion Report," Los Alamos National Laboratory document LA-UR-03-1841, Los Alamos, New Mexico. (LANL 2003, 076061)

LANL (Los Alamos National Laboratory), June 2003. "Characterization Well R-20 Completion Report," Los Alamos National Laboratory document LA-UR-03-1839, Los Alamos, New Mexico. (LANL 2003, 079600)

LANL (Los Alamos National Laboratory), June 2003. "Characterization Well R-23 Completion Report," Los Alamos National Laboratory document LA-UR-03-2059, Los Alamos, New Mexico. (LANL 2003, 079601)

LANL (Los Alamos National Laboratory), June 2003. "Characterization Well R-32 Completion Report," Los Alamos National Laboratory document LA-UR-03-3984, Los Alamos, New Mexico. (LANL 2003, 079602)

Longmire, P., D. Broxton, W. Stone, B. Newman, R. Gilkeson, J. Marin, D. Vaniman, D. Counce, D. Rogers, R. Hull, S. McLin, and R. Warren, May 2001. "Characterization Well R-15 Completion Report," Los Alamos National Laboratory report LA-13749-MS, Los Alamos, New Mexico. (Longmire et al. 2001, 070103)

Stone, W., D. Vaniman, P. Longmire, D. Broxton, M. Everett, R. Lawrence, and D. Larssen, April 2002. "Characterization Well R-7 Completion Report," Los Alamos National Laboratory report LA-13932-MS, Los Alamos, New Mexico. (Stone et al. 2002, 072717)

Vaniman, D., J. Marin, W. Stone, B. Newman, P. Longmire, N. Clayton, R. Lewis, R. Koch, S. McLin, G. WoldeGabriel, D. Counce, D. Rogers, R. Warren, E. Kluk, S. Chipera, D. Larssen, and W. Kopp, March 2002. "Characterization Well R-31 Completion Report," Los Alamos National Laboratory report LA-13910-MS, Los Alamos, New Mexico. (Vaniman et al. 2002, 072615)

7.3 Characterization Well Geochemistry Reports

Longmire, P., March 2002. "Characterization Well R-15 Geochemistry Report," Los Alamos National Laboratory report LA-13896-MS, Los Alamos, New Mexico. (Longmire 2002, 072614)

Longmire, P., April 2002. "Characterization Wells R-9 and R-9i Geochemistry Report," Los Alamos National Laboratory report LA-13927-MS, Los Alamos, New Mexico. (Longmire 2002, 072713)

Longmire, P., June 2002. "Characterization Well R-12 Geochemistry Report," Los Alamos National Laboratory report LA-13952-MS, Los Alamos, New Mexico. (Longmire 2002, 072800)

Longmire, P., July 2002. "Characterization Well R-19 Geochemistry Report," Los Alamos National Laboratory report LA-13964-MS, Los Alamos, New Mexico. (Longmire 2002, 073282)

Longmire, P., October 2002. "Characterization Well R-22 Geochemistry Report," Los Alamos National Laboratory report LA-13986-MS, Los Alamos, New Mexico. (Longmire 2002, 073676)

Longmire, P., May 2005. "Characterization Well R-25 Geochemistry Report," Los Alamos National Laboratory report LA-14198-MS, Los Alamos, New Mexico. (Longmire 2005, 088510)

Longmire, P., and F. Goff, December 2002. "Characterization Well R-7 Geochemistry Report," Los Alamos National Laboratory report LA-14004-MS, Los Alamos, New Mexico. (Longmire and Goff 2002, 075905)

7.4 Procedures Governing the Collection, Analysis, and Review of Groundwater Data

- RRES-WQH-SOP-048, Groundwater Sampling Using Bladder Pumps
- RRES-WQH-SOP-049, Groundwater Sampling Using Submersible Pumps
- RRES-WQH-SOP-050, Groundwater Sampling Using Westbay System
- ENV-DO-203, Field Water Quality Analyses
- ENV-DO-206, Sample Containers and Preservation
- ENV-DO-207, Handling, Packaging, and Transporting Field Samples
- ENV-WQH-QP-029, Creating and Maintaining Chain of Custody
- ENV-ECR QP-4.4, Record Transmittal to the Records Processing Facility

- RRES-ECR QP-5.13, Rev 0, Analytical Data Verification/Validation Process
- ENV-ECR SOP-05.02, Well Development
- ENV-ECR SOP-06.01, Purging and Sampling Methods for Single Completion Wells
- ENV-ECR SOP-06.03, Sampling for Volatile Organic Compounds in Groundwater
- ENV-ECR SOP-06.32, Multi-Level Groundwater Sampling of Monitoring Wells—Westbay MP System
- ENV-ECR SOP-15.01, Routine Validation of Volatile Organic Data
- ENV-ECR SOP-15.02, Routine Validation of Semivolatile Organic Data
- ENV-ECR SOP-15.03, Routine Validation of Organochlorine Pesticides and Polychlorinated Biphenyls Data
- ENV-ECR SOP-15.04, Routine Validation of High Explosives Data
- ENV-ECR SOP-15.05, Routine Validation of Inorganic Data
- ENV-ECR SOP-15.06, Routine Validation of Gamma Spectroscopy Data
- ENV-ECR SOP-15.07, Routine Validation of Chemical Separation Alpha Spectrometry, Gas Proportional Counting, and Liquid Scintillation Data
- ENV-ECR SOP-15.09, Chain of Custody for Analytical Data Packages

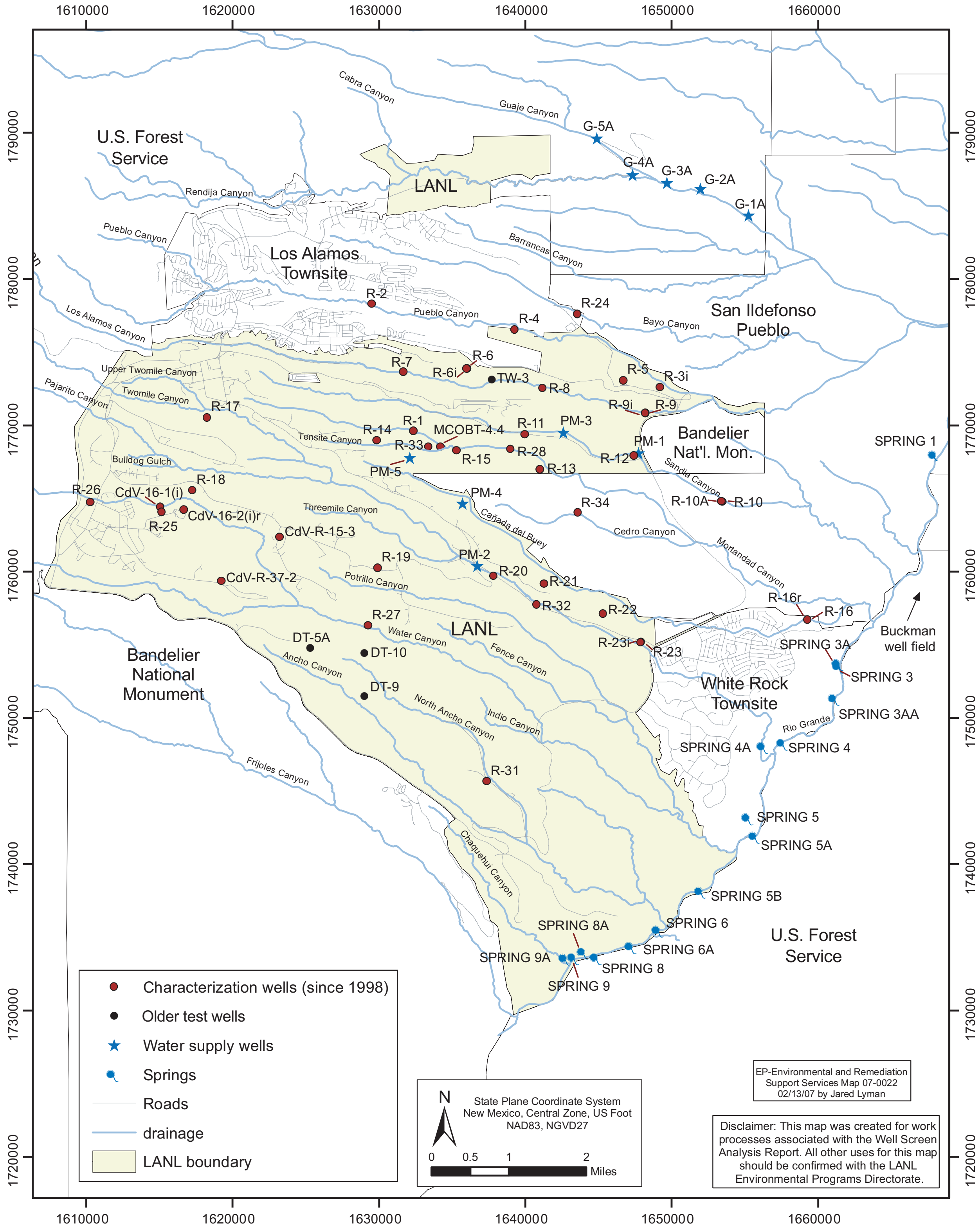


Figure 1-1. Map showing the location of wells and Rio Grande springs referenced in this report

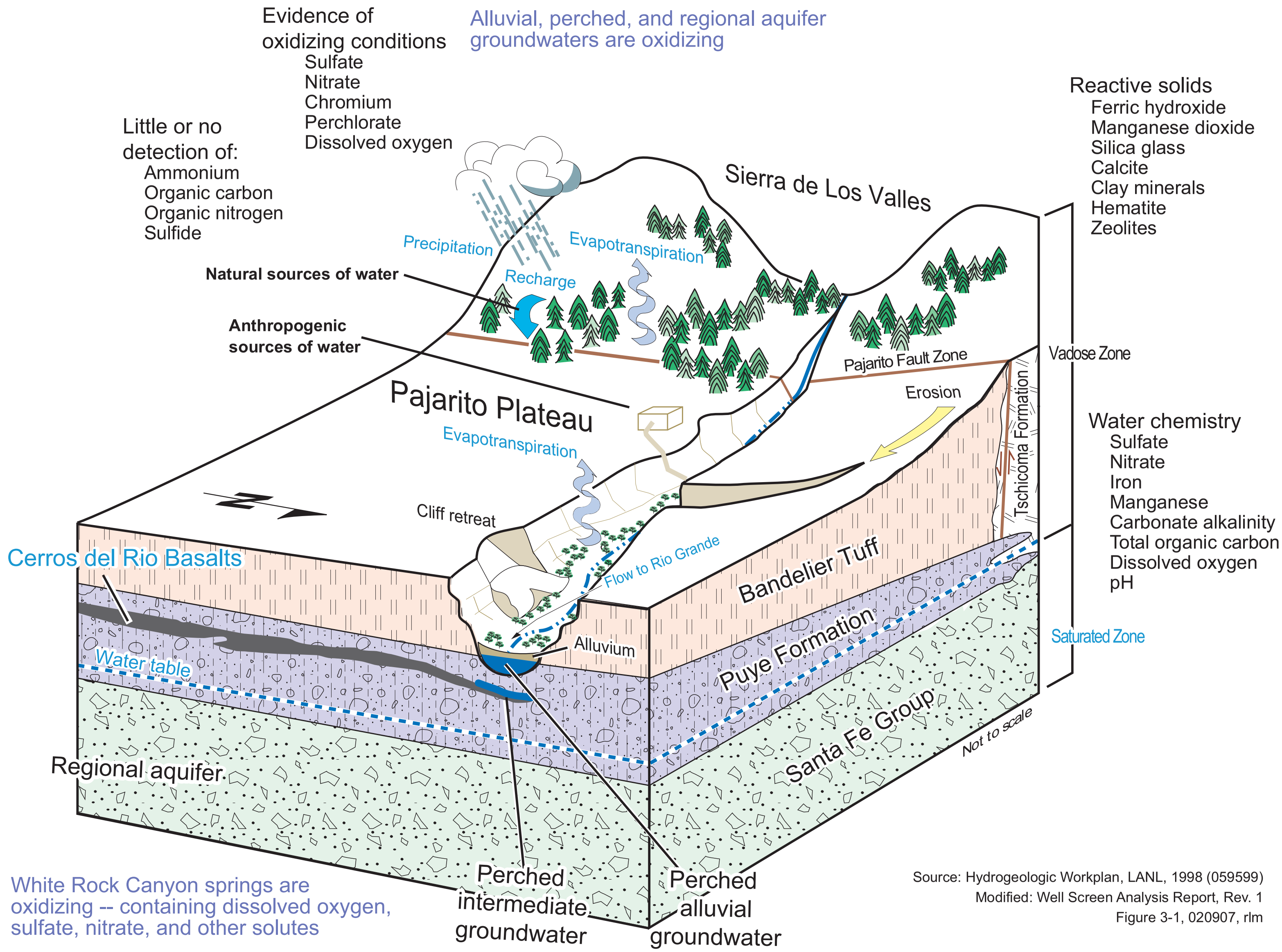
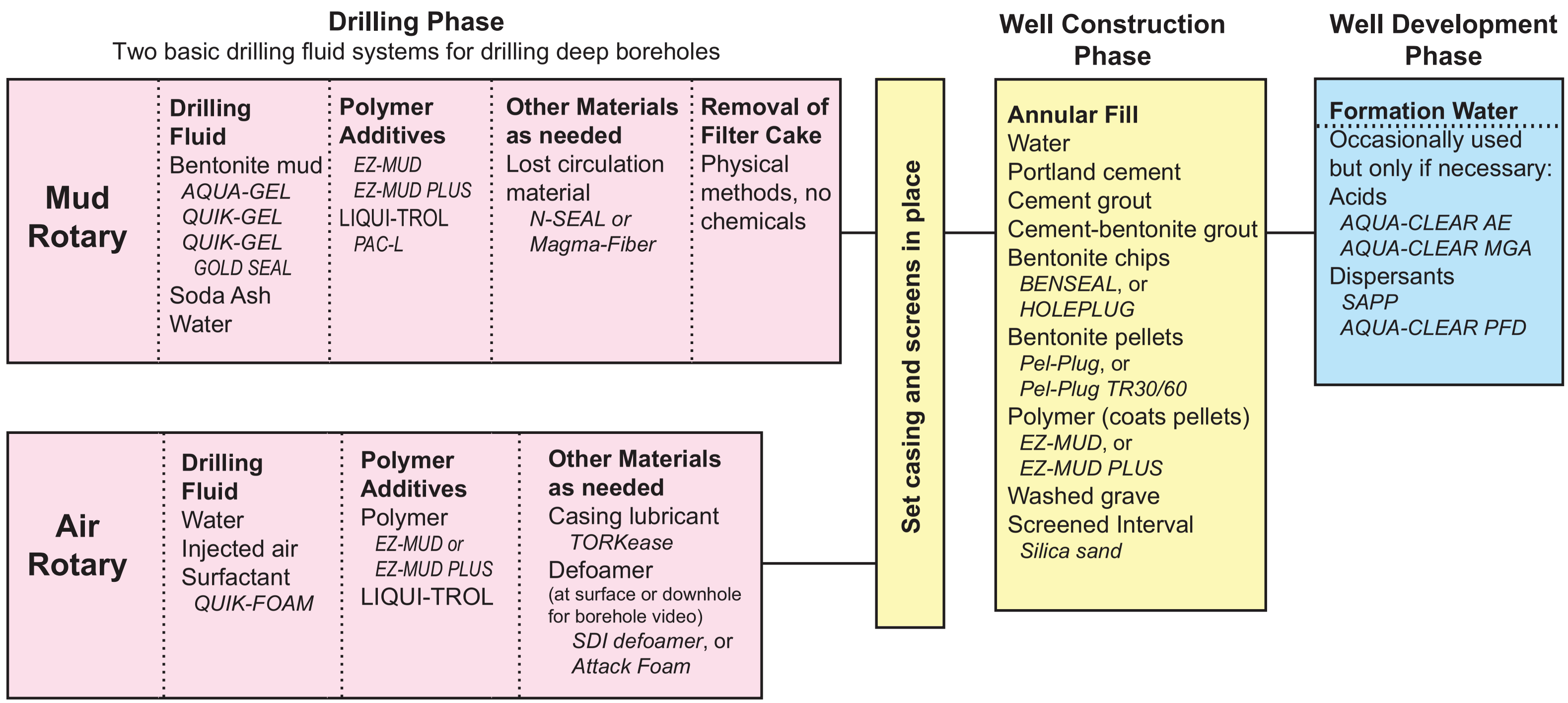
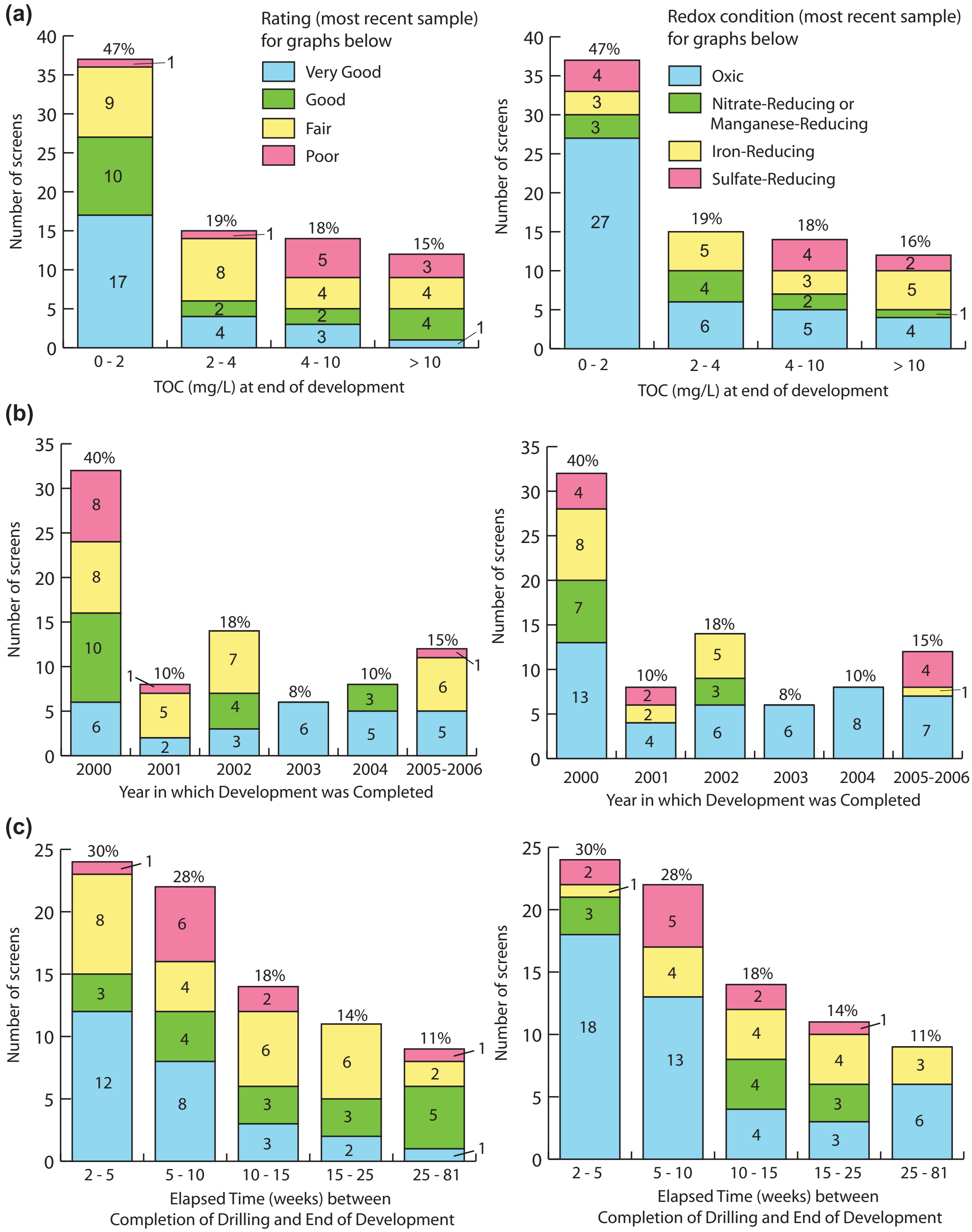


Figure 3-1. Conceptual model of natural geochemistry of the Pajarito Plateau



Note: This sketch clarifies, in a highly generalized way, the sequence in which chemicals are used to drill, complete, and develop a well, and the types of chemicals used in each of these phases. However, not all materials listed are used in all wells. Just as geologic formations vary widely in their properties, so does every well involve a unique combination of drilling materials added in varying amounts and at different times in the process.

Figure 4-1. Typical sequence of drilling fluid use



Sources: TOC data and dates for completion of drilling and well development from Table 4-1. Rating and redox condition for most recent sample from Table 6-1. Date for well development from Table B-1.

Figure 4-2. Present-day condition of well screen samples as a function of (a) total organic carbon concentration at end of well development, (b) the year in which the well was developed, and (c) time elapsed between completion of drilling and end of well development

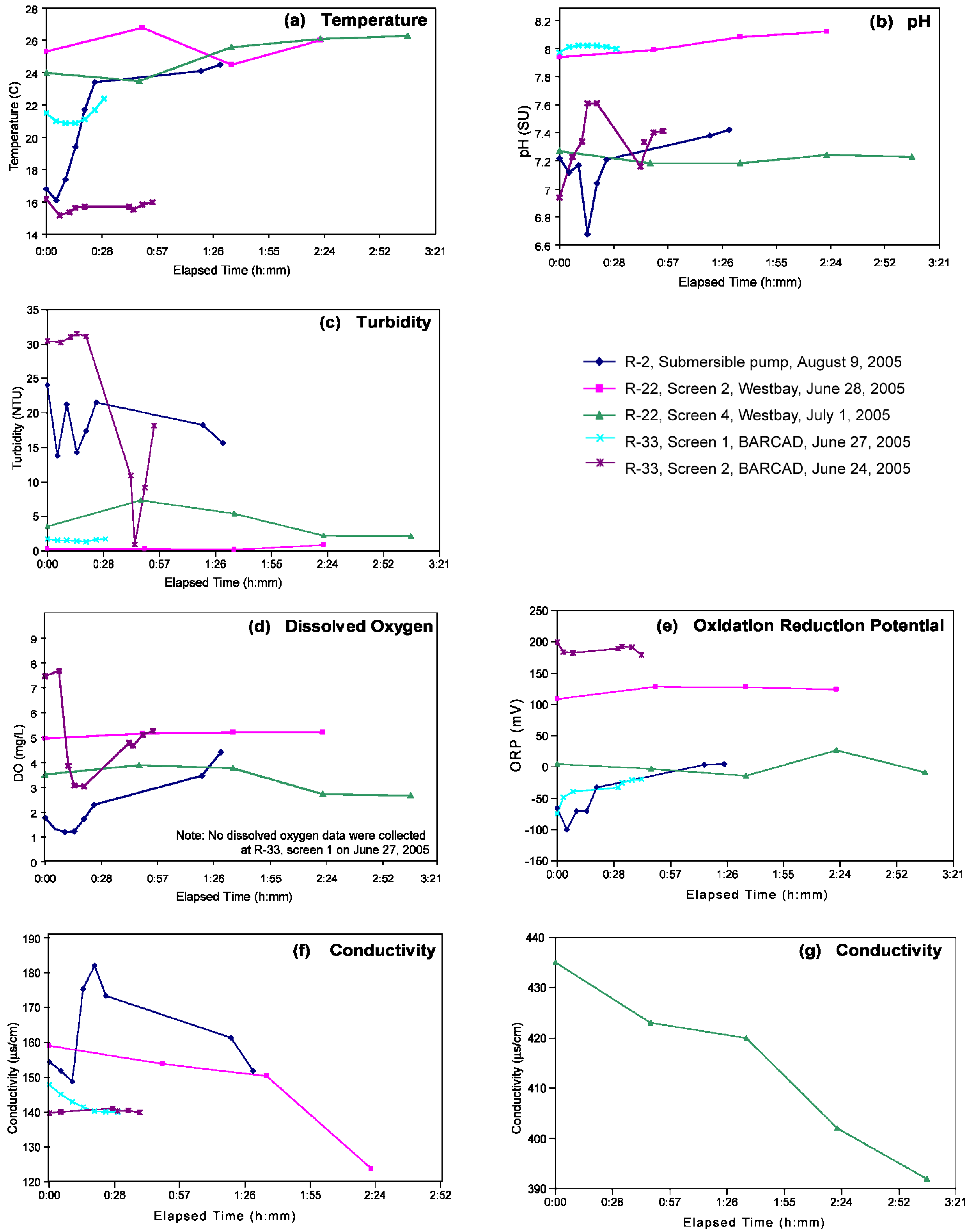


Figure 4-3a. Monitoring of field parameters prior to sampling at wells with screens in the regional aquifer (R-2, R-22, and R-33): (a) temperature, (b) pH, (c) turbidity, (d) dissolved oxygen, (e) oxidation reduction potential, (f) conductivity, and (g) conductivity

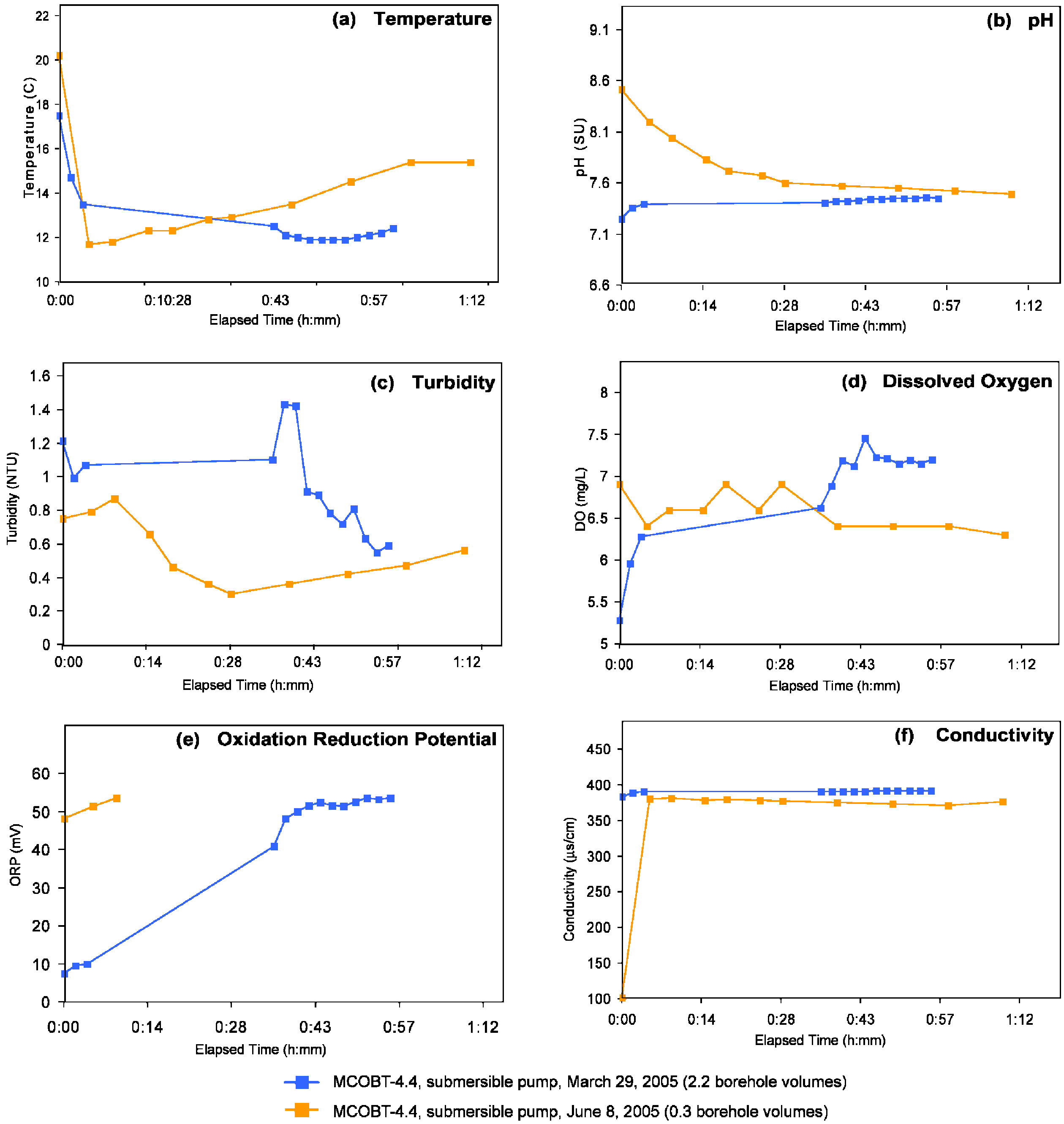


Figure 4-3b. Monitoring of field parameters prior to sampling at a well with a screen in the perched intermediate aquifer (MCOBT-4.4): (a) temperature, (b) pH, (c) turbidity, (d) dissolved oxygen, (e) oxidation reduction potential, and (f) conductivity

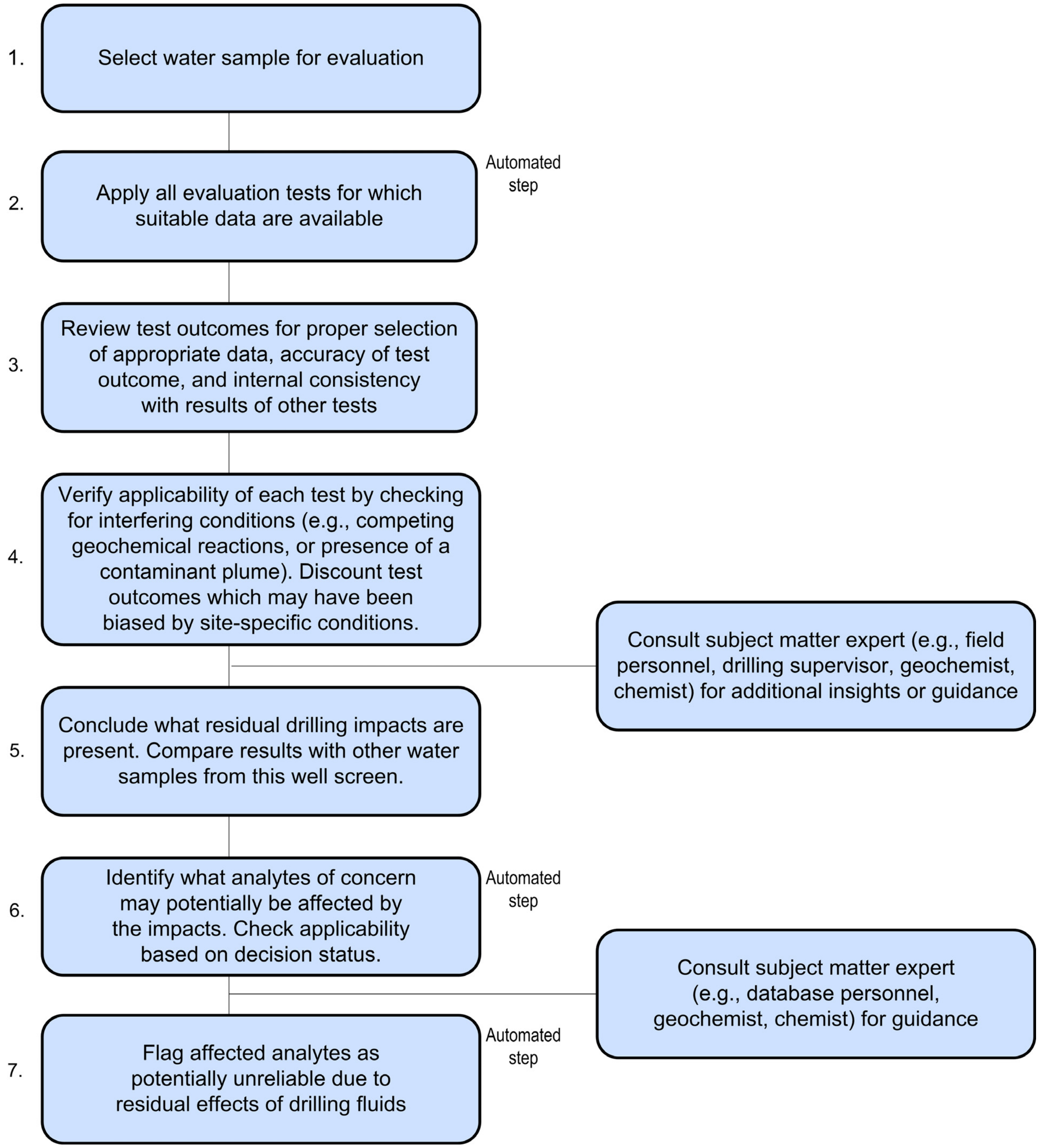


Figure 4-4. Sequence of steps for evaluating water-quality samples for impacts of residual drilling fluids

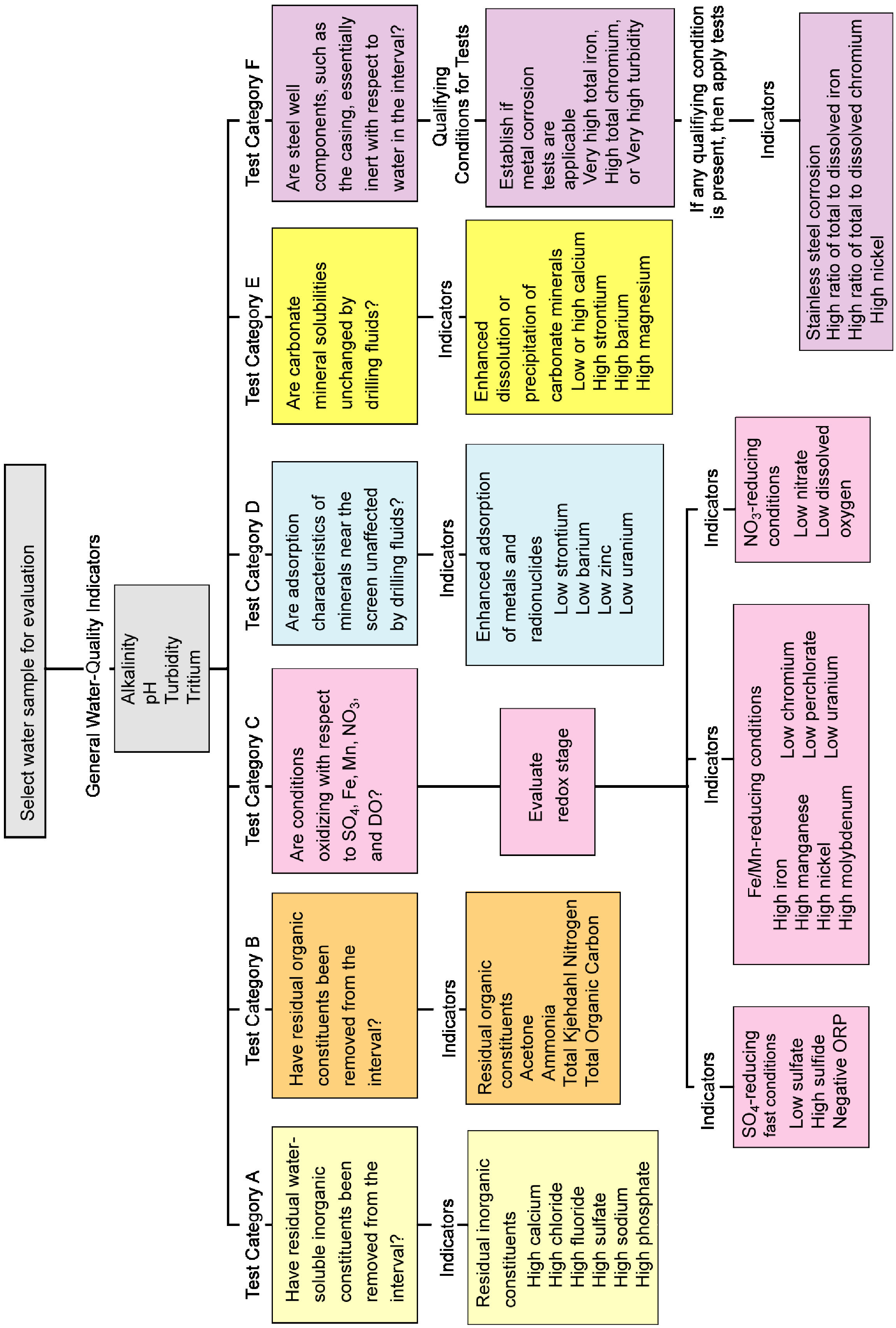


Figure 4-5. **Application of tests for evaluating the presence of categories of effects from residual drilling fluids**

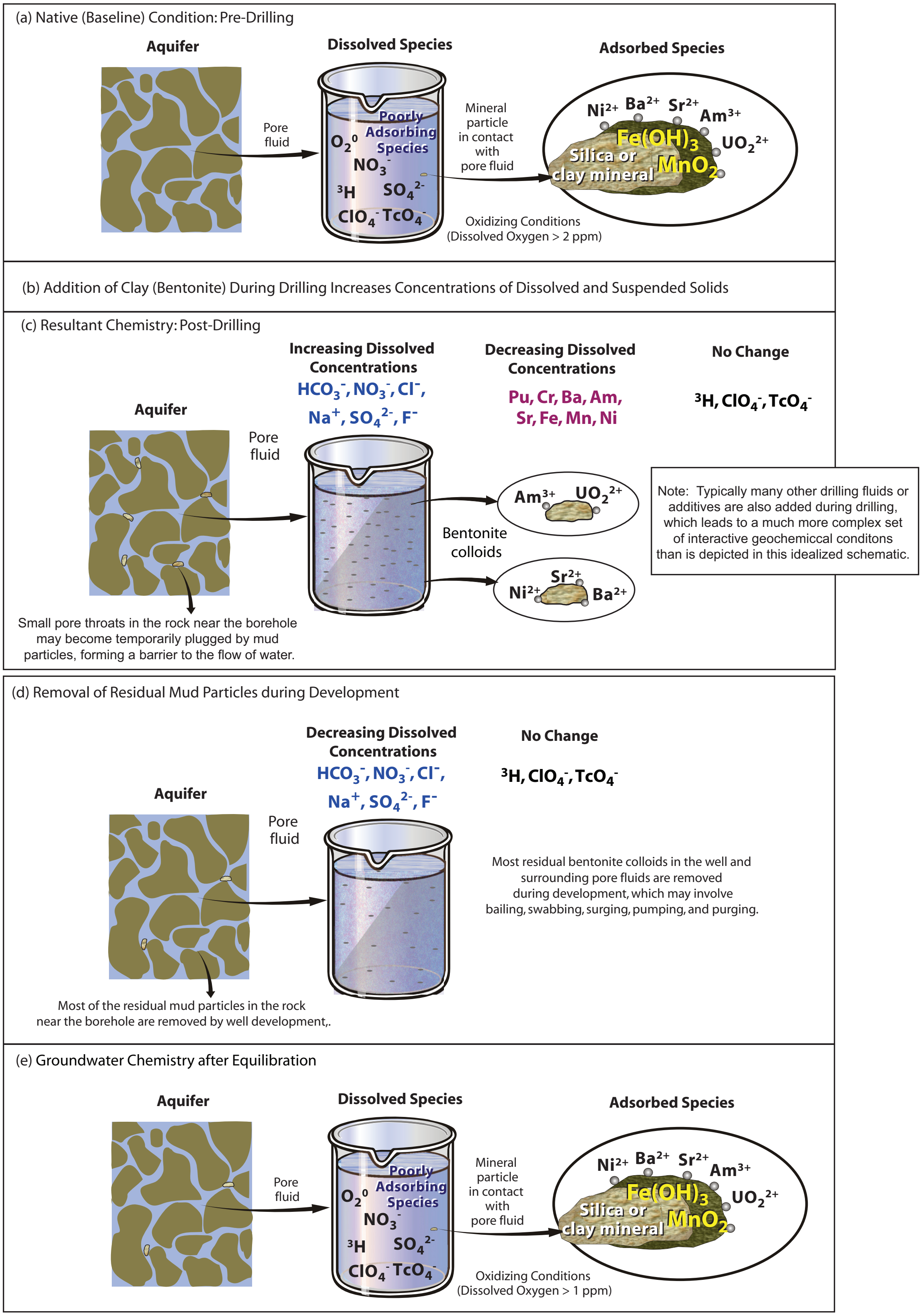


Figure 4-6. Conceptual model of the effects of bentonite-based drilling fluids on water quality

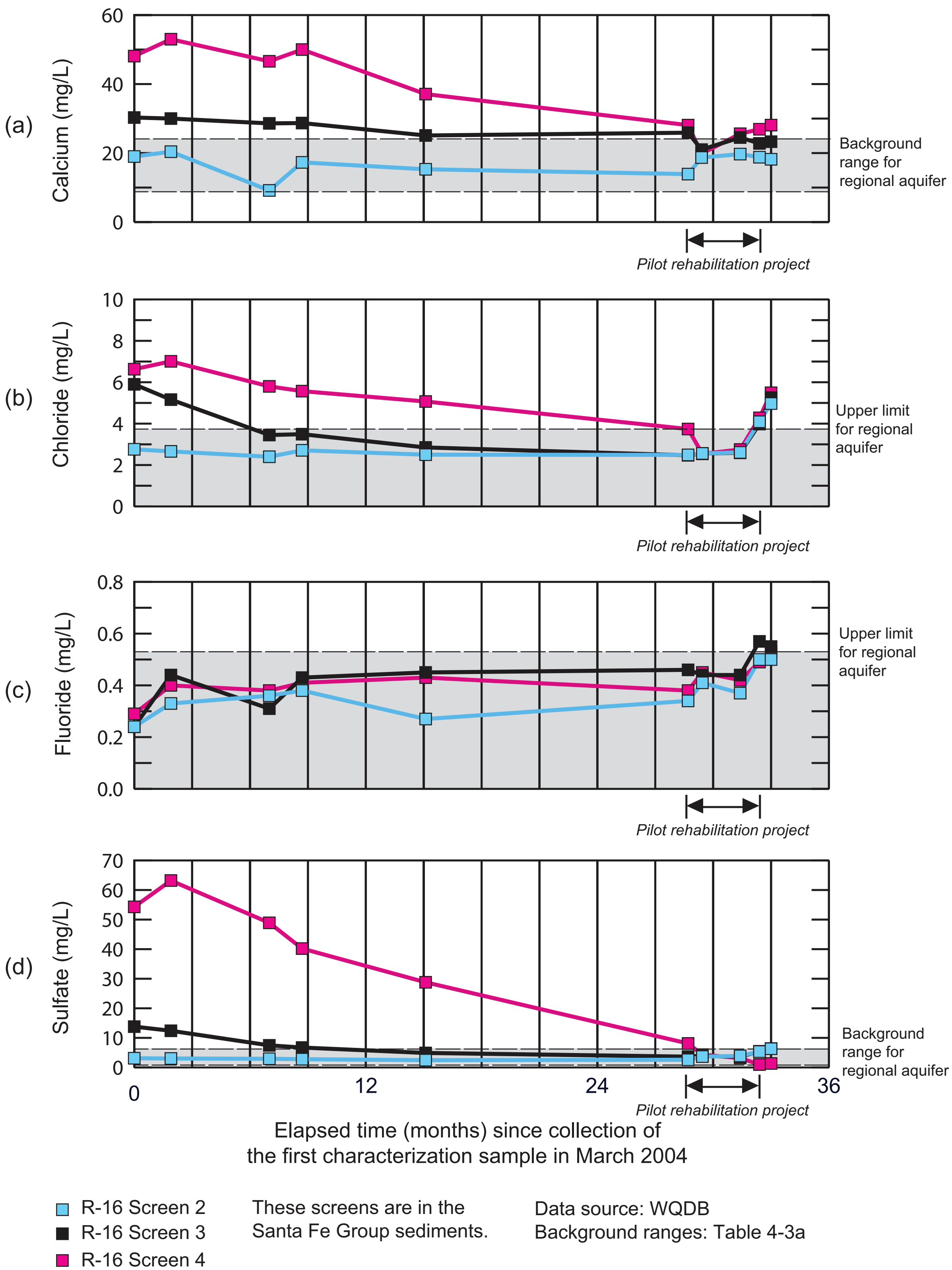


Figure 4-7. Evolution of indicators for residual water-soluble inorganic drilling fluids in R-16: (a) calcium, (b) chloride, (c) fluoride, (d) sulfate, (e) sodium, (f) phosphate, (g) alkalinity, and (h) pH

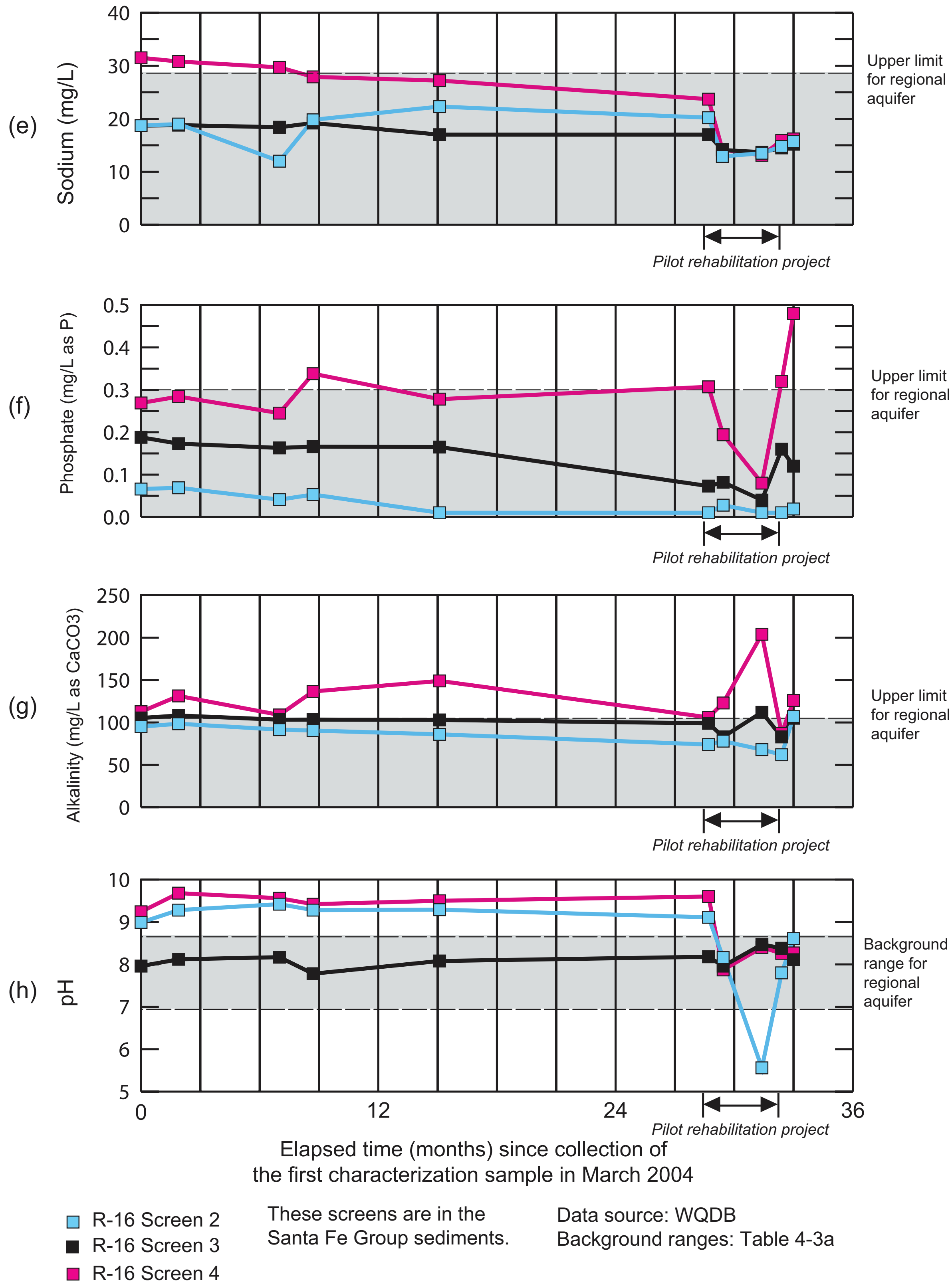
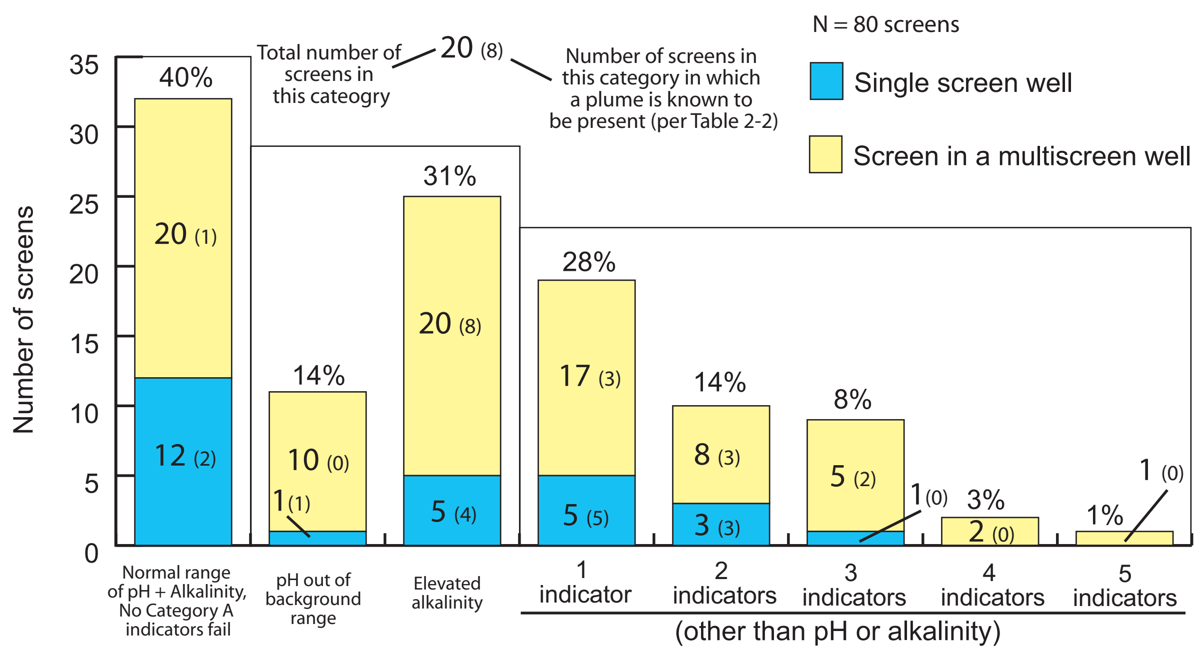
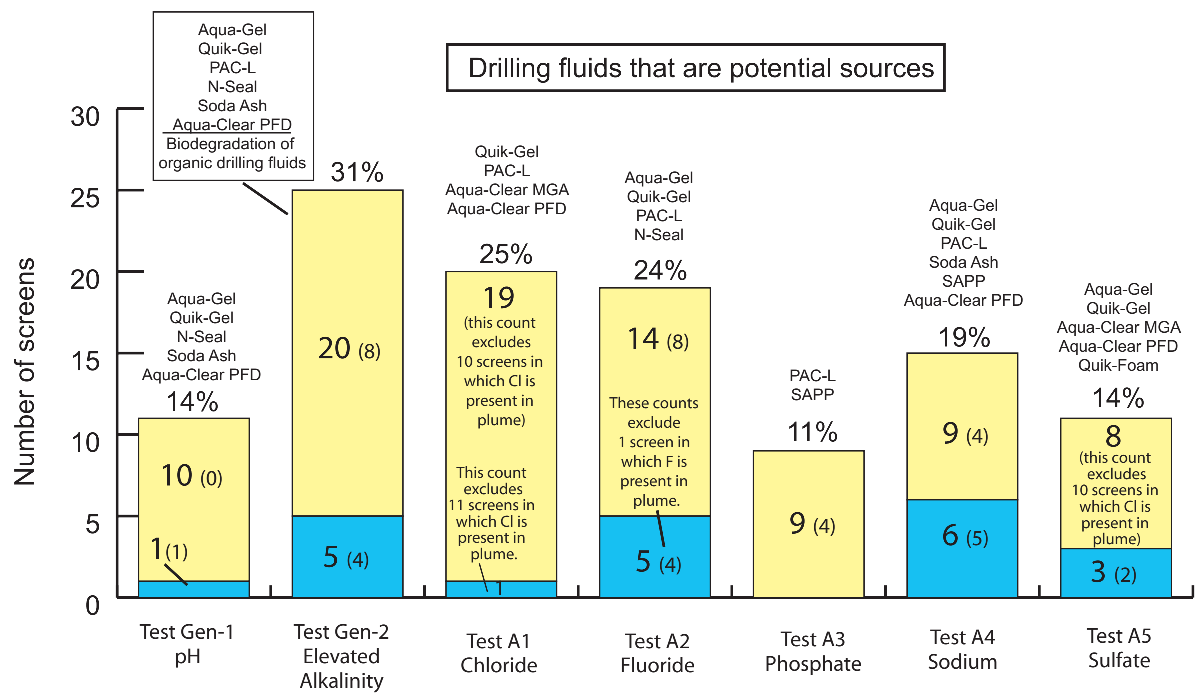


Figure 4-7 (continued). Evolution of indicators for residual water-soluble inorganic drilling fluids in R-16: (a) calcium, (b) chloride, (c) fluoride, (d) sulfate, (e) sodium, (f) phosphate, (g) alkalinity, and (h) pH

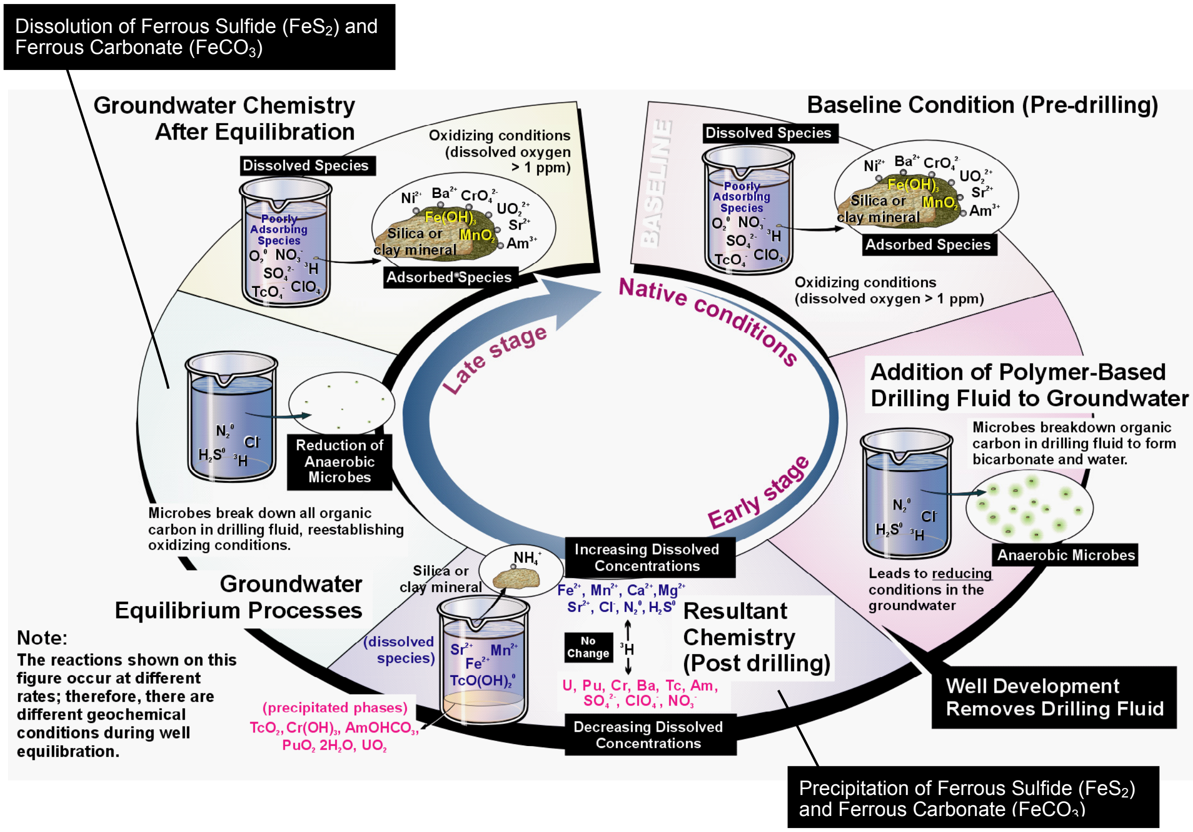


(a) Number of indicators of residual inorganic drilling fluids present in water sample



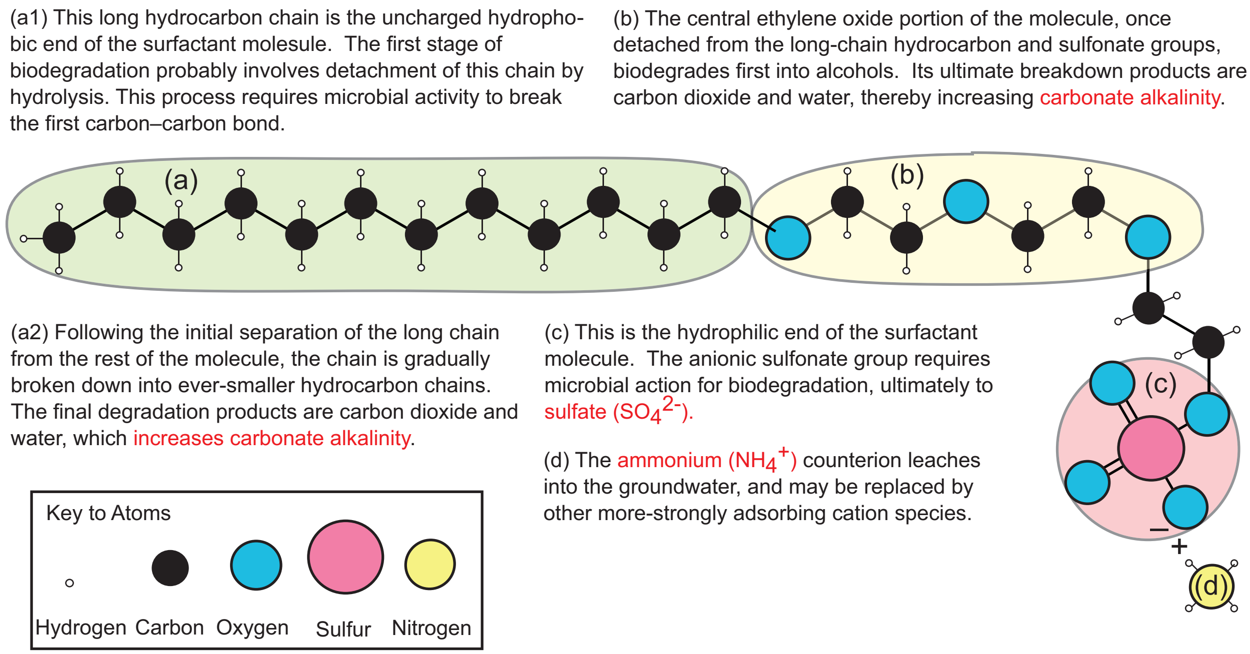
(b) Number of screens in which each indicator was present in water sample

Figure 4-8. Impacts of residual drilling fluids on water quality



Source: Modified from LANL 2004, 088420.

Figure 4-9. Conceptual model for the effects of polymer-based drilling fluids on water quality



Note: An example of an alcohol ethoxy sulfate (AES) is sodium laureth sulfate. The structure and biodegradation mechanisms for the surfactant in QUIK-FOAM are expected to be similar to those depicted for this widely-studied AES. In the molecule sketched above, ammonium has been substituted for sodium as the counterion, to more closely parallel the QUIK-FOAM surfactant's composition.

Figure 4-10. Biodegradation of an anionic surfactant (QUIK-FOAM constituent)

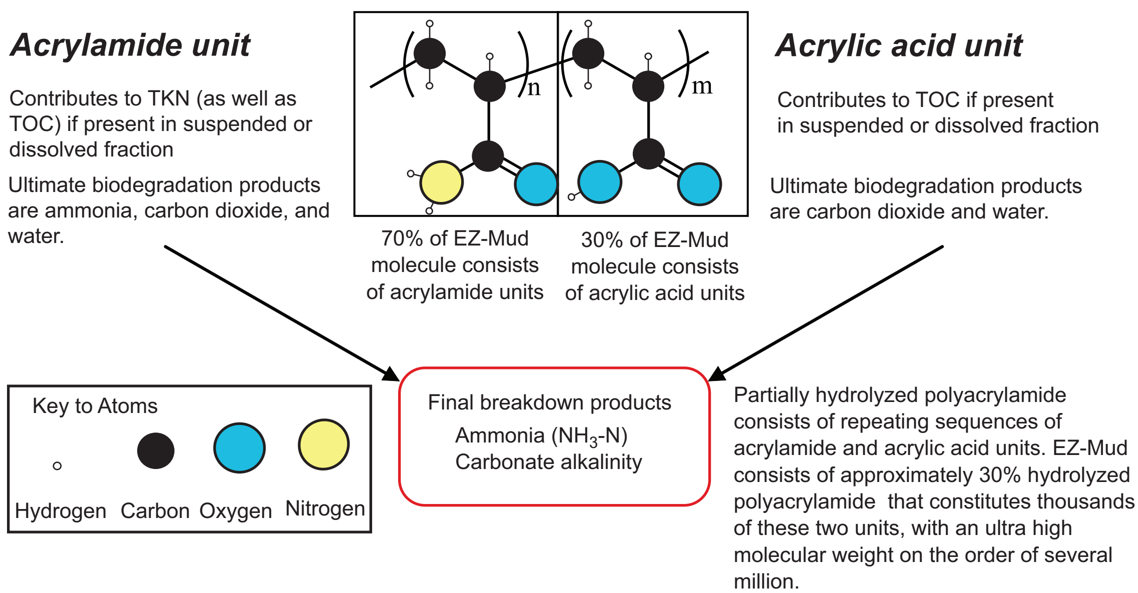


Figure 4-11. Biodegradation of polyacrylamide (EZ-MUD constituent)

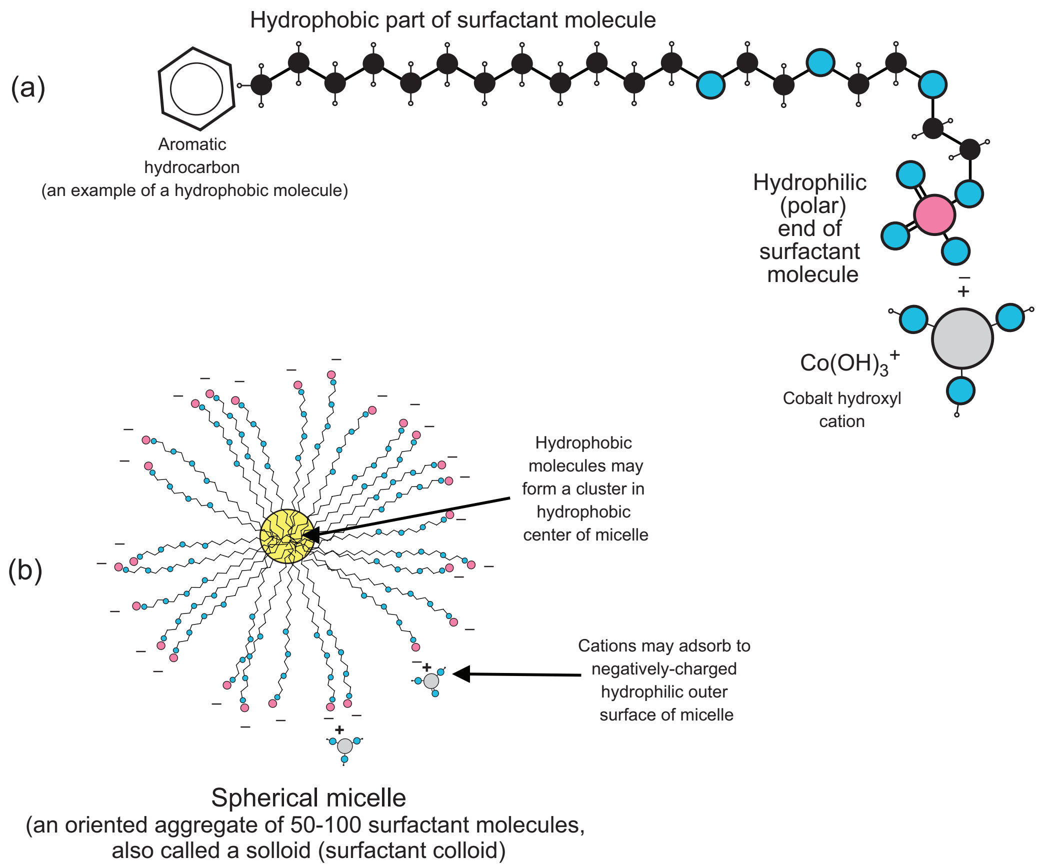


Figure 4-12. Schematics of potential interactions between anionic surfactants and constituents in groundwater: (a) interactions with hydrophobic and hydrophilic ends of a surfactant molecule, and (b) interactions with a surfactant micelle

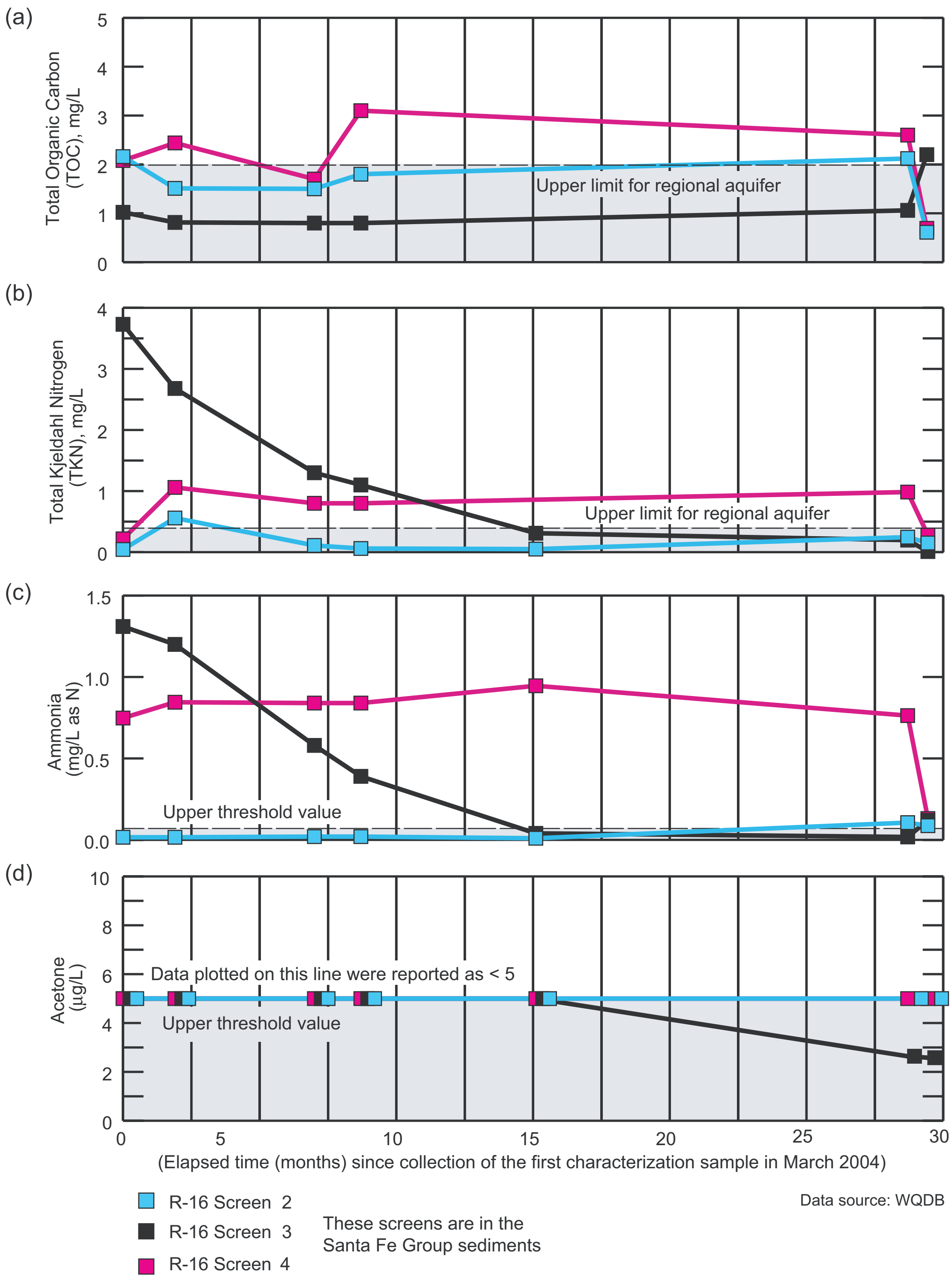
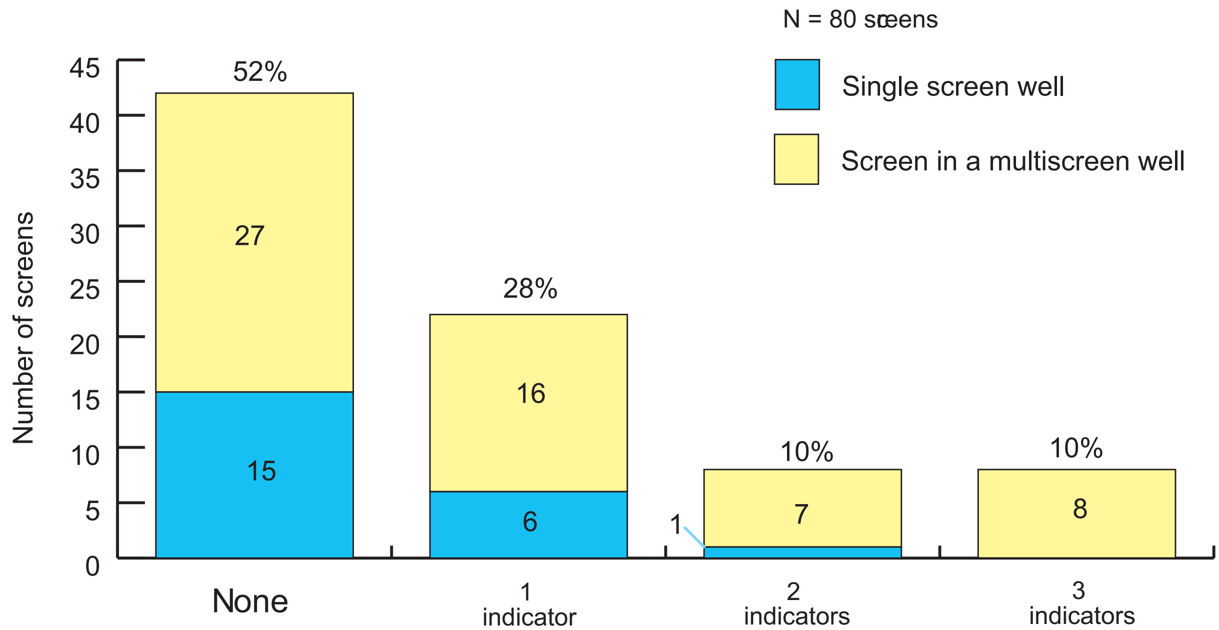
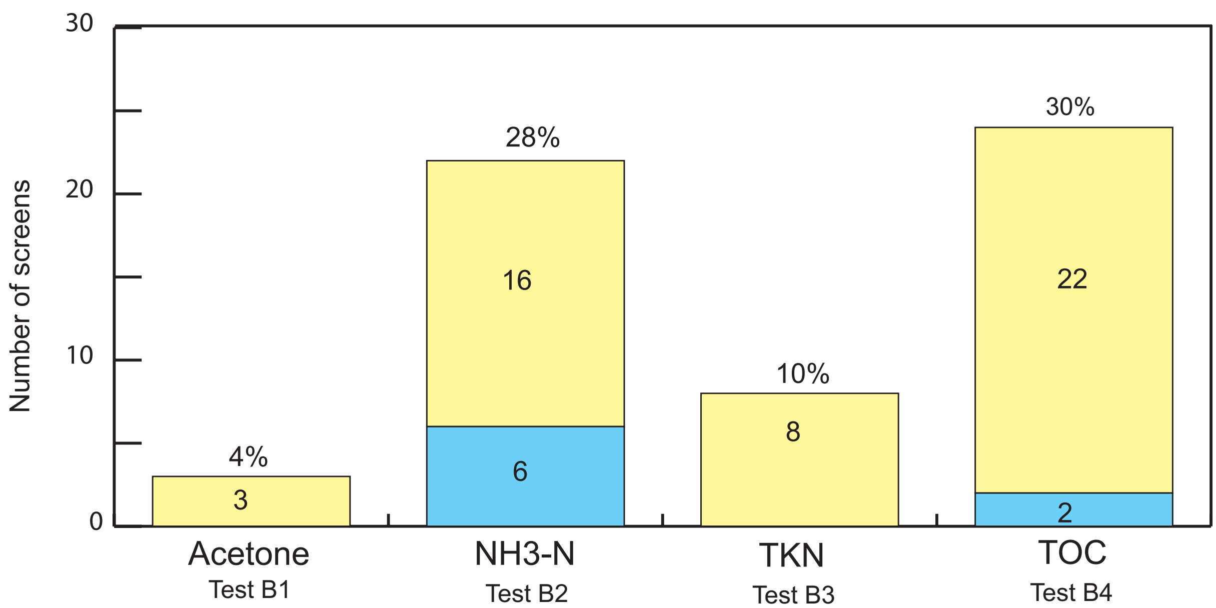


Figure 4-13. Evolution of indicators for residual organic drilling fluids in R-16: (a) total organic carbon, (b) total Kjeldahl nitrogen, (c) ammonia, and (d) acetone



(a) Number of indicators of residual organic drilling fluids present in the most recent water sample from each screen



(b) Number of screens in which each indicator was present in water sample (for the last time in which this constituent was measured in this screen)

Data source: Table C-4

Figure 4-14. Indicators for the presence of residual organic drilling fluids in the most recent water sample from each screen

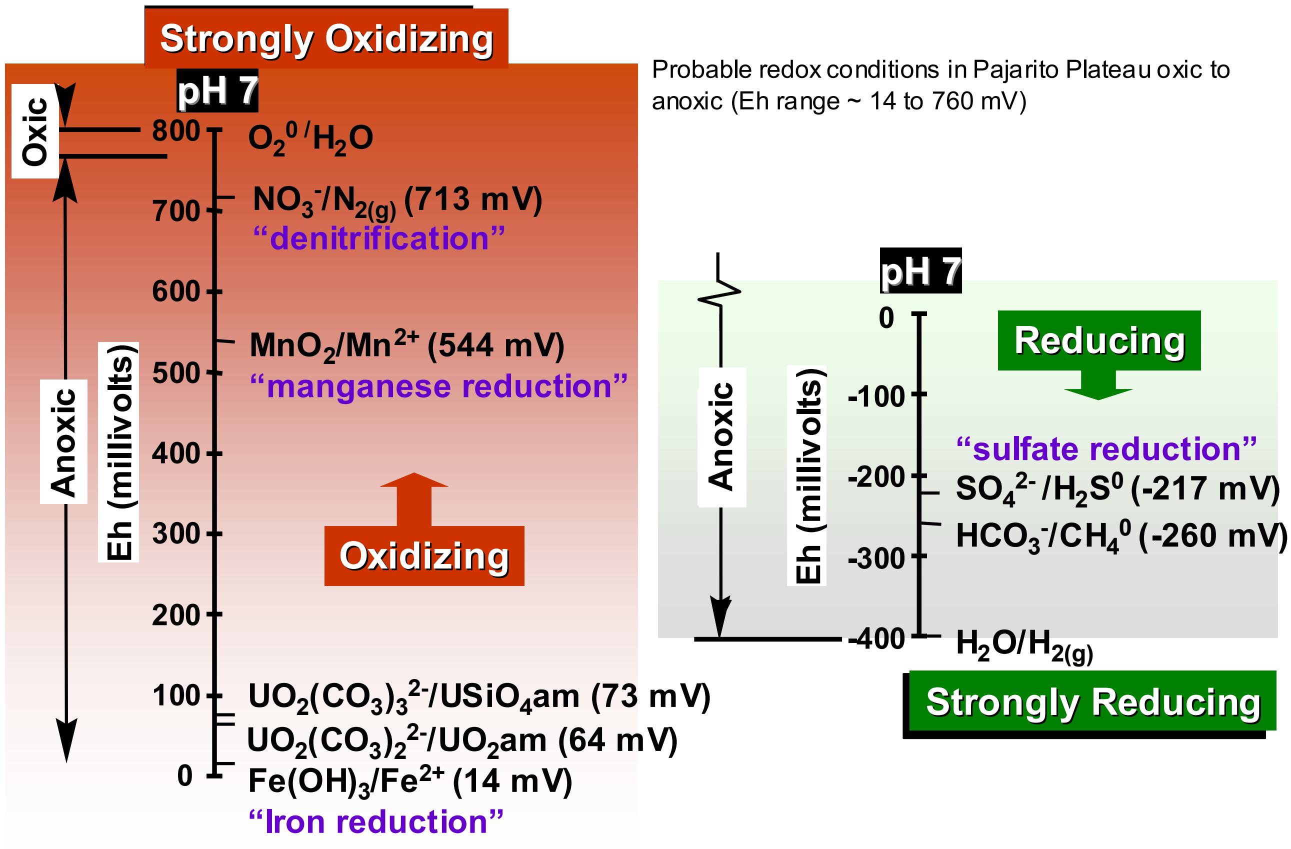


Figure 4-15. Selected redox couples (at pH 7 and 25 ºC) for Pajarito Plateau and surrounding areas

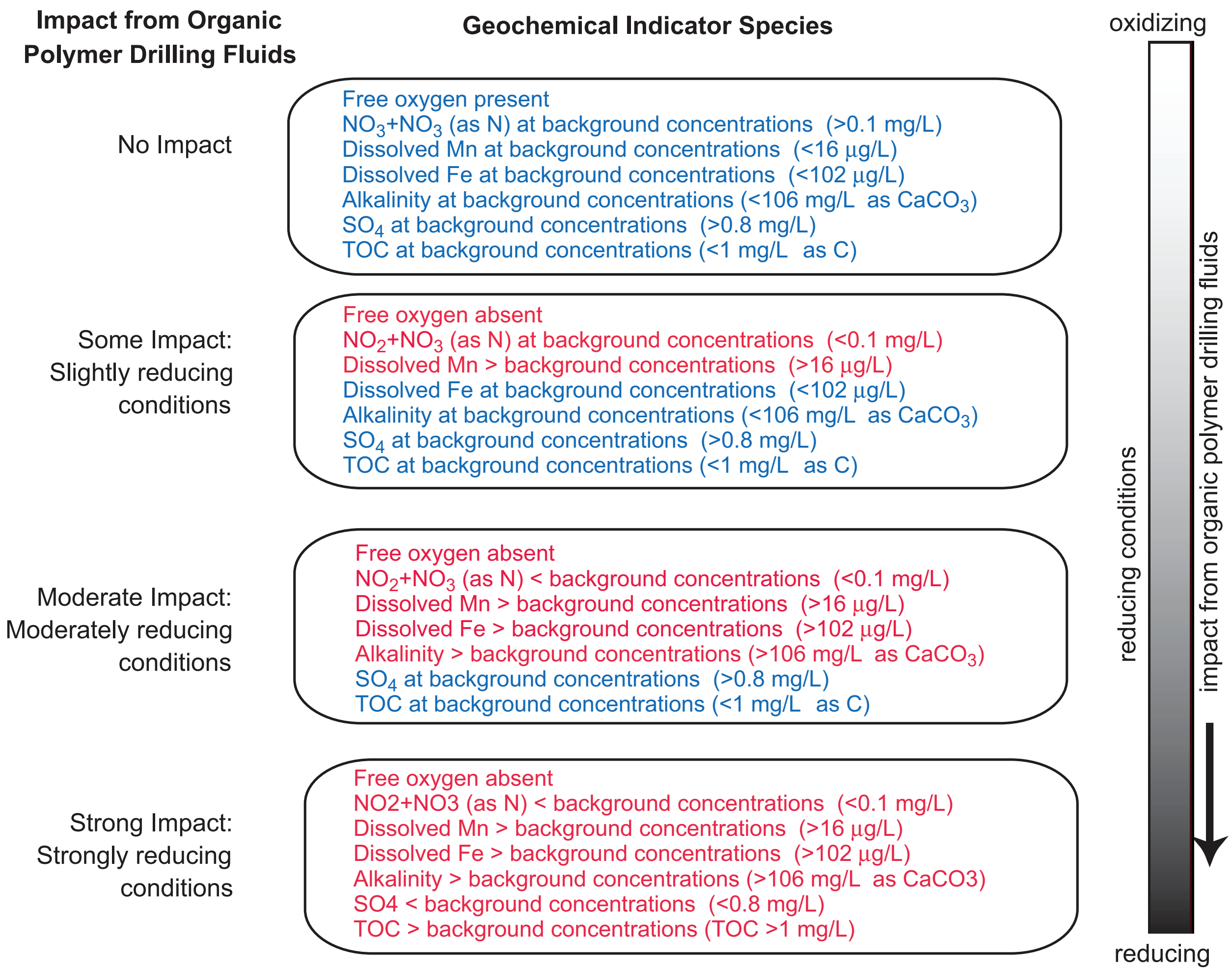


Figure 4-16. Redox criteria for assessing screens

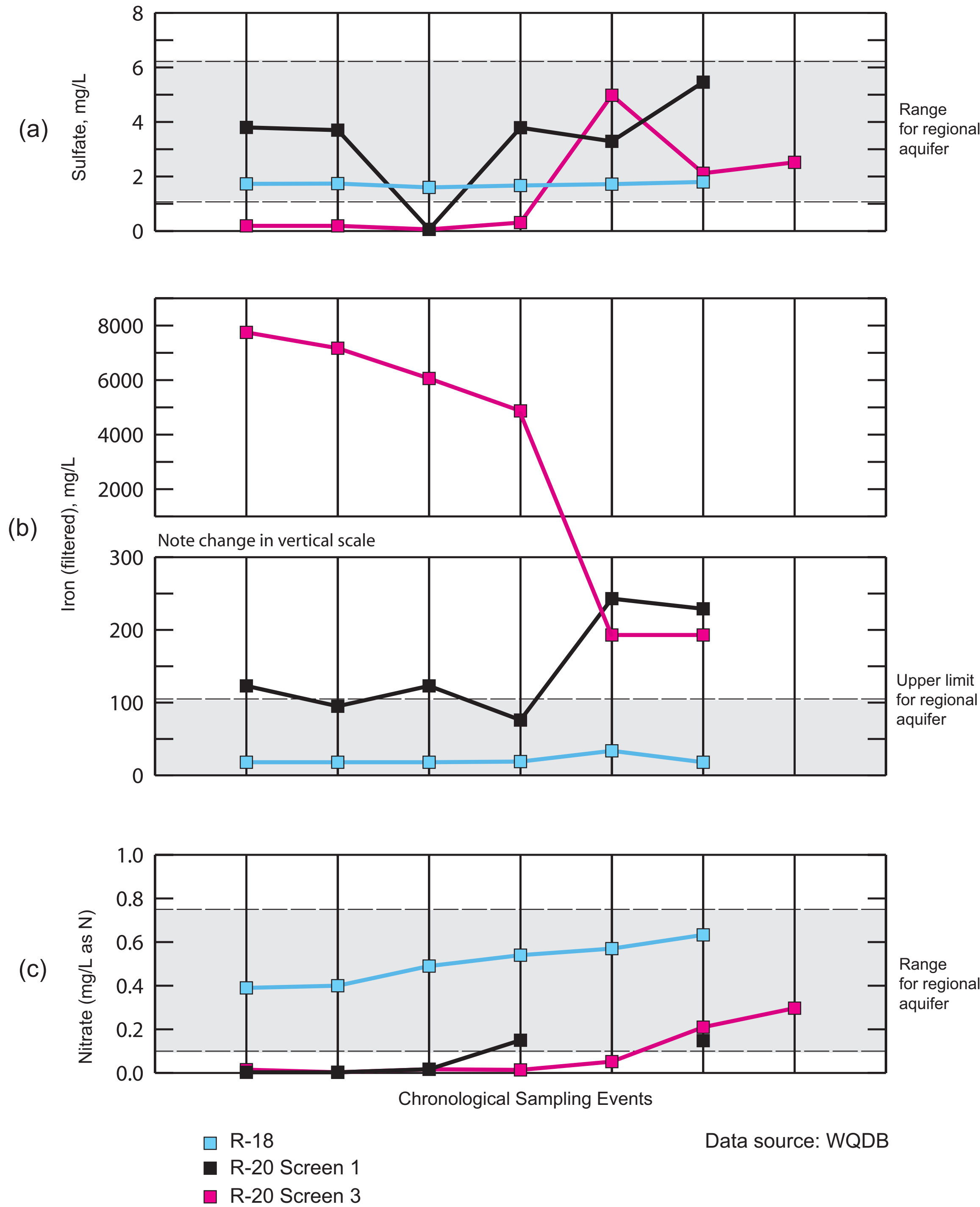


Figure 4-17. Evolution of redox indicators in wells R-18 and R-20

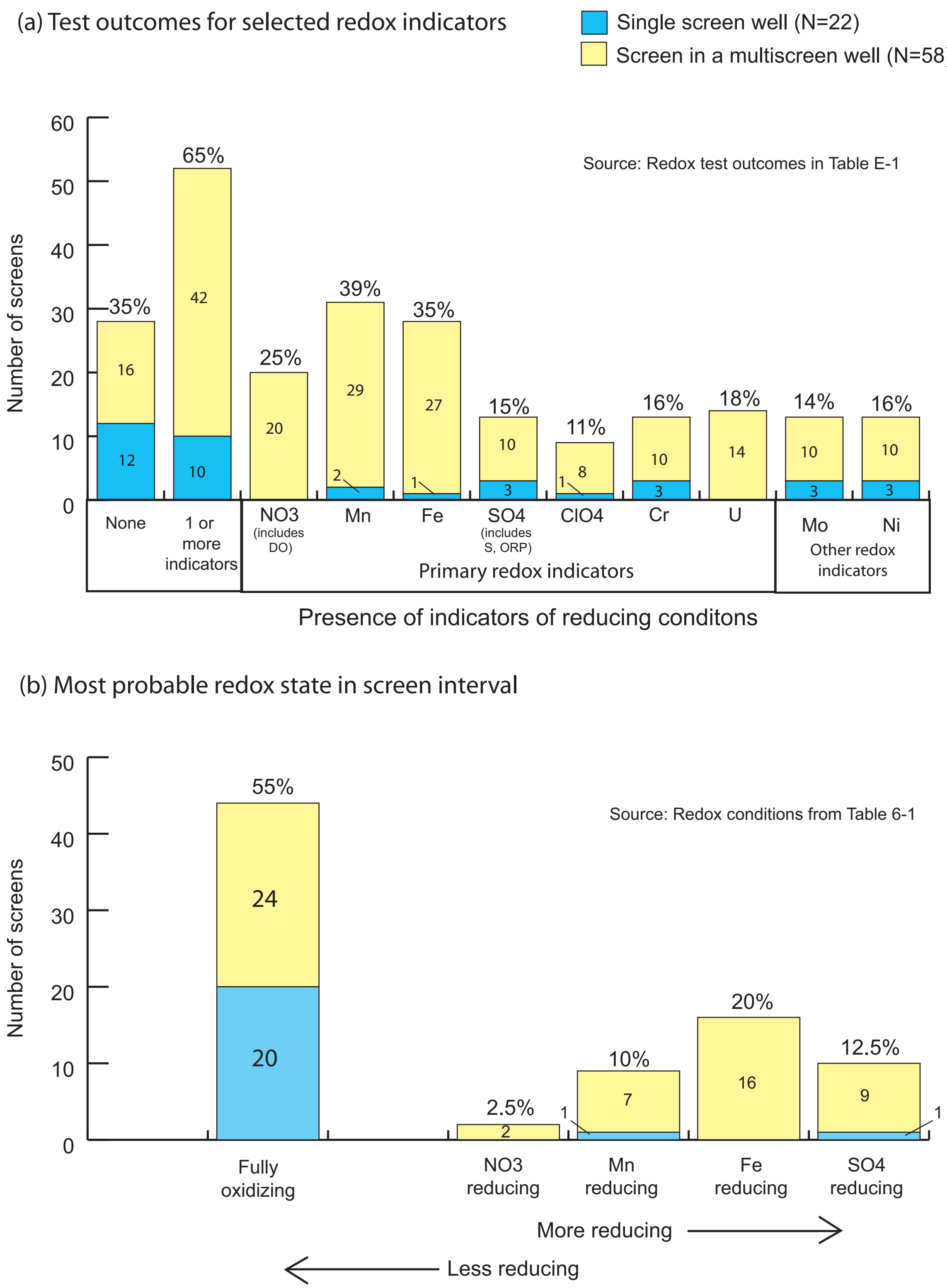
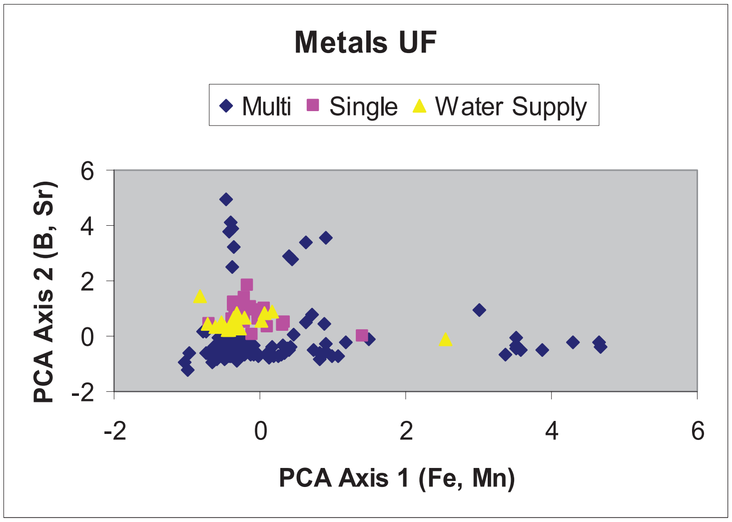
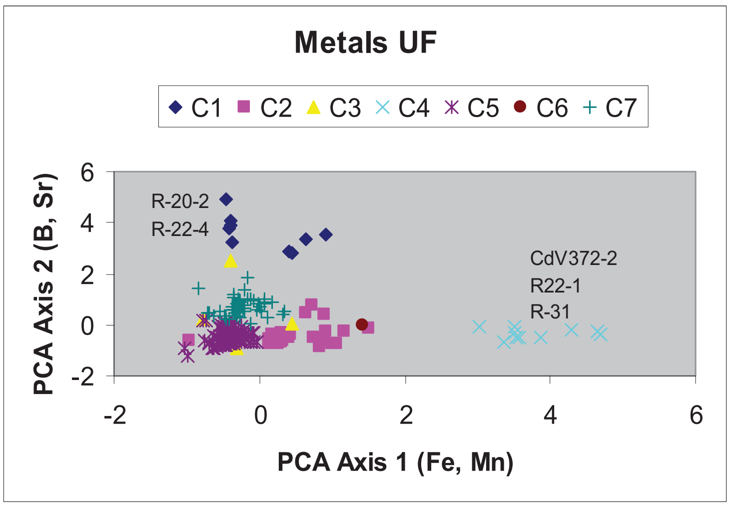


Figure 4-18. Effects of residual drilling fluids on redox conditions in groundwater



Many samples from single screen-wells show compositions consistent with water supply wells. Multiscreen wells show significant differences from supply wells.



Interpretation:

C5 = Consistent with White Rock Canyon springs or existing water-supply wells

C7 = Possible to slight impacts

C2, C3 = Moderate impacts

C1, C4, C6 = Significant impacts

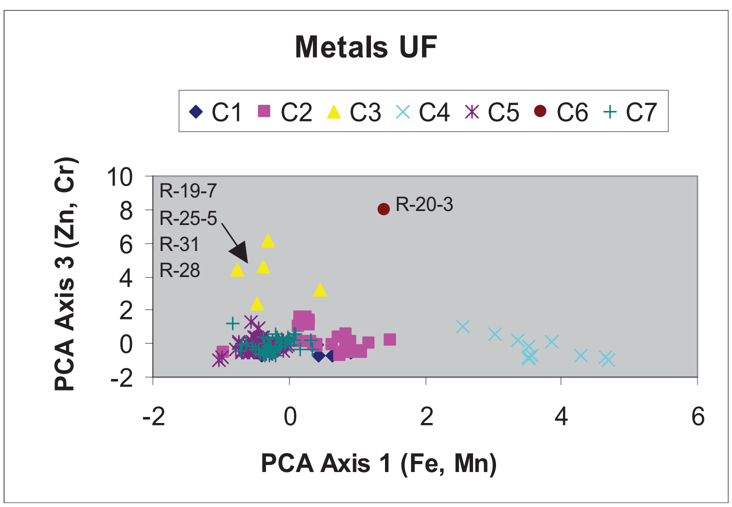
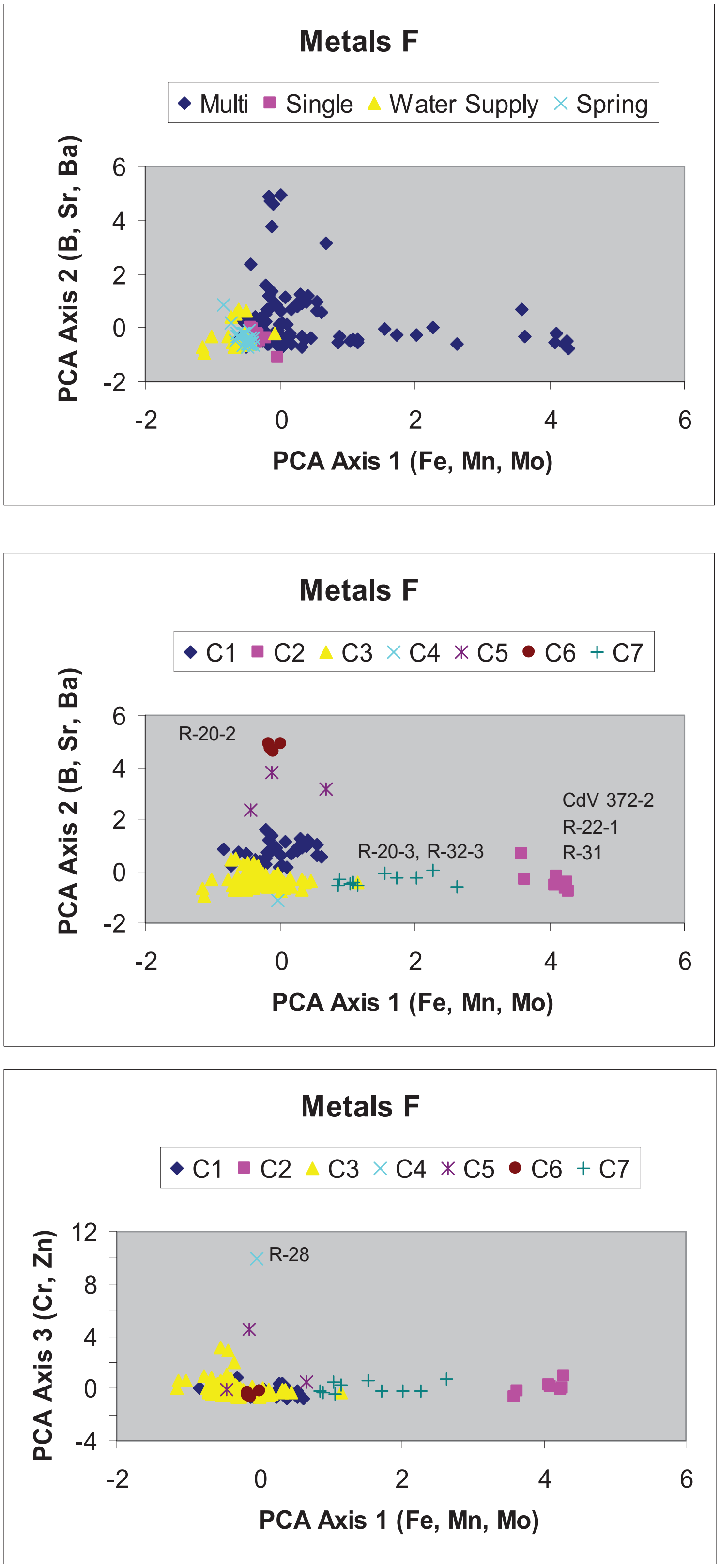


Figure 5-1. Principal component analysis of metals based on non-filtered water samples



Water supply wells consistent with springs, indicating minimal or no residual drilling impacts. Many single-screen wells consistent with springs and water-supply wells.

Interpretation:

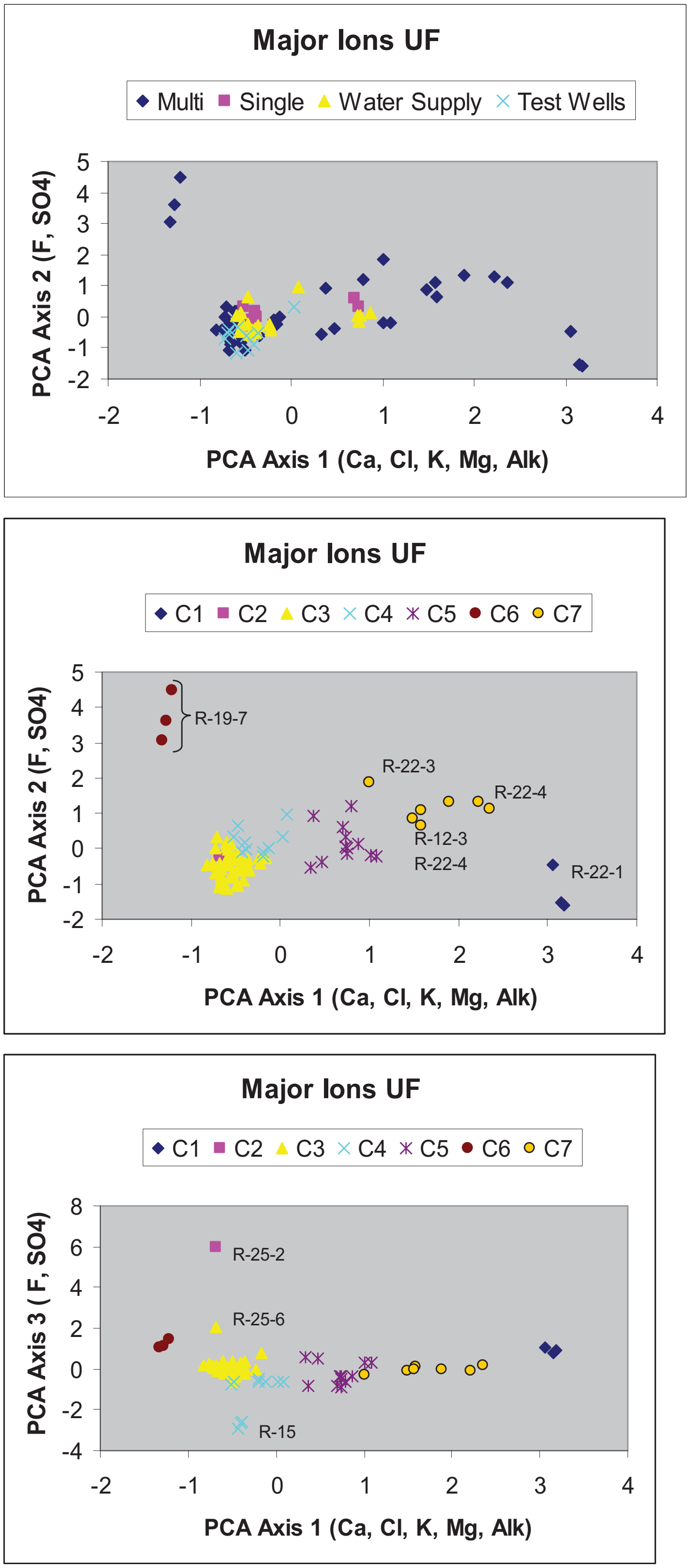
C3 = Consistent with White Rock Canyon springs or existing water-supply wells

C1 = Possible to slight impacts

C5, C7 = Moderate impacts

C2, C4, C6 = Significant impacts

Figure 5-2. Principal component analysis of metals based on filtered water samples



The chemistries of test wells are consistent with those of water supply wells. Most single-screen wells plot within chemistries represented by test and water supply wells.

Interpretation:

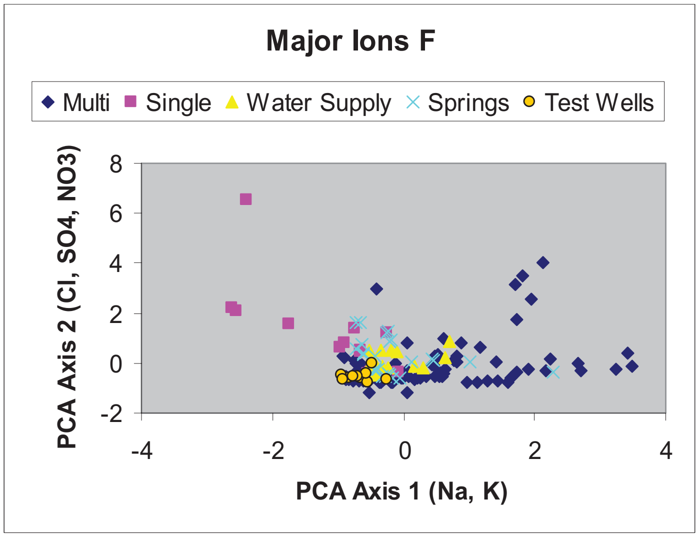
C3 = Consistent with White Rock Canyon springs or existing wells

C4 = Possible or slight impacts

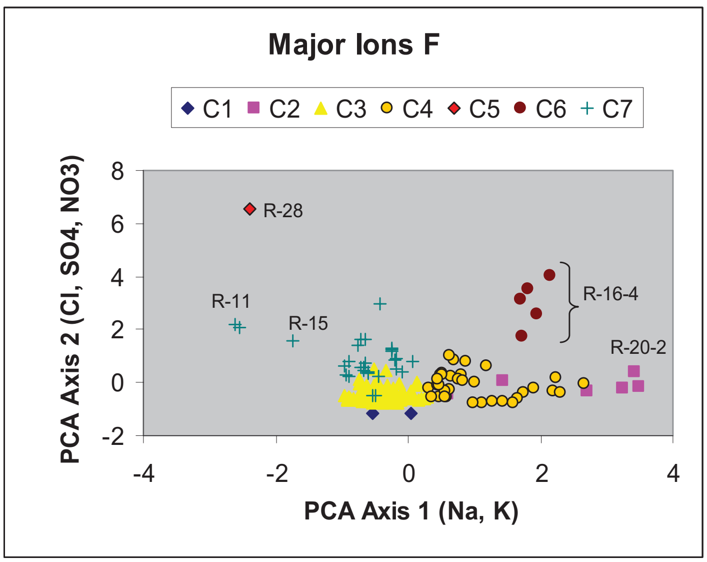
C5, C7 = Moderate impacts

C1, C2, C6 = Significant impacts

Figure 5-3. Principal component analysis of major ions based on non-filtered water samples



Tight grouping of test well, water supply and springs samples. Most single-screen wells consistent with these “baseline” stations. A few single-screen wells show elevated nitrate concentrations, which do not appear to be drilling related.



Interpretation:

C3 = Consistent with White Rock Canyon springs or existing wells

C7 = Possible or slight impacts

C4 = Moderate impacts

C1, C2, C5, C6 = Significant impacts

R-11 and R-15 show elevated NO_3 concentrations which do not appear to be drilling related. C7 appears to reflect natural chemical variability within aquifer, rather than drilling impacts.

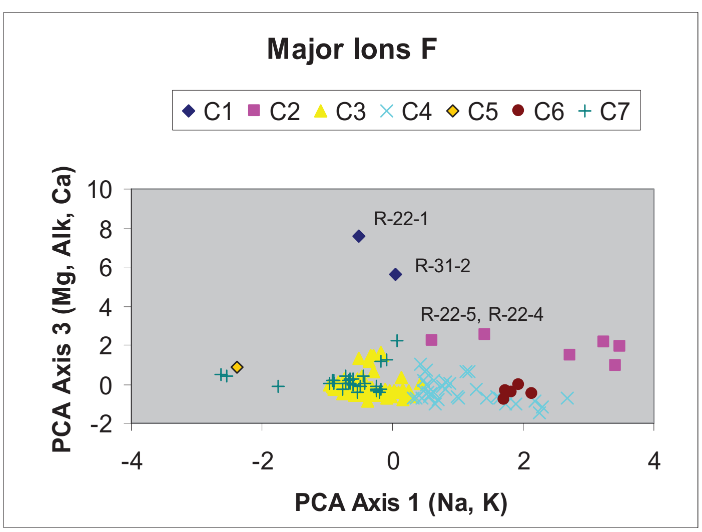


Figure 5-4. Principal component analysis of major ions based on filtered water samples

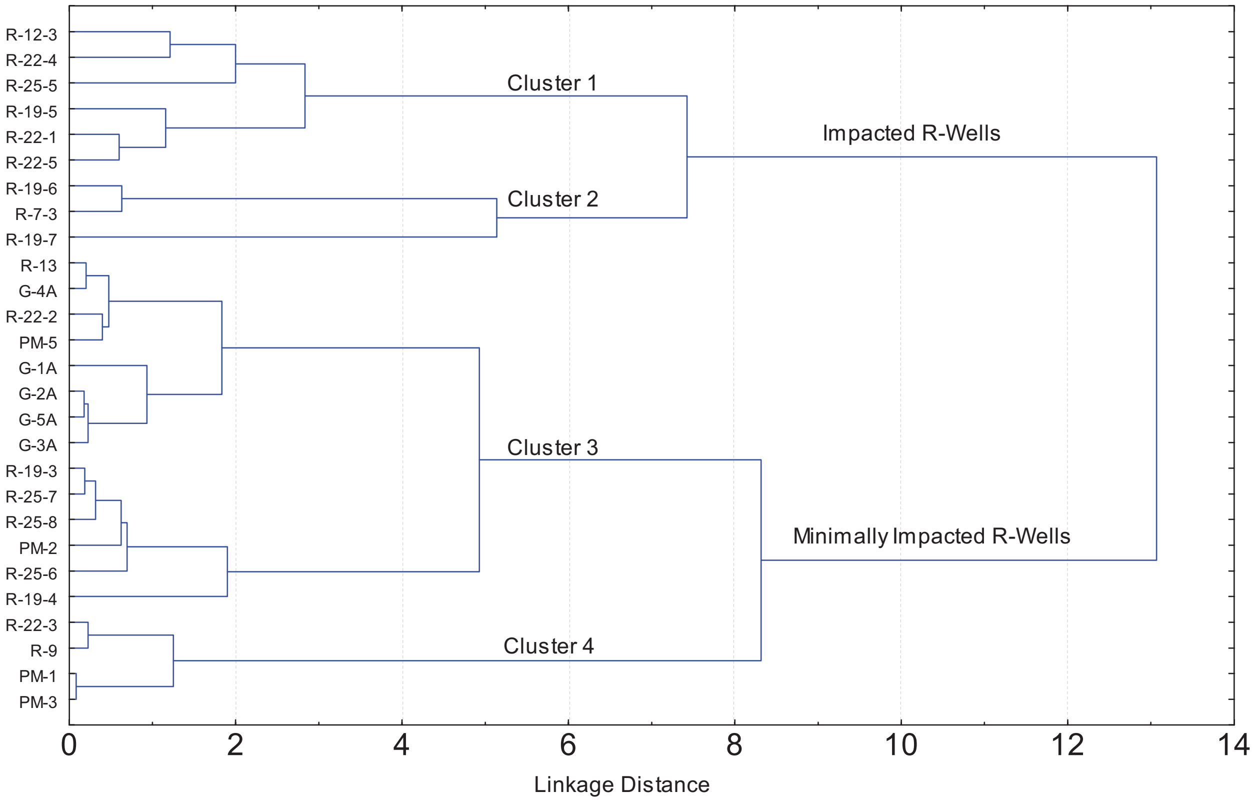


Figure 5-5. Hierarchical cluster analysis tree diagram for non-filtered metals and major ions (merged)

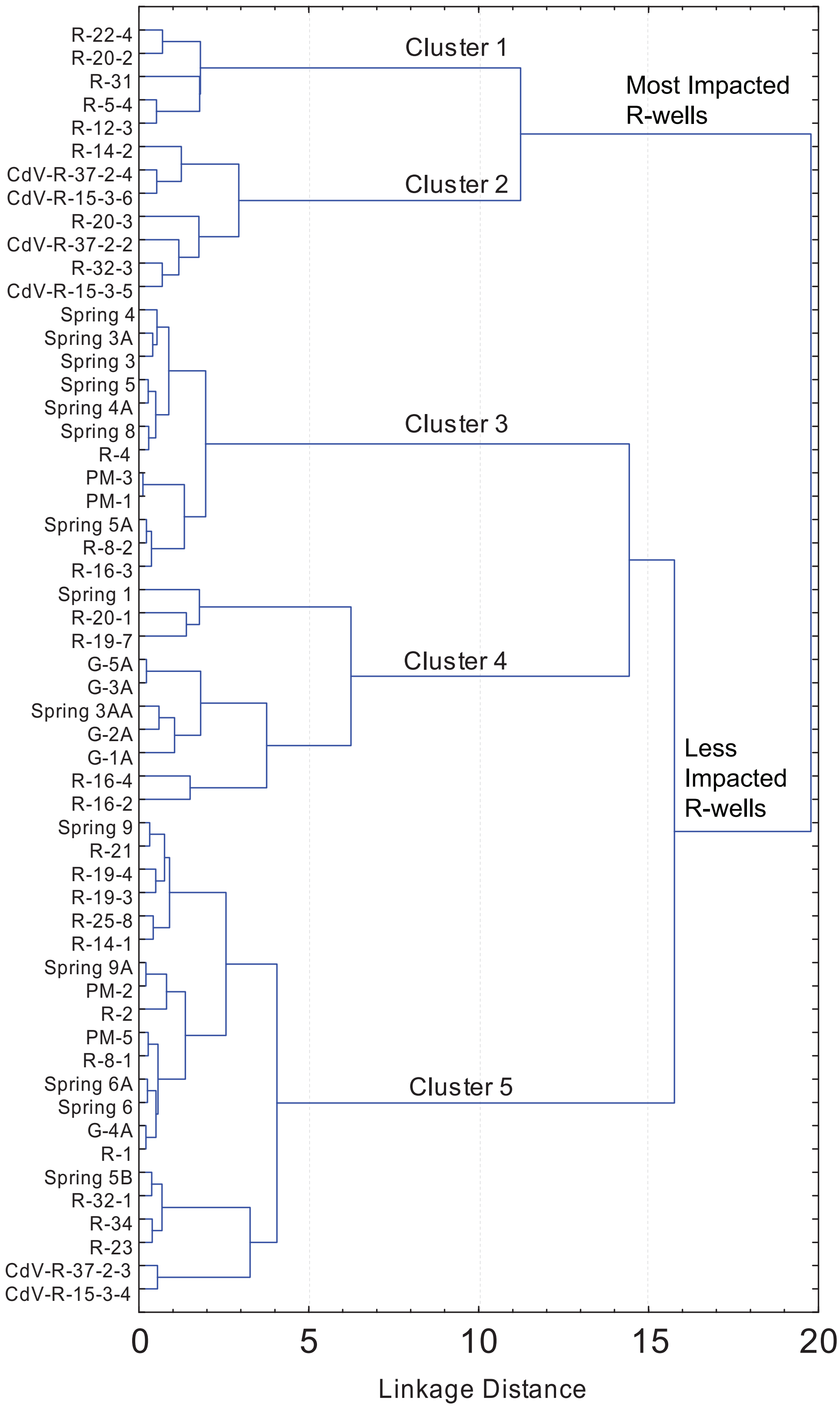
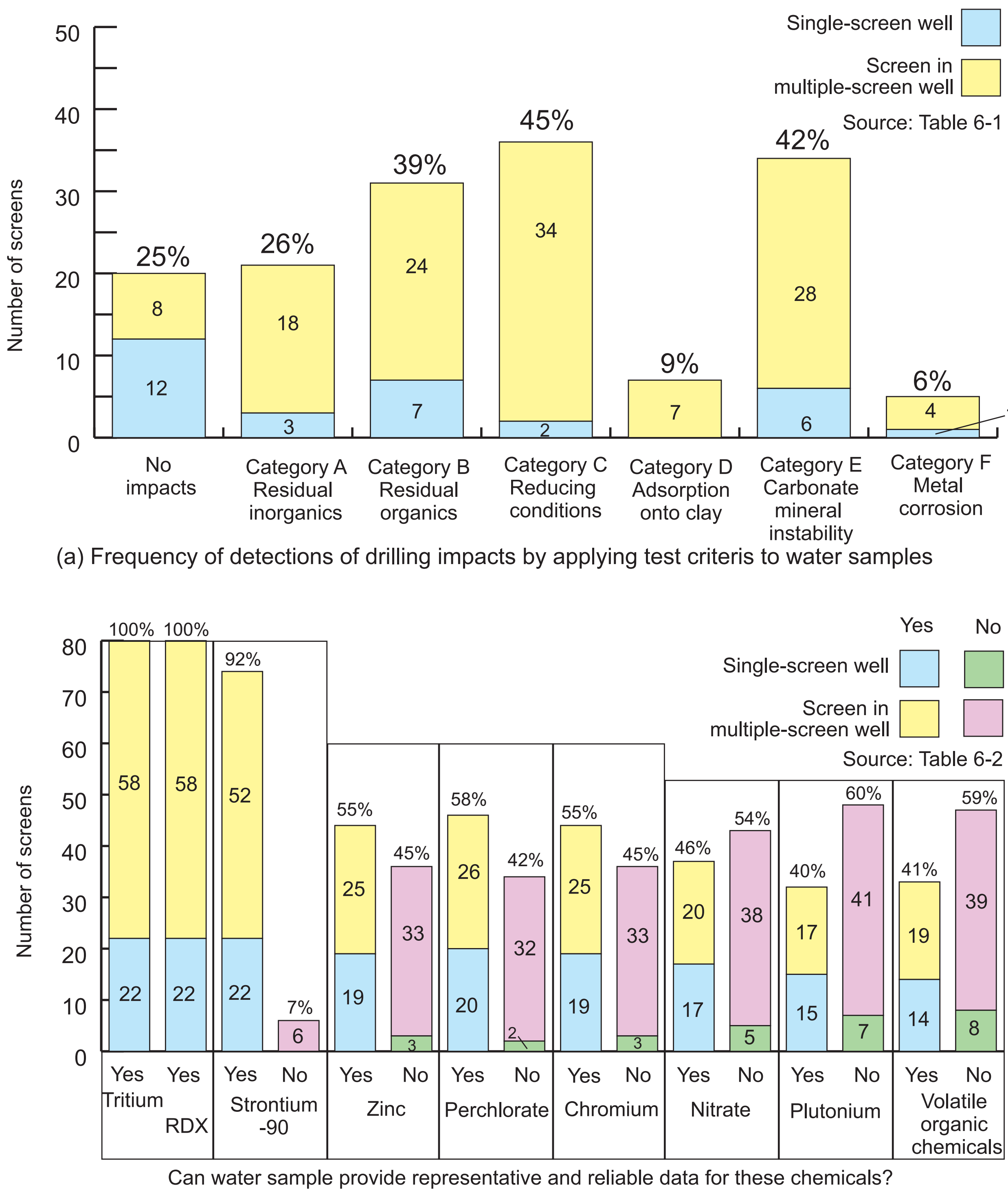


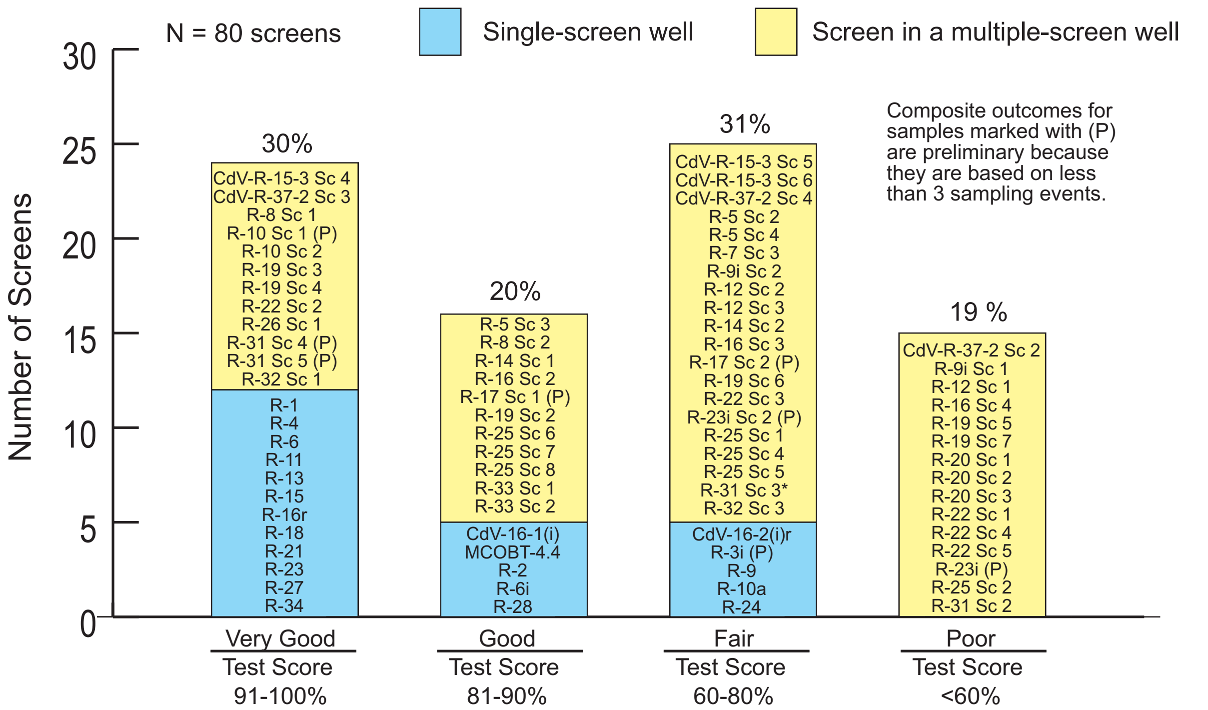
Figure 5-6. Hierarchical cluster analysis tree diagram for filtered metals and major ions (merged)



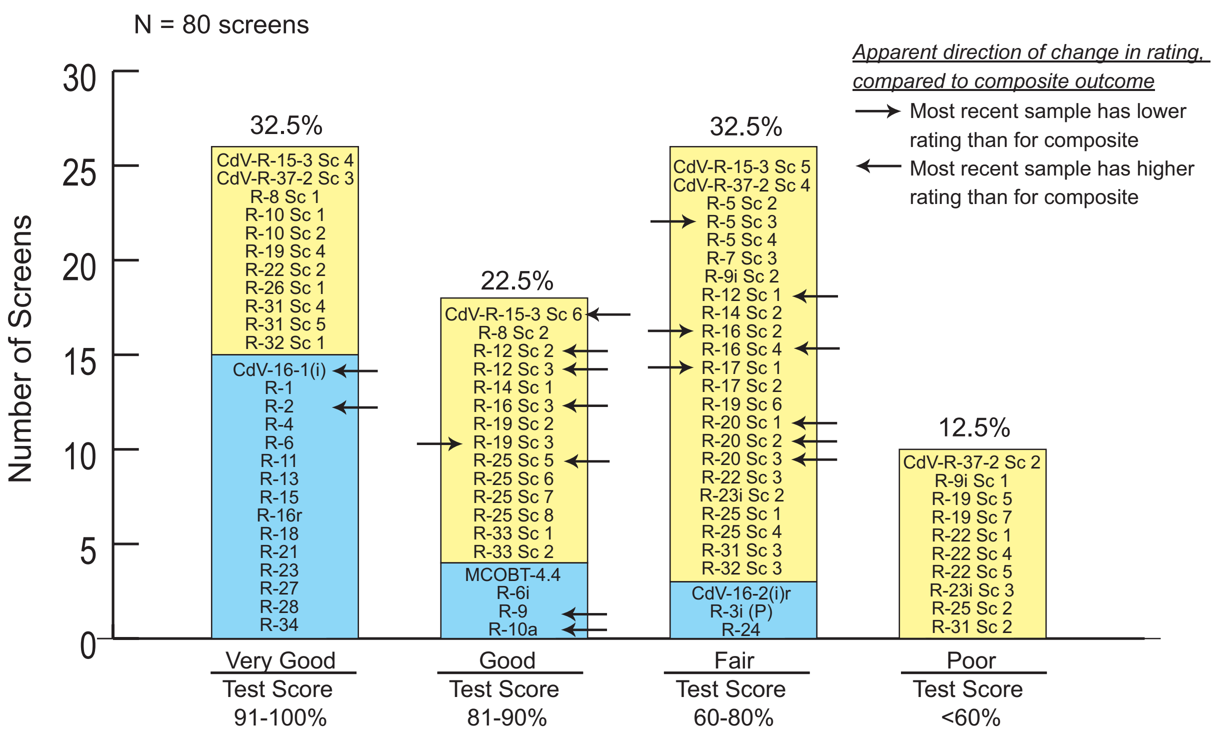
(a) Frequency of detections of drilling impacts by applying test criteris to water samples

(b) Assessment of data reliability based on outcomes of test criteria

Figure 6-1. **Ability of screen to provide reliable and representative water-quality data for tritium, perchlorate, strontium-90, nitrate, and RDX for the most recent sample**



(a) Composite outcome for all sample events included in this report



(b) Outcome for most recent sample event (as of 31-Dec-2006)

Figure 6-2. **Overall condition of screens for producing reliable and representative water-quality samples: (a) average outcome for three samples, (b) outcome for most recent sample**

Table 2-1
Indicators That May Not Be Applicable to a Water Sample Due to the Known Presence of a Contaminant Plume in the Screen Interval

Screen ID[a]	Well	Port Depth (ft)	Scr #	Watershed	^{3}H >1 pCi/L[a]	Local Plume	^{3}H >30 pCi/L[b]	Cl	ClO_4	Cr	NO_3	SO_4	U
1	CdV-16-1(i)	624	1	Cañon de Valle	Yes	Present	■[c]	■	■	—[d]	—	■	—
2	CdV-16-2(i)r	850	1	Cañon de Valle	Yes	Present	—	■	■	—	—	?[e]	—
3	CdV-R-15-3	1254	4	Cañon de Valle	—	None[f]	—	—	—	—	—	—	—
4	CdV-R-15-3	1350	5	Cañon de Valle	—	None	—	—	—	—	—	—	—
5	CdV-R-15-3	1640	6	Cañon de Valle	—	None	—	—	—	—	—	—	—
6	CdV-R-37-2	1200	2	Cañon de Valle	—	None	—	—	—	—	—	—	—
7	CdV-R-37-2	1359	3	Cañon de Valle	—	None	—	—	—	—	—	—	—
8	CdV-R-37-2	1551	4	Cañon de Valle	—	None	—	—	—	—	—	—	—
9	MCOBT-4.4	485	1	Mortandad	Yes	Present	■	■	■	■	—	■	—
10	R-1	1031	1	Mortandad	—	None	—	—	—	—	—	—	—
11	R-2	918	1	Pueblo	—	None	—	—	—	—	—	—	—
12	R-3i[g]	215	1	Pueblo	Yes	Present	—	■	—	—	■	■	■
13	R-4	793	1	Pueblo	Yes	Present	■	■	■	—	■	—	—
14	R-5	384	2	Pueblo	—	Present	—	■	■	■	■	■	■
15	R-5	719	3	Pueblo	—	Present	—	■	■	■	■	■	—
16	R-5	861	4	Pueblo	—	None	—	—	—	—	—	—	—
17	R-6	1205	1	Los Alamos	—	None	—	—	—	—	—	—	—
18	R-6i	602	1	Los Alamos	Yes	Present	■	■	■	—	■	■	—
19	R-7	915	3	Los Alamos	—	None	—	—	—	—	—	—	—
20	R-8	711	1	Los Alamos	—	None	—	—	—	—	—	—	—
21	R-8	825	2	Los Alamos	—	None	—	—	—	—	—	—	—
22	R-9	684	1	Los Alamos	Yes	Present	—	■	■	—	—	—	■
23	R-9i	199	1	Los Alamos	Yes	Present	■	■	—	—	—	■	—
24	R-9i	279	2	Los Alamos	Yes	Present	■	■	—	—	—	■	—
25	R-10	874	1	Sandia	—	None	—	—	—	—	—	—	—
26	R-10	1042	2	Sandia	—	None	—	—	—	—	—	—	—
27	R-10a	690	1	Sandia	—	Present	—	■	■	—	■	?	■
28	R-11	855	1	Sandia	Yes	Present	—	■	■	■	■	—	—
29	R-12	468	1	Sandia	Yes	Present	■	■	■	—	■	■	?
30	R-12	507	2	Sandia	Yes	Present	■	■	■	—	■	■	—
31	R-12	811	3	Sandia	Yes	Present	■	■	■	—	■	■	—
32	R-13	958	1	Mortandad	—	None	—	—	—	—	—	—	—
33	R-14	1204	1	Mortandad	—	None	—	—	—	—	—	—	—
34	R-14	1288	2	Mortandad	—	None	—	—	—	—	—	—	—
35	R-15	959	1	Mortandad	Yes	Present	■	■	■	■	■	■	—

Table 2-1 (continued)

Screen ID[a]	Well	Port Depth (ft)	Scr #	Watershed	^{3}H >1 pCi/L[a]	Local Plume	^{3}H >30 pCi/L[b]	Cl	ClO_4	Cr	NO_3	SO_4	U
36	R-16	866	2	Cañada del Buey	—	Indeter[e]	—	?	—	—	—	—	—
37	R-16	1018	3	Cañada del Buey	—	Indeter	—	?	—	—	—	—	—
38	R-16	1238	4	Cañada del Buey	—	Indeter	—	?	—	—	—	—	—
39	R-16r	600	1	Cañada del Buey	—	None	—	—	—	—	—	—	—
40	R-17	1057	1	Pajarito	—	None	—	—	—	—	—	—	—
41	R-17	1124	2	Pajarito	—	None	—	—	—	—	—	—	—
42	R-18	1358	1	Pajarito	—	None	—	—	—	—	—	—	—
43	R-19	909	2	Pajarito	—	None	—	—	—	—	—	—	—
44	R-19	1191	3	Pajarito	—	None	—	—	—	—	—	—	—
45	R-19	1413	4	Pajarito	—	None	—	—	—	—	—	—	—
46	R-19	1586	5	Pajarito	—	None	—	—	—	—	—	—	—
47	R-19	1730	6	Pajarito	—	None	—	—	—	—	—	—	—
48	R-19	1835	7	Pajarito	—	None	—	—	—	—	—	—	—
49	R-20	907	1	Pajarito	—	None	—	—	—	—	—	—	—
50	R-20	1150	2	Pajarito	—	None	—	—	—	—	—	—	—
51	R-20	1330	3	Pajarito	—	None	—	—	—	—	—	—	—
52	R-21	889	1	Cañada del Buey	—	None	—	—	—	—	—	—	—
53	R-22	907	1	Pajarito	Yes	None	—	—	—	—	—	—	—
54	R-22	963	2	Pajarito	—	None	—	—	—	—	—	—	—
55	R-22	1273	3	Pajarito	—	None	—	—	—	—	—	—	—
56	R-22	1378	4	Pajarito	—	None	—	—	—	—	—	—	—
57	R-22	1448	5	Pajarito	Yes	None	—	—	—	—	—	—	—
58	R-23	816	1	Pajarito	—	Present	—	—	—	—	■	—	—
59	R-23i[h]	470	2	Pajarito	Yes	Present	—	?	—	—	—	—	?
60	R-23i	524	3	Pajarito	Yes	Present	■	?	—	—	—	—	?
61	R-24	825	1	Bayo	—	Indeter	—	?	—	—	—	—	?
62	R-25	755	1	Cañon de Valle	Yes	Present	■	■	■	—	■	■	—
63	R-25	892	2	Cañon de Valle	Yes	Present	■	■	—	—	?	?	—
64	R-25	1192	4	Cañon de Valle	Yes	Present	■	■	—	—	?	?	—
65	R-25	1303	5	Cañon de Valle	Yes	Present	—	—	—	—	—	—	—
66	R-25	1406	6	Cañon de Valle	Yes	None	—	—	—	—	—	—	—
67	R-25	1606	7	Cañon de Valle	—	None	—	—	—	—	—	—	—
68	R-25	1796	8	Cañon de Valle	—	None	—	—	—	—	—	—	—
69	R-26	659	1	Cañon de Valle	—	None	—	—	—	—	—	—	—
70	R-27	852	1	Water	—	None	—	—	—	—	—	—	—
71	R-28	934	1	Mortandad	Yes	Present	■	■	■	■	■	■	—
72	R-31	532	2	Ancho	—	None	—	—	—	—	—	—	—

Table 2-1 (continued)

Screen ID[a]	Well	Port Depth (ft)	Scr #	Watershed	^{3}H >1 pCi/L[a]	Local Plume	^{3}H >30 pCi/L[b]	Cl	ClO_4	Cr	NO_3	SO_4	U
73	R-31	670	3	Ancho	—	None	—	—	—	—	—	—	—
74	R-31	831	4	Ancho	—	None	—	—	—	—	—	—	—
75	R-31	1011	5	Ancho	—	None	—	—	—	—	—	—	—
76	R-32	871	1	Pajarito	—	None	—	—	—	—	—	—	—
77	R-32	976	3	Pajarito	—	None	—	—	—	—	—	—	—
78	R-33	995	1	Mortandad	—	None	—	—	—	—	—	—	—
79	R-33	1112	2	Mortandad	—	None	—	—	—	—	—	—	—
80	R-34	895	1	Mortandad	—	None	—	—	—	—	—	—	—

[a] An "X" in this column indicates that tritium (^{3}H) is detected at this location, indicating the presence of a component of water less than 60 years old.

[b] An "X" in this column indicates that tritium (^{3}H) is present at this location as a constituent in a local contaminant plume. The threshold value of 30 pCi/L is based on the discussion of tritium in section 4.2.1 of the "Groundwater Background Investigation Report, Revision 2," (LANL 2006, 094856). The highest activity found was 30 pCi/L in an alluvial perched groundwater from Well LAO-B in 2006, which is interpreted as representing the upper limit for uncontaminated local groundwater.

[c] ■ = The constituent is known to be present in a local contaminant plume that has reached the screened interval.

[d] — = The constituent is either absent from any local plume, or else its presence is indeterminate with the information available at this time.

[e] ? = The constituent is detected at this location and is likely to be a plume constituent, but incontrovertible evidence for this origin is lacking at the present time.

[f] None = No local contaminant plume is known with certainty to be present at this location.

[g] Entries for R-3i are preliminary. Although a contaminant plume is present at this location, it has not yet been completely characterized. Constituents identified on this table are based in part on the similarities between groundwater from R-3i to that from nearby well APCO-1, which is mainly impacted by discharges of treated sewage effluent from the Bayo Sewage Treatment Plant.

[h] Entries for the two screens in R-23i are preliminary. Although a contaminant plume is present at this location, it has not yet been completely characterized.

Table 2-2
Primary Chemicals of Potential Concern for Individual Wells

Well	Watershed	TA	Potential Contaminants in Watershed[a]
CdV-16-1(i)	Upper Water Canyon and Cañon de Valle	TA-16	High explosive (HE) compounds[b], nitrate, perchlorate, uranium, barium, lead, copper, zinc
CdV-16-2(i)r	Upper Water Canyon and Cañon de Valle	TA-16	HE compounds[b], nitrate, perchlorate, uranium, barium, lead, copper, zinc
CdV-R-15-3	Upper Water Canyon and Cañon de Valle	TA-15	HE compounds[b], nitrate, perchlorate, uranium, barium, lead, copper, zinc
CdV-R-37-2	Upper Water Canyon and Cañon de Valle	TA-37	HE compounds[b], nitrate, perchlorate, uranium, barium, lead, copper, zinc
MCOBT-4.4	Mortandad/Ten Site Canyons	TA-5	Tritium, nitrate, perchlorate, uranium, plutonium, cesium-137, strontium-90, americium-241
R-1	Mortandad	TA-54	Tritium, nitrate, perchlorate, uranium, plutonium, cesium-137, strontium-90, americium-241, technetium-99
R-2	Pueblo	TA-74	Nitrate, plutonium-239/240, metals (e.g., mercury), tritium, perchlorate, uranium
R-3i	Pueblo	TA-74	Nitrate, plutonium-239/240, metals (e.g., mercury), tritium, perchlorate, uranium
R-4	Pueblo	Los Alamos	Nitrate, plutonium-239/240, metals (e.g., mercury), tritium, perchlorate, uranium
R-5	Pueblo	TA-74	Nitrate, plutonium-239/240, metals (e.g., mercury), tritium, perchlorate, uranium
R-6	Los Alamos/DP Canyon	TA-53	Tritium, cesium-137, strontium-90, nitrate, uranium, perchlorate, molybdenum
R-6i	Los Alamos/DP Canyon	TA-53	Tritium, cesium-137, strontium-90, nitrate, uranium, perchlorate, molybdenum
R-7	Los Alamos	TA-53	Tritium, cesium-137, strontium-90, nitrate, uranium, perchlorate
R-8	Los Alamos	TA-72	Tritium, cesium-137, strontium-90, nitrate, uranium, perchlorate, molybdenum
R-9	Los Alamos	TA-72	Tritium, cesium-137, strontium-90, nitrate, uranium, perchlorate
R-9i	Los Alamos	TA-72	Tritium, cesium-137, strontium-90, nitrate, uranium, perchlorate
R-10	Sandia Canyon	San Ildefonso Pueblo	Tritium, nitrate, perchlorate, uranium, plutonium
R-10a	Sandia Canyon	San Ildefonso Pueblo	Tritium, nitrate, perchlorate, uranium, plutonium
R-11	Sandia Canyon	TA-5	Tritium, nitrate, perchlorate, uranium, plutonium
R-12	Sandia Canyon	TA-72	Tritium, nitrate, perchlorate, uranium, plutonium
R-13	Mortandad	TA-5	Tritium, nitrate, perchlorate, uranium, plutonium, cesium-137, strontium-90, americium-241

Table 2-2 (continued)

Well	Watershed	TA	Potential Contaminants in Watershed[a]
R-14	Mortandad/Ten Site	TA-5	Tritium, nitrate, perchlorate, uranium, plutonium, cesium-137, strontium-90, americium-241, barium, lanthanides
R-15	Mortandad	TA-5	Tritium, nitrate, perchlorate, uranium, plutonium, cesium-137, strontium-90, americium-241, lanthanides
R-16	Cañada del Buey	White Rock Overlook	Tritium, County Sewage Treatment Plant effluent (nitrate, sulfate, metals)
R-16r	Cañada del Buey	White Rock Overlook	Tritium, County Sewage Treatment Plant effluent (nitrate, sulfate, metals)
R-17	Pajarito	TA-15	Metals, radionuclides, HE, VOCs, nitrate, perchlorate
R-18	Pajarito	TA-14	Metals, radionuclides, HE, VOCs, nitrate, perchlorate
R-19	Pajarito/Threemile	TA-36	HE, VOCs
R-20	Pajarito	TA-36	Metals, radionuclides, HE, VOCs, nitrate, perchlorate
R-21	Cañada del Buey	TA-54	Tritium, VOCs
R-22	Pajarito (mesa above canyon)	TA-54	Tritium, metals, radionuclides, VOCs, nitrate, perchlorate
R-23	Pajarito	TA-36	Metals, radionuclides, HE, VOCs, nitrate, perchlorate
R-23i	Pajarito	TA-36	Metals, radionuclides, HE, VOCs, nitrate, perchlorate
R-24	Bayo	TA-74	Tritium, nitrate, perchlorate, uranium, plutonium, cesium-137, strontium-90, americium-241, lanthanides
R-25	Cañon de Valle (mesa above canyon)	TA-16	HE compounds, barium, solvents, perchlorate
R-26	Cañon de Valle	TA-16	HE, barium, solvents, perchlorate
R-27	Water Canyon	TA-36	Metals, radionuclides, HE, VOCs, nitrate, perchlorate
R-28	Mortandad	TA-5	Tritium, nitrate, perchlorate, uranium, plutonium, cesium-137, strontium-90, americium-241, lanthanides, molybdenum-99
R-31	Ancho	TA-39	HE, radionuclides, metals, tritium
R-32	Pajarito	TA-36	Metals, radionuclides, VOCs, nitrate, perchlorate
R-33	Mortandad/Ten Site	TA-5	Tritium, nitrate, perchlorate, uranium, plutonium, cesium-137, strontium-90, americium-241. lanthanides
R-34	Mortandad (Cedro)	San Ildefonso	Tritium, nitrate, perchlorate, uranium, plutonium, cesium-137, strontium-90, americium-241, lanthanides

[a] Reference: Hydrogeologic Workplan (LANL 1998, 059599).

[b] HE compounds relevant to these wells are RDX, HMX, TNT, and PETN.

Table 4-1
Turbidity and Total Organic Carbon Concentrations
at the End of Development of the Well or Screen and for the Most Recent Sample

Well	Screen #	Screen Depth (ft)	End of Development[a]			Most Recent Sample[b]		
			Date	Turbidity (NTU[c])	TOC (mg/L)	Date	Turbidity (NTU)	TOC (mg/L)
CdV-16-1(i)	1	624	17-Dec-03	4.2	1.6	9-Mar-06	1.4	0.8
CdV-16-2(i)r	1	850	22-Aug-05	10.5	1.8	17-May-06	3.3	0.5
CdV-R-15-3	4	1254	2-Aug-00	1.4	1.5	27-Mar-06	0.3	<0.3
CdV-R-15-3	5	1350	1-Sep-00	1.5	4.5	28-Mar-06	0.4	1.6
CdV-R-15-3	6	1640	1-Sep-00	2.2	0.8	29-Mar-06	0.7	0.4
CdV-R-37-2	2	1200	21-Sep-01	4.9[d]	4.9[d]	21-Mar-06	3.4	4.2
CdV-R-37-2	3	1359	21-Sep-01	3.9	0.7	7-Jul-05	3.1	0.3
CdV-R-37-2	4	1551	21-Sep-01	4.7	3.9	22-Mar-06	1.1	0.7
MCOBT-4.4	1	485	13-Feb-02	0.8	0.8	8-Jun-05	0.6	1
R-1	1	1031	25-Nov-03	4.7	2.2	26-Oct-06	0.7	<0.3
R-2	1	918	11-Dec-03	11.2	2.2	24-Jul-06	7.6	0.6
R-3i	1	215	12-Sep-05	0.9	< 1	10-Aug-06	0.6	1.0
R-4	1	804	10-Oct-03	3.1	1.3	25-Jul-06	0.1	<0.3
R-5	2	384	21-Jun-01	nm[e]	nm	25-Jul-06	0.2	<0.3
R-5	3	719	21-Jun-01	15.5	0.5	26-Jul-06	0.2	4
R-5	4	861	21-Jun-01	8.8	3.7	5-May-05	0.5	0.8
R-6	1	1205	5-Jan-05	3.2	2.9	26-Jul-06	0.8	<0.3
R-6i	1	602	14-Feb-05	1.2	5.5	26-Jul-06	1.0	1.3
R-7	3	915	8-Feb-01	20.8	13.0	31-Jul-06	1.0	1.3[f]
R-8	1	711	14-Feb-02	nm	nm	1-Aug-06	0.2	<0.3
R-8	2	825	14-Feb-02	1.4	1.0	2-Aug-06	0.2	0.6[f]
R-9	1	684	13-Feb-00	< 1	26.0	31-Jul-06	3.6[f]	0.6
R-9i	1	199	7-Apr-00	2.7	3.0	10-Aug-06	0.2	3.4[f]
R-9i	2	279	7-Apr-00	2.6	4.2	10-Aug-06	0.5	1.4[f]
R-10	1	874	6-Oct-05	4.8	<0.5	12-Oct-06	0.9	1.2
R-10	2	1042	6-Oct-05	2.2	<0.5	12-Oct-06	1.2	1.3
R-10a	1	690	7-Sep-05	1.6	0.9	12-Oct-06	4.2	0.8
R-11	1	855	21-Oct-04	1.6	1.8	10-Oct-06	0.3	<0.3
R-12	1	468	6-Feb-00	3.3[d]	7.7[d]	10-Jul-06[g]	0.5[f]	0.5
R-12	2	507	6-Feb-00	2.8[d]	16[d]	11-Jul-06[g]	1.1	3.5
R-12	3	811	6-Feb-00	6.8[d]	45[d]	12-Jul-06[g]	0.9	1
R-13	1	958	30-Oct-01	2.7	0.3	25-Oct-06	4.2	0.3
R-14	1	1205	18-Nov-02	< 1	2.4	23-Oct-06	0.6	0.5
R-14	2	1289	18-Nov-02	< 1	2.0	23-Oct-06	1.0	2.1[f]
R-15	1	959	20-Feb-00	1.2	13.0	24-Oct-06	2.7	0.5

Table 4-1 (continued)

Well	Screen #	Screen Depth (ft)	End of Development[a]			Most Recent Sample[b]		
			Date	Turbidity (NTU[c])	TOC (mg/L)	Date	Turbidity (NTU)	TOC (mg/L)
R-16	2	866	4-Dec-02	1.3	2.1	20-Jul-06[g]	0.5	2.1
R-16	3	1018	4-Dec-02	0.9	1.9	20-Jul-06[g]	0.2	1.1
R-16	4	1238	4-Dec-02	1.9	2.2	20-Jul-06[g]	0.5	2.6
R-16r	1	600	17-Oct-05	4.3	1.0	1-Nov-06	0.6	0.3
R-17	1	1057	24-Feb-06	3.4	0.7	19-Oct-06	19.5	1
R-17	2	1124	24-Feb-06	3.8	<0.1	17-Oct-06	10	0.4
R-18	1	1358	24-Jan-05	2.3	1.7	18-Dec-06	1.4	0.4
R-19	2	909	24-Jun-00	25[d]	3.3	11-Dec-06	0.1	0.3[f]
R-19	3	1191	24-Jun-00	12.9	< 1	11-Dec-06	0.2	0.2[f]
R-19	4	1413	24-Jun-00	4.6	< 1	12-Dec-06	0.4	0.5
R-19	5	1586	24-Jun-00	4.6	8.9	11-Dec-06	2.4	6.4[f]
R-19	6	1730	24-Jun-00	5.1	2.7	11-Dec-06	0.2	0.6[f]
R-19	7	1835	24-Jun-00	4.9	6.3	18-Aug-06	15	2.3[f]
R-20	1	907	22-Dec-02	227	32.4[d]	6-Jun-06[g]	0.7	8.2
R-20	2	1150	22-Dec-02	2.8	2.1	7-Jun-06[g]	1.4	49
R-20	3	1330	22-Dec-02	4.2	2.8	8-Jun-06[g]	5.0	2.3
R-21	1	889	5-Dec-02	2.3	5.9	6-Nov-06	0.4	0.5
R-22	1	907	19-Nov-00	26[d]	11.0	26-Aug-06	7.8	6.4[f]
R-22	2	963	19-Nov-00	0.3[d]	< 1	7-Dec-06	0.3	<0.3
R-22	3	1274	19-Nov-00	4.2	4.9	8-Dec-06	0.5	1.2
R-22	4	1378	19-Nov-00	3.0	23.0	8-Dec-06	2.1	16.7[f]
R-22	5	1448	19-Nov-00	2.7	13.0	21-Aug-06	1.0	2.6[f]
R-23	1	816	20-Feb-03	1.4	< 1	18-Dec-06	1.8	<0.3
R-23i	2	470	20-Dec-05	1.7	<0.1	3-Oct-06	9.2	0.9
R-23i	3	524	20-Dec-05	2	1.8	11-Oct-06	785	1.1
R-24	1	825	20-Sep-05	2.4	1.0	27-Jul-06	0.7	0.5
R-25	1	755	13-Sep-00	1.6	< 1	2-Aug-05	9.1	0.9[f]
R-25	2	892	13-Sep-00	41.7	6.6	3-Aug-05	12	2.4[f]
R-25	4	1192	13-Sep-00	5.3	2.2	4-Aug-05	7.6	1.0[f]
R-25	5	1303	13-Sep-00	6.2	7.0	9-Aug-05	3.6	10.3[f]
R-25	6	1406	13-Sep-00	1.8	0.9	9-Dec-03	0.4	0.3
R-25	7	1606	13-Sep-00	10.2	1.7	8-Dec-03	1.4	0.2
R-25	8	1796	13-Sep-00	14.3	15.0	10-Aug-05	5.1	<0.5[f]
R-26	1	659	16-Nov-03	4.9	2.0	22-Feb-06	0.2	0.1[f]
R-27	1	852	14-Nov-05	3.1	1.2	1-Jul-06	0.8	<0.3
R-28	1	946	13-Jan-04	1.8	0.4	26-Oct-06	0.4	0.6
R-31	2	532	27-Mar-00	0.9	5.4[d]	28-Nov-06	1.9	5

Table 4-1 (continued)

Well	Screen #	Screen Depth (ft)	End of Development[a]			Most Recent Sample[b]		
			Date	Turbidity (NTU[c])	TOC (mg/L)	Date	Turbidity (NTU)	TOC (mg/L)
R-31	3	670	27-Mar-00	1.1	21.9[d]	30-Nov-06	1.0	3.4
R-31	4	831	27-Mar-00	1.9	6.7[h]	6-Dec-06	0.3	0.5
R-31	5	1011	27-Mar-00	2.7	2.4[h]	6-Dec-06	0.2	0.3
R-32	1	871	31-Oct-02	3.7	8.0	12-Dec-06	0.2	0.5
R-32	3	976	31-Oct-02	1.9	14.0	13-Dec-06	1.6	0.6
R-33	1	996	3-Dec-04	2.2	1.8	31-Oct-06	1.6	1.2[f]
R-33	2	1112	22-Nov-04	3.0	1.8	1-Nov-06	2.1	0.7[f]
R-34	1	895	2-Sep-04	3.7	2.0	30-Oct-06	22	<0.3

[a] Development date and data from well completion reports listed in Section 7.2, except where indicated otherwise.

[b] Sampling date, turbidity, and TOC concentrations for the most recent sample from Tables C-3 and C-4.

[c] NTU = Nephelometric turbidity unit.

[d] This parameter was not reported in the well completion report. The value used in this table is the first one reported in the WQDB for a sampling event that postdates the development date.

[e] nm = Not measured.

[f] This parameter was not reported in the WQDB. The value used in this table was reported for an earlier event.

[g] To ensure comparability with other screens in evaluating the long-term effectiveness of well development, the “most recent samples” used in this table for R-12, R-16, and R-20 are the ones collected immediately prior to the start of rehabilitation activities at these locations.

[h] TOC data were not reported for this sample; the value shown is Dissolved Organic Carbon (DOC) concentration.

Table 4-2
Categories of Residual Drilling Fluid Effects

Category		Examples of Sources	Examples of Effects	Overall Screening Question
A	Residual water-leachable inorganic constituents of drilling fluids Note: This category also includes the physical effects of residual solids	• Inorganic constituents leached from bentonite drilling mud or bentonite annular fill • Sulfide (as sulfamic acid) in AQUA-CLEAR MGA • Salts, acids, phosphate solutions, and soda ash added to drilling mixes or used during development • Residual clay particles	• Competition for adsorption sites • Mineral dissolution or precipitation • False indication of contaminant plume • Ligands (F, PO_4, CO_3 species, OH) may modify solubility and speciation of metal analytes in particular, including radionuclides • Residual clays and other solids, even if inert, may plug pore openings and thereby reduce hydraulic conductivity and create microenvironments	Have residual inorganic constituents of drilling fluids been removed from the screen interval?
B	Residual organic carbon and nitrogen constituents of drilling fluids	DOC and TOC from: • Alcohols in QUIK-FOAM • Hydrocarbons in EZ-MUD • Anionic surfactants in QUIK-FOAM • Polyacrylamide in EZ-MUD Organic nitrogen and NH_4 from: • NH_4^+ counterion in anionic surfactant product (QUIK-FOAM) • Polyacrylamide in EZ-MUD • Sulfamic acid in AQUA-CLEAR MGA	• Increased number and diversity of microbial populations • False indication of contaminant plume • Organic ligands may modify solubility and speciation of metal analytes, including radionuclides • Organic colloids or micelles may modify transport characteristics of other organic species or inorganic ions • Generation of intermediate organic species as degradation products (e.g., alcohols, aldehydes, acetate, formate) • Increased HCO_3, NH_4, and SO_4 concentrations as final inorganic degradation products	Have residual organic carbon and nitrogen constituents of drilling fluids been removed from the screen interval?

Table 4-2 (continued)

Category		Examples of Sources	Examples of Effects	Overall Screening Question
C	Reducing conditions	• Develops primarily as a result of residual organic carbon that fuels microbial populations	• May obscure presence of NO_3 and Cr in contaminant plumes • Precipitation, dissolution, or transformation of Fe- and Mn-bearing minerals • Release of adsorbed metal species from dissolved Fe-Mn minerals • Changes in mineral solubilities • Changes in speciation and thus transport characteristics of dissolved species	Are conditions oxidizing with respect to: • Dissolved oxygen? • Nitrate? • Manganese(IV)? • Iron(III)? • Sulfate?
D	Changes in adsorption capacities of surface-active minerals	• Residual clay from bentonite drilling mud • Changes in mineral surface properties initiated by changes in redox conditions	• Adsorption onto residual bentonite clay • Adsorption of metal species onto newly formed surfaces	Are adsorption capacities and characteristics of minerals near the screen unimpacted by residual drilling fluids?
E	Precipitation or dissolution of carbonate minerals	• Addition of Ca, carbonate, phosphate, and acids in drilling, well construction, and well development products	• Changes in concentrations of Ba, Sr, Ca, Mg • Carbonate ligands may modify solubility and speciation of metal analytes in particular, including radionuclides	Are carbonate mineral stabilities unchanged by residual drilling fluids?
F	Corrosion of steel components of well casing or screen	Formation of microcracks or pits at stressed steel	• Highly elevated concentrations of steel components: Fe, Cr, Mn • Metal transport by colloidal Fe oxides	Are steel components of the well essentially inert with respect to water in the screen interval?

Table 4-3a
Background Values for Key Indicator Species in the Regional Aquifer

Analyte	Symbol	Units	% Non-detects	Median	Lower Limit [a]		Upper Limit [b]	
Alkalinity (total carbonate)	$CaCO_3$	mg/L	0	66	50.7	5^{th} percentile	105.1	UTL[c]
Ammonium	NH_4-N	mg/L	93	ND[d] (<0.01)	ND (<0.01)	5^{th} percentile	0.05	Max detected[e]
Barium (filtered)	Ba	µg/L	5	21	4.68	5^{th} percentile	69.2	UTL
Calcium	Ca	mg/L	0	12	8.62	Min detected[f]	24.12	UTL
Chloride	Cl	mg/L	0	2.2	1.65	5^{th} percentile	3.75	UTL
Chromium (filtered)	Cr	µg/L	20	3.47	1.1	Min detected[g]	6.62	UTL
Chromium (total)	Cr	µg/L	29	3.00	1.2	Min detected[g]	9.80	Max detected
Fluoride	F	mg/L	9	0.32	0.11	5^{th} percentile	0.53	UTL
Iron (filtered)	Fe	µg/L	71	ND (<13)	ND (<13)	5^{th} percentile	102	90^{th} percentile[h]
Iron (total)	Fe	µg/L	38	21	ND (<13)	5^{th} percentile	102	90^{th} percentile
Magnesium	Mg	mg/L	0	3.0	0.53	5^{th} percentile	4.81	UTL
Manganese (filtered)	Mn	µg/L	67	ND (<2)	ND (<1)	5^{th} percentile	16	Max detected[e]
Molybdenum (filtered)	Mo	µg/L	49	1.1	ND (<1)	5^{th} percentile	3.82	UTL
Nickel (filtered)	Ni	µg/L	78	ND (<1)	ND (<1)	5^{th} percentile	1.7	Max detected
Nitrate (as N)	NO_3-N	mg/L	9	0.33	0.15	10^{th} percentile[i]	0.75	UTL
Perchlorate	ClO_4	µg/L	1	0.31	0.17	5^{th} percentile	0.45	UTL
pH	pH	SU	0	7.82	6.94	5^{th} percentile	8.65	UTL
Phosphate (as P)	PO_4-P	mg/L	69	ND (<0.035)	ND (<0.01)	5^{th} percentile	0.34	Max detected
Sodium	Na	mg/L	0	12.5	8.45	5^{th} percentile	28.55	UTL
Strontium (filtered)	Sr	µg/L	0	55.5	44.88	5^{th} percentile	179.8	UTL
Sulfate	SO_4	mg/L	3	2.9	0.80	Min detected	6.22	UTL
Total Kjeldahl Nitrogen	TKN	mg/L	57	ND (<0.044)	ND (<0.01)	5^{th} percentile	0.28	Approx 90^{th} percentile
Total organic carbon	TOC	mg/L	52	ND (<0.5)	ND (<0.2)	5^{th} percentile	1.0	Max detected[e]

Table 4-3a (continued)

Analyte	Symbol	Units	% Non-detects	Median	Lower Limit [a]		Upper Limit [b]	
Uranium (filtered)	U	µg/L	3	0.45	0.16	5th percentile	1.52	UTL
Zinc (filtered)	Zn	µg/L	61	1.9	ND (<2)	5th percentile	41.1	Max detected[e]

Source of values: Table 4.2-3 in Groundwater Background Investigation Report, Rev. 2 (LANL 2007, 094856)

[a] Except as noted otherwise, the lower limit is set at the 5th percentile for filtered or nonfiltered samples, whichever value is lowest.

[b] Except as noted otherwise, the upper limit is set at the UTL if available, the 90th percentile for filtered samples (if available), or the maximum detected values for the background data set.

[c] UTL = Upper threshold limit.

[d] ND = Not detected.

[e] The upper limits for ammonia, manganese, total organic carbon, and zinc are set at the maximum concentrations detected in background samples collected only from wells because the range in concentrations in background samples collected from springs that discharge from the regional aquifer extend significantly outside the range of values observed in the well samples.

[f] The lower limit for calcium is set at the minimum detected value for water samples from wells, excluding the single anomalously low concentration (0.61 mg/L) reported for PM-2 (05/24/06 sample); note that values for the other five samples from this well ranged from 8.6 to 10.7 mg/L.

[g] The lower limits for filtered and total chromium concentrations are set at the minimum detected value for background samples because a detected value is considered more representative of the prevailing oxidizing conditions in well samples.

[h] The upper limit for dissolved iron is set at the 90th percentile for total (nonfiltered) iron. Percentiles were not calculated for dissolved iron due to the high proportion of nondetects in this dataset.

[i] The lower limit for nitrate is set at the 10th percentile for filtered samples because the higher value is considered more representative of the prevailing oxidizing conditions in the regional aquifer.

[j] pH = -log[H+].

[k] SU = Standard units.

Table 4-3b

Background Values for Key Indicator Species in the Perched Intermediate Aquifer

Analyte	Symbol	Units	% Non-detects	Median	Lower Limit [a]		Upper Limit[b]	
Alkalinity (total carbonate)	$CaCO_3$	mg/L	0	38	33.8	5th percentile	52.00	UTL[c]
Ammonium	NH_4-N	mg/L	—[d]	—	[e]	—	[e]	—
Barium (filtered)	Ba	µg/L	0	16	1.4	5th percentile	71.83	UTL
Calcium	Ca	mg/L	0	7.6	4.39	Min detected[c]	17.31	UTL
Chloride	Cl	mg/L	0	1.4	0.99	5th percentile	1.75	95th percentile
Chromium (filtered)	Cr	µg/L	77	ND[f] (<1)	[e]	—	2.4	Max detected
Chromium (total)	Cr	µg/L	74	ND (<1)	[e]	—	2.4	Max detected
Fluoride	F	mg/L	0	0.12	0.04	5th percentile	0.23	UTL
Iron (filtered)	Fe	µg/L	45	20	ND (<10)	5th percentile	[e]	—
Iron (total)	Fe	µg/L	—	—	[e]	—	[e]	—
Magnesium	Mg	mg/L	0	1.7	0.78	5th percentile	6.12	UTL
Manganese (filtered)	Mn	µg/L	77	ND (<1)	ND (<1)	5th percentile	[e]	—
Molybdenum (filtered)	Mo	µg/L	55	ND (<1)	ND (<1)	5th percentile	4.3	Max detected
Nickel (filtered)	Ni	µg/L	86	ND (<1)	ND (<1)	5th percentile	[e]	—
Nitrate (as N)	NO_3-N	mg/L	0	0.34	0.18	Min detected	1.78	Max detected
Perchlorate	ClO_4	µg/L	—	—	[e]	—	[e]	—
pH[g]	pH	SU[h]	0	7.4	6.73	Min detected	8.80	UTL
Phosphate (as P)	PO_4-P	mg/L	14	0.02	ND (<0.01)	5th percentile	0.08	UTL
Sodium	Na	mg/L	0	7.2	5.17	5th percentile	12.19	UTL
Strontium (filtered)	Sr	µg/L	0	55	19.1	5th percentile	154.8	UTL
Sulfate	SO_4	mg/L	0	4.1	1.07	Min detected	4.48	95th percentile
Total Kjeldahl Nitrogen	TKN	mg/L	—	—	[e]	—	[e]	—
Total Organic Carbon	TOC	mg/L	—	—	[e]	—	[e]	—

Table 4-3b (continued)

Analyte	Symbol	Units	% Non-detects	Median	Lower Limit [a]		Upper Limit[b]	
Uranium (filtered)	U	µg/L	43	0.30	ND (<0.2)	5th percentile	0.72	UTL
Zinc (filtered)	Zn	µg/L	59	ND (<2)	ND (<1)	5th percentile	19	Max detected

Source of values: Table 4.2-2 in Groundwater Background Investigation Report, Rev. 2 (LANL 2007, 094856).

[a] Unless noted otherwise, the lower limit is set at the 5th percentile for filtered or nonfiltered samples, whichever value is lowest.

[b] The lower limit for filtered and total chromium is set at the minimum detected value for background samples, because a detected value is considered more representative of the prevailing oxidizing conditions in well samples.

[c] UTL = Upper threshold limit.

[d] — =Not calculated.

[e] Insufficient data to calculate statistical distribution parameters; use same limits as for regional aquifer (Table 4-3a).

[f] ND = Not detected.

[g] pH = -log[H+].

[h] SU = Standard units.

Table 4-4
Drilling Flag Codes and Drilling Reason Codes Assigned by the Data Qualification Protocol

Drilling Flag Code	Drilling Reason Code	Description	Examples of Analytes That Might Be Assigned This Code
J+	Res_Inorg1	Analyte Concentration may be biased high relative to that in pre-drilling groundwater due to leaching of inorganic constituents from drilling muds and fluids	Na, Cl, Alkalinity, SO_4
J-	Bentonite2	Analyte Concentration may be biased low relative to that in pre-drilling groundwater due to adsorption onto residual bentonite drilling mud.	Co-60, Cs-137, Sr-90, U-234
UJ	Bentonite3	Analyte Reporting Limit may be biased low relative to that in pre-drilling groundwater due to adsorption onto residual bentonite drilling mud.	Nondetects of Be, Cd, Hg
J+	Organic_Drill1	Analyte Concentration may be biased high relative to that in pre-drilling groundwater due to residual organic drilling fluid.	Detections of NH_3-N, TOC, acetone
J	Sul_Red1	Analyte concentration should be regarded as more uncertain than usual relative to that in pre-drilling groundwater due to sulfate reducing conditions.	Detections of Dioxins, HEXPs, Pesticides, SVOAs, VOAs
J-	Sul_Red4	Analyte concentration should be regarded as more uncertain than usual and biased low relative to that in pre-drilling groundwater due to sulfate reducing conditions.	Am-241, Co-60, Pu-239/240
J+	Sul_Red3	Analyte concentration should be regarded as more uncertain than usual and biased high relative to that in pre-drilling groundwater due to sulfate reducing conditions.	Detections of Sulfide
UJ	Sul_Red2	Analyte reporting limit should be regarded as more uncertain than usual relative to that in pre-drilling groundwater due to sulfate reducing conditions.	Nondetects of Dioxins, HEXPs, Pesticides, SVOAs, VOAs
J	Fe_Mn_Red1	Analyte concentration should be regarded as more uncertain than usual relative to that in pre-drilling groundwater due to iron and/or manganese reducing conditions.	Detections of Dioxins, HEXPs, Pesticides, SVOAs, VOAs
J-	Fe_Mn_Red4	Analyte concentration should be regarded as more uncertain than usual and biased low relative to that in pre-drilling groundwater due to iron and/or manganese reducing conditions.	Am-241, Co-60, Pu-239/240
J+	Fe_Mn_Red3	Analyte concentration should be regarded as more uncertain than usual and biased high relative to that in pre-drilling groundwater due to iron and/or manganese reducing conditions.	Detections of Ni, Mo
UJ	Fe_Mn_Red2	Analyte reporting limit should be regarded as more uncertain than usual relative to that in pre-drilling groundwater due to iron and/or manganese reducing conditions.	Nondetects of Dioxins, HEXPs, Pesticides, SVOAs, VOAs
J	Nitrate_Red1	Analyte concentration should be regarded as more uncertain than usual relative to that in pre-drilling groundwater due to nitrate reducing conditions.	Detections of Dioxins, HEXPs, Pesticides, SVOAs, VOAs
J-	Nitrate_Red4	Analyte concentration should be regarded as more uncertain than usual and biased low relative to that in pre-drilling groundwater due to nitrate reducing conditions.	Am-241, Co-60, Pu-239/240

Table 4-4 (continued)

Drilling Flag Code	Drilling Reason Code	Description	Examples of Analytes That Might Be Assigned This Code
J+	Nitrate_Red3	Analyte concentration should be regarded as more uncertain than usual and biased high relative to that in pre-drilling groundwater due to nitrate reducing conditions.	Detections of Alkalinity, Sulfide
UJ	Nitrate_Red2	Analyte reporting limit should be regarded as more uncertain than usual relative to that in pre-drilling groundwater due to nitrate reducing conditions.	Nondetects of Dioxins, HEXPs, Pesticides, SVOAs, VOAs
J+	Carbonate_1	Analyte concentration should be regarded as more uncertain than usual and biased high relative to that in pre-drilling groundwater due to enhanced dissolution of carbonate minerals due to residual drilling fluids	Ba, Ca, Mg, Sr, U
J-	Carbonate_2	Analyte concentration should be regarded as more uncertain than usual and biased low relative to that in pre-drilling groundwater due to enhanced precipitation of carbonate minerals due to residual drilling fluids	Ba, Ca, Mg, Sr, U
J	Carbonate_3	Analyte concentration should be regarded as more uncertain than usual relative to that in pre-drilling groundwater due to enhanced dissolution and/Or precipitation of carbonate minerals due to residual drilling fluids	Ba, Ca, Mg, Sr, U
J+	Corrosion_1	Analyte concentration should be regarded as more uncertain than usual and biased high relative to that in pre-drilling groundwater due to corrosion of the stainless steel casing	Fe, Cr, Ni
J	Corrosion_2	Analyte concentration should be regarded as more uncertain than usual relative to that in pre-drilling groundwater due to potential adsorption onto iron-(oxy)hydroxyl colloids generated from corrosion of the stainless steel casing	Ni, C
UJ	Corrosion_3	Analyte reporting limit should be regarded as more uncertain than usual relative to that in pre-drilling groundwater due to potential adsorption onto iron-(oxy)hydroxyl colloids generated from corrosion of the stainless steel casing	Ni, C

Table 4-5
Examples of Organic and Inorganic Drilling Fluids Used in Borehole Screen Intervals Drilled Primarily with Bentonite Mud

Well Screen	Screen Depth (ft)	Water (gal.)	Bentonite (lb)	PAC-L (lb)	N-SEAL (lb)	Soda Ash (lb)	MAGMA FIBER (lb)	QUIK-FOAM (gal.)	EZ-MUD (gal.)	LIQUI-TROL (gal.)
R-14 Screen 1	1205	14157	3836	95	247	0	292	23	0	3.2
R-14 Screen 2	1289	8485	2300	57	148	0	175	14	0	1.9
R-16 Screen 2	866	3120	2530	4	65	8	65	0	21	0.4
R-16 Screen 3	1018	2873	2330	4	60	8	60	0	19	0.4
R-16 Screen 4	1238	6550	5312	9	136	17	136	0	44	0.9
R-20 Screen 1	907	3253	614	17	9	0	54	0	0	7.7
R-20 Screen 2	1150	3361	634	18	9	0	56	0	0	8.0
R-20 Screen 3	1330	2784	525	15	8	0	46	0	0	6.5
R-32 Screen 1	871	7592	4234	8	135	0	135	0	4	0.7
R-32 Screen 3	976	7592	4234	8	135	0	135	0	4	0.7

Notes: This list is limited to screens in multiple-screen wells. It does not include the three single-screen wells drilled with bentonite mud (R-2, R-4, and R-6). This list does not include additional chemical treatments conducted after well installation. Information compiled by J. Pavletich from Well Completion Reports (LANL 2003, 076062; LANL 2003, 076061; LANL 2003, 079600; LANL 2003, 079602) and drillers' field logbooks. Quantities used in the interval are estimated from the total use by apportioning it according to the length of screen interval, including 10 ft above and below it. For example, if the total use over a 100-ft section is recorded as 90 gal. of Product X, and the screen interval is 10 ft, then the quantity used in that interval is estimated as 30-ft/100-ft = 0.33 x 90 gal. = 30 gal.

Table 4-6
Water-Soluble Inorganic Constituents Leached from Drilling Products

Constituent	AQUA-GEL GOLD SEAL (bentonite)	Bentonite (product not specified)	QUIK-GEL (bentonite)	PAC-L	N-SEAL	Soda Ash	Sodium Acid Pyro-phosphate (SAPP)[a]	AQUA-CLEAR PFD	AQUA-CLEAR MGA[a]	Silicone Defoamer (SDI)	QUIK FOAM
pH	9.65	—[b]	9.1	8.0	9.5	11.4	—	8.8	0.9	7.5	—
Na, mg/kg	4021	1347	5390	93553	64	340000[a]	207207	94665	1210	638	—
Ca, mg/kg	65	10	138	116	593	—	—	35	—	28	—
K, mg/kg	75	6	15	33	80	—	—	12	—	4	—
Alkalinity (mg/kg as $CaCO_3$)	4130	—	17596	85557	75254	1052213	—	147058	—	929	—
SO_4, mg/kg	7897	1008	9484	<4	96	—	—	5067	7800	99	—
Cl, mg/kg	18	116	65	20769	4	—	—	13453	790	22	—
F, mg/kg	9	7	11	1630	16	—	—	27	—	2	—
NO_3, mg/kg	109	197	237	<4	<0.2	—	—	<0.2	1200	<0.2	—
NH_4, mg/kg	—	—	—	—	—	—	—	—	—	—	13650[a]
PO_4, mg/kg	<0.5	6.5	<0.5	10587	<0.5	—	576577	220	—	<0.5	—

Notes: Concentrations in mg/kg of product as packaged. Concentrations determined on deionized-water leaches of products by Dale Counce and Pat Longmire (GGRL, EES-6), except where noted. Measured raw data are reported in Table A-10.

[a] Water-soluble concentrations were calculated assuming the following stoichiometric compositions:
SAPP: $H_2P_2O_7^{-} \bullet 2Na^{+}$
AQUA-CLEAR MGA: 80% sulfamic acid (H_3NO_3S) + 20% NaCl (per MSDS). The concentration reported above assumes that the sulfide has converted to SO_4.
Soda Ash: Na_2CO_3
QUIK-FOAM: Assumes NH_4^+ is the counterion for the anionic ethyleneoxide sulfate (AES) surfactant (Wisconsin Department of Natural Resources 2006, 094917), which comprises 47% of QUIK-FOAM (Table 4-9) and has an average molecular weight of 633 (Table A-13) (Robison 2006, 094883). Thus the estimated proportion of NH_4^+ (molecular weight=18) in QUIK-FOAM is $0.48 \times 18/633 \times 10^6$ = 13650 ppm.

[b] — = Not measured. Concentration is expected to be negligible.

Table 4-7
Evaluation of Chemical Indicators for Residual Water-Soluble Inorganic Constituents Leached from Drilling Products

	Regional Aquifer (from Table 4-3a)		AQUA-GEL GOLD SEAL (bentonite)	Bentonite (product not specified)	QUIK-GEL (bentonite)	PAC-L	N-SEAL	Soda Ash	Sodium Acid Pyrophosphate (SAPP)	AQUA-CLEAR MGA	AQUA-CLEAR PFD	QUIK-FOAM
Constituent	**Median**	**Upper Limit**	**25 lb[a]**	**25 lb[a]**	**25 lb[a]**	**1 lb[a]**	**5 lb[a]**	**0.25 lb[a]**	**33 lb[b]**	**5 lb[a]**	**1 gal.[a]**	**1 gal.[a]**
Na, mg/L	12	29	580	195	780	540	1.8	492	40000	7	550	—[c]
Ca, mg/L	12	24	9.4	1.4	20	0.7	17	—	—	—	0.2	—
K, mg/L	1.9[d]	3.1[d]	11	0.9	2.2	0.2	2.3	—	—	—	0.1	—
Alkalinity (mg/L as $CaCO_3$)	66	105	600	—	2550	495	2180	1520	—	—	850	—
SO_4, mg/L	2.9	6.2	1140	146	1370	0	3	—	—	45[e]	29	—
Cl, mg/L	2.2	3.8	2.6	17	9.4	120	0.1	—	—	4.6	78	—
F, mg/L	0.3	0.5	1.3	1.0	1.6	9.4	0.5	—	—	—	0.2	—
NO_3, mg/L	1.4[f]	3.2[f]	16	29	34	0	0	—	—	—	0	—
NH_4, mg/L	< 0.01	0.05	—	—	—	—	—	—	—	7.0	—	134
PO_4, mg/L	< 0.05	0.34	< 0.1	0.9	< 0.1	61	0	—	110200	—	1.3	—
Best candidates for indicators[g]	n/a[h]	n/a	Na, Alkalinity, SO_4, Cl, F, NO_3			Na, Alkalinity, Cl, F, PO_4	Ca, Alkalinity, F	Na, Alkalinity	Na, PO_4	SO_4 or S, Cl, NH_3	Na, Alkalinity, SO_4, Cl	NH_4

Notes: Extent of increase in concentration calculated assuming typical quantity used per 100 gallons drilling slurry. The concentrations shown above were calculated using the undiluted initial concentrations summarized in Table 4-6.

[a] Assumed quantity added per 100 gallons (based on industry guidance summarized in Table B-3).

[b] Estimated proportions used per 100 gal. in R-25.

[c] — = Not calculated because no data are available.

[d] Median and upper limit for K are from Table 4.2-3 in Groundwater Background Investigation Report, Rev. 2 (LANL 2007, 094856).

[e] Sulfur in AQUA-CLEAR MGA is initially in the form of sulfide. The concentration of SO_4 listed above corresponds to 15 mg/L as S^{2-}.

[f] Converted from units of nitrate (as N) which are used in Table 4-3a, to nitrate (as NO_3) shown here.

[g] These species appear to possess most of the desirable qualities listed for an indicator species in Section 4.3.

[h] n/a = Not applicable.

Table 4-8
Category A: Questions and Test Criteria for Residual Water-Soluble Inorganic Constituents of Drilling Fluids

Issue: Have residual inorganic constituents been sufficiently removed such that they do not modify transport characteristics of contaminants in the screen interval?

Screening Question	Assessment Criteria[a,b]	Consequence of "NO" response
Are concentrations of the following species all below the upper threshold value representative of maximum background concentrations in groundwater?	• A1—Is Chloride less than 3.8 mg/L (1.75 mg/L)? • A2—Is Fluoride less than 0.53 mg/L (0.23 mg/L)? • A3—Is Phosphate (as P) less than 0.3 mg/L (0.08 mg/L)? • A4—Is Sodium less than 29 mg/L (12 mg/L)? • A5—Is Sulfate less than 6.2 mg/L (4.5 mg/L)? • Gen1—Is pH within the range representative of background groundwater? • Gen2—Is Alkalinity (HCO_3+CO_3) less than 106 mg/L as $CaCO_3$ (52 mg/L)?	If NO for any analyte, then flag any detections of the following analytes as possibly elevated above predrilling concentrations (J+) due to residual water-soluble inorganic constituents of drilling products. General inorganic analytical suite: Alkalinity, Mg, Ca, Cl, F, Na, NO_3, PO_4, SO_4

[a] The assessment criteria lists the threshold value for the regional aquifer first, followed by a value for the perched intermediate aquifer shown in parentheses, if different. Threshold values are taken from Tables 4-3a and 4-3b.

[b] Although it was measured at high concentrations in the deionized-water leachates of bentonite drilling muds (Tables 4-6 and 4-7), elevated NO_3 is not considered a reliable indicator species for residual inorganic drilling fluids because it is commonly present in contaminant plumes and is very sensitive even to slightly reducing conditions.

Table 4-9
Compositions of QUIK-FOAM and EZ-MUD

Drilling Product Constituents	Concentration in Raw Product (wt %)[a]	%C for this Constituent (wt %)[b]	Constituent's Contribution of TOC to Raw Product (ppm)
QUIK-FOAM			
Water	40.0	0	0
Acetone	0.2	62	992
Isopropyl alcohol (IPA)	4.5	60	26775
Ethanol	7.5	52	39175
Anionic AES #1: Decyl nona(ethyleneoxide) sulfate (probably with NH_4^+ counterion[c])	43.2	53	229015
Anionic AES #2: Dodecyl hexa(ethyleneoxide) sulfate (probably with NH_4^+ counterion[c])	4.0	54	21748
Total	100.0		317705
EZ-MUD			
Alkanes with hydrocarbon chain lengths of C11-14: tridecane, dodecane, undecane, tetradecane	69.5	83	577242
Partially hydrolyzed (30.5%) polyacrylamide	30.5	51	154648
Total	100.0		731890

[a] Characterization data reported by Larson (2006, 094892) and Robison (2006, 094883; 2006, 094891).

[b] Calculated based on stoichiometric formulas.

[c] Based on information listed for QUIK-FOAM in Wisconsic Department of Natural Resources (2006, 094917).

Table 4-10
Water-Soluble Organic Constituents Leached from Drilling Products

Constituent	AQUA-GEL GOLD SEAL	QUIK-GEL	PAC-L	QUIK-FOAM[a]	EZ-MUD[a]	N-SEAL	AQUA-CLEAR PFD	Silicone Defoamer (SDI)
Oxalate	<0.2	<0.2	<4	—[b]	—	<0.2	11057	<0.2
TKN[c] (calculated)	—	—	—	10,600[d]	41000	—	—	—
TOC	—	—	—	318000	732000	—	—	—
DOC	124	94	196664	67000[e]	—	30	2950[f]	2654
Estimated DOC in drilling slurry[g]	18	14	1140	—	—	0.9	—	15

Notes: Concentrations in mg/kg of product as packaged. Concentrations determined on deionized-water leaches of products by Dale Counce and Pat Longmire (GGRL, EES-6), except where noted in footnote a.

[a] Based on characterization data reported by Larson (2006, 094892) and Robison (2006, 094883).

[b] — = Not calculated because no data are available.

[c] TKN = Total dissolved concentration of reduced nitrogen, which is the combination of organically-bound nitrogen and ammonia

[d] Assumes NH_4^+ is the counterion of the AES molecule, which comprises 47% of QUIK-FOAM (Table 4-9) and has an average molecular weight of 633 (Robison 2006, 094883). Thus, the estimated proportion of N (atomic weight = 14) is $0.48 \times 14/633 \times 10^6$ = 10,616 ppm (rounded to 10,600 ppm). This value is assumed to apply to TKN as well.

[e] Sum of measured concentrations of acetone (0.16%), isopropyl alcohol (4.5%), and ethanol (7.5%) in QUIK-FOAM (Larson 2006, 094892).

[f] DOC in AQUA-CLEAR PFD is 27% of the formula weight of oxalate ($C_2H_2O_4$), which comprises about 80% of this product.

[g] Assumes the rate of use per 100 gal. of water is as shown in Table 4-7.

Table 4-11
Category B: Questions and Criteria for Residual Organic Constituents of Drilling Fluids

Issue: Have residual organic drilling fluids been sufficiently removed such that groundwater samples are reliable and representative of the groundwater? [a]

Screening Question	Assessment Criteria[b]	Consequence of "NO" response
Are concentrations of the following organic indicators all below the threshold value representative of background concentrations in groundwater?	Are all of the following conditions met? • B1—Is acetone either below the method detection limit or less than 5 µg/L? • B2—Is ammonium (as N) less than 0.05 mg/L? • B3—Is total Kjeldahl nitrogen (TKN)[b] less than 0.28 mg/L? • B4—Is total organic carbon (TOC) below 1 mg/L?	If NO, flag any detected concentrations of the following analytes as possibly greater than predrilling concentrations (J+) due to the presence of residual organic fluids: • DOC, TOC, TKN, Ammonia (as N), acetone Note: This flag is not applicable to any non-detects for these analytes.

[a] The assessment criteria are the same for the regional aquifer and the perched intermediate aquifer because there is not expected to be a significant difference between these two populations for these species. Threshold values are taken from Tables 4-3a and 4-3b, except for acetone. In the case of acetone, the threshold is selected for the practical reason that a significant proportion of the data for this analyte in the WQDB are reported relative to a reporting limit of 5 µg/L.

[b] TKN = Total dissolved concentration of reduced nitrogen, which is the combination of organically-bound nitrogen and ammonia.

Table 4-12
Selected Redox Couples

	Redox Element		Oxidized Species	Reduced Species	Eh (mV)[a]
	Carbon	C(III/II)	PCA[b]	PCE[b]	1130
	Chloride	Cl(VII/-I)	ClO_4^-	Cl^-	976
→[c]	Oxygen	O(0/-II)	O_2(g)	H_2O	800
→	Nitrogen	N(V/0)	NO_3^-	N_2(g)	713
	Plutonium	Pu(V/IV)	PuO_2^+	PuO_2	634
	Carbon	C(II/II, 0)	PCE	TCE	580
	Plutonium	Pu(V/IV)	PuO_2^+	$Pu(OH)_4^0$	556
→	Manganese	Mn(IV/II)	MnO_2(s)	Mn^{2+}	544
	Carbon	C(II, 0/0)	TCE[b]	t-DCE[b]	540
→	Chromium	Cr(VI/III)	CrO_4^{2-}	$Cr(OH)_2^+$	500
	Selenium	Se(VI/IV)	SeO_4^{2-}	SeO_3^{2-}	446
	Carbon	C(0/-II)	t-DCE[b]	vinyl chloride	370
→	Uranium	U(VI/IV)	$UO_2(CO_3)_2^{2-}$	$USiO_4$(am)	73
→	Uranium	U(VI/IV)	$UO_2(CO_3)_2^{2-}$	UO_2(am)	64
	Plutonium	Pu(IV/III)	PuO_2	$PuCO_3^+$	15
→	Iron	Fe(III/II)	$Fe(OH)_3$	Fe^{2+}	14
	Molybdenum	Mo(VI/IV)	MoO_4^{2-}	MoS_2(s)	-203
→	Sulfur	S(VI/-II)	SO_4^{2-}	H_2S(aq)	- 217
	Arsenic	As(V/III)	$HAsO_4^{2-}$	H_3AsO_3(aq)	- 249
	Carbon	C(IV/-IV)	HCO_3^-	CH_4(g)	- 260
	TNT		TNT[b]	2-ADNT[b]	- 390
	Hydrogen	H(I/0)	H_2O	H_2(g)	- 400
	TNT		TNT[b]	4-ADNT[b]	- 430

Notes: g = Gas; s = solid, aq = aqueous, mV = millivolts.

[a] Redox potentials at pH 7 and 25◦C.

[b] 2-ADNT = 2-Amino-4,6-dinitrotoluene; 4-ADNT = 4-Amino-2,6-dinitrotoluene; PCA = perchloroethane (hexachloroethane); PCE = perchloroethylene; TCE = trichloroethylene; t-DCE = trans-dichloroethylene; TNT = 2,4,6-trinitrotoluene.

[c] ⟶ = Redox pairs used in this assessment as indicator species for in-situ redox conditions.

Table 4-13
Behavior of Inorganic and Organic Species under Reducing Conditions

Analytical Suite	Analytes That May Not Be Representative of Predrilling Concentrations Under Reducing Conditions				
	Sulfate Reducing Conditions (SO_4 below background)	**Iron-Reducing Conditions (Dissolved Fe concentrations elevated above background)**	**Manganese-Reducing Conditions (Dissolved Mn concentrations elevated above background)**	**Nitrate-Reducing Conditions (NO_3 below background)**	**Unaffected by Redox Conditions**
General Inorganics	Bicarbonate alkalinity, calcium, magnesium, nitrate, perchlorate, sulfate, pH	Bicarbonate alkalinity, calcium, magnesium, nitrate, pH	Bicarbonate alkalinity, calcium, magnesium, nitrate, pH	Bicarbonate alkalinity, calcium, magnesium, nitrate, pH	Bromide, chloride, fluoride, total phosphorus
Metals	Antimony, arsenic, barium, beryllium, boron, cadmium, chromium, cobalt, copper, iron, lead, manganese, mercury, molybdenum, nickel, selenium, silver, strontium, thallium, uranium, vanadium, zinc	Antimony, arsenic, barium, beryllium, boron, cadmium, chromium, cobalt, copper, iron, lead, manganese, mercury, molybdenum, nickel, selenium, silver, strontium, thallium, uranium, vanadium, zinc	Antimony, arsenic, barium, beryllium, boron, cadmium, chromium, cobalt, copper, iron, lead, manganese, mercury, molybdenum, nickel, selenium, silver, strontium, thallium, uranium, vanadium, zinc	—	—
Radionuclides	Same list of analytes for Mn, Fe and SO_4-reducing conditions: Americium-241, cerium isotopes (139, 141, 144), cesium-137, cobalt-60, europium isotopes (152, 154, 155), lanthanum-140, neodynium-147, plutonium isotopes (238, 239, 240), radium 226 and 228, strontium-90, technetium-99, uranium isotopes (234, 235, 236, 238)			—	Tritium
High Explosives and Degradation Products (HEXP)	Same list of analytes for all reducing conditions: HEXP analytes: amino-dinitrotoluenes, dinitrobenzenes, dinitrotoluenes, nitrobenzenes, nitroglycerine, nitrotoluenes, DNX, HMX, MNX, PETN, tetryl, TNX, trinitrobenzene				RDX
Dioxins and Furans	Same list of analytes for all reducing conditions: All chlorodibenzodioxins and chlorodibenzofurans				—
Pesticides and PCBs	Same list of analytes for all reducing conditions: All pesticides and PCBs: Aldrin, Arochlors, BHCs, chlordanes, DDD, DDE, DDT, Dieldrin, Endosulfans, Endosulfan sulfate, Endrin, Endrin aldehyde, Endrin Ketone, Heptachlor, Heptachlor epoxide, Methoxychlor, Toxaphene				—
Herbicides	Same list of analytes for all reducing conditions: All herbicides: Alachlor, Atrazine, MCPA, D[2,4-], DB[2,4-], Dalapon, DBCP, Dicamba, Dichlorprop, Dinoseb, Diquat, Endothall, Glyphosate, MCPP, Paraquat, Picloram, Simazine, T[2,4,5-], TP[2,4,5-]				—

Table 4-13 (continued)

Analytical Suite	Analytes That May Not Be Representative of Predrilling Concentrations Under Reducing Conditions				
	Sulfate Reducing Conditions (SO_4 below background)	Iron-Reducing Conditions (dissolved Fe concentrations elevated above background)	Manganese-Reducing Conditions (dissolved Mn concentrations elevated above background)	Nitrate-Reducing Conditions (NO_3 below background)	Unaffected by Redox Conditions
Diesel Range Organics (if not included elsewhere)	Same list of analytes for all reducing conditions: Diesel Range Organics; Total Petroleum Hydrocarbons Diesel Range Organics (TPH-DRO)				—
Polynuclear Aromatic Hydrocarbons (PAHs)	Same list of analytes for all reducing conditions: All PAHs: Acenaphthene, acenaphthylene, acetylamidofluorene[2-], anthracene, benz(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, chrysene, bibenz(a,h)anthracene, fluoranthene, fluorene, indeno(1,2,3-cd)pyrene, methylcholanthrene[3-], methylnaphthalenes, naphthalene, phenanthrene, pyrene				—
SVOAs and VOAs (if not already included in above categories)	Same list of analytes for all reducing conditions: All SVOAs/VOAs: acetone, benzene, benzidine, benzoic acid, benzyl alcohol, bis(2-ethylhexyl)phthalate, bromodichloromethane, bromoform, bromomethane, butanone[2-], butylbenzylphthalate, carbazole, carbon disulfide, carbon tetrachloride, chloro-3-methylphenol[4-], chlorobenzene, chloroethane, chloroform, chloromethane, chloronaphthalene[2-], chlorophenol[2-], dibenzofuran, dibromochloromethane, dichlorobenzenes, dichloroethanes, dichloroethenes, diethyl phthalate, dimethyl phthalate, di-n-butyl phthalate, di-n-octyl phthalate, diphenylhydrazine[1,2-], ethylbenzene, hexachlorobutadiene, isopropyltoluene[4-], methyl tert-butyl ether, methyl-2-penta[4-], methylene chloride, methylphenol[4-], nitrophenol[2-], pentachlorophenol, phenol, pyridine, tetrachloroethane[1,1,1,2-], tetrachloroethane[1,1,2,2-], tetrachloroethene, toluene, trichlorobenzenes, trichloroethanes, trichloroethene, trichlorofluoromethane [CFC-11], timethylbenzene[1,2,4-], vinyl chloride, xylenes				—

Table 4-14
Category C: Questions and Criteria for Redox Conditions Near the Screen Interval

Issue: Have oxidizing conditions been re-established such that groundwater samples are reliable and representative of the groundwater?

Screening Question	Assessment Criteria[a]	Consequence of "NO" response[b]
Is sulfur present in its oxidized (SO_4) form?	Are all the following conditions met? • C1—Is sulfate present above 0.8 mg/L (1.0 mg/L)? • C2—Is sulfide less than 0.01 mg/L? • C3—Is oxidation-reduction potential (ORP) greater than 0 mV?	If NO, then flag the following analytes as possibly not reliable or representative of predrilling concentrations (J) due to chemical transformation, desorption from Fe/Mn (oxy)hydroxides, or mineral precipitation under sulfate-reducing conditions initiated by the presence of residual organic fluids: • General inorganic analytical suite: Alkalinity, Ca, NO_3+NO_2-N, SO_4, ClO_4 • Metals analytical suite: Ag, As, Ba, B, Be, Cd, Co, Cr, Cu, Fe, Hg, Mn, Mo, Ni, Pb, Sb, Se, Tl, U, V, Zn • Radionuclide analytical suite: Am-241, Ce-139, Ce-141, Ce-144, Cs-137, Co-60, Eu-152, Eu-154, Eu-155, La-140, Nd-147, Pu-238,239,240, Ra-226, Ra-228, Sr-90, U-234,235,236,238
Have redox conditions been restored to oxidizing conditions with respect to sulfate, iron, and manganese?	Are all the following conditions met? • C4—Is dissolved iron less than 102 µg/L? • C5—Is dissolved manganese less than 16 µg/L? • C6—Is perchlorate detected above 0.17 µg/L? • C7—Is uranium detected above 0.17 µg/L (0.1 µg/L)? • C8—Is dissolved nickel less than 5 µg/L (3 µg/L)? • C9—Is dissolved molybdenum less than 4 µg/L? • C10—Is dissolved chromium greater than 1 µg/L?	If NO, then flag the following analytes as possibly not reliable or representative of predrilling concentrations (J) due to chemical transformation, desorption from Fe/Mn (oxy)hydroxides, or mineral precipitation under reducing conditions initiated by the presence of residual organic fluids: • General inorganic analytical suite: Alkalinity, Ca, NO_3+NO_2-N • Metals analytical suite: Ag, As, Ba, B, Be, Cd, Co, Cr, Cu, Fe, Hg, Mn, Mo, Ni, Pb, Sb, Se, Tl, U, V, Zn • Radionuclide analytical suite: Am-241, Ce-139, Ce-141, Ce-144, Cs-137, Co-60, Eu-152, Eu-154, Eu-155, La-140, Nd-147, Pu-238,239,240, Ra-226, Ra-228, Sr-90, U-234,235,236,238
Have redox conditions been restored to oxidizing conditions with respect to nitrate and dissolved oxygen?	Are the following conditions met? • C11—Is nitrate + nitrite detected above 0.1 mg/L as N? • C12—Is dissolved oxygen greater than 2 mg/L?	If NO, then flag the following analytes as possibly not reliable or representative of predrilling concentrations (J) due to chemical transformation under reducing conditions initiated by the presence of residual organic fluids: • General inorganic analytical suite: Alkalinity, Ca, NO_3+NO_2-N

[a] The assessment criteria lists the threshold value for the regional aquifer first, followed by a value for the perched intermediate aquifer shown in parentheses, if different. Values are taken from Tables 4-3a and 4-3b, unless otherwise noted.

[b] In addition to the species listed below, also flag the following analytes if any condition listed in this table is not met: all HE and HE degradation products; all herbicides, pesticides, PCBs, dioxins, and furans; all Diesel Range Organics; all SVOAs and VOAs.

Table 4-15
Adsorption Behavior of Inorganic and Organic Species on Sodium-Bentonite Drilling Mud

Analytical Suite	Tables of Relevant Analytes and Sorption Parameters	Partition Coefficient (K_d)	
		Negligible Adsorption K_d < 1 mL/g	**Possibly Significant Adsorption K_d > 1 mL/g[a]**
General Inorganics	Table A-1 Table A-11 Table A-12	Bicarbonate alkalinity, bromide, chloride, fluoride, nitrate, perchlorate, sulfate	Ammonia, calcium, magnesium, phosphates, sodium
Metals	Table A-2 Table A-11 Table A-12	Arsenic, boron, chromate, molybdate, nickel, selenate, uranyl carbonates	Antimony, barium, beryllium, cadmium, cesium, cobalt, copper, iron, lead, manganese, mercury, silver, strontium, thallium, vanadium, zinc
Radionuclides	Table A-3 Table A-11 Table A-12	Tritium, technetium-99, uranium isotopes (234, 235, 236, 238)	Isotopes of americium, cerium, cesium, cobalt, europium, lanthanum, neodymium, plutonium, radium, sodium, strontium
High Explosives and Degradation Products (HEXP)	Table A-4	Dinitrobenzenes, nitrobenzenes, nitroglycerine, RDX, trinitrobenzene	Dinitrotoluenes, HMX, nitrotoluenes, PETN, tetryl, trinitrotoluene[2,4,6-] K_d unknown: DNX, MNX, TNX
Dioxins and Furans	Table A-5	—	All chlorodibenzodioxins and chlorodibenzofurans
Pesticides and PCBs	Table A-5	—	All: Aldrin, Arochlors, BHCs, chlordanes, DDD, DDE, DDT, Dieldrin, Endosulfans, Endosulfan sulfate, Endrin, Endrin aldehyde, Endrin Ketone, Heptachlor, Heptachlor epoxide, Methoxychlor, Toxaphene
Herbicides	Table A-6	Alachlor, Atrazine, MCPA, D[2,4-], Dalapon, DBCP, Dicamba, Dichlorprop, Dinoseb, Endothall, MCPP, Picloram, T[2,4,5-], Simazine	DB[2,4-], Glyphosate, TP[2,4,5-], Diquat
Diesel Range Organics (analytes not included elsewhere)	Table A-6	—	Diesel Range Organics; Total Petroleum Hydrocarbons Diesel Range Organics (TPH-DRO)
Polynuclear Aromatic Hydrocarbons (PAHs)	Table A-7	—	All: Acenaphthene, acenaphthylene, acetylamidofluorene[2-], anthracene, benz(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, chrysene, bibenz(a,h)anthracene, fluoranthene, fluorene, indeno(1,2,3-cd)pyrene, methylcholanthrene[3-], methylnaphthalenes, naphthalene, phenanthrene, pyrene

Table 4-15 (continued)

Analytical Suite	Tables of Relevant Analytes and Sorption Parameters	Partition Coefficient (K_d)	
		Negligible Adsorption K_d < 1 mL/g	**Possibly Significant Adsorption K_d > 1 mL/g[a]**
SVOAs and VOAs (analytes not included elsewhere)	Table A-8	Acetone, benzene, butanone[2-], carbon tetrachloride, chloroethane, chloroform, dichlorethanes, dichloroethene, dichloroethylene, MTBE, methylene chloride, tetrachloroethanes, trichloroethanes, trichloroethene, trichlorofluoromethane, vinyl chloride, benzoic acid, bromoform, bromomethane, dibromochloromethane, methyl-2-pentanone[4-], phenol, pyridine,	chlorobenzene, Dichlorobenzenes, ethylbenzene, trichlorobenzenes, tetrachloroethene, toluene, benzidine, bis(2-ethylhexyl)phthalate, butylbenzylphthalate, carbazole, chloronaphthalene[2-], chlorophenol[2-], dibenzofuran, dimethyl phthalate, di-n-butyl phthalate, hexachlorobutadiene, isopropyltoluene[4-], pentachlorophenol, xylenes, 2-nitrophenol, 4-methylphenol, bromodichloromethane, diethyl phthalate, diphenylhydrazine[1,2-], trimethylbenzene

[a] When an applicable measurement of the K_d values for an organic compound is not available, this parameter has been estimated in Tables A-4 through A-8 as the product of the organic compound's organic-carbon partition coefficient (K_{OC}) and an assumed organic-carbon fraction (f_{OC}) value of 0.001 for bentonite. The only documented measurement of f_{OC} for Wyoming bentonite, which is the most common source of bentonite drilling mud in the U.S., is 0.004 (Table A-9). To be conservative, the above tabulation of compounds for which K_d > 1 mL/g is based on this reported value.

Table 4-16
Category D: Questions and Test Criteria for Changes in Adsorption Capacities of Surface-Active Minerals

Issue: Has residual surface-active minerals (primarily bentonite clay) been sufficiently removed such that they do not interfere with transport of contaminants into the screen interval?

Screening Question	Assessment Criteria[a]	Consequence of "NO" response
Are water-quality data reliable and representative for general inorganics, metals, and radionuclides that would adsorb onto residual bentonite if present?	D1—Is the concentration of dissolved strontium above the minimum background concentration for groundwater (45 µg/L, 19 µg/L for perched intermediate zone)?	If NO, then flag the following analytes as possibly less than predrilling concentrations (J-) due to adsorption onto residual bentonite: • Ca, Mo, Sr, V, Sr-90
	D2—Is the concentration of dissolved uranium above the minimum background concentration (0.17 µg/L for regional aquifer, 0.1 µg/L for perched intermediate zone)?	If NO, then flag the following analytes as possibly less than predrilling concentrations (J-) due to adsorption onto residual bentonite: • U, U-234, 235, 236, 238
	D3—Is the concentration of dissolved barium above the minimum background concentration (4.7 µg/L for regional aquifer, 1.4 µg/L for perched intermediate zone)? D4—Is the concentration of dissolved zinc above the instrument detection limit? Note: Zn is considered here to be an appropriate indicator species for the adsorption behavior of metal cations and Cs-137, Co-60, Eu isotopes, La-140, and Nd-147.	If NO, then flag any <u>nondetects</u> of the following analytes as possibly less than predrilling concentrations (UJ-) due to adsorption onto residual bentonite: Metals: Ag, Ba, Be, Cd, Cr, Co, Cu, Fe, Pb, Hg, Mn, Mo, Sb, Tl, Zn Radionuclides: Cs-137, Co-60, Eu-152, Eu-154, Eu-155, La-140, Nd-147
	Note: Some radionuclides adsorb so strongly to clays, including bentonite, that they are rarely detected in groundwater. As a result, we are not aware of any suitable indicator species that are routinely measured and that can be used to evaluate whether or not the nondetects are representative of groundwater concentrations.	Flag any <u>nondetects</u> of the following analytes as possibly less than predrilling concentrations (UJ-) due to adsorption onto residual bentonite: Am-241, Ce-139, Ce-141, Ce-144, Pu-238,239,240, Ra-226, Ra-228

Table 4-16 (continued)

Screening Question	Assessment Criteria[a]	Consequence of "NO" response
Are water-quality data reliable and representative for HE and HE degradation products?	NO for HE and HE degradation products with an adsorption coefficient (K_d) greater than 1 mL/g. YES for all other relevant HE and HE degradation products because these do not adsorb or partition onto bentonite.	Flag the following HE and HE degradation products as possibly less than predrilling concentrations (UJ-) due to adsorption onto residual bentonite: DNX, HMX, MNX, PETN, tetryl, TNT
Are water-quality data reliable and representative for Herbicides, Pesticides, PCBs, Dioxins, and Furans?	NO for pesticides, PCBs, dioxins and furans. These species are assumed to partition or adsorb onto bentonite, with K_d values much greater than 1 mL/g. YES for most herbicides (except as listed in the right-hand column). These species adsorb poorly onto bentonite, with K_d values less than 1 mL/g.	Flag all pesticides, PCBs, dioxins, and furans as possibly less than predrilling concentrations (UJ-) due to adsorption onto residual bentonite. Flag the following herbicides as possibly less than predrilling concentrations (UJ-) due to adsorption onto residual bentonite: Diquat, glyphosate, TP[2,4,5-]
Are water-quality data reliable and representative for Diesel Range Organics?	NO for Diesel Range Organic species that are petroleum hydrocarbons. These long-chain aliphatic hydrocarbons are assumed to adsorb or partition strongly onto bentonite, with K_d values greater than 1 mL/g.	Flag the following DRO analytes as possibly less than predrilling concentrations (UJ-) due to adsorption onto residual bentonite: DRO, TPH-DRO
Are water-quality data reliable and representative for SVOAs/VOAs (LANL Specific)?	NO for SVOAs/VOAs that have an adsorption coefficient (K_d) greater than 1 mL/g. YES for all other SVOAs/VOAs because these adsorb poorly onto bentonite, with Kd values less than 1 mL/g.	Flag the following SVOAs/VOAs as possibly less than predrilling concentrations (UJ-) due to adsorption onto residual bentonite: Dioxins, PCBs, and pesticides Polynuclear aromatic hydrocarbons (PAHs) Other SVOCs/VOCs not already included in other categories: Benzidine, bis(2-ethylhexyl)phthalate, butylbenzylphthalate, carbazole, chloronaphthalene[2-], chlorophenol[2-], dibenzofuran, dichlorobenzene[1,4-], dimethyl phthalate, di-n-butyl phthalate, di-n-octyl phthalate, hexachlorobutadiene, isopropyltoluene[4-], pentachlorophenol, trichlorobenzene[1,2,4-], trichlorobenzene[1,2,3-]

[a] The assessment criteria lists the threshold value for the regional aquifer first, followed by a value for the perched intermediate aquifer shown in parentheses, if different. Values are taken from Tables 4-3a and 4-3b, unless otherwise noted.

Table 4-17
Category E: Questions and Criteria for Precipitation or Dissolution of Carbonate Minerals Near the Screen Interval

Issue: Are carbonate minerals stable in the screen interval such that groundwater samples are reliable and representative of predrilling groundwater?

Screening Question	Assessment Criteria[a]	Consequence of "NO" Response
Are the following indicators of carbonate mineral stability representative of background conditions in groundwater?	• E1—Is dissolved barium within the range considered representative of background groundwater (4.7<x<69 µg/L; 1.4<x<71 µg/L)? • E2 Is dissolved calcium within the range considered representative of background groundwater (8.7<x<25 mg/L; 4.4<x<18 mg/L)? • E3—Is dissolved magnesium within the range considered representative of background groundwater (<6.1 mg/L, <4.8 mg/L)? • E4—Is dissolved strontium within the range considered representative of background groundwater (<180 µg/L; <155 µg/L)? • E5—Is dissolved uranium within the range considered representative of background groundwater (<1.5 µg/L; <0.72 µg/L)? • Gen1—Is pH within the range considered representative of background groundwater? • Gen2—Is alkalinity within the range considered representative of background groundwater (<105 mg/L, <52 mg/L)?	If NO, flag the following analytes as possibly not representative of predrilling concentrations (J) due to active dissolution or precipitation of carbonate minerals as a result of drilling-induced changes in water chemistry: Ca, Ba, Mg, Mn, Sr, U, Alkalinity, pH, Fe

[a] The assessment criteria lists the threshold value for the regional aquifer first, followed by a value for the perched intermediate aquifer shown in parentheses, if different. Values are taken from Tables 4-3a and 4-3b, unless otherwise noted.

Table 4-18
Category F: Questions and Criteria for Metal Corrosion of Well Components

Issue: Is the integrity of the well casing and screen intact such that groundwater samples are reliable and representative of the groundwater?

Screening Question	Assessment Criteria[a]	Consequence of "NO" Response
Are concentrations of the following indicators of stainless steel corrosion all below the threshold value representative of background concentrations in groundwater?	• F1[b]—Is total iron less than 500 µg/L? • F2—If NO to the above question, then is the ratio of total to dissolved iron less than 10? • F3[b]—Is total chromium less than the upper threshold limit for background (10 µg/L, 5 µg/L)? • F4— If NO to the above question, then is the ratio of total chromium to dissolved chromium less than 5? • F5—Is dissolved nickel less than 50 µg/L? • F6[c] —Is turbidity less than 5 NTU?	If NO, flag detections of the following analytes as possibly greater than predrilling concentrations (J+) due to corrosion of the stainless steel well casing: Fe, Cr, Ni, B, Mo, V, Ti, Nb, W Turbidity

[a] The assessment criteria lists the threshold value for the regional aquifer first, followed by a value for the perched intermediate aquifer shown in parentheses, if different. Values are taken from Tables 4-3a and 4-3b, unless otherwise noted.

[b] This test is a qualifying condition that establishes whether or not the following test criterion is applicable.

[c] This test is neither required nor sufficient to establish the presence or absence of metal corrosion. However, it can determine the level of confidence that one should have in the outcome of the other test criteria.

Table 4-19
Residual Effects of Drilling Products on Water Quality

Product Name	Chemical Description	Indicators of Residual Product*	Potential Residual Effects of Product on Water Quality	Other Products Often Used with This One
AQUA-CLEAR AE	Acid and acid enhancers	Low pH	May kill off native bacteria in formation, thereby delaying biodegradation process for residual organic drilling fluids until population recovers	AQUA-CLEAR MGA Soda Ash
AQUA-CLEAR MGA	80% Sulfamic acid (H_3NO_3S) and 20% NaCl	NH_4, SO_4, S, Na, Cl, low pH	May kill off native bacteria in formation, thereby delaying biodegradation process for residual organic drilling fluids until population recovers	AQUA-CLEAR AE Soda Ash
AQUA-CLEAR PFD	Copolymer containing phosphate-free dispersant	Na, Alkalinity, Cl, PO_4, SO_4, TOC	Any residual copolymer left in the formation may not biodegrade quickly, and may cause TOC to stay slightly elevated for a long time	
AQUA-GEL	Sodium bentonite with 0.0125% polyacrylate polymer	SO_4, Na, NO_3, TKN, NH_4, Alkalinity, K, TOC, F, Cl, Ca	Any residual copolymer left in the formation may not biodegrade quickly, and may cause TOC to stay slightly elevated for a long time	MAGMA FIBER N-SEAL
AQUA-GEL GOLD SEAL	Pure sodium bentonite, no chemical treatment	SO_4, Na, NO_3, Alkalinity, K, F, Cl, Ca	Inorganic salts that occur naturally in the clay product leach into water Provides adsorption sites for a wide variety of inorganic and organic species Can plug formation porosity	
EZ-MUD	Partially hydrolyzed polyacrylamide / polyacrylate copolymer in hydrocarbon (long-chain alkanes) solution	TKN, NH_4, TOC	Coats clay particles Any residual hydrocarbons and copolymer left in the formation may not biodegrade quickly, and may cause TOC to stay slightly elevated for a long time	Soda Ash
EZ-MUD PLUS	High molecular weight version of EZ-Mud	TKN, NH_4, TOC	If formed, copolymer micelles could plug pores Any residual hydrocarbons and copolymer left in the formation may not biodegrade quickly, and may cause TOC to stay slightly elevated for a long time	Soda Ash
LIQUI-TROL	Modified natural cellulosic polymer suspended in oil.	TOC	Any residual cellulose and oil left in the formation may not biodegrade quickly, and may cause TOC to stay slightly elevated for a long time	Bentonite mud
MAGMA FIBER	Specially formulated extrusion spun mineral fiber.	Alkalinity, F, Ca, K, TOC	May physically plug pores in zones of lost circulation May chemically plug pores by precipitation of silica gel	Bentonite mud Hydrochloric and acetic acids

Table 4-19 (continued)

Product Name	Chemical Description	Indicators of Residual Product*	Potential Residual Effects of Product on Water Quality	Other Products Often Used with This One
N-SEAL	Specially formulated extrusion spun mineral fiber.	Alkalinity, F, Ca, K, TOC	May physically plug pores in zones of lost circulation May chemically plug pores by precipitation of silica gel	Bentonite mud Hydrochloric and acetic acids
PAC-L	Modified natural cellulosic polymer	TOC, PO_4, Cl, Na, F, Alkalinity	Coats clay Any residual cellulose or oil left in the formation may not biodegrade quickly, and may cause TOC to stay slightly elevated for a long time	Bentonite mud
PEL-PLUG	Compressed bentonite pellets, 100% pure, chemically untreated and unaltered.	Na, Alkalinity	Coarser than bentonite mud material, and thus effects may not be as significant. Inorganic salts that occur naturally in the clay product leach into water Provides adsorption sites for a wide variety of inorganic and organic species Can plug formation porosity	—
PEL-PLUG TR30/60	Bentonite pellet coated with a natural resin	Na, Alkalinity, TOC	Resin coating (composition unknown) may cause false indication of contaminant plume	—
QUIK-FOAM	Alcohol ethoxy sulfates (AES), in ammonium salt form	Acetone, TOC, NH_4, TKN	Any residual AES surfactant left in the formation may not biodegrade quickly, and may cause TOC to stay slightly elevated for a long time	—
QUIK-GEL	Sodium bentonite with 0.11% sodium polyacrylate polymer	SO_4, Na, Alkalinity, NO_3, TOC, Cl, F, Ca	Any residual polymer left in the formation may not biodegrade quickly, and may cause TOC to stay slightly elevated for a long time	Soda ash MAGMA FIBER N-SEAL
SAPP	Sodium acid pyrophosphate	Na, PO_4	Formation of PO4 complexes could modify transport characteristics of selected metals and radionuclides	—
SDI DEFOAMER	Organosilicone emulsion	TOC	Effect is expected to be minimal due to verysmall volumes involved	—
SODA ASH	Sodium carbonate	Na, Alkalinity, high pH	Precipitates Ca carbonates, and thereby shifts the groundwater's degree of saturation with Ba, Mg, and Sr carbonate minerals.	—
TORKEASE	Emulsion of complex stearates	TOC	Relatively negligible	—

* Indicators are listed approximately in order of the extent to which they are predicted to be elevated above their median background concentrations in the regional aquifer (Table 4-3a), based on concentrations measured in product leachate (Tables 4-7 and A-10).

Table 4-20
Indicator Species and Test Threshold Values for Identifying Drilling Fluid Impacts

Indicator	Analyte Code	Condition Being Evaluated	Test Code[a]	UOM	Test Threshold for Passing Test	
					Perched	Regional Aquifer
Acetone	Acetone	Residual organics	B1	µg/L	< 5	< 5
Alkalinity (HCO_3+CO_3) (field)	ALK-HCO_3+CO_3	General indicator	Gen-2	mg/L	< 52	< 105
Ammonium (as Nitrogen)	NH_3-N	Residual organics	B2	mg/L	< 0.05	< 0.05
Barium (dissolved)	Ba	Adsorption/desorption	D3	µg/L	> 1.4	> 4.7
Barium (dissolved)	Ba	Carbonate minerals	E2	µg/L	< 71	< 69
Calcium (dissolved)	Ca	Carbonate minerals	E1	mg/L	4.4 < x < 18	8.7 x < 25
Chloride	Cl	Residual inorganics	A1	mg/L	< 1.75	< 3.8
Chromium (dissolved)	Cr	Redox condition (Fe/Mn)	C10	µg/L	> 0.4	> 0.8
Chromium (total)	Cr (Total)	Metal corrosion	F3	µg/L	< 7.4	< 10
Chromium ratio (total/dissolved)	Cr (NF/F) ratio	Metal corrosion	F4	ratio	< 5	< 5
Dissolved oxygen	DO	Redox condition (NO_3)	C12	mg/L	> 2	> 2
Fluoride	F	Residual inorganics	A2	mg/L	< 0.23	< 0.53
Iron (dissolved)	Fe	Redox condition (Fe/Mn)	C4	µg/L	< 102	< 102
Iron (Total)	Fe (NF)	Metal corrosion	F1	µg/L	< 500	< 500
Iron ratio (total/dissolved)	Fe (NF/F) ratio	Metal corrosion	F2	ratio	< 10	< 10
Magnesium	Mg	Carbonate minerals	E4	mg/L	< 6.1	< 4.8
Manganese	Mn	Redox condition (Fe/Mn)	C5	µg/L	< 14	< 14
Molybdenum	Mo	Redox condition (Fe/Mn)	C9	µg/L	< 4	< 4
Nickel (dissolved)	Ni	Redox condition (Fe/Mn)	C8	µg/L	< 2.5	< 2.5
Nickel (dissolved)	Ni	Metal corrosion	F5	µg/L	< 50	< 50
Nitrate + Nitrite (as Nitrogen)	NO_3+NO_3-N	Redox condition (NO_3)	C11	mg/L	> 0.2	> 0.1
Oxidation Reduction Potential	ORP	Redox condition (SO_4)	C3	meV	> 0	> 0
Perchlorate	ClO_4	Redox condition (Fe/Mn)	C6	µg/L	> 0.17	> 0.17

Table 4-20 (continued)

Indicator	Analyte Code	Condition Being Evaluated	Test Code[a]	UOM	Test Threshold for Passing Test	
					Perched	Regional Aquifer
pH (field)	pH	General indicator	Gen-1	SU	6.7< x < 8.8	6.9 < x < 8.6
Phosphate (as phosphorus)	PO_4-P	Residual inorganics	A3	mg/L	< 0.08	< 0.34
Sodium	Na	Residual inorganics	A4	mg/L	< 12.2	< 29
Strontium (dissolved)	Sr	Adsorption/desorption	D1	µg/L	> 19	> 44
Strontium (dissolved)	Sr	Carbonate minerals	E3	µg/L	< 155	< 180
Sulfate	SO_4	Residual inorganics	A5	mg/L	< 4.5	< 62
Sulfate	SO_4	Redox condition (SO_4)	C1	mg/L	> 1.07	> 0.8
Sulfide	S	Redox condition (SO_4)	C2	mg/L	< 0.01	< 0.01
Total Kjeldahl Nitrogen	TKN	Residual organics	B3	mg/L	< 0.28	< 0.28
Total organic carbon	TOC	Residual organics	B4	mg/L	< 1	< 1
Turbidity	Turbidity	General indicator	Gen-3	NTU	< 5	< 5
Uranium (dissolved)	U	Redox condition (Fe/Mn)	C7	µg/L	> 0.1	> 0.17
Uranium (dissolved)	U	Adsorption/desorption	D2	µg/L	> 0.1	> 0.17
Uranium (dissolved)	U	Carbonate minerals	E5	µg/L	< 0.72	< 1.5
Zinc (dissolved)	Zn	Adsorption/desorption	D4	µg/L	> DL[b]	> DL

Source of threshold values: Tables 4-3a and 4-3b, with lower limits set by truncating the lower statistical limit to two significant figures, and with upper limits set by rounding the upper statistical limit up to the nearest two significant figures (three significant figures in the case of alkalinity in the regional aquifer).

[a] The test code is keyed to the table in which this indicator is used. The letter indicates the drilling effects category, and the number indicates the sequence in which this indicator is listed in the table of tests for that category (Table 4-8 for Category A, Table 4-11 for Category B, Table 4-14 for Category C, Table 4-16 for Category D, Table 4-17 for Category E, and Table 4-18 for Category F).

[b] DL = Detection limit.

Table 4-21
Applicability of Indicator Species Used in this Report*

Indicator	Test	Applicability to Categories of Drilling Effects	Comments on Adequacy, Qualifications, and Limitations
Acetone	*B1*	Cat B—indicator of residual organics • Highly useful for the first year or two following development because readily detectable • Stays in solution due to its high solubility and negligible adsorption onto mineral surfaces	• Due to its very high solubility, acetone is removed to a much greater extent during development than are other larger and more adsorptive organics • The value of acetone as an indicator of residual organics decreases with time after development because it biodegrades much more quickly than most other organic species of concern • Measured value can be biased high because acetone is ubiquitous in the environment and therefore often present in field trip and laboratory blanks
Alkalinity (carbonate)	*Gen-2*	Cat A—indicator of residual inorganics (e.g., soda ash) Cat B—indicator of residual organics because CO_2, the primary control on alkalinity concentrations, is a biodegradation product of organic substances Cat B—indicator of reducing conditions because CO_2, the primary control on alkalinity concentrations, is a biodegradation product Cat D—can affect adsorption behavior of analytes which form carbonate complexes with differing ionic charges Cat E—controlling factor for carbonate mineral solubility	• The most relevant alkalinity measurement is that obtained in the field or a nearby onsite laboratory because changes in concentrations can occur during transit to an offsite laboratory. However, field measurements are not always obtained or reported in the WQDB. • Difficult to obtain reliable and representative alkalinity measurements from Westbay systems • Can be difficult to interpret as indicator species due to multiple sources and interacting controls • May be significantly affected by presence of contaminant plume • Test outcome can be biased low under highly-reducing (methanogenic) conditions because dissolved inorganic carbonate can be reduced to methane (CH_4)
Ammonium	*B3*	Cat B—indicator of residual organic drilling fluids that contain nitrogen (e.g., EZ-Mud)	• Residual organic sources of NH_3 may not be immediately apparent if the source material has a long biodegradation half-life (e.g., residual polyacrylamide from EZ-Mud), if microbial populations are not acclimated, or if microbial activity if suppressed under the prevailing geochemical conditions • May not always monotonically improve with time. If biodegradation is delayed until suitable environmental conditions develop, then this parameter may increase in concentration after first decreasing • Biodegradation rate affected by redox conditions

Table 4-21 (continued)

Indicator	Test	Applicability to Categories of Drilling Effects	Comments on Adequacy, Qualifications, and Limitations
Barium	*D3, E1*	Cat D—surrogate for strongly adsorbing species proposed by NMED and EPA Cat E—indicator for carbonate mineral stability because dissolved Ba concentrations are controlled primarily by alkalinity and sulfate concentrations	• Very limited utility as surrogate for strongly adsorbing species in local groundwaters. The mobility of Ba in local groundwaters is enhanced by its formation of neutral complexes with carbonate and sulfate. • Test outcome can be biased high if this species is present in a contaminant plume at the sampled location • Test threshold values may not be valid if pH, alkalinity, and redox conditions are outside the range of background values • Can be difficult to interpret as indicator species due to multiple interacting controls • Reliable interpretation may require geochemical modeling
Calcium	*E2*	Cat E—primary indicator of carbonate mineral stability	• Test threshold values may not be valid if pH, alkalinity, and redox conditions are outside the range of background values • May be present as residual inorganic drilling fluid • Can be difficult to interpret as indicator species due to multiple interacting controls • Interpretation may require geochemical modeling
Chloride	*A3*	Cat A—indicator of residual inorganics	• Test outcome can be biased high if this species is present in a contaminant plume at the sampled location
Chromium	*C10, F3, F4*	Cat C—negligibly low concentration indicates reducing conditions Cat F—highly elevated concentration is an indicator of stainless steel corrosion	• Test outcome can be biased high if this species is present in a contaminant plume at the sampled location • Data for both filtered and nonfiltered samples not always available but are required for reliable interpretation with respect to corrosion
Fluoride	*A4*	Cat A—indicator of residual inorganics	• Test outcome can be biased high if this species is present in a contaminant plume at the sampled location
Iron	*F1,F2*	Cat C—elevated concentrations indicates reducing conditions that dissolve Fe/Mn oxyhydroxide minerals and release adsorbed metals Cat F—highly elevated total concentration in presence of low dissolved concentration is an indicator of stainless steel corrosion	• May be biased low due to precipitation of metal sulfides under highly reducing conditions • Data for both filtered and nonfiltered samples not always available but are required for reliable interpretation with respect to corrosion
Magnesium	*E4*	Cat E—indicator for carbonate mineral stability because dissolved Mg concentrations are controlled primarily by Ca and alkalinity concentrations	• None noted

Table 4-21 (continued)

Indicator	Test	Applicability to Categories of Drilling Effects	Comments on Adequacy, Qualifications, and Limitations
Manganese	*C5*	Cat C—negligibly low concentration indicates reducing conditions	• Test outcome can be biased high if this species is present in a contaminant plume at the sampled location • May be biased low due to precipitation of metal sulfides under highly reducing conditions
Molybdenum	*C9*	Cat C—elevated concentrations indicates reducing conditions that dissolve Fe/Mn oxyhydroxide minerals and release adsorbed metals	• Test outcome can be biased high if this species is present in a contaminant plume (such as cooling water discharge) at the sampled location • Elevated concentrations might be attributable to leaching from bentonite drilling mud (Table A-10)
Nickel	*C8, F5*	Cat C—elevated concentrations indicates reducing conditions that dissolve Fe/Mn oxyhydroxide minerals and release adsorbed metals Cat F—highly elevated concentration is an indicator of stainless steel corrosion	• None noted
Nitrate + Nitrite	*C11*	Cat C—negligibly low concentration indicates reducing conditions	• Test outcome can be biased high if this species is present in a contaminant plume at the sampled location
Oxidation Reduction Potential	*C3*	Cat C—negligibly low value indicates reducing conditions. May be the most reliable indicator of SO_4-reducing conditions if this condition is obscured by the presence of SO_4 in a contaminant plume	• Difficult to obtain reliable measurements from Westbay systems • Not available for older water samples • Can be difficult to use as indicator species due to multiple sources and interacting controls • May be biased high due to aeration of cascading water as water level drops during purging, in screens located at or near the top of a saturated zone
Oxygen, Dissolved	*C12*	Cat C—low concentration indicates reducing conditions. May be the most reliable indicator of NO_3-reducing conditions if this condition is obscured by the presence of NO_3 in a contaminant plume	• Difficult to obtain reliable measurements from Westbay systems • Not routinely obtained for Westbay screens • May be biased high due to aeration of cascading water as water level drops during purging, in screens located at or near the top of a saturated zone
Perchlorate	*C6*	Cat C—negligibly low concentration indicates reducing conditions	• Commonly present in contaminant plumes

Table 4-21 (continued)

Indicator	Test	Applicability to Categories of Drilling Effects	Comments on Adequacy, Qualifications, and Limitations
pH (field)	*Gen-1*	General qualitative indicator, not tied to a specific residual drilling effect Cat A—indicator of residual inorganics (e.g., acids) Cat B—low pH can be an indicator of residual organics because H is a biodegradation product of organic substances Cat D—can affect adsorption behavior of analytes by pH controls on speciation Cat E—controlling factor for carbonate mineral solubility	• Most appropriate measurement is obtained in the field or onsite laboratory due to changes that can occur in transit to offsite laboratory. However, onsite measurements are not always obtained or available for Westbay screens. • Difficult to obtain reliable measurements from Westbay systems • Can be difficult to interpret as indicator species due to multiple interacting controls
Phosphate	*A9*	Cat A—indicator of residual inorganics	• Not present in very many drilling products
Sodium	*A6*	Cat A—indicator of residual inorganics	• Test outcome can be biased high if this species is present in a contaminant plume at the sampled location
Strontium	*D1, E3*	Cat D—surrogate for adsorption of Strontium-90 Cat E—indicator for carbonate mineral stability because dissolved Sr concentrations are controlled primarily by Ca and alkalinity concentrations	• Test threshold values may not be valid if pH, alkalinity, and redox conditions are outside the range of background values • Can be difficult to interpret as indicator species due to multiple interacting controls • Reliable interpretation may require geochemical modeling
Sulfate	*A5, C1*	Cat A—indicator of residual inorganics Cat C—low concentration indicates SO4-reducing conditions	• Can be biased high due to fast oxidation of any dissolved sulfide upon exposure to atmosphere, or during transit to offsite laboratory • Test outcome can be biased high if this species is present in a contaminant plume at the sampled location
Sulfide	*C2*	Cat C—elevated concentration indicates SO_4-reducing conditions. May be the most reliable indicator of SO4-reducing conditions if this condition is obscured by the presence of SO_4 in a contaminant plume	• Most appropriate measurement is obtained in the field or onsite laboratory due to rapid oxidation to sulfate during transit to an offsite laboratory. • Field or other onsite measurements are not always obtained for Westbay screens. • May be biased low due to degassing of water when exposed to atmosphere • May be biased low due to precipitation of metal sulfides under highly reducing conditions
Total Kjeldahl Nitrogen	*B2*	Cat B—indicator of residual organic drilling fluids that contain nitrogen (e.g., EZ-Mud)	• Test outcome can be biased low if the residual organic species adsorb to minerals or are otherwise not in solution

Table 4-21 (continued)

Indicator	Test	Applicability to Categories of Drilling Effects	Comments on Adequacy, Qualifications, and Limitations
Total Organic Carbon	*B1*	Cat B—indicator of residual organics	• Test outcome can be biased low if the residual organic species adsorb to minerals or are otherwise not in solution
Turbidity	*Gen-3*	General qualitative indicator, not tied to a specific residual drilling effect Cat F—high turbidity is a qualifying condition for application of tests for metal corrosion	• High turbidity may be caused by a quickly dropping water level (i.e., cascading water), if the screen interval intercepts the water table • Multiple causes of turbidity may complicate its interpretation as an indicator
Uranium	*C7, D2, E5*	Cat C—negligibly low concentration indicates reducing conditions Cat D—surrogate for adsorption of uranium isotopes Cat E—indicator for carbonate mineral stability because dissolved U concentrations are controlled primarily by Ca and alkalinity concentrations	• Test outcome can be biased high if this species is present in a contaminant plume at the sampled location • Not reliable test for adsorption if reducing conditions are present
Zinc	*D4*	Cat D—surrogate for strongly adsorbing metals	• Applicability as a surrogate may be limited in some geochemical environments in which the mobilityof zinc may be enhanced by complexation with carbonate and other ligands • Test outcome can be biased high if this species is present in a contaminant plume at the sampled location

* A listed test code signifies that this analyte is used as one of the indicators for that category.

Table 5-1
Constituents Identified as Principal Components in Groundwater Data Sets

Data Set	PC 1	PC 2	PC 3	PC 4	Total Variation Explained by PCs 1, 2,& 3
Metals UF	Fe, Mn	B, Sr	Zn, Cr		65%
Metals F	Fe, Mn, Mo	B, Sr, Ba	Cr, Zn		65%
Major ions UF	Ca, Cl, K, Mg, total alkalinity	F, SO_4	Na vs. NO_3		72%
Major ions F	Na, K	Cl, SO_4, NO_3	Mg, total alkalinity, Ca		72%
Merged Metals and Major Ions UF	B, Ba, Sr Ca, Cl, K, Mg, total alkalinity	Fe, Mn vs V, NO_3, U	F	Na, SO_4	78% (includes PC4)
Merged Metals and Major Ions F	Fe, Mn vs Cr, V, NO_3, U	Ba, Sr, Ca, Cl, K	Na vs Mg	Zn	71% (includes PC4)

Notes: F = Filtered, UF = unfiltered, PC = principal component.

Table 5-2
Mean Concentrations in Clusters Identified for the Most Recent Nonfiltered Samples

Cluster	Total Carbonate Alkalinity (mg/L)	Ba (µgL)	Ca (µgL)	Fe (µgL)	Mn (µgL)	Na (mg/L)	$NO_3 + NO_2$-N (mg/L)	Sr (µgL)	U (µgL)	V (µgL)	Likely Drilling Effects
1	143	162	34	3802	874	255	0.07	397	0.43	1	Significant reducing conditions; carbonate minerals; possible residual bentonite (Na)
2	71	36	5	1251	329	35	0.01	31	0.66	1	Moderate reducing conditions
3	65	23	13	90	11	40	0.39	67	0.52	14	Minimal
4	102	86	24	57	23	19	0.47	140	1.48	13	Minimal; indication of naturally elevated Alk, Ba, Sr (PM-1, -3)

Notes: Cluster 1 Members: R-12-3, R-19-5, R-22-1, R-22-4, R-22-5, R-22-6, R-25-5
Cluster 2 Members: R-7-3, R-19-6, R-19-7
Cluster 3 Members: R-13, R-19-3, R-19-4, R-25-6, R-25-7, R-25-8, G-1A, G-2A, G-3A, G-5A
Cluster 4 Members: R-9, R-22-3, PM-1, PM-3

Table 5-3
Mean Concentrations in Clusters Identified for the Most Recent Filtered Samples

Cluster	Total Carbonate Alkalinity (mg/L)	Ba (µgL)	Ca (µgL)	Fe (µgL)	Mn (µgL)	Na (mg/L)	$NO_3 + NO_2$-N (mg/L)	Sr (µgL)	U (µgL)	V (µgL)	Likely Drilling Effects
1	203	233	38	424	654	39	0.01	698	0.79	1	Significant; highly elevated carbonates, reducing conditions
2	61	80	12	4320	600	14	0.01	114	0.07	2	Highly reducing conditions
3	91	51	20	8	2	17	0.78	143	1.19	12	Minimal; oxidizing conditions; indication of naturally elevated Sr (PM-1, -3)
4	87	26	15	95	23	28	0.27	128	0.83	16	Slight to moderate; elevated Sr, some reducing conditions
5	64	24	12	20	12	12	0.34	61	0.53	8	Minimal

Notes: Cluster 1 Members: R-5-4, R-12-3, R-20-2, R-22-4, R-31

Cluster 2 Members: CdV-R-15-3-5, CdV-R-15-3-6, CdV-R-37-2-2, CdV-R-37-2-4, R-14-2, R-20-2

Cluster 3 Members: R-4, R-8-2, R-16-3, Spring 3, Spring 3A, Spring 4, Spring 4A, Spring 5, Spring 5A, Spring 8, PM-1, PM-3

Cluster 4 Members: R-16-2, R-16-4, R-19-7, Spring 1, Spring 3AA, G-1A, G-2A, G-3A, G-5A

Cluster 5 Members: CdV-R-15-3-4, CdV-R-37-2-3, G-4A, PM-2, PM-5, PM-5, R-1, R-2, R-14-1, R-19-3, R-21, R-23, R-25-8, Spring 5B, Spring 6, Spring 6A, Spring 9A

Table 5-4
Results of Principal Component Analysis for Wells

Well Screen	Interpretation of PCA Results for Most Recent Sampling Event: Identification of Potential Impacts			
	Metals UF (Figure 5-1)	Metals F (Figure 5-2)	Major Ions UF (Figure 5-3)	Major Ions F (Figure 5-4)
CdV-15-3-4	√[a]	√	—[b]	√
CdV-15-3-5	Possible to Slight	Possible to Slight	—	√
CdV-15-3-6	√	√	—	√
CdV-37-2-2	Significant	Significant	—	√
CdV-37-2-3	√	√	—	√
CdV-37-2-4	√	√	—	√
R-1	√	√	—	√
R-2	√	√	—	√
R-4	√	√	—	Possible to Slight
R-5-3	Possible to Slight	√	—	Possible to Slight
R-5-4	Possible to Slight	Possible to Slight	—	Possible to Slight
R-7-3	Moderate	—	√	—
R-8-1	√	√	—	√
R-8-2	Possible to Slight	Possible to Slight	—	Moderate
R-9	Possible to Slight	—	Moderate	—
R-11	√	√	—	Possible to Slight
R-12-3	Possible to Slight	Moderate	Moderate	Possible to Slight
R-13	√	—	√	—
R-14-1	√	√	—	√
R-14-2	Moderate	Moderate	—	√
R-15	√	√	Possible to Slight	Possible to Slight
R-16-2	√	√	—	Moderate
R-16-3	√	√	—	Moderate
R-16-4	Possible to Slight	Possible to Slight	—	Significant
R-19-3	√	√	√	√
R-19-4	√	√	√	√
R-19-5	Possible to Slight	—	Moderate	—
R-19-6	√	—	√	—
R-19-7	Moderate	√	Significant	Possible to Slight
R-20-1	√	Possible to Slight	—	Possible to Slight
R-20-2	Significant	Significant	—	Significant
R-20-3	Moderate	Moderate	—	Possible to Slight
R-21	√	√	—	√
R-22-1	Significant	Significant	Significant	Significant
R-22-2	√	√	Possible to Slight	√
R-22-3	Possible to Slight	Possible to Slight	Moderate	Possible to Slight
R-22-4	Significant	Moderate	Moderate	Significant
R-22-5	Possible to Slight	Moderate	Moderate	Significant

Table 5-4 (continued)

Well Screen	Interpretation of PCA Results for Most Recent Sampling Event: Identification of Potential Impacts			
	Metals UF (Figure 5-1)	**Metals F (Figure 5-2)**	**Major Ions UF (Figure 5-3)**	**Major Ions F (Figure 5-4)**
R-23	√	√	—	Moderate
R-25-4	—	—	—	√
R-25-5	Possible to Slight	Moderate	Significant	—
R-25-6	√	—	√	—
R-25-7	√	—	√	—
R-25-8	√	√	√	√
R-28	Significant	Moderate	—	Significant
R-31-2	Significant	Significant	—	Significant
R-32-1	√	√	—	√
R-32-3	Moderate	Moderate	—	√
R-33-1	Moderate	√	√	√
R-33-2	√	√	√	—
R-33-3	—	—	—	—
R-34	√	√	—	√

Source: Results plotted in Figures 5-1 through 5-4.

[a] √ = Chemistry appears to be consistent with that for existing wells or White Rock Canyon springs.

[b] — = Well screen samples not evaluated.

Table 5-5
Comparison of Water-Quality Assessment Outcomes and PCA Results for Recent Sampling Events

	Outcome of Water-Quality Assessment Method				
	Outcome	**Poor** **Rating < 60%**	**Fair** **Rating 60% – 80%**	**Good** **Rating 80% – 90%**	**Very Good** **Rating 91% – 100%**
Outcome of PCA Method	Not analyzed by principal component analysis	R-9i-1 R-12-1 (pre-rehab)[a] R-23i-3 (P) R-25-2	CdV-16-2(i)r R-3i (P)[b] R-5-2 R-9i-2 R-12-2 (pre-rehab) R-17-1 (P) R-17-2 (P) R-23i-2 (P) R-24 (P) R-25-1 R-31-3 (P)	MCOBT-4.4 R-6i R-10a R-19-2	CdV-16-1i R-6[c] R-10-1 R-10-2 R-16r R-18 R-26-1 R-27 (P) R-31-4 (P) R-31-5 (P)
	Consistent with White Rock Canyon springs or existing wells		CdV-R-37-2-4 R-19-6 R-25-4	CdV-R-15-3-6 R-14-1 R-19-3 R-25-6 R-25-7 R-25-8 R-33-2	CdV-R-15-3-4 CdV-R-37-2-3 R-1 R-2[c] R-8-1 R-13 R-19-4 R-21 R-32-1[c] R-34
	Possible to slight impacts	R-20-1[c] (pre-rehab)	CdV-R-15-3-5 R-5-3 R-5-4		R-4[c] R-11 R-15[c] R-22-2
	Moderate impacts	R-19-5 R-20-3[c] (pre-rehab)	R-7-3 R-12-3 (pre-rehab) R-14-2[c] R-16-3[c] (pre-rehab) R-22-3 R-32-3[c]	R-8-2 R-9 R-16-2[c] (pre-rehab) R-33-1	R-23
	Significant impacts	CdV-R-37-2-2 R-16-4[c] (pre-rehab) R-19-7 R-20-2[c] (pre-rehab) R-22-1 R-22-4 R-22-5 R-31-2	R-25-5		R-28

Sources: Tables 5-4 and G-1.

Notes: Shaded cells indicate consistent outcomes. The water-quality assessment rating is based on test outcomes using only the applicable criteria, which differs from the PCA approach in which all data are used to define clusters. Table 2-2 lists screen intervals for which some test criteria are not applicable due to the known presence of a contaminant plume.

[a] Pre-rehab=Rating is based on water quality data obtained before pilot rehabilitation activities began at this well.

[b] (P) = Result considered preliminary either because less than 3 sample events were available or because the most recent event occurred more than 2 years ago.

[c] Screen interval drilled with bentonite drilling mud.

Table 6-1
Summary of Ratings for Composite Samples and for Most Recent Sample

Well Screen				Composite[e]			Most Recent Event						Conditions Present in Screen Interval (as described in section 6.2)									
ID[a]	Well	Port depth (ft)	Scr #	Nr	Score and Rating		Date	Score and Rating		Overall Trend	Level of confidence	Rating in WSAR Rev 0	Mod water	Plume	Outside pH-Alk range	Resid Inorg	Resid Org	Redox stage	Enhanced adsorption	Fe min	CO_3 min	Steel corros
1	CdV-16-1(i)	624	1	4	85	Good	Mar-06	91	V Good	Improving	High	V Good	■	■	—	—	—	Oxic	—	—	—	—
2	CdV-16-2(i)r	850	1	4	77	Fair	May-06	79	Fair	Variable	Moderate	Not rated	■	■	—	■	—	Oxic	—	—	—	■
3	CdV-R-15-3	1254	4	6	98	V Good	Mar-06	97	V Good	Stable	High	Good	—	—	—	—	—	Oxic	—	—	—	—
4	CdV-R-15-3	1350	5	6	62	Fair	Mar-06	63	Fair	Stable	High	Poor	—	—	■	—	■	SO_4	—	—	■	—
5	CdV-R-15-3	1640	6	6	79	Fair	Mar-06	84	Good	Improving	High	Fair	—	—	—	—	—	Mn	—	—	—	—
6	CdV-R-37-2	1200	2	6	51	Poor	Mar-06	50	Poor	Stable	High	Poor	—	—	■	—	■	SO_4	—	■	■	—
7	CdV-R-37-2	1359	3	6	98	V Good	Mar-06	91	V Good	Stable	High	V Good	—	—	—	—	—	Oxic	—	—	—	?
8	CdV-R-37-2	1551	4	6	72	Fair	Mar-06	74	Fair	Stable	High	Fair	—	—	—	—	—	Fe	Sr	■	—	—
9	MCOB T-4.4	485	1	4	84	Good	Jun-05	80	Good	Variable	Moderate	V Good	■	■	—	—	■	Oxic	—	—	■	—
10	R-1	1031	1	7	99	V Good	Oct-06	100	V Good	Stable	High	V Good	—	—	—	—	—	Oxic	—	—	—	—
11	R-2	918	1	5	89	Good	Jul-06	94	V Good	Improving	High	Good	—	—	—	—	■	Oxic	—	—	—	—
12	R-3i	215	1	1	61	Not rated	Aug-06	61	Fair	Indeter	Low	Not rated	■	■	■	■	■	Oxic	—	—	■	—
13	R-4	793	1	5	93	V Good	Jul-06	94	V Good	Stable	High	Good	■	■	—	■	■	Oxic	—	—	—	—
14	R-5	384	2	4	77	Fair	Jul-06	75	Fair	Stable	High	V Good	—	■	■	—p	—p	Oxic	—	—	■	—
15	R-5	719	3	4	83	Good	Jul-06	79	Fair	Stable	Moderate	V Good	—	■	—	—p	■	Oxic	—	—	■	—
16	R-5	861	4	3	66	Fair	May-05	70	Fair	Stable	Moderate	Fair	—	—	■	—	—	Fe	—	—	■	—
17	R-6	1205	1	5	95	V Good	Jul-06	97	V Good	Stable	High	Good	—	—	—	—	■	Oxic	—	—	—	—
18	R-6i	602	1	5	73	Good[e]	Jul-06	73	Good[e]	Stable	Moderate	Good	■	■	■	—	■	Oxic	—	—	■	—
19	R-7	915	3	4	62	Fair	Jul-06	63	Fair	Stable	High	Poor	—	—	■	—	—	SO_4	Sr	■	■	—
20	R-8	711	1	4	96	V Good	Aug-06	94	V Good	Stable	High	V Good	—	—	—	—	—	Oxic	—	—	—	—
21	R-8	825	2	4	87	Good	Aug-06	89	Good	Stable	Moderate	Fair	—	—	■	—	—	Oxic	—	—	■	—
22	R-9	684	1	6	76	Fair	Jul-06	82	Good	Improving	Moderate	V Good	■	■	■	—	—	Mn	—	—	■	—
23	R-9i	199	1	4	54	Poor	Aug-06	56	Poor	Improving	Moderate	Fair	■	■	■	■	■	Mn	—	—	■	—

Table 6-1 (continued)

Well Screen				Composite[e]			Most Recent Event						Conditions Present in Screen Interval (as described in section 6.2)									
ID[a]	Well	Port depth (ft)	Scr #	Nr	Score and Rating		Date	Score and Rating		Overall Trend	Level of confidence	Rating in WSAR Rev. 0	Mod water	Plume	Outside pH-Alk range	Resid Inorg	Resid Org	Redox stage	Enhanced adsorption	Fe min	CO_3 min	Steel corros
24	R-9i	279	2	4	67	Fair	Aug-06	71	Fair	Improving	Moderate	Fair	■	■	—	■	■	Mn	—	—	—	—
25	R-10	874	1	2	95	V Good	Oct-06	97	V Good	Indeter	Low	Not rated	—	—	—	—	■	Oxic	—	—	—	—
26	R-10	1042	2	3	98	V Good	Oct-06	97	V Good	Indeter	Low	Not rated	—	—	—	—	■	Oxic	—	—	—	—
27	R-10a	690	1	5	78	Fair	Oct-06	83	Good	Improving	Moderate	Not rated	—	■	■	—p	—	Oxic	—	—	■	—
28	R-11	855	1	7	93	V Good	Oct-06	93	V Good	Stable	Moderate	V Good	■	■	—	—p	—	Oxic	—	—	—	—
29	R-12	468	1	6	49	Poor	Sep-06	63	Fair	Improving	Moderate	Poor	■	■	■	—p	■	Mn	—	—	■	—
30	R-12	507	2	6	65	Fair	Oct-06	84	Good	Improving	Moderate	Not rated	■	■	■	—	—	Oxic	—	—	—	—
31	R-12	811	3	7	60	Fair	Oct-06	87	Good	Improving	Moderate	Fair	■	■	—	—	—	Oxic	—	—	■	—
32	R-13	958	1	7	99	V Good	Oct-06	100	V Good	Stable	High	Good	—	—	—	—	—	Oxic	—	—	—	—
33	R-14	1204	1	6	91	Good [e]	Oct-06	97	Good [e]	Improving	High	V Good	—	—	—	—	—	Mn	—	—	—	—
34	R-14	1288	2	6	70	Fair	Oct-06	70	Fair	Stable	High	Poor	—	—	—	■	—	Fe	—	■	■	—
35	R-15	959	1	6	97	V Good	Oct-06	100	V Good	Stable	High	V Good	■	■	—	—	—	Oxic	—	—	—	—
36	R-16	866	2	10	80	Good	Dec-06	77	Fair	Degrading	Moderate	Fair	—	?	—	■	—	Mn	—	—	—	—r
37	R-16	1018	3	10	77	Fair	Dec-06	82	Good	Improving	Moderate	Good	—	?	—	■	—	Oxic	—	—	■	—
38	R-16	1238	4	9	52	Poor	Dec-06	67	Fair	Improving	Moderate	Poor	—	?	■	■	—	Mn	—	—	■	—
39	R-16r	600	1	7	91	V Good	Nov-06	91	V Good	Improving	High	Not rated	—	—	—	—	—	Oxic	—	—	—	—
40	R-17	1057	1	2	84	Good	Oct-06	86	Fair [e]	Indeter	Low	Not rated	—	—	—	—	—	SO_4	—	—	—	—
41	R-17	1124	2	1	83	Not rated	Oct-06	83	Fair	Indeter	Low	Not rated	—	—	—	—	—	Fe	Sr	—	—	—
42	R-18	1358	1	6	98	V Good	Dec-06	100	V Good	Stable	High	V Good	—	—	—	—	—	Oxic	—	—	—	—
43	R-19	909	2	5	79	Fair	Dec-06	81	Good	Stable	Moderate	Fair	—	—	—	■	—	Oxic	—	—	—	—
44	R-19	1191	3	6	95	V Good	Dec-06	90	Good	Stable	Moderate	Fair	—	—	—	—	?	NO_3	—	—	—	—
45	R-19	1413	4	6	95	V Good	Dec-06	97	V Good	Stable	Moderate	Good	—	—	—	—	—	Oxic	Sr	—	—	—
46	R-19	1586	5	5	47	Poor	Dec-06	50	Poor	Stable	Moderate	Poor	—	—	■	—	■	SO_4	—	■	■	—
47	R-19	1730	6	5	64	Fair	Dec-06	67	Fair	Stable	Moderate	Poor	—	—	■	—	■	Fe	Sr	■	■	—
48	R-19	1835	7	6	47	Poor	Dec-06	40	Poor	Stable	Moderate	Fair	—	—	■	■	■	Fe	Sr	—	■	—
49	R-20	907	1	7	58	Poor	Oct-06	80	Fair	Improving	Moderate	Poor	—	—	—	—	■	Fe	—	—	■	—
50	R-20	1150	2	5	39	Poor	Jul-06	88	Fair [e]	Improving	High	Poor	—	—	—	—	■	Fe	—	—	■	—
51	R-20	1330	3	6	58	Poor	Oct-06	68	Fair	Improving	High	Fair	—	—	—	■	■	Fe	—	■	■	—
52	R-21	889	1	5	99	V Good	Nov-06	100	V Good	Stable	High	V Good	—	—	—	—	—	Oxic	—	—	—	—
53	R-22	907	1	5	38	Poor	Dec-06	35	Poor	Stable	High	Poor	■	—	■	—p	?	SO_4	—	■	■	—
54	R-22	963	2	5	98	V Good	Dec-06	100	V Good	Stable	High	V Good	—	—	—	—	—	Oxic	—	—	—	—
55	R-22	1273	3	6	73	Fair	Dec-06	75	Fair	Stable	High	Good	—	—	■	■	■	Oxic	—	—	■	—
56	R-22	1378	4	6	43	Poor	Dec-06	50	Poor	Stable	High	Poor	—	—	■	■	■	Fe	—	■	■	—
57	R-22	1448	5	5	47	Poor	Dec-06	50	Poor	Stable	High	Poor	■	—	■	■	■	Fe	—	■	■	—
58	R-23	816	1	5	98	V Good	Dec-06	100	V Good	Stable	High	V Good	—	■	—	—	—	Oxic	—	—	—	—

Table 6-1 (continued)

Well Screen				Composite[e]			Most Recent Event			Overall Trend	Level of confidence	Rating in WSAR Rev. 0	Conditions Present in Screen Interval (as described in section 6.2)									
ID[a]	Well	Port depth (ft)	Scr #	Nr	Score and Rating		Date	Score and Rating					Mod water	Plume	Outside pH-Alk range	Resid Inorg	Resid Org	Redox stage	Enhanced adsorption	Fe min	CO_3 min	Steel corros
59	R-23i	470	2	2	66	Fair	Oct-06	64	Fair	Indeter	Low	Not rated	■	■	■	■	—	SO_4	—	—	■	—
60	R-23i	524	3	2	59	Poor	Oct-06	57	Poor	Indeter	Low	Not rated	■	■	■	■	■	SO_4	—	—	■	■
61	R-24	825	1	5	71	Fair	Jul-06	73	Fair	Stable	High	Not rated	—	?	■	—p	■	SO_4	—	■	■	—
62	R-25	755	1	4	66	Fair	Aug-05	66	Fair	Degrading	Low	Fair	■	■	■	—	—	Fe	—	■	—p	■
63	R-25	892	2	4	51	Poor	Aug-05	45	Poor	Degrading	Low	Fair	■	■	■	■	■	Fe	Ba	■	—	■
64	R-25	1192	4	3	75	Fair	Aug-05	77	Fair	Indeter	Low	V Good	■	■	■	■	—	Oxic	—	—	■	—
65	R-25	1303	5	4	63	Fair	Aug-05	76	Fair	Improving	Low	Fair	■	■	—	—	—	Fe	—	■	—	—
66	R-25	1406	6	3	89	Good	Dec-03	92	Good[e]	Indeter	Low	V Good	■	—	—	—	—	Oxic	—	—	—	—
67	R-25	1606	7	3	95	Good[e]	Dec-03	96	Good[e]	Indeter	Low	V Good	—	—	—	—	—	Oxic	—	—	—	—
68	R-25	1796	8	3	95	Good[e]	Aug-05	94	Good[e]	Stable	Low	Good	—	—	—	■	—	Oxic	—	—	—	—
69	R-26	659	1	4	95	V Good	Feb-06	100	V Good	Stable	High	Good	—	—	—	—	—	Oxic	—	—	—	—
70	R-27	852	1	4	92	V Good	Jul-06	97	V Good	Improving	High	Not rated	—	—	—	—	—	Oxic	—	—	—	—
71	R-28	934	1	7	90	Good	Oct-06	90	V Good[e]	Stable	High	V Good	■	■	—	—	—	Oxic	—	—	—p	—
72	R-31	532	2	3	50	Poor	Nov-06	50	Poor	Stable	High	Poor	—	—	■	—	■	SO_4	—	■	■	—
73	R-31	670	3	2	65	Fair	Nov-06	68	Fair	Stable	Moderate	Not rated	No data	—	—	—	■	Fe	—	■	—	—
74	R-31	831	4	2	97	V Good	Dec-06	97	V Good	Stable	Moderate	Not rated	No data	—	—	—	—	Oxic	—	—	—	—
75	R-31	1011	5	2	93	V Good	Dec-06	97	V Good	Stable	Moderate	Not rated	No data	—	■	—	—	Oxic	—	—	—	—
76	R-32	871	1	5	92	V Good	Dec-06	94	V Good	Stable	High	V Good	—	—	—	—	—	Oxic	—	—	—	—
77	R-32	976	3	5	68	Fair	Dec-06	77	Fair	Improving	High	Poor	—	—	—	—	■	Fe	—	—	■	—
78	R-33	995	1	4	89	Good	Oct-06	89	Good	Stable	High	Fair	—	—	—	—	—	Oxic	—	—	—	—
79	R-33	1112	2	5	89	Good	Nov-06	89	Good	Stable	High	V Good	—	—	—	?	—	Oxic	—	—	—	—
80	R-34	895	1	6	92	V Good	Oct-06	97	V Good	Improving	High	Good	—	—	—	—	—	Oxic	—	—	—	—

Nr=number, Scr #=screen number, WSAR=Well Screen Analysis Report, V Good=Very Good

? means the constituent is detected at this location and is likely to be a plume constituent but incontrovertible evidence for this origin is lacking at the present time

"■" in this column indicates that tritium (^3H) is detected at this location, indicating the presence of a component of water less than 60 years old.

"Indeter" means that the presence or absence of a plume at this location cannot be determined with confidence, although the water quality is definitely not representative of uncontaminated groundwater. The screens to which this designation applies are R-16 and R-24, which are each located next to one of the county's two sewage treatment facilities (in White Rock and Bayo Canyon, respectively).

P means one of the indicators is detected at this location but that the test is not applicable because the indicator is known to be a plume constituent..

r means the indicators for this category of effects are not reliable due to disturbances to the screen interval during recent pilot rehabilitation activities.

Table 6-1 (continued)

Note: A black filled square in a table column indicates that the condition is inferred as likely to be present in the most recent water sample from that screen, based on a review of relevant geochemical data and their trends. These inferences about the likely presence or absence of drilling effects are subject to change as additional information is obtained. The criteria for designating a condition as being present are summarized below:

- "Mod water"=modern water, in which tritium is present at consistently detectable (> 1 pCi/L) activities, based on a review of data in Table C-3. Although this is not a drilling impact, this information nonetheless may influence geochemical interpretations and levels of confidence in the outcome.
- "Plume"=contaminant plume, based on information compiled in Table 2-1.
- "Outside pH-Alk range"=pH and/or carbonate alkalinity values extend significantly above the upper limits for background groundwater, or pH extends below its lower background limit, based on field and laboratory data compiled in Table C-3 and summarized in Table C-8 in the column labeled "General Indicators."
- "Resid Inorg"=residual inorganic constituents from downhole drilling products (Category A), based on geochemical data compiled in Appendix C and summarized in Table C-8 in the column labeled "Category A - Residual Inorganics."
- "Resid Org"=residual organic constituents derived from downhole drilling products (Category A), based on geochemical data compiled in Table C-4 and summarized in Table C-8 in the column labeled "Category B - Residual Organics."
- "Redox Stage"=most probable redox stage based on a review of relevant indicators compiled in Appendix C and summarized in Table C-8 in the column labeled "Category C – Redox Stages" to determine which redox stage is most consistent with the observed concentrations and trends.
- "Fe min"=geochemical evidence indicates a high probability that the predrilling iron mineralogy has been significantly altered, e.g., as iron sulfides or iron carbonates, as a result of an extended period of very reducing conditions in the presence of an adequate in-situ reserve of accessible iron (III) in the formation mineralogy. Identifying where this condition may have developed cannot be determined with confidence based on data from a single water sample, but rather requires a review of redox data trends extending over several months to a year or more. Entries in Table 6-1 are based on a review of redox data compiled in Appendix C and summarized in Table C-8 in the column labeled "Category C – Redox."
- "Enhanced adsorption"=geochemical evidence indicates that adsorption of some species may be enhanced above that expected for adsorption onto formation materials, due to the presence of residual clays or other adsorbant introduced with drilling fluids. Based on review of data compiled in Appendix C and summarized in able C-8 in the column labeled "Category D – Adsorption."
- "CO_3 min"=Barium, calcium, magnesium, strontium, and/or sulfate values extend significantly outside the limits for background groundwater, based on field and laboratory data compiled in Appendix C and summarized in Table C-8 in the column labeled "Category E – Carbonate Minerals."
- "Steel corros"=corrosion of the stainless steel well casing or screen appears to be present, based on data compiled in Appendix C and summarized in Table C-8 in the column labeled "Category F – Steel Corrosion."

[a] Screen ID—unique identifier assigned to each screen addressed by this report in order to simplify management of information

[b] Composite score and rating—average score calculated as the percent of all tests with passing outcomes (i.e., score has not been weighted for any variability in the number of outcomes per event). However, see footnote d below for exceptions.

[c] The rating for the "most recent sample" in WSAR Rev 0 is almost always for an earlier sampling event than is used in this report and thus not altogether comparable to the most recent rating in this updated and revised report.

[d] The composite scores and ratings for screens in R-12, R-16, and R-20 are based on average scores calculated only for sampling events prior to the rehabilitation pilot studies. The rehabilitation activities occurred at R-12 from 23-Sep-2006 to 19-Oct-2006 (isolation packers were installed until a dedicated sampling system can be re-installed); at R-16 from 2-Aug-2006 to 12-Aug-2006 (Westbay was reinstalled and completed on 28-Aug-2006); and at R-20 from 29-Jun-2006 to 17-Oct-2006. The scores and ratings for the most recent samples from these well screens all apply to post-rehabilitation samples.

[e] Qualitative ratings for some screens have been adjusted for the following reasons:

- R-6i—F, Na and Ca in samples from this single-screen well consistently exceed the upper threshold limits for these analytes but these exceedances are probably not due to residual drilling fluids. Because the concentrations are fairly stable and not decreasing with time, the more likely explanations are either (a) the sampling locations used to establish background levels for these analytes did not capture the full range of their variability in intermediate perched zones, or (b) these analytes may be part of, or affected by, the contaminant plume intersected by this well, which contains Cl, ClO_4, NO_3, and tritium. Consequently, ratings for the composite and most recent sample from R-6i have been upgraded to "Good."
- R-14 Screen 1—Although all test outcomes are defensible and result in a score above 90%, it is inappropriate to assign a rating of "Very Good" to a sample which is still reducing (although improving with time) with respect to NO_3 and Mn.
- R-17 Screen 1—Downgraded to "Fair" because the variability observed in some of the indicators (e.g., decreasing Cl, NO_3 and SO_4 concentrations) and very high turbidity suggests that conditions may not have stabilized in this screen interval.

Table 6-1 (continued)

- R-20 Screen 2—The test outcomes result in a score of 88, implying a dramatic improvement in the screen's condition immediately following completion of pilot rehabilitation activities. However, additional sampling events are needed to establish the extent to which the improved conditions continue to exist.
- R-25 Screens 6, 7 and 8—downgraded to "Good" because geochemical trends indicate that, as of the last time these screens were sampled, they had not yet attained stable levels but rather still showed diminishing presence of water from upper screens
- R-28—Although the score of 90% for the most recent sample would result in a rating of "Good," the failed test outcomes for Ca, Mg, and Ni are probably not attributable to residual drilling effects. In the case of Ca and Mg, the stability of their concentrations in R-28 suggests that the sampling locations used to establish background levels for Ca and Mg did not capture the full range of their variability in the top of the regional aquifer. Secondly, the lack of Fe-reducing conditions in R-28 suggests that the failed test for elevated Ni is not due to desorption from dissolution of iron-bearing minerals but rather from its possible presence in the contaminant plume at this screen. Hence, its rating is upgraded to "Very Good" on the assumption that the negative test outcomes for these three analytes are not valid at this site.

Table 6-2a
Comparison of Ratings for Most Recent Sample

Rating for "Most Recent Sample" (as of Aug-05) in the Well Screen Analysis Report (WSAR) Rev 0	Rating for "Most Recent Sample" (as of Dec-06) in this Report			
	Very Good	**Good**	**Fair**	**Poor**
Very Good	CdV-R-37-2 Screen 3 CdV-16-1(i) R-1 R-8 Screen 1 R-11 R-15 R-18 R-21 R-22 Screen 2 R-23 R-28 R-32 Screen 1 R-34	MCOBT-4.4 R-9 R-14 Screen 1 R-25 Screen 6 R-25 Screen 7 R-33 Screen 2	R-5 Screen 2 R-5 Screen 3 R-25 Screen 4	—
Good	CdV-R-15-3 Screen 4 R-2 R-4 R-6 R-13 R-19 Screen 4 R-26 Screen 1	R-6i R-16 Screen 3 R-25 Screen 8	R-16 Screen 2 R-22 Screen 3	—
Fair	—	CdV-R-15-3 Screen 6 R-8 Screen 2 R-12 Screen 3 R-19 Screen 2 R-19 Screen 3 R-25 Screen 5 R-33 Screen 1	CdV-R-37-2 Screen 4 R-5 Screen 4 R-9i Screen 2 R-20 Screen 3 R-25 Screen 1	R-9i Screen 1 R-19 Screen 7 R-25 Screen 2
Poor	—	—	CdV-R-15-3 Screen 5 R-7 Screen 3 R-12 Screen 1 R-14 Screen 2 R-16 Screen 4 R-19 Screen 6 R-20 Screen 1 R-20 Screen 2 R-32 Screen 3	CdV-R-37-2 Screen 2 R-19 Screen 5 R-22 Screen 1 R-22 Screen 4 R-22 Screen 5 R-31 Screen 2
Not rated in WSAR R0	R-10 Screen 1 R-10 Screen 2 R-16r R-27 R-31 Screen 4 R-31 Screen 5	R-10a R-12 Screen 2	CdV-R-16-2(i)r R-3i (p) R-17 Screen 1 R-17 Screen 2 R-23i Screen 2 R-24 R-31 Screen 3	R-23i Screen 3

Note: Shaded cells indicate that the same qualitative rating was assigned to the "most recent sample" from this screen in both revisions of the well screen analysis report.

— = None.

Table 6-2b
Comparison of Ratings Assigned in WSAR R0 and this Report, for the "Most Recent Sample" as of August 2005

Ratings in Well Screen Analysis Report (WSAR) Rev 0		Rating in this Report: Very Good	Good	Fair	Poor
	Very Good	CdV-R-37-2 Sc 3 R-1 R-4 R-8 Sc 1 R-11 R-14 Sc 1 R-15 R-18 R-21 R-22 Sc 2 R-23 R-25 Sc 6 R-25 Sc 7 R-32 Sc 1	CdV-16-1(i) MCOBT-4.4 R-5 Sc 3 R-28 R-33 Sc 2	R-5 Sc 2 R-9 R-25 Sc 4	—
	Good	CdV-R-15-3 Sc 4 R-6 R-13 R-19 Sc 4 R-25 Sc 8 R-26 Sc 1	R-2 R-34	R-6i R-16 Sc 3 R-22 Sc 3	—
	Fair	R-19 Sc 3	CdV-R-15-3 Sc 6 R-8 Sc 2 R-16 Sc 2 R-25 Sc 5 R-33 Sc 1	CdV-R-37-2 Sc 4 R-5 Sc 4 R-9i Sc 1 R-9i Sc 2 R-12 Sc 3 R-19 Sc 2 R-20 Sc 3 R-25 Sc 1	R-25 Sc 2 R-19 Sc 7
	Poor	—	—	R-7 Sc 3 R-14 Sc 2 R-19 Sc 6 R-32 Sc 3	CdV-R-15-3 Sc 5 CdV-R-37-2 Sc 2 R-12 Sc 1 R-16 Sc 4 R-19 Sc 5 R-20 Sc 1 R-20 Sc 2 R-22 Sc 1 R-22 Sc 4 R-22 Sc 5 R-31 Sc 2

Note: Shaded cells indicate that the same qualitative rating was assigned to the "most recent sample" from this screen in both revisions of the well screen analysis report.

— = None.

Table 6-2c
Evaluation for Residual Inorganic Drilling Fluids (Category A in this report) in WSAR R0 and in this Report, for the "Most Recent Sample" as of August 2005

		Outcome in this Report			
		Residual Inorganics are Absent		**Residual Inorganics are Present**	
Outcomes in Well Screen Analysis Report (WSAR) Rev 0	Residual Inorganics are Absent	R-2 R-6 R-32 Sc 1		R-4 R-20 Sc 3 R-32 Sc 3	
	Residual Inorganics are Present	R-16 Sc 2 R-16 Sc 3		R-14 Sc 2 R-16 Sc 4 R-20 Sc 1 R-20 Sc 2	
	Not evaluated for Residual Inorganics in WSAR R0	CdV-R-15-3 Sc 4 CdV-R-15-3 Sc 6 CdV-R-37-2 Sc 2 CdV-R-37-2 Sc 3 CdV-R-37-2 Sc 4 R-1 R-7 Sc 3 R-8 Sc 2 R-12 Sc 3 R-13 R-14 Sc 1 R-15 R-18 R-19 Sc 3 R-19 Sc 4	R-19 Sc 5 R-19 Sc 6 R-21 R-22 Sc 1 R-22 Sc 2 R-22 Sc 5 R-25 Sc 1 R-25 Sc 5 R-25 Sc 6 R-25 Sc 7 R-28 R-31 Sc 2 R-33 Sc 1 R-33 Sc 2 R-34	CdV-16-1(i) CdV-R-15-3 Sc 5 MCOBT-4.4 R-5 Sc 2 R-5 Sc 3 R-5 Sc 4 R-6i R-8 Sc 1 R-9 R-9i Sc 1 R-9i Sc 2	R-11 R-12 Sc 1 R-12 Sc 2 R-19 Sc 2 R-19 Sc 7 R-22 Sc 3 R-22 Sc 4 R-23 R-25 Sc 2 R-25 Sc 4 R-25 Sc 8 R-26 Sc 1

Note: Shaded cells indicate that the same qualitative rating was assigned to the "most recent sample" from this screen in both revisions of the well screen analysis report.

Table 6-2d
Evaluation for Residual Organic Drilling Fluids (Category B in this report) in WSAR R0 and in this Report, for the "Most Recent Sample" as of August 2005

Outcomes in Well Screen Analysis Report (WSAR) Rev 0	Outcome in this Report: Residual Organics are Absent			Outcome in this Report: Residual Organics are Present
Residual Organics are Absent	CdV-R-37-2 Sc 3 CdV-R-15-3 Sc 4 CdV-R-15-3 Sc 6 R-1 R-2 R-4 R-5 Sc 2 R-5 Sc 3 R-5 Sc 4 R-8 Sc 1 R-8 Sc 2 R-9	R-11 R-12 Sc 3 R-13 R-14 Sc 1 R-15 R-16 Sc 2 R-18 R-19 Sc 4 R-21 R-22 Sc 2 R-23 R-25 Sc 1	R-25 Sc 6 R-25 Sc 7 R-25 Sc 8 R-26 Sc 1 R-28 R-32 Sc 1 R-33 Sc 1 R-33 Sc 2 R-34	CdV-R-37-2 Sc 2 R-6 R-7 Sc 3 R-16 Sc 3 R-19 Sc 3 CdV-16-1(i) MCOBT-4.4 R-6i R-9i Sc 1 R-9i Sc 2 R-25 Sc 4 R-25 Sc 5
Residual Organics are Present	—			CdV-R-15-3 Sc 5 CdV-R-37-2 Sc 4 R-12 Sc 1 R-14 Sc 2 R-16 Sc 4 R-19 Sc 2 R-19 Sc 5 R-19 Sc 6 R-19 Sc 7 R-20 Sc 1 R-20 Sc 2 R-20 Sc 3 R-22 Sc 1 R-22 Sc 3 R-22 Sc 4 R-22 Sc 5 R-25 Sc 2 R-31 Sc 2 R-32 Sc 3

Note: Shaded cells indicate that the same qualitative rating was assigned to the "most recent sample" from this screen in both revisions of the well screen analysis report.

— = None.

Table 6-2e
Apparent Redox Condition (Category C in this report) Determined in WSAR R0 and in this Report, for the "Most Recent Sample" as of August 2005

Redox Outcomes in Well Screen Analysis Report (WSAR) Rev 0	Redox Condition in this Report: Oxic	NO_3-Reducing	Fe/Mn Reducing	SO_4-Reducing
Oxic	CdV-16-1(i) MCOBT-4.4 R-1 R-4 R-5 Sc 3 R-8 Sc 1 R-15 R-18 R-21 R-22 Sc 2 R-23 R-25 Sc 6 R-25 Sc 7 R-28 R-32 Sc 1	—	R-9 R-19 Sc 7	—
NO_3-Reducing	R-11	—	—	—
Fe/Mn Reducing	R-5 Sc 2 R-13 R-19 Sc 2 R-22 Sc 3 R-25 Sc 8	—	R-5 Sc 4 R-9i Sc 1 R-9i Sc 2 R-12 Sc 3 R-22 Sc 4 R-25 Sc 1 R-25 Sc 4 R-25 Sc 5 R-33 Sc 2	CdV-R-15-3 Sc 6 R-16 Sc 2
SO_4-Reducing	CdV-R-15-3 Sc 4 CdV-R-37-2 Sc 3 R-6 R-6i R-8 Sc 2 R-19 Sc 3 R-19 Sc 4 R-26 Sc 1 R-34	—	CdV-R-37-2 Sc 4 R-2 R-12 Sc 1 R-14 Sc 1 R-16 Sc 3 R-16 Sc 4 R-25 Sc 2 R-33 Sc 1	CdV-R-15-3 Sc 5 CdV-R-37-2 Sc 2 R-7 Sc 3 R-14 Sc 2 R-19 Sc 5 R-19 Sc 6 R-20 Sc 1 R-20 Sc 2 R-20 Sc 3 R-22 Sc 1 R-22 Sc 5 R-31 Sc 2 R-32 Sc 3

Note: Shaded cells indicate that the same qualitative rating was assigned to the "most recent sample" from this screen in both revisions of the well screen analysis report.

— = None.

Table 6-3
Capability of Screen to Provide Reliable and Representative Samples for Selected Chemicals of Potential Concern

Well Screen				Most recent event			Capable of providing reliable and representative sample for COPC[b]												
ID[a]	Well	Port depth (ft)	Scr	Date	Score and Rating		3H	Ba	Cl	ClO_4	Cr	NO_3	Zn	VOCs	Cs-137	Pu	Sr-90	RDX	TNT
1	CdV-16-1(i)	624	1	Mar-06	91	V Good	■	■	■	■	■	■	■	■	■	■	■	■	■
2	CdV-16-2(i)r	850	1	May-06	79	Fair	■	■	—	■	—	—	—	■	—	—	■	■	■
3	CdV-R-15-3	1254	4	Mar-06	97	V Good	■	■	■	■	■	—	■	—	■	■	■	■	—
4	CdV-R-15-3	1350	5	Mar-06	63	Fair	■	—	■	—	—	—	—	—	—	—	■	■	—
5	CdV-R-15-3	1640	6	Mar-06	84	Good	■	—	■	—	—	—	—	—	■	—	■	■	—
6	CdV-R-37-2	1200	2	Mar-06	50	Poor	■	—	■	—	—	—	—	—	—	—	■	■	—
7	CdV-R-37-2	1359	3	Mar-06	91	V Good	■	■	■	■	—	■	—	■	—	■	■	■	■
8	CdV-R-37-2	1551	4	Mar-06	74	Fair	■	—	■	—	—	—	—	—	—	—	—	■	—
9	MCOBT-4.4	485	1	Jun-05	80	Good	■	—	■	■	■	■	■	—	■	—	■	■	—
10	R-1	1031	1	Oct-06	100	V Good	■	■	■	■	■	■	■	■	■	■	■	■	■
11	R-2	918	1	Jul-06	94	V Good	■	■	■	■	■	■	■	—	■	■	■	■	—
12	R-3i	215	1	Aug-06	61	Fair	■	—	—	■	■	—	■	—	■	—	■	■	—
13	R-4	793	1	Jul-06	94	V Good	■	■	—	■	■	—	■	—	■	■	■	■	—
14	R-5	384	2	Jul-06	75	Fair	■	—	■	■	■	■	■	■	■	—	■	■	■
15	R-5	719	3	Jul-06	79	Fair	■	—	■	■	■	■	■	—	■	—	■	■	—
16	R-5	861	4	May-05	70	Fair	■	—	■	—	—	—	—	—	—	—	■	■	—
17	R-6	1205	1	Jul-06	97	V Good	■	■	■	■	■	■	■	—	■	■	■	■	—
18	R-6i	602	1	Jul-06	73	Good [e]	■	—	■	■	■	■	■	—	■	—	■	■	—
19	R-7	915	3	Jul-06	63	Fair	■	—	■	—	—	—	—	—	—	—	—	■	—
20	R-8	711	1	Aug-06	94	V Good	■	■	■	■	■	■	■	■	■	■	■	■	■
21	R-8	825	2	Aug-06	89	Good	■	—	■	■	■	■	■	■	■	—	■	■	■
22	R-9	684	1	Jul-06	82	Good	■	—	■	—	—	—	—	—	—	—	■	■	—
23	R-9i	199	1	Aug-06	56	Poor	■	—	—	—	—	—	—	—	—	—	■	■	—
24	R-9i	279	2	Aug-06	71	Fair	■	—	—	—	—	—	—	—	—	—	■	■	—
25	R-10	874	1	Oct-06	97	V Good	■	■	■	■	■	■	■	—	■	■	■	■	—
26	R-10	1042	2	Oct-06	97	V Good	■	■	■	■	■	■	■	—	■	■	■	■	—
27	R-10a	690	1	Oct-06	83	Good	■	—	■	■	■	■	■	■	■	—	■	■	■
28	R-11	855	1	Oct-06	93	V Good	■	■	■	■	■	■	■	■	■	■	■	■	■
29	R-12	468	1	Sep-06	63	Fair	■	—	■	—	—	—	—	—	—	—	■	■	—
30	R-12	507	2	Oct-06	84	Good	■	—	■	■	■	■	■	■	■	—	■	■	■
31	R-12	811	3	Oct-06	87	Good	■	—	■	■	■	■	■	■	■	—	■	■	■

Table 6-3 (continued)

Well Screen				Most recent event			Capable of providing reliable and representative sample for COPC[b]												
ID[a]	Well	Port depth (ft)	Scr	Date	Score and Rating		3H	Ba	Cl	ClO_4	Cr	NO_3	Zn	VOCs	Cs-137	Pu	Sr-90	RDX	TNT
32	R-13	958	1	Oct-06	100	V Good	■	■	■	■	■	■	■	■	■	■	■	■	■
33	R-14	1204	1	Oct-06	97	Good[e]	■	■	■	—	—	—	—	—	—	—	■	■	—
34	R-14	1288	2	Oct-06	70	Fair	■	—	—	—	—	—	—	—	—	—	■	■	—
35	R-15	959	1	Oct-06	100	V Good	■	■	■	■	■	■	■	■	■	■	■	■	■
36	R-16	866	2	Dec-06	77	Fair	■	—	—	—	—	—	—	—	—	—	■	■	—
37	R-16	1018	3	Dec-06	82	Good	■	—	—	■	■	—	■	■	■	—	■	■	■
38	R-16	1238	4	Dec-06	67	Fair	■	—	—	—	—	—	—	—	—	—	■	■	—
39	R-16r	600	1	Nov-06	91	V Good	■	■	■	■	■	■	■	■	■	■	■	■	■
40	R-17	1057	1	Oct-06	86	Fair[e]	■	—	■	—	—	—	—	—	—	—	■	■	—
41	R-17	1124	2	Oct-06	83	Fair	■	—	■	—	—	—	—	—	—	—	—	■	—
42	R-18	1358	1	Dec-06	100	V Good	■	■	■	■	■	■	■	■	■	■	■	■	■
43	R-19	909	2	Dec-06	81	Good	■	■	—	■	■	—	■	■	■	■	■	■	■
44	R-19	1191	3	Dec-06	90	Good	■	■	■	■	■	—	■	—	■	■	■	■	—
45	R-19	1413	4	Dec-06	97	V Good	■	■	■	■	■	■	■	■	■	■	—	■	■
46	R-19	1586	5	Dec-06	50	Poor	■	—	■	—	—	—	—	—	—	—	■	■	—
47	R-19	1730	6	Dec-06	67	Fair	■	—	■	—	—	—	—	—	—	—	—	■	—
48	R-19	1835	7	Dec-06	40	Poor	■	—	—	—	—	—	—	—	—	—	—	■	—

Table 6-3 (continued)

Well Screen				Most recent event			Capable of providing reliable and representative sample for COPC[b]												
ID[a]	Well	Port depth (ft)	Scr	Date	Score and Rating		3H	Ba	Cl	ClO_4	Cr	NO_3	Zn	VOCs	Cs-137	Pu	Sr-90	RDX	TNT
49	R-20	907	1	Oct-06	80	Fair	■	—	■	—	—	—	—	—	—	—	■	■	—
50	R-20	1150	2	Jul-06	88	Fair[e]	■	—	■	—	—	—	—	—	—	—	■	■	—
51	R-20	1330	3	Oct-06	68	Fair	■	—	—	—	—	—	—	—	—	—	■	■	—
52	R-21	889	1	Nov-06	100	V Good	■	■	■	■	■	■	■	■	■	■	■	■	■
53	R-22	907	1	Dec-06	35	Poor	■	—	■	—	—	—	—	—	—	—	■	■	—
54	R-22	963	2	Dec-06	100	V Good	■	■	■	■	■	■	■	■	■	■	■	■	■
55	R-22	1273	3	Dec-06	75	Fair	■	—	—	■	■	—	■	—	■	—	■	■	—
56	R-22	1378	4	Dec-06	50	Poor	■	—	—	—	—	—	—	—	—	—	■	■	—
57	R-22	1448	5	Dec-06	50	Poor	■	—	—	—	—	—	—	—	—	—	■	■	—
58	R-23	816	1	Dec-06	100	V Good	■	■	■	■	■	■	■	■	■	■	■	■	■
59	R-23i	470	2	Oct-06	64	Fair	■	—	—	—	—	—	—	—	—	—	■	■	—
60	R-23i	524	3	Oct-06	57	Poor	■	—	—	—	—	—	—	—	—	—	■	■	—
61	R-24	825	1	Jul-06	73	Fair	■	—	■	—	—	—	—	—	—	—	■	■	—
62	R-25	755	1	Aug-05	66	Fair	■	—	■	—	—	—	—	—	—	—	■	■	—
63	R-25	892	2	Aug-05	45	Poor	■	—	—	—	—	—	—	—	—	—	■	■	—
64	R-25	1192	4	Aug-05	77	Fair	■	—	—	■	■	—	■	■	■	—	■	■	■
65	R-25	1303	5	Aug-05	76	Fair	■	—	■	—	—	—	—	—	—	—	■	■	—
66	R-25	1406	6	Dec-03	92	Good[e]	■	■	■	■	■	■	■	■	■	■	■	■	■

Table 6-3 (continued)

Well Screen				Most recent event			Capable of providing reliable and representative sample for COPC[b]												
ID[a]	Well	Port depth (ft)	Scr	Date	Score and Rating		3H	Ba	Cl	ClO_4	Cr	NO_3	Zn	VOCs	Cs-137	Pu	Sr-90	RDX	TNT
67	R-25	1606	7	Dec-03	96	Good[e]	■	■	■	■	■	■	■	■	■	■	■	■	■
68	R-25	1796	8	Aug-05	94	Good[e]	■	■	■	■	■	■	■	■	■	■	■	■	■
69	R-26	659	1	Feb-06	100	V Good	■	■	■	■	■	■	■	■	■	■	■	■	■
70	R-27	852	1	Jul-06	97	V Good	■	■	■	■	■	■	■	■	■	■	■	■	■
71	R-28	934	1	Oct-06	90	V Good[e]	■	■	■	■	■	■	■	■	■	■	■	■	■
72	R-31	532	2	Nov-06	50	Poor	■	—	■	—	—	—	—	—	—	—	■	■	—
73	R-31	670	3	Nov-06	68	Fair	■	—	■	—	—	—	—	—	—	—	■	■	—
74	R-31	831	4	Dec-06	97	V Good	■	■	■	■	■	■	■	■	■	■	■	■	■
75	R-31	1011	5	Dec-06	97	V Good	■	—	■	■	■	■	■	■	■	—	■	■	■
76	R-32	871	1	Dec-06	94	V Good	■	■	■	■	■	■	■	■	■	■	■	■	■
77	R-32	976	3	Dec-06	77	Fair	■	—	■	—	—	—	—	—	—	—	■	■	—
78	R-33	995	1	Oct-06	89	Good	■	■	■	■	■	■	■	■	■	■	■	■	■

Table 6-3 (continued)

Well Screen				Most recent event			Capable of providing reliable and representative sample for COPC[b]												
ID[a]	Well	Port depth (ft)	Scr	Date	Score and Rating		3H	Ba	Cl	ClO_4	Cr	NO_3	Zn	VOCs	Cs-137	Pu	Sr-90	RDX	TNT
79	R-33	1112	2	Nov-06	89	Good	■	■	■	■	■	■	■	■	■	■	■	■	■
80	R-34	895	1	Oct-06	97	V Good	■	■	■	■	■	■	■	■	■	■	■	■	■
Number of screens that are capable of providing reliable and representative sample for COC																			
• Screens in single-screen well							22	16	19	20	19	17	19	14	18	15	22	22	14
• Screens in multi-screen well							58	18	42	26	25	20	25	19	25	17	52	58	20
Total							80	34	61	46	44	37	44	33	43	32	74	80	34
Percent of all screens							100%	42.5%	76.3%	57.5%	55%	46.3%	55%	41.3%	53.8%	40%	92.5%	100%	42.5%

Notes: COPC = Chemical of potential concern. ■ = Screen can provide reliable and representative sample for this COPC. — = Screen cannot provide reliable and representative sample for this COPC.

[a] Screen ID—unique identifier assigned to each screen addressed by this report in order to simplify management of information.

[b] Conditions under which screen can provide reliable and representative sample for COC, with high level of confidence:

- Ba—pH-alkalinity conditions within range of normal background (General conditions); redox conditions above Mn-reducing stage (Category C); no evidence for enhanced adsorption of Ba (Category D); no significant changes in carbonate mineral stabilities (Category E)
- Cl—Absence of residual water-soluble inorganic drilling fluids (Category A). Not affected by any other category of geochemical drilling effects.
- ClO_4—Redox conditions above Mn-reducing stage (Category C). Not affected by other categories of geochemical drilling effects.
- Cr—Redox conditions above Mn-reducing stage (Category C); no significant changes to Fe mineralogy in screen interval; no evidence for steel corrosion (Category F)
- NO_3— Absence of residual water-soluble inorganic drilling fluids (Category A). Redox conditions above NO_3-reducing stage (Category C). Not affected by other categories of geochemical drilling effects.
- Zn— Redox conditions above Mn-reducing stage (Category C); no significant changes to Fe mineralogy in screen interval; no evidence for enhanced adsorption of Zn (Category D); no evidence for steel corrosion (Category F)
- VOCs—Absence of residual organics (Category B); redox conditions above NO_3-reducing stage (Category C)
- Cs-137—Redox conditions above Mn-reducing stage (Category C); no significant changes to Fe mineralogy in screen interval; no evidence for enhanced adsorption of Zn (Category D); no evidence for steel corrosion (Category F)
- Plutonium—pH-Alkalinity conditions within range of normal background (General conditions); redox conditions above Mn-reducing stage (Category C); no significant changes to Fe mineralogy in screen interval; no evidence for enhanced adsorption of Zn (Category D); no significant changes in carbonate mineral stabilities (Category E); no evidence for steel corrosion (Category F)
- Sr-90—No evidence for enhanced adsorption of Sr (Category D)
- RDX—All geochemical conditions. Not affected by any category of geochemical drilling effects.
- TNT—Absence of residual organics (Category B); redox conditions above NO_3-reducing stage (Category C)

Table 6-4
Trends in Water-Quality Assessment Outcomes

	Outcome	Very Good Rating 91% – 100%	Good Rating 80% – 90%	Fair Rating 60% – 80%	Poor Rating < 60%
Trend	Stable	CdV-R-15-3 Sc 4 CdV-R-37-2 Sc 3 R-1 R-4[a] R-6[a] R-8 Sc 1 R-11 R-13 R-15 R-18 R-19 Sc 3 R-19 Sc 4 R-21 R-22 Sc 2 R-23 R-26 Sc 1 R-31 Sc 4 R-31 Sc 5 R-32 Sc 1	CdV-16-1(i) R-5 Sc 3 R-6i R-8 Sc 2 R-19 Sc 2 R-25 Sc 8 R-28 R-33 Sc 1 R-33 Sc 2	CdV-R-15-3 Sc 5 CdV-R-37-2 Sc 4 R-5 Sc 2 R-5 Sc 4 R-7 Sc 3 R-14 Sc 2[a] R-19 Sc 6 R-22 Sc 3 R-24 R-31 Sc 3 R-32 Sc 3	CdV-R-37-2 Sc 2 R-19 Sc 5 R-19 Sc 7 R-22 Sc 1 R-22 Sc 4 R-22 Sc 5 R-31 Sc 2
	Improving	R-16r R-27 R-34	R-2[a] R-14 Sc 1[a]	CdV-R-15-3 Sc 6 R-9 R-9i Sc 2 R-10a (P)[b] R-12 Sc 2 R-12 Sc 3 R-16 Sc 3[a] R-25 Sc 5	R-9i Sc 1 R-12 Sc 1[a] R-16 Sc 4[a] R-20 Sc 1[a] R-20 Sc 2[a] R-20 Sc 3[a]
	Degrading	—[c]	R-16 Sc 2[a]	R-25 Sc 1	R-25 Sc 2
	Indeterminate or variable	R-10 Sc 1 (P) R-10 Sc 2	MCOBT-4.4 R-17 Sc 1 (P) R-25 Sc 6 R-25 Sc 7	CdV-16-2(i)r R-3i (P) R-17 Sc 2 (P) R-23i Sc 1 (P) R-25 Sc 4	R-23i Sc 2 (P)

Source: Table 6-1.

[a] Screen interval drilled with bentonite drilling mud.

[b] (P) = Result considered preliminary if it is based on less than 3 sample events, or if the most recent event occurred more than 2 years ago.

[c] — = None; Sc = screen.

Appendix A

Relevant Analytes and Chemicals of Potential Concern

A-1.0 OVERVIEW

The purpose of this appendix is to compile chemical characteristics for analytes, chemicals, and drilling products relevant to this report. This information establishes the technical basis for identifying which analytes may be affected by residual drilling impacts and for selecting suitable geochemical indicators for those impacts.

A-2.0 RELEVANT ANALYTES AND CHEMICALS OF POTENTIAL CONCERN

The list of relevant analytes in Tables A-1 through A-8 of this appendix was compiled based on background concentrations, source characterization, and groundwater monitoring conducted since the early 1960s. These tables are organized approximately to parallel the analytical suites defined in the Water Quality Database (WQDB):

- General inorganic analytes (Table A-1)
- Trace metal analytes (Table A-2)
- Radionuclides (Table A-3)
- High-explosive analytes (Table A-4)
- Dioxins, furans, pesticides, and polychlorinated biphenyls (PCBs) (Table A-5)
- Herbicides and diesel range organics (Table A-6)
- Polynuclear aromatic hydrocarbons (Table A-7)
- Semivolatile and volatile organic compounds (Table A-8)

For Tables A-1 through A-3, representative speciation of groundwater from the regional aquifer was calculated using MINTEQA2 software and assuming 25°C, 4.8 mg/L dissolved oxygen, $10^{-2.57}$ atm CO_2, and median background concentrations (Table 4.2-4e, "Groundwater Background Investigation Report," Rev. 0; LANL 2005, 090580).

The test criteria used to identify the presence of specific residual drilling fluid impacts, and the applicability of flags to specific analytes if an impact is present, are defined for each category of drilling effects in the main text of the report as follows:

Drilling Effect	Title or Description	Report Section	Report Table
Category A	Residual water-soluble inorganic constituents of drilling fluids and additives	4.4	4-8
Category B	Residual organic components of drilling fluids and additives	4.5	4-11
Category C	Modification of in-situ oxidation-reduction (redox) conditions	4.6	4-13 and 4-14
Category D	Modification of surface-active mineral surfaces	4.7	4-15 and 4-16
Category E	Changes in carbonate mineral stability	4.8	4-17
Category F	Corrosion of stainless-steel well components	4.9	4-18

Table D-2 in Appendix D summarizes the geochemical indicators and associated test criteria for each of the six categories of drilling effects. Table 4-4 in the report's main text lists the drilling flag codes and associated drilling reason codes that are assigned to analytes and chemicals of potential concern that are identified as potentially to be impacted if a particular drilling effect is present.

A-3.0 CHEMICAL CHARACTERIZATION OF DRILLING PRODUCTS

Tables A-9 through A-13 summarize key chemical characteristics of drilling products:

- Mineralogical composition and other characteristics of Wyoming bentonite (Table A-9)
- Inorganic analytes and organic carbon leached from various drilling products (Table A-10)
- Clay soil adsorption coefficients (Table A-11)
- Sodium bentonite clay adsorption coefficients (Table A-12)
- Chemical structures of selected constituents of organic drilling products (Table A-13)

Table A-1
General Inorganic Analyses Relevant to this Report

Analyte	Dominant Species in the Regional Aquifer	Test Criterion[a]	Category Under Which Drilling Flag Codes Could Be Assigned[b]
Alkalinity (total carbonate)	HCO_3^-	Gen-2	A, E
Ammonia (NH_3-N)	NH_4^+	B2	B
Calcium	Ca^{2+}	E2	E
Chloride	Cl^-	A1	A
Dissolved oxygen (field)	O_2	C12	C
Fluoride	F^-	A2	A, E
Magnesium	Mg^{2+}	E3	E
Nitrate	NO_3^-	C11	A, C
Perchlorate	ClO_4^-	C6	C
pH (field)	H^+	Gen-1	A, E
Phosphorus (total)	$H_2PO_4^-$	A3	A
Sodium	Na^+	A4	A
Sulfate	SO_4^{2-}	A5, C1	A, C
Sulfide	S^{2-}	C2	C
Total Kjehldahl nitrogen	Organic nitrogen compounds, including acids, neutral species, and bases	B3	B
Total organic carbon	Humic and fulvic acids, small molecular-weight organic acids	B4	B
Phosphorus (total)	$H_2PO_4^-$	A3	A

[a] Table D-2 in Appendix D defines each of these geochemical indicators and associated test criteria.

[b] Analytes affected by a particular category of drilling impacts are identified in the corresponding section 4 that discusses that category, as outlined in the introduction to this appendix. Examples of drilling flag codes to be assigned to affected analytes are listed in Table 4-4.

Table A-2
Metal Analytes Relevant to this Report

Analyte	Dominant Species in the Regional Aquifer	Test Criterion[a]	Category Under Which Drilling Flag Codes Could Be Assigned[b]
Antimony	$Sb(OH)_6^-$, $Sb(OH)_5^0$ (ATSDR 1992, 090533)	—[c]	D
Arsenic	$[HAsO_4]^{2-}$, $H_2AsO_4^-$	—	C, D
Barium	Ba^{+2}	D3, E1	D, E
Beryllium	Be^{2+} (ATSDR 2002, 090555)	—	C, D
Boron	$[B(OH)_3]^0$	—	E
Cadmium	Cd^{+2}	—	C, D, F
Cesium	Cs^+	—	C, D
Chromium	CrO_4^{2-}, $Cr(OH)_3$ aq, $Cr(OH)_2^+$	C10, F3, F4	C, F
Cobalt	Co^{2+}	—	C, D, F
Copper	Cu^{2+}	—	C, D, F
Iron	Fe^{2+}, $[Fe(OH)_2]^0$, $FeOH^+$, $Fe(OH)_3^-$	C4, F1, F2	C, E, F
Lead	Pb^{2+}	—	C, D, F
Manganese	Mn^{2+}	C5	C, D, F
Mercury	Hg^{2+}	—	C, D, F
Molybdenum	MoO_4^-	C9	C, D, F
Nickel	$NiCO_3$ aq	C8, F5	C, F
Selenium	SeO_3^{2-}, SeO_4^{2-}, $HseO_3^-$	—	C
Silver	Ag^+	—	D
Strontium	Sr^{2+}, $SrHCO_3^+$	D1, E4	A, D, E
Thallium	Tl^+ (ATSDR 1992, 090560, p. 54)	—	D
Uranium	$[UO_2(CO_3)_2]^{2-}$, $[UO_2(CO_3)_3]^{4-}$, $UO_2CO_3^0$	C7, D2, E5	C, D, E
Vanadium	$H_2VO_4^-$, HVO_4^{2-} (ATSDR 1992, 090556)	—	C, D
Zinc	Zn^{2+}	D4	C, D, F

Note: Most of the listed metals, including antimony, beryllium, cesium, cobalt, silver, thallium, vanadium, and zinc are generally not detected in the native regional aquifer and are only included for purposes of speciation calculations.

[a] Table D-2 in Appendix D defines each of these geochemical indicators and associated test criteria.

[b] Analytes affected by a particular category of drilling impacts are identified in the corresponding section 4 that discusses that category, as outlined in the introduction to this appendix. Examples of drilling flag codes to be assigned to affected analytes are listed in Table 4-4.

[c] — = Not applicable.

Table A-3
Radionuclides Relevant to this Report

Analyte	Dominant Species in the Regional Aquifer	Category Under Which Drilling Flag Codes Could Be Assigned[a]
Americium-241	$AmCO_3^+$, $Am(CO_3)^{2-}$, $Am(OH)^{2+}$	C, D, E
Cerium-139, -141, -144	$CeCO_3^+$	C, D, E
Cesium-137	Cs^+	C, D
Cobalt-60	$Co_2(OH)_3^+$	C, D
Europium-152, -154, -155	$EuCO_3^+$	C, D, E
Lanthanum-140	$LaCO_3^+$	C, D, E
Neodymium-147	$NdCO_3^+$	C, D, E
Plutonium-238, -239, -240	PuO_2^+, PuO_2CO_3 aq, $Pu(CO_3)_3^{2-}$	C, D, E
Radium-226, -228	Ra^{2+}	C, D, E
Strontium-90	Sr^{2+}, $SrHCO_3^+$	C, D, E
Technetium-99	TcO_4^-	C, D
Tritium	HTO^0	—[b]
Uranium-234	$[UO_2(CO_3)_2]^{2-}$, $[UO_2(CO_3)_3]^{4-}$, $UO_2CO_3^0$	C, D, E
Uranium-235/236	$[UO_2(CO_3)_2]^{2-}$, $[UO_2(CO_3)_3]^{4-}$, $UO_2CO_3^0$	C, D, E
Uranium-238	$[UO_2(CO_3)_2]^{2-}$, $[UO_2(CO_3)_3]^{4-}$, $UO_2CO_3^0$	C, D, E

Note: Isotopes of americium, plutonium, cesium, cobalt, iodine, technetium, strontium, and lanthanides are not detected in the native regional aquifer and are only included for purposes of speciation calculations.

[a] Analytes affected by a particular category of drilling impacts are identified in the corresponding section 4 that discusses that category, as outlined in the introduction to this appendix. Examples of drilling flag codes to be assigned to affected analytes are listed in Table 4-4.

[b] — = Not applicable.

Table A-4
High Explosives Analytes and Degradation Products Relevant to this Report

Analyte in the HEXP[a] Analytical Suite (and Selected Synonyms)	Stoichiometric Formula	CAS RN[b]	K_{OC}[c,d]	K_d[e] (mL/g)[d]	Category Under Which Drilling Flag Codes Could Be Assigned[f]
Amino-2,6-dinitrotoluene[4-] *Syn*: 4-ADNT	C7 H7 N3 O4	19406-51-0	—[g]	< 0.1 [based on data for 2-ADNT]	C
Amino-4,6-dinitrotoluene[2-] *Syn*: 2-ADNT	C7 H7 N3 O4	35572-78-2	—	< 0.1[h] [WE99]	C
Dinitrobenzene[1,2-] (ortho) *Syn*: 1,2-DNB	C6 H4 N2 O4	528-29-0	30 [VE01]	< 0.1 [based on K_{OC}][i]	C
Dinitrobenzene[1,3-] (meta) [j] *Syn*: 1,3-DNB	C6 H4 N2 O4	99-65-0	106 [SRC] 150 [HA96]	< 0.1[h] [WE99] 0.2[k] [HA96] 0.1 [FE98]	C
Dinitrobenzene[1,4-] (para) *Syn*: 1,4-DNB	C6 H4 N2 O4	100-25-4	150 [HSDB[l]]	< 0.2 [based on K_{OC}]	C
Dinitrotoluene[2,4-] [j] *Syn*: 2,4-DNT	C7 H6 N2 O4	121-14-2	251 [VE01]	0.3 [based on K_{OC}]	C
Dinitrotoluene[2,6-] [j] *Syn*: 2,6-DNT	C7 H6 N2 O4	606-20-2	78 [VE01]	0.1 [based on K_{OC}]	C
Dinitrotoluene[3,4-] *Syn*: 3,4-DNT	C7 H6 N2 O4	610-39-9	413 [SRC]	0.4 [based on K_{OC}]	C
Hexahydro-1,3-dinitroso-5-nitro-1,3,5-triazine *Syn:* DNX	C3 H6 N6 O4	—	—	—	C, D
Octogen; Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine; cyclotetramethylene tetranitramine *Syn:* HMX	C4 H8 N8 O8	2691-41-0	3.5 [AT97]	< 0.1 [based on K_{OC}] 0.7[m] [MO03] 8.0[n] [MO03]	C, D
Hexahydro-1-nitroso-3,5-dinitro-1,3,5-triazine *Syn:* MNX	C3 H6 N6 O5	—	—	—	C, D

Table A-4 (continued)

Analyte in the HEXP[a] Analytical Suite (and Selected Synonyms)	Stoichiometric Formula	CAS RN[b]	K_{OC}[c,d]	K_d[e] (mL/g)[d]	Category Under Which Drilling Flag Codes Could Be Assigned[f]
Nitrobenzene [o]	C6 H5 N O2	98-95-3	1 to 103 [VE01, SE86, HSDB] 229 [SRC]	0.2 [based on K_{OC}]	C
4-Methylnitrobenzene; 4-nitrobenzene *Syn:* Nitrotoluene[4-] (para)	C7 H7 N O2	99-99-0	460 [HSDB]	0.5 [based on K_{OC}]	C
1,2,3-Propanetriol trinitrate *Syn:* Nitroglycerine	C3 H5 N3 O9	55-63-0	468 [SRC] 180 [HSDB]	0.5 [based on K_{OC}]	C
Pentaerythritol tetranitrate *Syn:* PETN	C5 H8 N4 O12	78-11-5	179 to 1720 [HSDB]	0.2 to 2 [based on K_{OC}]	C, D
Cyclonite; hexahydro-1,3,5-trinitro-1,3,5-triazine; cyclotrimethylenetrinitramine *Syn:* RDX	C3 H6 N6 O6	121-82-4	63 to 270 [AT95a] 42 to 167 [HSDB]	<0.3 [based on K_{OC}] < 1 [AT95a] 0.8 [SH01] 0.3 to 1.9[m] [MO03] 6.6[n][MO03]	C
Nitramine; 2,4,6-trinitrophenylmethylnitramine; N,2,4,6-tetranitro-N-methylaniline *Syn:* Tetryl	C7 H5 N5 O8	479-45-8	2100 [HSDB] 1300 to 3000 [AT95b]	1.3 to 3 [based on K_{OC}] 5.8 [HA96]	C, D
Hexahydro-1,3,5-trinitroso-1,3,5-triazine *Syn:* TNX	C3 H6 N6 O3	13980-04-6	—	—	C, D
Trinitrobenzene[1,3,5-] [j]	C6 H3 N3 O6	99-35-4	104 to 178 [HSDB] 20 [VE01]	< 0.2 [based on K_{OC}]	C

Table A-4 (continued)

Analyte in the HEXP[a] Analytical Suite (and Selected Synonyms)	Stoichiometric Formula	CAS RN[b]	K_{OC}[c,d]	K_d[e] (mL/g)[d]	Category Under Which Drilling Flag Codes Could Be Assigned[f]
Trinitrotoluene[2,4,6-] *Syn*: alpha-TNT	C7 H5 N3 O6	118-96-7	300 to 1100 [AT95c] 1100 to 1900 [HSDB] 308 [SRC] 524 to 1584 [VE01]	< 0.1[h] [WE99] 1.7[k] [HA96] 35 to 84 [HSDB] 131[n] [MO03] 4 to 167[m] [MO03] 416[o] [MO03] 0.3 to 1.9 [based on K_{OC}]	C, D

[a] HEXP = High explosive degradation products.

[b] CAS RN = Chemical Abstract Service registry number.

[c] K_{OC} = Organic-carbon normalized partition coefficient.

[d] References for parameter values are indicated in square brackets following the value, as follows: AT95a=ATSDR 1995, 090534; AT95b=ATSDR 1995, 090558; AT95c=ATSDR 1995, 090559; AT97=ATSDR 1997, 090557; FE98=Fesch and Haderlein 1998, 090576; HA96=Haderlein et al. 1996, 090572; HSDB=National Library of Medicine 2005, 090524; MA92=Mackay et al. 1992, 094915; MO03=Monteil-Rivera et al. 2003, 090570; SE86=Seip et al. 1986, 090568; SH99=Sheremata et al. 1999, 090566; SH01=Sheremata et al. 2001, 090567; SRC=Syracuse Research Corporation 2005, 090573; VE01=Verschueren 2001, 094917; WE99=Weissmahr et al. 1999, 090561.

[e] K_d = Distribution coefficient.

[f] Analytes affected by a particular category of drilling impacts are identified in the corresponding section 4 that discusses that category, as outlined in the introduction to this appendix.

[g] — = Data are not available.

[h] Sorption coefficient was measured on Na-kaolinite with and without adsorbed natural organic matter [Weissmahr et al. 1999, 090561, p. 2596].

[i] K_d is estimated as 0.1% K_{OC}, where 0.1% is the assumed organic-carbon content of the residual bentonite drilling mud in the screen interval.

[j] This analyte is also included in the semivolatile organic compound (SVOC) analytical suite.

[k] Sorption coefficient was measured on Ca-montmorillonite (Haderlein et al. 1996, 090572, p. 616).

[l] HSDB = Hazardous Substances Data Bank.

[m] Sorption coefficient was measured on soils with total organic carbon ranging from 0.08 to 0.33%, and clay fractions ranging from 6 to 32% (Monteil-Rivera et al. 2003, 090570, Tables 1, 3, and 4).

[n] Sorption coefficient was measured on Aqua-Gel (Monteil-Rivera et al. 2003, 090570, Table 4).

[o] Sorption coefficient was measured on montmorillonite (Monteil-Rivera et al. 2003, 090570, Table 4).

Table A-5
Dioxins, Furans, Pesticides, and PCBs Relevant to this Report

Analyte (and Selected Synonyms)	Stoichiometric Formula	CAS RN[a]	K_{OC}[b,c]	K_d[d] (mL/g) [based on K_{OC}][e]	Category Under Which Drilling Flag Codes Could Be Assigned[f]
Dioxin/Furan (DIOX/FUR) Analytical Suite					
Heptachlorodibenzodioxin[1,2,3,4,6,7,8-] Syn: 1,2,3,4,6,7,8-HpCDD [g]	C12 H Cl7 O2	35822-46-9	3×10^5 to 6×10^7 [MA92]	300 to 60,000	C, D
Heptachlorodibenzofuran[1,2,3,4,6,7,8-] Syn: 1,2,3,4,6,7,8-HpCDF [g]	C12 H Cl7 O	67562-39-4	1×10^6 to 8×10^7 [MA92]	1000 to 80,000	C, D
Hexachlorodibenzodioxin[1,2,3,4,7,8-] Syn: 1,2,3,4,7,8-HxCDD [g]	C12 H2 Cl6 O2	39227-28-6	1×10^5 to 1×10^7 [MA92]	100 to 10,000	C, D
Hexachlorodibenzofuran[1,2,3,4,7,8-] Syn: 1,2,3,4,7,8-HxCDF [g]	C12 H2 Cl6 O	70648-26-9	3×10^7 [MA92]	30,000	C, D
Pentachlorodibenzodioxin[1,2,3,7,8-] Syn: 1,2,3,7,8-PCDD [g]	C12 H3 Cl5 O2	40321-76-4	82,000 [HSDB[h]] 7×10^4 to 2×10^6 [i] [MA92]	70 to 2000	C, D
Pentachlorodibenzofuran[1,2,3,7,8-] Syn: 1,2,3,7,8-PCDF [g]	C12 H3 Cl5 O	57117-41-6	4×10^5 to 3×10^7 [j] [MA92]	400 to 30,000	C, D
Tetrachlorodibenzodioxin[2,3,7,8-] Syn: 2,3,7,8-TCDD [g]	C12 H4 Cl4 O2	1746-01-6	5×10^5 to 4×10^7 [MA92]	500 to 40,000	C, D
Tetrachlorodibenzofuran[2,3,7,8-] Syn: 2,3,7,8-TCDF [g]	C12 H4 Cl4 O	51207-31-9	2×10^5 to 3×10^7 [MA92]	200 to 30,000	C, D
Octachlorodibenzodioxin Syn: OCDD [g]	C12 Cl8 O2	3268-87-9	8×10^5 to 8×10^7 [MA92]	800 to 80,000	C, D
Octachlorodibenzofuran Syn: OCDF [g]	C12 Cl8 O	39001-02-0	1×10^6 to 3×10^7 [MA92]	1000 to 30,000	C, D
Heptachlorodibenzodioxins (total)[k]	C12 H Cl7 O2	37871-00-4	3×10^5 to 6×10^7 [assumed same as 1,2,3,4,6,7,8-HpCDD]	300 to 60,000	C, D
Hexachlorodibenzodioxins (total)[k]	C12 H2 Cl6 O2	34465-46-8	1×10^5 to 1×10^7 [assumed same as 1,2,3,4,7,8-HxCDD]	100 to 10,000	C, D
Pentachlorodibenzodioxins (total)[k]	C12 H3 Cl5 O2	36088-22-9	7×10^4 to 2×10^6 [assumed same as 1,2,3,4,7-PCDD]	70 to 2000	C, D

Table A-5 (continued)

Analyte (and Selected Synonyms)	Stoichiometric Formula	CAS RN[a]	K_{OC}[b,c]	K_d[d] (mL/g) [based on K_{OC}][e]	Category Under Which Drilling Flag Codes Could Be Assigned[f]
Pentachlorodibenzofurans (total)[k]	C12 H3 Cl5 O	30402-15-4	4 x 10^5 to 3 x 10^7 [assumed same as 2,3,4,7,8-PCDF]	400 to 30,000	C, D
Pesticide/PCB (PEST/PCB) Analytical Suite (excluding analytes that have already been listed in the DIOX/FUR or PEST/PCB analytical suites)					
Aldrin[g]	C12 H8 Cl6	309-00-2	400 to 28,000 [HSDB] 410 [KE80]	0.4 to 28	C, D
Aroclor-1016 (approximate chlorine content of 42%; approximate distribution of chlorinated biphenyls in Aroclor 1016 are as follows: <1.0% mono-, 21.2% di-, 51.5% tri-, 27.3% tetra-, <0.6% pentachlorobiphenyl; biogrades slowly [HSDB])	Tri- and tetra-chlorobiphenyl	12674-11-2	17,000 to 46,000 [HSDB]	17 to 46	C, D
Aroclor-1221 (biphenyl, 12.7%; 2-chlorobiphenyl, 28.4%; 4-chlorobiphenyl, 18.7%; 2,2'-dichlorobiphenyl, 9.2%; 2,4-dichlorobiphenyl, 3.5%; 2,4'-dichlorobiphenyl, 13.6%; 4,4'-dichlorobiphenyl, 6.2%; biodegrades relatively rapidly [HSDB])	Dichlorobiphenyl	11104-28-2	6300 to 16,000 [HSDB]	6 to 16	C, D
Aroclor-1232 (biodegrades relatively rapidly)	Mono, di- and tri-chlorobiphenyl	11141-16-5	11,000 to 180,000 [HSDB]	11 to 180	C, D
Aroclor-1242 (composed of 3% mono-, 13% di-, 38% tri-, 30% tetra-, 22% penta-, and 4% hexachlorobiphenyls; biogrades slowly [HSDB, VE01])	Tri- and tetra-chlorobiphenyl	53469-21-9	10,000 to 126,000 [HSDB]	10 to 126	C, D
Aroclor-1248 (polychlorobiphenyl containing 48% chlorine. It is comprised of 2% di-, 18% tri-, 40% tetra-, 36% penta-, and 4% hexa-chlorobiphenyls; biogrades slowly [HSDB, VE01])	Tetrachlorinated biphenyl	12672-29-6	25,000 to 79,000 [HSDB]	25 to 79	C, D

Table A-5 (continued)

Analyte (and Selected Synonyms)	Stoichiometric Formula	CAS RN[a]	K_{OC}[b,c]	K_d[d] (mL/g) [based on K_{OC}][e]	Category Under Which Drilling Flag Codes Could Be Assigned[f]
Aroclor-1254 (polychlorobiphenyl containing 54% chlorine. It is comprised of 11% tetra-, 49% penta-, 34% hexa-, and 6% hepta- chlorobiphenyls; resistant to biodegradation [HSDB, VE01])	Pentachlorinated biphenyl	11097-69-1	42,500 [HSDB, KE80]	43	C, D
Aroclor-1260 (polychlorobiphenyl mixture containing 60% chlorine. It is composed of 12% penta-, 38% hexa-, 41% hepta-, 8% octa-, and 1% nona-chlorobiphenyls; resistant to biodegradation [HSDB, VE01])	Heptachlorinated biphenyl	11096-82-5	63,000 to 1.6 x 10^6 [HSDB]	63 to 1600	C, D
Aroclor-1262	—[i]	37324-23-5	—	—	C, D
BHC[alpha-][j] *Syn*: alpha-hexachlorocylohexane; alpha-HCH	C6 H6 Cl6	319-84-6	2000 [HSDB]	2 to 14 [HSDB]	C, D
BHC[beta-][j] *Syn*: beta-hexachlorocylohexane; beta-HCH	C6 H6 Cl6	319-85-7	2500 to 13,000 [HSDB]	2.5 to 13	C, D
BHC[delta-] [j] *Syn*: delta-hexachlorocylohexane; delta-HCH	C6 H6 Cl6	319-86-8	700 to 2700 [HSDB] 4260	0.7 to 4	C, D
BHC[gamma-] [g] *Syn*: 1,2,3,4,5,6-Hexachlorocyclohexane (Lindane)	C6 H6 Cl6	58-89-9	200 to 4800 [HSDB] 911 [KE80]	0.2 to 5	C, D
Chlordane[alpha-] *Syn*: trans-chlordane	C10 H6 Cl8	5103-71-9	20,000 to 76,000 [HSDB]	20 to 76	C, D
Chlordane[gamma-] *Syn*: cis-chlordane	C10 H6 Cl8	5103-74-2	251,000	251	C, D
DDD[4,4'-] [g] *Syn*: Dichlorodiphenyl dichloroethane	C14 H10 Cl4	72-54-8	16200 80,500 [KE80]	80	C, D
DDE[4,4'-] [g] *Syn*: Dichlorodiphenyl dichloroethylene	C14 H8 Cl4	72-55-9	50,100 55,000 [KE80]	55	C, D

Table A-5 (continued)

Analyte (and Selected Synonyms)	Stoichiometric Formula	CAS RN[a]	K_{OC}[b,c]	K_d[d] (mL/g) [based on K_{OC}][e]	Category Under Which Drilling Flag Codes Could Be Assigned[f]
DDT[4,4'-] [g]	C14 H9 Cl5	50-29-3	151,000 238,000 [KE80]	238	C, D
Dieldrin [g]	C12 H8 Cl6 O	60-57-1	2000 to 23,000 [HSDB] 35,600 [KE80]	2 to 23	C, D
Endosulfan I (alpha)[g]	C9 H6 Cl6 O3 S	959-98-8	2000 to 20,000 [HSDB]	2 to 20	C, D
Endosulfan II (beta)[g]	C9 H6 Cl6 O3 S	33213-65-9	2000 to 20,000 [HSDB]	2 to 20	C, D
Endosulfan Sulfate[g]	C9 H6 Cl6 O4 S	1031-07-8	32,000 [HSDB]	32	C, D
Endrin[g]	C12 H8 Cl6 O	72-20-8	11,420 [HSDB] 34,000 [KE80]	11	C, D
Endrin Aldehyde[g]	C12 H8 Cl6 O	7421-93-4	4300 [HSDB]	4.3	C, D
Endrin Ketone	C12 H8 Cl6 O	53494-70-5	4300 [HSDB]	4.3	C, D
Heptachlor[g] *Syn*: heptachlorodicyclopentadiene	C10 H5 Cl7	76-44-8	13,000 to 661,000 [HSDB] 30,000 [KE80]	13 to 661	C, D
Heptachlor Epoxide[g]	C10 H5 Cl7 O	1024-57-3	100 [HSDB, VE01] 7800 [HSDB]	0.1 to 8	C, D
Methoxychlor[4,4'-][g]	C16 H15 Cl3 O2	72-43-5	80,000 [HSDB, KE80]	80	C, D
Tetrachlorodibenzodioxins (total)	C12 H4 Cl4 O2	41903-57-5	150,000 [HSDB]	150	C, D
Tetrachlorodibenzofurans (totals)	C12 H4 Cl4 O	55722-27-5	2×10^5 to 3×10^7 [assumed same as 2,3,7,8-TCDF above]	200 to 30,000	C, D

Table A-5 (continued)

Analyte (and Selected Synonyms)	Stoichiometric Formula	CAS RN[a]	K_{OC}[b,c]	K_d[d] (mL/g) [based on K_{OC}][e]	Category Under Which Drilling Flag Codes Could Be Assigned[f]
Toxaphene (technical grade) (very complex but reproducible mixture of at least 175 C10 polychloro-derivatives, having an approximate overall empirical formula of C10H10Cl8; each congener has its own K_{oc} value [HSDB])	C10 H10 Cl8	8001-35-2	7200 [KE80] 210,000 to 1 x 10^6 [HSDB]	7 to 1000	C, D

[a] CAS RN = Chemical Abstract Service registry number.

[b] K_{OC} = Organic-carbon normalized partition coefficient.

[c] References for parameter values are indicated in square brackets following the value, as follows: HSDB=National Library of Medicine 2005, 090524; KE80=Kenaga 1980, 090571; MA92=Mackay et al. 1992, 094915 Table A-5; ST82=Strek and Weber 1982, 090577; VE01=Verschueren 2001, 094917.

[d] K_d = Distribution coefficient.

[e] K_d is estimated as 0.1% K_{OC}, where 0.1% is the assumed organic-carbon content of the residual bentonite drilling mud in the screen interval.

[f] Analytes affected by a particular category of drilling impacts are identified in the corresponding section 4 that discusses that category, as outlined in the introduction to this appendix.

[g] This analyte is also part of the SVOC analytical suite.

[h] HSDB = Hazardous Substances Data Bank.

[i] K_{OC} determined for 1,2,3,4,7-PCDD.

[j] K_{OC} determined for 2,3,4,7,8-PCDF.

[k] This analyte is also part of the PEST/PCB analytical suite.

[l] — = Data are not available.

Table A-6
Herbicides and Diesel Range Organics Relevant to this Report

Analyte (and Selected Synonyms)	Stoichiometric Formula	CAS RN[a]	K_{OC}[b,c]	K_d[d] (mL/g)[c]	Category Under Which Drilling Flag Codes Could Be Assigned[e]
Herbicide (HERB) Analytical Suite					
2-chloro-2';6';-diethyl-N-(methoxymethyl)acetanilide *Syn:* Alachlor	C14 H20 Cl N O2	15972-60-8	160 [VE01] 190 [KE80] 170 [DI95, EXT]	0.2	C, D
2-chloro-2';6';-diethyl-N-(methoxymethyl)acetanilide *Syn:* Atrazine	C14 H20 Cl N O2	1912-24-9	149 [KE80] 53 [SI90] 45 to 100 [VE01] 100 [DI95, EXT]	0.1	C, D
2-methyl-4-chlorophenoxyacetic acid *Syn*: MCPA; Chloro-o-tolyloxyacetic[4-] acid	C9 H9 Cl O3	94-74-6	100 [EXT]	0.1	C, D
2,4-dichlorophenoxyacetic acid *Syn*: D[2,4-][g]	C8 H6 Cl2 O3	94-75-7	109 [SRC] 20 [EXT, KE80]	0.1	C, D
2,2-dichloropropionic acid *Syn*: Dalapon[g]	C3 H4 Cl2 O2	75-99-0	1 [EXT] 3 [KE80] 2.3 [SRC]	< 0.1	C, D
4-(2,4-dichlorophenoxy)butanoic acid; 2,4-dichlorophenoxy-butyric acid *Syn*: DB[2,4-][g]	C10 H10 Cl2 O3	94-82-6	530 [KE80, SRC] 20 [EXT] 20 to 100 [KE80]	0.5	C, D
DBCP *Syn*: Dibromo-3-chloropropane[1,2-][h]	C3 H5 Br2 Cl	96-12-8	129 [KE80]	0.1	C, D
2-methoxy-3,6-dichlorobenzoic acid *Syn*: Dicamba[g]	C8 H6 Cl2 O3	1918-00-9	2 [EXT] 0.4 [KE80] 0 to 115 [SRC]	< 0.1	C, D
2,4-dichlorophenoxy-a-propionic acid *Syn*: Dichloroprop[g]	C9 H8 Cl2 O3	120-36-5	< 50 for pH greater than 6 [HSDB[i]]	< 0.1	C, D

Table A-6 (continued)

Analyte (and Selected Synonyms)	Stoichiometric Formula	CAS RN[a]	K_{OC}[b,c]	K_d[d] (mL/g)[c]	Category Under Which Drilling Flag Codes Could Be Assigned[e]
DNBP; 2,4-dinitro-6-sec-butylphenol (DNBP) *Syn*: Dinoseb[g,j]	C10 H12 N2 O5	88-85-7	30 [EXT] 124 [KE80, SRC]	0.1	C, D
1-1'-ethylene-2,2'-bipyridinium-dibromide *Syn:* Diquat; Diquat dibromide Note: Diquat is generally present as a bivalent cation that adsorbs by ion-exchange [HSDB].	C12 H12 Br2 N2	231-36-7 85-00-7 (cation)	2000 [HSDB]	2	C, D
7-oxabicyclo(2,2,1)heptane-2,3-dicarboxylic acid *Syn*: aquathol K; Endothall	C8 H10 O5	145-73-3	8 [HSDB, KE80]	< 0.1	C, D
N-(phosphonomethyl)glycine; glyphosate acid *Syn:* Glyphosate Note: adsorption mechanism to clays is H-bonding and ion exchange, not hydrophobic partitioning [HSDB, VE01]]	C3 H8 N O5 P	1071-83-6	2600 to 4900 [HSDB] 2640 [KE80]	8 to 138 [VE01]	C, D
Mecoprop; 2-(4-chloro-2-methylphenoxy) propionic acid *Syn:* MCPP	C10 H11 Cl O3	93-65-2	5 to 13 [HSDB]	< 0.1	C, D
4-amino-3,5,6-trichloropicolinic acid *Syn:* Picloram	C7 H3 Cl3 N2 O2	1918-02-1	0.03 to 26 [HSDB] 17 [KE80]	< 0.1	C, D
2,4,5-trichlorophenoxyacetic acid *Syn*: T[2,4,5-][g]	C8 H5 Cl3 O3	93-76-5	80 [SRC] 53 [KE80]	0.1	C, D
2-(2,4,5-trichlorophenoxy)propionic acid; *Syn*: TP[2,4,5-] Silvex[g]	C9 H7 Cl3 O3	93-72-1	2600 [HSDB, SRC, KE80]	2.6	C, D
Simazine *Syn:* 2-chloro-4,6-bis(ethylamino)-s-triazine	C7 H12 Cl N5	122-34-9	140 [HSDB] 135 [KE80]	< 0.2	C, D
Diesel Range Organics (DRO) (excluding analytes that have already been listed as part of the HERB analytical suite)					
Diesel Range Organics	na[k]	68334-30-6	1000 to 10^9 [AT99]	> 1	C, D
Methyl (4-chloro-2methylphenoxy) acetate; 2-methyl-4-chlorophenoxyacetic acid *Syn:* MCPA; MCPA methyl ester	C10 H11 Cl O3 C9 H9 Cl O3	2436-73-9 94-74-6	50 to 60 [HSDB]	< 1	C, D

Table A-6 (continued)

Analyte (and Selected Synonyms)	Stoichiometric Formula	CAS RN[a]	K_{OC}[b,c]	K_d[d] (mL/g)[c]	Category Under Which Drilling Flag Codes Could Be Assigned[e]
Total Petroleum Hydrocarbons Diesel Range Organics (TPH-DRO)	na	na	1000 to 10[g] [AT99]	> 1	C, D

[a] CAS RN = Chemical Abstract Service registry number.

[b] K_{OC} = Organic-carbon normalized partition coefficient.

[c] References for parameter values are indicated in square brackets following the value, as follows: AT99=ATSDR 1999, 090528; DI95=Diaz-Diaz et al. 1995, 090549; EXT=EXTOXNET database (Oregon State University 2005, 090526); HSDB=National Library of Medicine 2005, 090524; JA90=Jafvert 1990, 090547; KE80=Kenaga 1980, 090571; SE86=Seip et al. 1986, 090568; SI90=Singh et al. 1990, 090578; SRC=Syracuse Research Corporation 2005, 090573; VE01=Verschueren 2001, 094917.

[d] K_d = Distribution coefficient.

[e] Analytes affected by a particular category of drilling impacts are identified in the corresponding section 4 that discusses that category, as outlined in the introduction to this appendix.

[f] K_d is estimated as 0.1% K_{OC}, where 0.1% is the assumed organic-carbon content of the residual bentonite drilling mud in the screen interval.

[g] This analyte is also part of the DRO analytical suite.

[h] This analyte is also part of the volatile organic compound (VOC) analytical suite.

[i] HSDB = Hazardous Substances Data Bank.

[j] This analyte is also part of the SVOC analytical suite.

[k] na = Data are not available.

Table A-7
Polynuclear Aromatic Hydrocarbons (PAHs) Relevant to this Report

Analyte in the SVOC Analytical Suite	Stoichiometric Formula	CAS RN	K_{OC}[a]	K_d (mL/g)[a]	Category Under Which Drilling Flag Codes Could Be Assigned[b]
Acenaphthene	C12 H10	83-32-9	3890 [SRC, SZ90]	3.9	C, D
Acenaphthylene	C12 H8	208-96-8	5620 [SRC, SZ90]	5.6	C, D
Acetylaminofluorene[2-] *Syn*: N-2-Fluorenylacetamide	C15 H13 N O	53-96-3	1380 [SRC]	1.4	C, D
Anthracene	C14 H10	120-12-7	15,800 [SRC, KA81]	16	C, D
Benz(a)anthracene	C18 H12	56-55-3	200,000 [SRC]	200	C, D
Benzo(a)pyrene	C20 H12	50-32-8	5×10^6 [SRC]	5000	C, D
Benzo(b)fluoranthene	C20 H12	205-99-2	156,000 [SRC]	156	C, D
Benzo(g,h,i)perylene	C22 H12	191-24-2	406,000 [SRC]	406	C, D
Benzo(k)fluoranthene	C20 H12	207-08-9	22,000 [SRC]	22	C, D
Chrysene	C18 H12	218-01-9	133,000 [SRC]	133	C, D
Dibenz(a,h)anthracene	C22 H14	53-70-3	2×10^6 [SRC, ME80]	2000	C, D
Dimethylbenz(a)anthracene[7,12]	C20 H16	57-97-6	225,308 [SRC, ME80]	225	C, D
Fluoranthene	C16 H10	206-44-0	30,000 to 300,000 [HSDB] 41,400 [SRC]	30 to 300	C, D
Fluorene	C13 H10	86-73-7	2830 [SRC]	2.8	C, D
Indeno(1,2,3-cd)pyrene	C22 H12	193-39-5	1.6×10^6 [SRC]	1600	C, D
Methylcholanthrene[3-]	C21 H16	56-49-5	2.0×10^6 [SRC, ME80]	2000	C, D
Methylnaphthalene[1-]	C11 H10	90-12-0	730 [SRC]2291 [VO87]	2.3	C, D
Methylnaphthalene[2-]	C11 H10	91-57-6	8500 [SRC, KE80]	8.5	C, D
Naphthalene	C10 H8	91-20-3	400 to 1000 [VE01] 871 [SRC] 1300 [KE80]	1.0	C, D
Phenanthrene	C14 H10	85-01-8	18,800 [SRC, VO87] 23,000 [KE80]	19	C, D
Pyrene	C16 H10	129-00-0	62,700 [SRC, ME80] 84,000 [KE80]	63 to 84 [based on K_{OC}] 5400 [VO87]	C, D

CAS RN—Chemical Abstract Service registry number, K_d—distribution coefficient, K_{OC}—Organic-carbon normalized partition coefficient, HSDB—Hazardous Substances Data Bank

[a] References for parameter values are indicated in square brackets following the value, as follows: HSDB=National Library of Medicine 2005, 090524; KA81=Karickhoff 1981, 090546; KE80=Kenaga 1980, 090571; ME80=Means et al. 1980, 090527; SRC=Syracuse Research Corporation 2005, 090573; SZ90=Szabo et al. 1990, 090564; VE01=Verschueren 2001, 094917; VO87=Vowles and Mantoura 1987, 090562.

[b] K_d is estimated as 0.1% K_{OC}, where 0.1% is the assumed organic-carbon content of the residual bentonite drilling mud in the screen interval.

Table A-8
Semivolatile and Volatile Organic Analytes Relevant to this Reporta

Analyte in the SVOC or VOC Analytical Suite (and Selected Synonyms)	Stoichiometric Formula	CAS RN	K_{OC}[a]	K_d (mL/g)[a]	Category Under Which Drilling Flag Codes Could Be Assigned[a]
Acetone	C3 H6 O	67-64-1	18 [SRC]	0.02	B, C[a]
Benzene	C6 H6	71-43-2	49 [SRC] 83 [KE80] 60 [KA81] 38 to 53 [VE01, SE86]	< 0.1	C
Benzidine	C12 H12 N2	92-87-5	462 to 4900 [HSDB]	4.9	C, D
Benzoic Acid	C7 H6 O2	65-85-0	“Low” [HSDB] (biodegrades)	< 1	C, D
Benzyl Alcohol	C7 H8 O	100-51-6	< 5 to 15 [HSDB]	< 0.1	C
Bis(2-ethylhexyl)phthalate *Syn*: DEHP	C24 H38 O4	117-81-7	87,420 to 352,000 [HSDB]	352	C, D
Bromodichloromethane	C H Br Cl2	75-27-4	35 to 251 [HSDB]	0.3	C, D
Tribromomethane *Syn:* Bromoform	C H Br3	75-25-2	35 [HSDB]	< 0.1	C
Mmethyl bromide *Syn:* Bromomethane	C H3 Br	74-83-9	9 to 22 [HSDB]	< 0.1	C
Butanone[2-] (MEK; methyl ethyl ketone)	C4 H8 O	78-93-3	5.2 [SRC]	< 0.1	C
Butylbenzylphthalate	C19 H20 O4	85-68-7	2000 to 50,000 [HSDB]	50	C, D
Carbazole	C12 H9 N	86-74-8	114 to 12500 [HSDB]	13	C, D
Carbon disulfide	C S2	75-15-0	89 [SRC]	< 0.1	C
Carbon tetrachloride	C Cl4	56-23-5	224 [SRC] 110 [KE80]	0.2	C
3-methyl-4-chlorophenol; p-chloro-m-cresol *Syn:* Chloro-3-methylphenol[4-	C7 H7 Cl O	59-50-7	490 [HSDB]	0.5	C, D
Chlorobenzene	C6 H5 Cl	108-90-7	275 [SRC] 400 [VE01, DA91]	0.4	C, D
Chloroethane	C2 H5 Cl	75-00-3	38 [SRC]	< 0.1	C
Chloroform	C H Cl3	67-66-3	40 [SRC]	< 0.1	C
Methyl chloride *Syn:* Chloromethane	C H3 Cl	74-87-3	14 [HSDB]	< 0.1	C
Chloronaphthalene[2-]	C10 H7 Cl	91-58-7	3000 [HSDB]	3	C, D
Chlorophenol[2-]	C6 H5 Cl O	95-57-8	51 to 5012 [HSDB]	5	C, D
Dibenzofuran	C12 H8 O	132-64-9	4200 [HSDB]	4	C, D

Table A-8 (continued)

Analyte in the SVOC or VOC Analytical Suite (and Selected Synonyms)	Stoichiometric Formula	CAS RN	K_{OC}[a]	K_d (mL/g)[a]	Category Under Which Drilling Flag Codes Could Be Assigned[a]
Dibromochloromethane	C H Br2 Cl	124-48-1	35 [HSDB]	< 0.1	C
Dichlorobenzene[1,2-] (ortho)	C6 H4 Cl2	95-50-1	280 [SRC] 830 [VE01, DA91]	0.8	C, D
Dichlorobenzene[1,3-] (meta)	C6 H4 Cl2	541-73-1	293 [SRC] 1700 [VE01, DA91]	1.7	C, D
Dichlorobenzene[1,4-] (para)	C6 H4 Cl2	106-46-7	390 [KE80] 600 [SRC] 1660 [VE01]	1.7	C, D
Dichloroethane[1,1-]	C2 H4 Cl2	75-34-3	40 [SRC]	< 0.1	C
Dichloroethane[1,2-]	C2 H4 Cl2	107-06-2	32 [SRC]	< 0.1	C
Dichloroethene[cis-1,2-]	C2 H2 Cl2	540-59-0	35 to 50 [SRC]	< 0.1	C
Dichloroethylene[1,1-]	C2 H2 Cl2	75-35-4	343 [SRC]	0.3	C, D
Dichloroethylene[trans-1,2-]	C2 H2 Cl2	156-60-5	35 [SRC]	< 0.1	C
Diethyl phthalate	C12 H14 O4	84-66-2	69 to 704 [HSDB]	0.7	C, D
Dimethyl phthalate	C10 H10 O4	131-11-3	80 to 10^5 [HSDB]	100	C, D
Di-n-butyl phthalate *Syn*: DBP	C16 H22 O4	84-74-2	1100 to 1400 [HSDB]	1.4	C, D
Di-n-octyl phthalate *Syn:* DNOP	C24 H38 O4	117-84-0	6.1 x 10^5 [HSDB]	610	C, D
Diphenylhydrazine[1,2-]	C12 H12 N2	122-66-7	950 [HSDB]	1	C, D
Ethylbenzene	C8 H10	100-41-4	250 [SRC]	0.3	C, D
Hexachlorobutadiene	C4 Cl6	87-68-3	5020 to 275,000 [HSDB]	275	C, D
Isopropyltoluene[4-] *Syn:* p-cymene	C10 H14	99-87-6	4050 [HSDB]	4	C, D
Methyl tert-Butyl Ether (MTBE)	C5 H12 O	1634-04-4	11 [SRC, VE01]	< 0.1	C
Methyl-2-pentanone[4-] Syn: methyl isobutyl ketone, MIBK	C6 H12 O	108-10-1	123 [HSDB]	0.1	C
Methylene chloride	C H2 Cl2	75-09-2	28 [SRC]	< 0.1	C
p-cresol, 1-hydroxy-4-methylbenzene *Syn:* Methylphenol[4-]	C7 H8 O	106-44-5	49 to 646 [HSDB]	0.6	C, D
Nitrophenol[2-]	C6 H5 N O3	88-75-5	32 to 266 [HSDB]	0.3	C, D
Pentachlorophenol	C6 H Cl5 O	87-86-5	1000 to 4000 [HSDB]	4	C, D
Phenol	C6 H6 O	108-95-2	16 to 91 [HSDB] 27 [KE80]	< 0.1	C
Pyridine	C5 H5 N	110-86-1	50 [HSDB]	< 0.1	C

Table A-8 (continued)

Analyte in the SVOC or VOC Analytical Suite (and Selected Synonyms)	Stoichiometric Formula	CAS RN	K_{OC}[a]	K_d (mL/g)[a]	Category Under Which Drilling Flag Codes Could Be Assigned[a]
Tetrachloroethane[1,1,1,2-]	C2 H2 Cl4	630-20-6	93 [SRC] 99 [VE01]	0.1	C
Tetrachloroethane[1,1,2,2-]	C2 H2 Cl4	79-34-5	79 [SRC, VE01]	0.1	C
Tetrachloroethylene	C2 Cl4	127-18-4	363 [SRC, KA81] 177 to 350 [HSDB, SE86]	0.4	C, D
Toluene	C7 H8	108-88-3	38 to 302 [SRC, HSDB, SE86]	0.3	C, D
Trichlorobenzene[1,2,3-]	C6 H3 Cl3	87-61-6	4030 [SRC] 7413 [VE01, DA91]	7.4	C, D
Trichlorobenzene[1,2,4-]	C6 H3 Cl3	120-82-1	885 to 2100 [VE01] 1430 [SRC] 6760 [DA91]	6.8	C, D
Trichloroethane[1,1,1-]	C3 H3 Cl3	71-55-6	179 [SRC]	0.2	C
Trichloroethane[1,1,2-]	C3 H3 Cl3	79-00-5	79 [SRC] 60 to 108 [HSDB, SE86]	0.1	C
Trichloroethene	C2 H Cl3	79-01-6	104 [SRC] 70 to 140 [HSDB, SE86]	0.1	C
Trichlorofluoromethane [CFC-11]	C Cl3 F	75-69-4	93 [SRC]	0.1	C
Trimethylbenzene[1,2,4-] (pseudocumene)	C9 H12	95-63-6	720 [HSDB]	0.7	C, D
Vinyl chloride	C2 H3 Cl	75-01-4	30 [SRC]	< 0.1	C
Xylene (Total)	C8 H10	1330-20-7	129 to 289	0.3	C, D
Xylene[1,2-] [ortho]	C8 H10	95-47-6	129 [SRC]	0.1	C
Xylene[1,3-] [meta]	C8 H10	108-38-3	190 [SRC] 129 to 289 [SE86]	0.3	C, D

CAS RN—Chemical Abstract Service registry number, K_d—distribution coefficient, K_{OC}—Organic-carbon normalized partition coefficient, HSDB—Hazardous Substances Data Bank.

[a] References for parameter values are indicated in square brackets following the value, as follows: DA91=Dannenfelser et al. 1991, 090522; HSDB=National Library of Medicine 2005, 090524; KA81=Karickhoff 1981, 090546; KE80=Kenaga 1980, 090571; ME80=Means et al. 1980, 090527; SE86=Seip et al. 1986, 090568; SRC=Syracuse Research Corporation 2005, 090573; VE01=Verschueren 2001, 094917.

[b] K_d is estimated as 0.1% K_{OC}, where 0.1% is the assumed organic-carbon content of the residual bentonite drilling mud in the screen interval.

Table A-9
Mineralogical Composition and Other Physico-Chemical Characteristics of Wyoming Bentonite

Mineral Composition [MU83[a]]			
Montmorillonite	%	75	
Kaolinite	%	< 1	
Mica	%	< 1	
Quartz	%	15.2	
Feldspar	%	5 to 8	
Pyrite	%	0.3	
Calcite	%	1.4	
Others	%	2	
Organic carbon	%	0.4	
Other Constituents [WA96[b]]			
Sodium chloride (NaCl)	wt %	0.007	
Calcium sulfate ($CaSO_4$)	wt %	0.34	
Physical Characteristics [LA95[c]]			
Specific weight	g/cm^3	2.70	
Specific area	m^2/g	562	
Exchangeable Cations [LA95] [MU83]			
Total cation exchange capacity (CEC)	meq/100g	79	78
Na^+	meq/100g	56.0	62.4
Ca^{2+}	meq/100g	30.1[d]	7.4[d]
Mg^{2+}	meq/100g	15.6	3.0
K^+	meq/100g	2.3	0.2

[a] MU83=Müller-Vonmoos and Kahr 1983, as cited by Bradbury and Baeyens 2002, 090607.

[b] WA96=Wanner et al. 1996, 090529.

[c] LA95=Lajudie et al. 1995, 090542.

[d] The concentration of exchangeable calcium reported by Müller-Vonmoos and Kahr 1983 is lower than that reported by Lajudie et al. 1995 because the former authors subtracted the contribution of calcium derived from dissolution of calcium sulfate in the bentonite.

Table A-10
Inorganic Analytes and Organic Carbon Leached from Various Drilling Products Using Deionized Water

Analyte	Abbrev.	Unit	Aqua-Clear PFD	Aqua-Gel Gold Seal	Bara-Foam	Barolift	Bentonite	N-Seal	PAC-L	Quik-Gel	SDI	Soda Ash	Spun Basalt	SAPP
Alkalinity (calculated)	ALK-HCO_3 +CO_3	ppm $CaCO_3$	147058	4130	107	112		75254	85557	17596	929	1052213	—	
Antimony	Sb	ppm	<0.001	0.039		<0.002	0.056	0.02	<0.2	<0.01	<0.001		—	
Arsenic	As	ppm	<0.01	0.203		<0.02	1.374	<0.01	<0.2	0.091	<0.01		—	
Barium	Ba	ppm	0.255	0.116		<0.02	0.018	0.209	1.103	0.101	0.149		—	
Bicarbonate	HCO_3	ppm	174870	2515	131	137		89959	104380	19665	1133	58700	—	
Boron	B	ppm	0.687	0.581		0.184	1.008	0.379		0.302	0.06		—	
Bromide	Br	ppm	<0.2	<0.2		<0.2	0.27	<0.2		6.34	<0.2		—	
Calcium	Ca	ppm	34.8	65.2	27	1.67	9.98	593	116	138	27.8		—	
Carbonate	CO_3	ppm	2233	1241	0	0		910	0	886	0	602459	—	
Cesium	Cs	ppm	0.01	0.029		<0.02	<0.009	<0.01	<0.2	0.02	<0.01		—	
Chloride	Cl	ppm	13453	18.3		0.83	116	3.98	20769	65.1	21.7		2.89	
Chromium	Cr	ppm	1.277	0.097		0.018	0.082	0.009	2.941	0.07	0.035		—	
Copper	Cu	ppm	1.866	1.357		0.043	0.062	0.171	3.492	0.131	0.08		—	
Dissolved organic carbon	DOC	ppm	137481	124		1527		30.4	196664	94.2	2654		—	
Fluoride	F	ppm	26.9	8.53		<0.3	7.24	16.02	1630	10.6	1.89		11.5	
Iron	Fe	ppm	2.259	4.07	1.84	0.334	<0.09	<0.1	5.514	0.503	0.199		—	
Lead	Pb	ppm	0.147	0.021		<0.02	<0.001	<0.01	0.368	<0.01	<0.01		—	
Magnesium	Mg	ppm	1.87	17.3	5.65	0.33	1.28	0.85	16.5	13.8	5.47		—	
Manganese	Mn	ppm	0.088	0.019	<0.2	0.04	0.016	<0.01	0.368	0.08	0.015		—	
Mercury	Hg	ppm	0.012	<0.001		0.002	0.002	<0.001	<0.02	<0.001	0.001		—	
Molybdenum	Mo	ppm	0.167	0.659		<0.02	2.473	<0.01	<0.2	0.825	<0.01		—	
Nickel	Ni	ppm	0.403	0.087		<0.02	0.016	0.019	0.368	0.04	0.03		—	
Nitrate	NO_3	ppm	<0.2	109		<0.3	197	<0.2	<4	237	<0.2		6.48	
Phosphate	PO_4	ppm	220	<0.5		31.4	6.5	<0.5	10587	<0.5	<0.5		0.84	576577
Potassium	K	ppm	11.7	75.1	75	6.01	6.05	80.1	33.1	15.4	4.08		—	
Rubidium	Rb	ppm	0.01	0.078		<0.02	0.011	0.171	<0.2	0.04	<0.01		—	
Selenium	Se	ppm	0.069	0.087		<0.02	0.092	0.066	<0.2	0.191	<0.01		—	
Sodium	Na	ppm	94665	4021	77600	9.35	1347	64.2	93553	5390	638		—	207207

Table A-10 (continued)

Analyte	Abbrev.	Unit	Aqua-Clear PFD	Aqua-Gel Gold Seal	Bara-Foam	Barolift	Bentonite	N-Seal	PAC-L	Quik-Gel	SDI	Soda Ash	Spun Basalt	SAPP
Stronti)	Sr	ppm	0.393	1.163		<0.02	0.03	1.137	0.551	2.011	0.129		—	
Sulfate	SO_4	ppm	5067	7897		0.41	1008	95.7	<4	9484	99.2		35.7	
Total organic carbon	TOC	ppm				2840							299	
Uranium	U	ppm	<0.01	0.04		<0.02	0.07	0.023	<0.2	0.04	<0.01		—	
Vanadium	V	ppm	0.334	0.048		<0.04	0.128	0.152	<0.4	<0.02	<0.02		—	
Zinc	Zn	ppm	0.295	0.126		0.1	<0.009	<0.02	<0.4	<0.02	0.05		—	
CALCULATED TOTAL	CALCULATED TOTAL		428073	16101	77841	4556	2703	91756	427772	36010	4587		—	
pH	pH	SU	8.75	9.65	6.93	4.82		9.47	7.97	9.09	7.48	11.38	—	
Acetate	Acetate		+	-		+	++	-	+	-	+		+	
Formate	Formate		+	-		+	++	-	+	-	+		+	

Note: This work was conducted by Dale Counce and Patrick Longmire of Los Alamos National Laboratory's EES-6 Group (unpublished as of yet).
- = Not detected.
+ = Detected.
— = Not measured.

Table A-11
Clay Soil Adsorption Coefficients (K_ds)

Element	Number of Observations	Adsorption Coefficient K_d (mL/g)		
		Mean[a]	Minimum[b]	Maximum[b]
Elements that adsorb weakly (K_d < 80 mL/g)				
Technetium	4	1	1.16	1.32
Iodine	8	1	0.2	29
Phosphorus	1	35	—[c]	—
Calcium	1	50	—	—
Neptunium	4	55	0.4	2575
Bromide	1	75	—	—
Potassium	1	75	—	—
Elements that adsorb moderately (K_d between 80 and 500 mL/g)				
Molybdenum	7	90	13	400
Strontium	24	110	3.6	32,000
Iron	7	165	15	2121
Manganese	23	180	24	48,945
Silica	1	180	—	—
Silver	5	180	100	300
Antimony	1	250	—	—
Rubidium	1	270	—	—
Elements that adsorb strongly (K_d between 500 and 5000 mL/g)				
Cobalt	15	550	20	14,000
Lead	1	550	—	—
Cadmium	10	560	112	2450
Nickel	10	650	305	2467
Tin	1	670	—	—
Selenium	1	740	—	—
Beryllium	1	1300	—	—
Chromium	1	1500	—	—
Uranium	7	1600	46	395,000
Cesium	28	1900	37	31,500
Zinc	23	2400	200	100,000
Zirconium	1	3300	—	—
Elements that adsorb very strongly (K_d > 5000 mL/g)				
Plutonium	18	5100	316	190,000
Thorium	5	5800	244	160,000
Americium	11	8400	25	400,000
Radium	8	9100	696	56,000
Cerium	4	20,000	12,000	31,623

Source: Sheppard and Thibault 1990, 090541, Table A-3.

[a] Mean of the natural logarithms of the observed values.

[b] The wide range of values most likely reflects the varied geochemical conditions under which these coefficients were obtained.

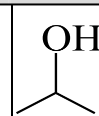
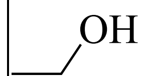
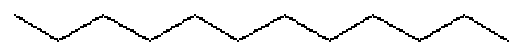
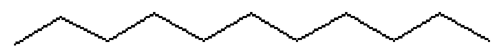
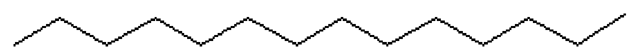
[c] — = Not reported.

Table A-12
Sodium-Bentonite Clay Adsorption Coefficients

Element	K_d (mL/g)*	Reference
Americium	20 to 200	Shibutani et al. 1994, 090540
	1400	Westsik et al. 1982, 090544
Cesium	309	Wanner et al. 1996, 090529
	480	Jurček and Jedináková-Křižová 1998, 090554
	1000	Westsik et al. 1982, 090544
	1400	Torstenfelt 1986, 090530
	32,000	Missana et al. 2004, 090538
Iodine	1	Torstenfelt 1986, 090530
Mercury	152 to 427	Akçay et al. 1996, 090531
Neptunium	29	Westsik et al. 1982, 090544
Nickel	300 to 3200	Grauer 1994, 090543
Plutonium	900 to 30,000	Shibutani et al. 1994, 090540
Strontium	53	Wang et al. 2004, 090535
	96	Wang et al. 2004, 090535
	155	Jurček and Jedináková-Křižová 1998, 090554
	2900	Torstenfelt 1986, 090530
	6800	Westsik et al. 1982, 090544
Technetium	< 50 (no Fe) 50 (0.5% Fe)	Torstenfelt 1986, 090530
Uranium	2.7 to 6.4	Akçay et al. 1996, 090531
	8	Westsik et al. 1982, 090544
	93	Torstenfelt 1986, 090539
	1000	Missana et al. 2004, 090538

* The wide range of K_d values reflects the varied geochemical conditions under which these coefficients were obtained, and emphasizes the importance of obtaining site-specific adsorption data for realistic evaluations of the distribution of these elements in groundwater. Nonetheless, this compilation serves the purpose of this report by permitting a qualitative ranking of the elements by adsorption potential (i.e., weak, moderate, strong, very strong).

Table A-13
Chemical Structures of Selected Constituents of Organic Drilling Products

Chemical	CAS RN	MW	Structural Formula	Stoichiometric Formula	Structure
Quik-Foam Constituents					
Isopropanol	67-63-0	60	$CH_3CHOHCH_3$	C_3H_8O	
Ethanol	64-17-5	46	CH_3CH_2OH	C_2H_6O	
Decyl nona(ethyleneoxide) sulfate		634	$H_3C\text{-}(CH_2)_9\text{-}(OCH_2CH_2)_9\text{-}OSO_3^-$	$C_{28}\text{-}H_{57}\text{-}O_{13}\text{-}S^-$	This molecule has a structure very similar to that of another alcohol ethoxy sulfate (AES), which is shown in Figure 4-10.
Dodecyl hexa(ethyleneoxide) sulfate		530	$H_3C\text{-}(CH_2)_{11}\text{-}(OCH_2CH_2)_6\text{-}OSO_3^-$	$C_{24}\text{-}H_{49}\text{-}O_{10}\text{-}S^-$	This molecule has a structure very similar to that of another alcohol ethoxy sulfate (AES), which is shown in Figure 4-10.
EZ-Mud Constituents					
n-Dodecane	112-40-3	170	$CH_3(CH_2)_{10}CH_3$	$C_{12}H_{26}$	
Undecane	1120-21-4	156	$CH_3(CH_2)_9CH_3$	$C_{11}H_{24}$	
Tetradecane	629-59-4	198	$CH_3(CH_2)_{12}CH_3$	$C_{14}H_{30}$	
Partially hydrolyzed (30%) polyacrylamide		~10^6	$(C_3\text{-}H_5\text{-}N\text{-}O)_x$	$(C_3\text{-}H_5\text{-}N\text{-}O)_x$	This molecule consists of repeating sequences of acrylamide and acrylic acid units that are shown in Figure 4-11.

Sources: Robison 2006, 094891; Larson 2006, 094892; Robison 2006, 094883.
MW = Molecular weight

REFERENCES

The following list includes all documents cited in this appendix. 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.

Akçay, H., S. Kilinç, and C. Karapire, September 1996. "A Comparative Study on the Sorption and Desorption of Hg, Th and U on Clay," *Journal of Radioanalytical and Nuclear Chemistry,* Vol. 214, No. 1, pp. 51-66. (Akçay et al. 1996, 090531)

ATSDR (Agency for Toxic Substances and Disease Registry), July 1992. "Toxicological Profile for Thallium," TP-54, U.S. Department of Health and Human Services, Public Health Service, Atlanta, Georgia, http://www.atsdr.cdc.gov/toxprofiles/tp54.pdf. (ATSDR 1992, 090560)

ATSDR (Agency for Toxic Substances and Disease Registry), July 1992. "Toxicological Profile for Vanadium and Compounds," TP-58, U.S. Department of Health and Human Services, Public Health Service, Atlanta Georgia, http://www.atsdr.cdc.gov/toxprofiles/tp58.html. (ATSDR 1992, 090556)

ATSDR (Agency for Toxic Substances and Disease Registry), September 1992. "Toxicological Profile for Antimony and Compounds," TP-23, U.S. Department of Health and Human Services, Public Health Service, Atlanta Georgia, http://www.aatsdr.cdc.gov/toxprofiles/tp23.pdf. (ATSDR 1992, 090533)

ATSDR (Agency for Toxic Substances and Disease Registry), June 1995. "Toxicological Profile for RDX," TP-78, U.S. Department of Health and Human Services, Public Health Service, Atlanta Georgia, http://www.atsdr.cdc.gov/toxprofiles/tp78.html. (ATSDR 1995, 090534)

ATSDR (Agency for Toxic Substances and Disease Registry), June 1995. "Toxicological Profile for Tetryl," TP-80, U.S. Department of Health and Human Services, Public Health Service, Atlanta, Georgia, http://www.atsdr.cdc.gov/toxprofiles/tp80.html. (ATSDR 1995, 090558)

ATSDR (Agency for Toxic Substances and Disease Registry), June 1995. "Toxicological Profile for 2,4,6-Trinitrotoluene (TNT)." TP-81, U.S. Department of Health and Human Services, Public Health Service, Atlanta Georgia, http://www.atsdr.cdc.gov/toxprofiles/tp81.html (ATSDR 1995, 090559)

ATSDR (Agency for Toxic Substances and Disease Registry), September 1997. "Toxicological Profile for HMX," TP-98, U.S. Department of Health and Human Services, Public Health Service, Atlanta Georgia, http://www.atsdr.cdc.gov/toxprofiles/tp98.html. (ATSDR 1997, 090557)

ATSDR (Agency for Toxic Substances and Disease Registry), September 1999. "Toxicological Profile for Total Hydrocarbons (TPH)," TP-123, U.S. Department of Health and Human Services, Public Health Service, Atlanta Georgia, http://www.atsdr.cdc.gov/toxprofiles/tp123.html. (ATSDR 1999, 090528)

ATSDR (Agency for Toxic Substances and Disease Registry), September 2002. "Toxicological Profile for Beryllium." TP-4, U.S. Department of Health and Human Services, Public Health Service, Atlanta Georgia, http://www.atsdr.cdc.gov/toxprofiles/tp4.html. (ATSDR 2002, 090555)

Bradbury, M.H., and B. Baeyens, June 2002. "Porewater chemistry in compacted re-saturated MX-80 bentonite: Physico-chemical characterisation and geochemical modelling," PSI Bericht Nr. 02-10, Paul Scherrer Institut (PSI), Waste Management Laboratory, Villigen PSI, Switzerland. (Bradbury and Baeyens 2002, 090607)

Dannenfelser R-M., M. Paric, M. White, and S.H. Yalkowsky, 1991. "A Compilation of Some Physico-Chemical Properties for Chlorobenzenes," *Chemosphere*, Vol. 23, No. 2, pp. 141–165. (Dannenfelser et al. 1991, 090522)

Diaz-Diaz, R., C. Gaggi, J.C. Sanchez-Hernandez, and E. Bacci, 1995. "The Role of Soil and Active Ingredient Properties in Degradation of Pesticides: A Preliminary Assessment," *Chemosphere,* Vol. 30, No. 12, pp. 2375–2386. (Diaz-Diaz et al. 1995, 090549)

Fesch, C., and S.B. Haderlein, 1998. "Competitive Sorption and Multiple-Species Subsurface Transport of Nitro-Aromatic Explosives: Implications for their Mobility at Contaminated Sites," *Groundwater Quality: Remediation and Protection* (Proceedings of the GQ'98 Conference held at Tubingen, Germany, September 1998), IAHS Publ. No. 250. (Fesch and Haderlein 1998, 090576)

Grauer, R., 1994. "Bentonite as a Backfill Material in a High-Level Waste Repository," *Materials Research Society Bulletin*, Vol. 19, No. 12, pp. 43–46. (Grauer 1994, 090543)

Haderlein, S.B., K.W. Weissmahr, and R.P. Schwarzenbach, 1996. "Specific Adsorption of Nitroaromatic Explosives and Pesticides to Clay Minerals," *Environmental Science and Technology*, Vol. 30, pp. 612–622. (Haderlein et al. 1996, 090572)

Jafvert,C.T., 1990. "Sorption of Organic Acid Compounds to Sediments: Initial Model Development," *Ecotoxicology and Environmental Safety*, Vol. 9, pp. 1259–1268. (Jafvert 1990, 090547)

Jurček, P., and V. Jedináková-Křižová, 1998. "Sorption and Diffusion Processes with ^{134}Cs and ^{85}Sr in Natural Sorbents," *Journal of Radioanalytical and Nuclear Chemistry*, Vol. 229, Nos. 1-2, pp. 57–60. (Jurček and Jedináková-Křižová 1998, 090554)

Karickhoff, S.W., 1981. "Semi-Empirical Estimation of Sorption of Hydrophobic Pollutants on Natural Sediments and Soils," *Chemosphere*, Vol. 10, pp. 833–846. (Karickhoff 1981, 090546)

Kenaga, E.E., 1980. "Predicted Bioconcentration Factors and Soil Coefficients of Pesticides and Other Chemicals," *Ecotoxicology and Environmental Safety*, Vol. 4, pp. 26–38. (Kenega 1980, 090571)

Lajudie, A., J. Raynal, J-C. Petit, and P. Toulhoat, 1995. "Clay-Based Materials for Engineered Barriers: A Review," *Materials Research Society Symposium Proceedings*, Vol. 353, pp. 221–230. (Lajudie et al. 1995, 090542)

LANL (Los Alamos National Laboratory), June 2005. "Groundwater Background Investigation Report," Los Alamos National Laboratory document LA-UR-05-2295, Los Alamos, New Mexico. (LANL 2005, 090580)

Larson, T., October 30, 2006. "Drilling Fluid Characterization," Los Alamos National Laboratory memorandum to J. Fabryka-Martin (EES-6) from T. Larson (EES-6), Los Alamos, New Mexico. (Larson 2006, 094892)

Mackay, D., W.Y. Shiu, and K.C. Ma, 1992. Excerpted pages from the *Illustrated Handbook of Physical-Chemical Properties and Environmental Fate for Organic Chemicals*. Vol. II, Lewis Publishers, Boca Raton, Florida. (Mackay et al. 1992, 094915)

Means, J.C., S.G. Wood, J.J. Hassett, and W.L. Banwart, 1980. “Sorption of Polynuclear Aromatic Hydrocarbons by Sediment and Soils,” *Environmental Science and Technology*, Vol. 14, pp. 1524–1528. (Means et al. 1980, 090527)

Missana, T., M. Garcia-Gutierrez, and U. Alonso, 2004. “Kinetics and Irreversibility of Cesium and Uranium Sorption onto Bentonite Colloids in a Deep Granitic Environment,” *Applied Clay Science*, Vol. 26, pp. 137–150. (Missana et al. 2004, 090538)

Monteil-Rivera, F., Groom, C., and Hawari, J., 2003. “Sorption and Degradation of Octahydro-1,3,5,7-Tetranitro-1,3,5,7-tetrazocine in Soil, *Environmental Science and Technology*, Vol. 37, pp. 3878–3884. (Monteil-Rivera et al. 2003, 090570)

Müller-Vonmoos, M., and G. Kahr, 1983. “Mineralogische Untersuchungen von Wyoming Bentonite MX-80 und Montigel,” Report NTB 83-13, National Cooperative for the Disposal of Nuclear Waste (Nagra), Wettingen, Switzerland (cited in Bradbury and Baeyens 2002, 090607).

National Library of Medicine, TOXNET (Toxicology Data Network), Hazardous Substances Data Bank (HSDB), http://toxnet.nlm.nih.gov/, accessed November 7, 2005. (National Library of Medicine 2005, 090524)

Oregon State University, EXTOXNET (EXtension TOXicology NETwork), Pesticide Information Profiles, http://ace.orst.edu/info/extoxnet/, accessed November 7, 2005. (Oregon State University 2005, 090526)

Robison, T., November 6, 2006. “Characterization of Quik-Foam (Draft for review and comment),” Los Alamos National Laboratory memorandum to J. Fabryka-Martin (EES-6) from T. Robison (C-CSE), Los Alamos, New Mexico. (Robison 2006, 094883)

Robison, T., December 6, 2006. “Characterization of EZ-Mud (Draft for review and comment),” Los Alamos National Laboratory memorandum to J. Fabryka-Martin (EES-6) from T. Robison (C-CSE), Los Alamos, New Mexico. (Robison 2006, 094891)

Seip, H.M., J. Alstad, G.E. Carlsberg, K. Martinsen, and R. Skaane, 1986. “Measurement of Mobility of Organic Compounds in Soils,“ *The Science of the Total Environment*, Vol. 50, pp. 87–101. (Seip et al. 1986, 090568)

Sheppard, M.I., and D.H. Thibault, 1990. “Default Soil Solid/Liquid Partition Coefficients, K_ds, for Four Major Soil Types: A Compendium,” *Health Physics,* Vol. 59, No. 4, pp. 471–482. (Sheppard and Thibault 1990, 090541)

Sheremata T.W., S. Thiboutot, G. Ampleman, L. Paquet, A. Halasz, and J. Hawari, 1999. “Fate of 2,4,6-Trinitrotoluene and Its Metabolites in Natural and Model Soil Systems,” *Environmental Science and Technology*, Vol. 33, pp. 4002–4008. (Shermata et al. 1999, 090566)

Sheremata T.W., A. Halasz, L. Paquet, S. Thiboutot, G. Ampleman, and J. Hawari, 2001. “The Fate of the Cyclic Nitramine Explosive RDX in Natural Soil,” *Environmental Science and Technology*, Vol. 35, pp. 1037–1040. (Sheremata et al. 2001, 090567)

Shibutani, T., M. Yui, and H. Yoshikawa, 1994. “Sorption Mechanism of Pu, Am and Se on Sodium-Bentonite,” *Materials Research Society Symposium Proceedings*, Vol. 333, pp. 725–730. (Shibutani et al. 1994, 090540)

Singh, G., W.F. Spencer, M.M. Cliath, and M.T. Vangenuchten, 1990. "Sorption Behavior of s-triazine and Thiocarbamate Herbicides on Soils," *Journal of Environmental Quality*, Vol. 19, pp. 520–525. (Singh et al. 1990, 090578)

Strek, H. J. and J.B. Weber, 1982. "Behavior of Polychlorinated Biphenyls (PCBs) in Soils and Plants," *Environmental Pollution (Series A)*, Vol. 28, pp. 291–312. (Strek and Weber 1982, 090577)

Syracuse Research Corporation, Environmental Fate Database, CHEMFATE, http://www.syrres.com/esc/efdb.htm, accessed November 7, 2005. (Syracuse Research Corporation 2005, 090573)

Szabo,G., S.L. Prosser, and R.A. Bulman, 1990. "Determination of the Adsorption Coefficient (K_{oc}) of Some Aromatics for Soil by RP-HPLC on Two Immobilized Humic Acid Phases," *Chemosphere*, Vol. 21, pp. 777–788. (Szabo et al. 1990, 090564)

Torstenfelt, B., 1986. "Migration of the Actinides Thorium, Protactinium, Uranium, Neptunium, Plutonium, and Americium in Clay," *Radiochimica Acta*, Vol. 39, pp. 105–112. (Torstenfelt 1986, 090539)

Torstenfelt, B., 1986. "Migration of the Fission Products Strontium, Technetium, Iodine and Cesium in Clay," *Radiochimica Acta*, Vol. 39, pp. 97–104. (Torstenfelt 1986, 090530)

Verschueren, K., 2001. Excerpted pages from the *Handbook of Environmental Data on Organic Chemicals*. Vol. 1, 4th ed., John Wiley & Sons, Inc., New York, New York. (Verschueren 2001, 094917)

Vowles, P.D., and R.F.C. Mantoura, 1987. "Sediment-Water Partition Coefficients and HPLC Retention Factors of Aromatic Hydrocarbons," *Chemosphere*, Vol. 16, pp. 109–116. (Vowles and Mantoura 1987, 090562)

Wang, X., Y. Chen, and Y. Wu, 2004. "Sorption and Desorption of Radiostrontium on Powdered Bentonite: Effect of pH and Fulvic Acid," *Journal of Radioanalytical and Nuclear Chemistry*, Vol. 261, No. 3, pp. 497–500. (Wang et al. 2004, 090535)

Wanner, H., Y. Albinsson, and E. Wieland, 1996. "A Thermodynamic Surface Model for Caesium Sorption on Bentonite," *Fresenius Journal of Analytical Chemistry*, Vol. 354, pp. 763–769. (Wanner et al. 1996, 090529)

Weissmahr, K.W., M. Hildenbrand, R.P. Schwarzenbad, and S.B. Haderlein, 1999. "Laboratory and Field Scale Evaluation of Geochemical Controls on Groundwater Transport of Nitroaromatic Ammunition Residues," *Environmental Science and Technology*, Vol. 33, pp. 2593–2600. (Weissmahr et al. 1999, 090561)

Westsik, J.H., Jr., L.A. Bray, F.N. Hodges, and E.J. Wheelwright, 1982. "Permeability, Swelling and Radionuclide Retardation Properties of Candidate Backfill Materials," *Materials Research Society Proceedings*, Vol. 6, pp. 329–336. (Westsik et al. 1982, 090544)

Appendix B

Drilling Methods and Dates,
Screen Descriptions, and Sampling Events

Table B-1
Well Drilling, Construction, and Development Histories

Well	Well Drilling Completed	Well Construction Completed	Well Development Completed	Total Volume Purged (gal.)	Volume Removed During Hydrologic Testing (gal.)	Sampling System Installation Completed[a]	Total Depth (ft bgs)	Water Table Depth (ft)	Screen Type	# Screens[b]
CdV-16-1(i)	6-Nov-03	12-Nov-03	17-Dec-03	5468	2526	na[c]	683	564	Single	1
CdV-16-2(i)r	24-Jul-05	30-Jul-05	22-Aug-05	11624	304	na	874	840	Single	1
CdV-R-15-3	27-Apr-00	20-Jun-00	1-Sep-00	39770	na	19-Sep-00	1722	1245	Multiple	6
CdV-R-37-2	5-Aug-01	17-Aug-01	21-Sep-01	27340	na	8-Oct-01	1664	1197	Multiple	4
MCOBT-4.4	14-Jun-01	1-Jul-01	13-Feb-02	1895	na	na	767	na	Single	1
R-1	8-Nov-03	14-Nov-03	25-Nov-03	9760	8912	na	1165	1003	Single	1
R-2	17-Oct-02	22-Oct-03	11-Dec-03	11895	4976	na	944	892.5	Single	1
R-3i	14-Aug-05	16-Aug-05	9-Dec-05	1015	na	na	268[d]	191	Single	1
R-4	26-Sep-03	3-Oct-03	10-Oct-03	14150	42197	na	843	732	Single	1
R-5	20-May-01	31-May-01	21-Jun-01	14230	na	19-Jul-01	902	685	Multiple	4
R-6	11-Nov-04	4-Dec-04	5-Jan-05	19263	11001	na	1303	1158	Single	1
R-6i	9-Dec-04	20-Dec-04	14-Feb-05	1031	3975	na	660	na	Single	1
R-7	12-Jan-01	31-Jan-01	8-Feb-01	3000	na	26-Feb-01	1097	903	Multiple	3
R-8	27-Jan-02	1-Feb-02	14-Feb-02	19740	2250	24-Feb-02	880	709	Multiple	2
R-9	1-Oct-99	1-Oct-99	13-Feb-00	3000	26700	na	771	688	Single	1
R-9i	9-Mar-00	11-Mar-00	7-Apr-00	4465	na	15-Apr-00	322	na	Multiple	2
R-10	16-Sep-05	5-Oct-05	6-Oct-05	81000	51000	15-May-06	1165	651	Multiple	2
R-10a	29-Jul-05	18-Aug-05	7-Sep-05	135609	37823	na	7665	624	Single	1
R-11	2-Oct-04	8-Oct-04	21-Oct-04	na	85976	na	926.5	835.5	Single	1
R-12	10-Jan-00	21-Jan-00	6-Feb-00	1613	na	1-Mar-00	886	805	Multiple	3
R-13	20-Sep-01	6-Oct-01	30-Oct-01	24710	na	na	1133	834	Single	1
R-14	2-Jul-02	11-Jul-02	18-Nov-02	205010	4750	25-Nov-02	1327	1182	Multiple	2
R-15	31-Aug-99	7-Sep-99	20-Feb-00	657	41130	na	1107	964	Single	1

Table B-1 (continued)

Well	Well Drilling Completed	Well Construction Completed	Well Development Completed	Total Volume Purged (gal.)	Volume Removed During Hydrologic Testing (gal.)	Sampling System Installation Completed[a]	Total Depth (ft bgs)	Water Table Depth (ft)	Screen Type	# Screens[b]
R-16	29-Aug-02	7-Sep-02	4-Dec-02	76850	22800	10-Dec-02	1287	642	Multiple	4
R-16r	27-Sep-05	11-Oct-05	17-Oct-05	20711	9378	na	655	564	Single	1
R-17	13-Dec-05	4-Jan-06	24-Feb-06	18557	16583	12-Dec-06	1167	1036	Multiple	2
R-18	2-Dec-04	14-Dec-04	24-Jan-05	18870	12933	na	1440	1288	Single	1
R-19	13-Mar-00	1-Apr-00	24-Jun-00	50000	na	11-Sep-00	1903	1178	Multiple	7
R-20	6-Sep-02	15-Sep-02	22-Dec-02	87008	8840	18-Jan-03	1365	837	Multiple	3
R-21	17-Nov-02	20-Nov-02	5-Dec-02	3205	13337	na	995	803	Single	1
R-22	11-Oct-00	19-Oct-00	19-Nov-00	38877	na	8-Dec-00	1489	890	Multiple	5
R-23	27-Sep-02	2-Oct-02	20-Feb-03	31870	na	na	935	829	Single	1
R-23i	22-Oct-05	10-Nov-05	20-Dec-05	32146	1189 (Screen 3 only)	15-Dec-06	695	525	Multiple	3
R-24	25-Aug-05	12-Sep-05	20-Sep-05	15781	8666	na	881	720	Single	1
R-25	24-Feb-99	5-Mar-99	13-Sep-00	192000	na	2-Oct-00	1942	1286	Multiple	9
R-26	17-Oct-03	21-Oct-03	16-Nov-03	41069	14225	16-Jan-04	1491	604	Multiple	2
R-27	22-Oct-05	7-Nov-05	14-Nov-05	38792	na	na	987	811	Single	1
R-28	9-Dec-03	17-Dec-03	13-Jan-04	15250	10059	na	1005	888.8	Single	1
R-31	8-Feb-00	19-Feb-00	27-Mar-00	14930	na	6-Apr-00	1103	522	Multiple	5
R-32	7-Aug-02	12-Aug-02	10-Nov-02	114970	28920	17-Nov-02	1008	783.4	Multiple	3
R-33	3-Oct-04	13-Oct-04	22-Nov-04	122180	26418	3-Dec-04	1140	979	Multiple	2
R-34	9-Aug-04	20-Aug-04	2-Sep-04	34120	16852	na	1065	796	Single	1

Source: Compiled from the well completion reports listed at the end of this appendix.

[a] Westbay sampling systems were installed in all multiple-screen wells with the following exceptions: R-10 (BASKI system), R-17 (BASKI system), R-23i (BASKI system), and R-33 (BARCAD system).

[b] This screen count (total, 95 screens) includes several screens that are dry, plugged, or otherwise not suitable or capable for providing water-quality samples. Table B-5 indicates which screens provide samples, and which ones do not.

[c] na = Not available.

[d] The R-3i corehole collapsed to 237.5 ft bgs prior to well construction and was backfilled with bentonite pellets (along with a small quantity of EZ-MUD) and sand from 237.5 to 222.6 ft bgs before well construction.

Table B-2
Drilling Methods and Materials Used in Each Well

Well	Drilling Method	EZ-MUD	QUIK-FOAM	Bentonite Mud	Other Drilling Additives
CdV-16-1(i)	Fluid-assisted air rotary. Screen interval drilled using QUIK-FOAM and EZ-MUD; no bentonite mud	x	x	—	WELL-GUARD drilling thread; potassium bromide (KBr) added as tracer
CdV-16-2(i)r	Air-rotary and fluid-assisted air-rotary	x	x	—	VERSAFOAM surfactant, defoaming agent
CdV-R-15-3	Open-hole fluid-assisted air-rotary; no bentonite mud but screens 3 and 5 partially obscured with bentonite-rich annular fill	x	x	x	—
CdV-R-37-2	Fluid-assisted air-rotary reverse-circulation (open hole to 794'; casing advance to 1208'); no bentonite mud	x	x	—	—
MCOBT-4.4	Fluid-assisted air-rotary; no bentonite mud	x	x	—	—
R-1	Fluid-assisted air rotary (140' – 1165'); no bentonite mud	x	x	—	Potassium bromide tracer, WELL-GUARD drilling thread
R-2	Fluid-assisted air rotary (143'–403'); mud rotary (403'–944') with Aqua-Gel bentonite	x	x	x	PAC-L, soda ash, potassium bromide tracer, WELL-GUARD drilling thread
R-3i	Open-hole air rotary coring rig	—	—	—	Collapsed portion of borehole backfilled with bentonite pellets containing small amount of EZ-MUD
R-4	Open-hole air rotary with foam (40'–266'); mud rotary (266'–843') with Aqua-Gel bentonite	x	x	x	PAC-L, soda ash, WELL-GUARD drilling thread
R-5	Open-hole down-the-hole hammer bit (130'–828'), casing advance (570–850'); air-rotary, at times fluid-assisted with polymer additives; no bentonite mud	x	x	—	—
R-6	Air rotary (to 945'), mud rotary (945'–1303')	x	x	x	MAX-GEL, N-SEAL, PAC-L, soda ash
R-6i	Air rotary; fluid-assisted air rotary; no bentonite mud	—	x	—	—
R-7	Fluid-assisted air rotary, reverse circulation; advanced casing (to 290'); no bentonite mud	x	x	—	—
R-8	DTH: casing advance (to 706'); open-hole (684'–862'); casing-advance through slough (to 809'); open-hole (809'–880'); no bentonite mud	x	x	—	—
R-9	Air rotary (to 771'); with casing advance at times; no bentonite mud	x	x	—	—
R-9i	Open-hole rotary methods; no bentonite mud	—	—	—	—

Table B-2 (continued)

Well	Drilling Method	EZ-MUD	QUIK-FOAM	Bentonite Mud	Other Drilling Additives
R-10	Air rotary and mud rotary	—	x	x	DRISPAC
R-10a	Air rotary and fluid-assisted air rotary	x	x	—	Defoaming agent
R-11	Fluid-assisted open-hole air-rotary; no bentonite mud	x	x	—	None noted
R-12	Open-hole, air rotary with casing advance; no bentonite mud	x	x	—	TORKease
R-13	Fluid-assisted open-hole air rotary; no bentonite mud but bentonite fell into the well during backfilling operations and was difficult to remove	—	x	x	Lost hydraulic fluid (165 gal. at 800–832 ft bgs)
R-14	Fluid-assisted air rotary (above water table); mud rotary (below water table)	—	x	x	Soda ash, PAC-L, N-SEAL, Magma Fiber, LIQUI-TROL, Aqua Clear MGA, AE, and PFD
R-15	Casing advance, fluid-assisted air rotary	x	—	x	TORKease, EZ-Mud and bentonite slurries used to lubricate between casing and borehole wall
R-16	Fluid-assisted air rotary (to 867'); mud rotary (867'–1287')	x	x	x	Liqui-Trol, Magma Fiber, N-SEAL, PAC-L, soda ash, Aqua Clear PFD
R-16r	Air rotary, fluid-assisted air-rotary, air rotary casing hammer (ARCH)	x	x	—	—
R-17	Air rotary	x	x	—	Defoamer
R-18	Air rotary (to 771'); fluid-assisted air rotary; no bentonite mud	x	x	—	—
R-19	Air rotary (dry to 143'; with lubrication slurry for 143'–1902.5'); no bentonite mud	x	x	—	TORKease
R-20	Conventional mud rotary using QUIK-GEL (bentonite), fluid-assisted air rotary with casing-advance, and air rotary core with wireline retrieval	—	x	x	Liqui-Trol, Magma Fiber, N-SEAL, soda ash, PAC-L, Aqua Clear MGA, AE, and PFD
R-21	Air rotary; no bentonite mud	x	x	—	—
R-22	Fluid-assisted reverse-circulation air rotary drilling with casing advance; no bentonite mud	x	x	—	—
R-23	Fluid-assisted air rotary; used QUIK-GEL (bentonite) only to stiffen QUIK-FOAM	—	x	—	Liqui-Trol, Magma Fiber, N-SEAL, PAC-L, soda ash
R-23i	Air rotary casing hammer (ARCH)	x	x	—	Defoamer
R-24	Air rotary and fluid-assisted air rotary	x	x	—	—

Table B-2 (continued)

Well	Drilling Method	EZ-MUD	QUIK-FOAM	Bentonite Mud	Other Drilling Additives
R-25	Air rotary with casing advance; fluid assist with QUIK-FOAM and EZ-MUD (588'–1427', 1507'–1547'); no bentonite mud	x	x	—	Magma Fiber, MF-1 flocculant, TORKease, SAPP (during well development)
R-26	Air rotary, fluid-assisted air rotary (from 205 to 1000 ft bgs; QUIK-FOAM and EZ-MUD), mud rotary (1000 ft to total depth [TD]; Aqua-Gel bentonite, soda ash, and Pac-L)	x	x	x	PAC-L, soda ash
R-27	Air rotary and foam-assisted air rotary	x	x	—	—
R-28	Air rotary (to 325'), fluid-assisted air rotary (QUIK-FOAM and EZ-MUD); no bentonite mud	x	x	—	Potassium bromide tracer, WELL-GUARD drilling thread
R-31	Air rotary (to 345'), air rotary with lubricating slurry containing TORKease and EZ-MUD (345'–1103'); no bentonite mud	x	x	—	TORKease
R-32	Fluid-assisted air rotary with soda ash, QUIK-GEL, Liqui-Trol, and QUIK-FOAM (to 908'); mud rotary using QUIK-GEL (bentonite) and Liqui-Trol (908'–1008')	x	x	x	Liqui-Trol, Magma Fiber, N-SEAL, PAC-L, soda ash
R-33	Air rotary, fluid-assisted air rotary with QUIK-FOAM and EZ-MUD; no bentonite mud	x	x	—	Defoaming agent
R-34	Air rotary, fluid-assisted air rotary with QUIK-FOAM and EZ-MUD; no bentonite mud	x	x	—	WELL-GUARD drilling thread; KBr added as tracer

Source: Compiled from well completion reports and geochemistry reports listed at the end of this appendix.

Table B-3
Descriptions of Drilling Fluid Products Used in Wells

Product Name	Description	Typical Amount Added per 100 gal. of Water	Use
AQUA-CLEAR AE	Liquid blend of acid and acid enhancers (AE), solution pH 1.1.	5–9 gal. or Add 1 gal. Aqua-Clear AE to every 10 lb Aqua-Clear modified granular acid (MGA)	Well rehabilitation; to control bacterial slime caused by iron- and sulfate-reducing bacteria. Used in combination with Aqua-Clear MGA. Acts by replacing solution in well screen and adjacent formation, emplaced by surging, swabbing, or other method of agitation. Must be flushed and neutralized (e.g., with soda ash) following the rehabilitation procedure.
AQUA-CLEAR MGA	Dry blend of modified granular acid (MGA) and additives used in the removal of iron, manganese and carbonate scale. pH of 10% solution—0.9	50–100 lb	Acid for cleaning well. Removes scale and incrustation from the water well screen, casing, gravel pack and pumping equipment. Must be flushed and neutralized (e.g., with soda ash) following the rehabilitation procedure.
AQUA-CLEAR PFD	Dry granular copolymer viscosifying agent containing a phosphate-free dispersant (PFD), pH (neat)—6.5 to 7.5	0.2 gal. (0.2% by volume)	Applied to screens after drilling to loosen drilling mud cake, in combination with screen surging and bailing. Also used as a mud thinner by reducing viscosity and gel strength of drilling fluid
AQUA-GEL	Powdered (200-mesh) Wyoming sodium bentonite (primarily montmorillonite) with 0.0125% polyacrylate polymer added	30–50 lb	Drilling mud. Functions as a viscosifier and filtrate reducer in drilling fluid.
AQUA-GEL GOLD SEAL	Untreated powdered (200-mesh) sodium bentonite (primarily montmorillonite) from Wyoming)	30–50 lb	Drilling mud, especially for environmental drilling because it contains no polymer additives or chemical treatments. Functions as a viscosifier and filtrate reducer in drilling fluid.
DRISPAC Polymer	Polyanionic cellulosic polymers suspended in a glycol ether base fluid Note: Identical to PAC-L except for oil suspension	0.2–1.6 gal./bbl (barrel volume)	Controls fluid loss, produces a thick filter cake, improves mud stability. Stable suspension that eliminates problems of polymer lumping and incomplete viscosity development; provides dispersion of particles in treated fluids before hydration begins

Table B-3 (continued)

Product Name	Description	Typical Amount Added per 100 gal. of Water	Use
EZ-MUD	Liquid polymer emulsion containing partially hydrolyzed polyacrylamide/polyacrylate (PHPA) copolymer. Solution pH (1qt/100 gal.)—8.5	1 qt	Drilling fluid additive, to stabilize borehole, provide lubricity, and stiffening the foam to improve foam performance. Primarily used as a borehole stabilizer to prevent reactive shale and clay from swelling and sloughing. Also added to low-solids drilling fluids to increase lubricity, fluid viscosity, and to improve carrying capacity of air/foam injection fluids. Acts by encapsulating or coating the clay particle to render it inert and to retard the swelling process long enough to complete the well. Breaks down chemically with bleach (sodium hypochlorite) at 1 gal. per 100 gal. Requires pH between 8.5 to 9.5.for the make-up water used to mix the EZ-MUD.
EZ-MUD PLUS	High molecular weight version of EZ-MUD. Liquid polymer emulsion containing PHPA copolymer. Solution pH (1 qt/100 gal.)—8.5	1 qt	Same as EZ-MUD
LIQUI-TROL	Free-flowing, liquid suspension of a modified natural cellulosic polymer, in an ultraclean oil. Solution pH (0.3% solution)—9.0	2 qt (when added to QUIK-GEL slurry)	Drilling fluid additive, added to QUIK-GEL slurry to yield a drilling mud system suitable for drilling in water sensitive formations. Stabilizes formation, improves drilling mud suspension and stabilization properties, and improves foam performance and hole cleaning by improving cuttings transport.
MAGMA FIBER	Specially formulated extrusion spun mineral fiber. Coarse, long, flexible vitreous fiber made from blast furnace slag and/or basalt (mixture).	n/a*	Mixed into mud system to give increased circulation by bridging and plugging off voids, fractures and all types of permeable formations. The network of fibers traps solids to create an effective seal. Interlocking mineral fiber provides a strong framework for an extremely durable mud cake. Removed by simple acidization, leaving a greater volume of flow channels open for production. In an acid solution, acid-soluble consitutents dissolve, the alumino-silica structure breaks down, and the remaining material dissolves. The SiO_2 forms soluble silicic acid which, with time, come together to form short soluble chains of polysilicic acid. Eventually silica gel may form and drop out of solution. Although MAGMA FIBER is highly soluble in 7.5% to 15% HCl acid, the manufacturer recommends that a 10% HVL / 5% acetic mixture be used so as to ensure that the silica acid remains in solution. Use one gal. of acid for every two pounds of MAGMA FIBER used. May give off H_2S gas when acid is added.

Table B-3 (continued)

Product Name	Description	Typical Amount Added per 100 gal. of Water	Use
N-SEAL	95% acid-soluble lost-circulation material; especially formulated extrusion spun mineral fiber.	5–20 lb	Additive for lost circulation material. Due to its solubility in weak acids, N-SEAL is easily removed from production zones. To dissolve 1 lb of N-SEAL, treat with 1–2 lb Aqua-Clear MGA or 0.5–1 gal. of 10% HCl/5% acetic acid blend
PAC-L	Modified natural cellulosic polymer (fiber), provides filtration control in most water-based drilling fluids without substantially increasing viscosity. PAC-L, when added to QUIK-GEL or BORE-GEL slurry, yields a drilling mud system suitable for drilling in sandy formation. pH (1% aqueous solution)—7.75	0.5–2 lb	Provide filtration control in water-based drilling fluids. Reduce fluid loss without significantly increasing fluid viscosity. Encapsulate shale (or clay) to prevent swelling and disintegration. Minimize rod chatter, rotational torque and circulating pressure. Improve hole cleaning and core recovery.
PEL-PLUG	Compressed bentonite pellets 100% pure, chemically unaltered.	n/a	For sealing casing and hole abandonment.
PEL-PLUG TR30/60	Compressed bentonite pellet with a timed-release (TR) biodegradable nonsticking coating. Coating is described as “natural resin in aqueous solution”	n/a	The TR coating, developed by PDSCo, allows the pellets to be poured through standing water without sticking together, eliminating void and bridging. Delayed swelling is critical for deep holes. The MSDS lists Sodium Carbonate as an ingredient.
QUIK-FOAM	Proprietary blend of alcohol ethoxy sulfates (AES) which are biodegradable, is an effective high-quality, high-expansion foaming agent. QUIK-FOAM can be added to fresh, brine, or brackish water for air/foam, air/gel-foam, or mist drilling applications. Ammonium salt form.	0.5–2 gal.	Foaming agent: Enhances the rate of cuttings removal; increases the ability of lifting large volumes of water; reduces the sticking tendencies of wet clays, thereby eliminating mud rings and wall packing; reduces erosion of poorly consolidated formations; provides a technique for drilling in zones with lost circulation; increases borehole stability
QUIK-GEL	Finely ground (200-mesh), premium-grade, high-yielding treated Wyoming sodium bentonite. QUIK-GEL contains 0.11% sodium and polyacrylate polymer (Wisconsin DNR 2006, 094912). pH (3% solution)—8.9	Normal drilling: 15–25 lb Unconsolidated formation: 35–50 lb Gel/foam drilling system: 12–15 lb	Imparts viscosity, fluid loss control and gelling characteristics to drilling fluids. Forms a low-solids drilling fluid. Reduces filtration by forming a thin filter cake with low permeability and excellent suspension properties. Improves hole-cleaning capability of drilling fluids. Mix with foaming agents to make “gel/foam” drilling fluids for air/foam drilling applications. Recommended pretreatment of make-up water with 1–2 lb soda ash per 100 gal. to increase yield.
SAPP	Sodium acid pyrophosphate	n/a	Thins low-pH mud systems

Table B-3 (continued)

Product Name	Description	Typical Amount Added per 100 gal. of Water	Use
SDI DEFOAMER	Organosilcone emulsion	(1 cup in 5 gal. water)	Defoamer, applied at ground surface. Occasionally used sparingly downhole for downhole video.
Soda ash	Anhydrous sodium carbonate (Na_2CO_3) in the form of white granular powder. pH (5% solution)—11.5	100–200 lb See entries under "Use" for Aqua Clear AE, Aqua Clear MGA, and QUIK-GEL	Acid neutralizer; alkalinity and water-hardness control. Used to raise pH so as to precipitate soluble calcium in drilling muds, thereby improving the performance of bentonite and polymer product. Product warning: Do not add in excess as overtreatment can lead to detrimental effects and reduced performance of the drilling fluid components.
TORKease	Emulsion of complex stearates	n/a	Mud additive used to reduce friction
Versa-Foam	Anionic surfactant composed of alkyl ether sulfate (ammonium salt). CETCO drilling product.	2–4 quarts	Helps remove drill cuttings

Source: Product information from various drilling supply companies.
*n/a = Not applicable.

Table B-4
Zone of Saturation and Lithologic Unit Where Well Screen is Located

Screen ID	Well	Port Depth (ft)	Screen #	Saturated Zone	Lithologic Unit
1	CdV-16-1(i)	624	1	Intermediate	Otowi Member of Bandelier Tuff
2	CdV-16-2(i)r	850	1	Intermediate	Puye Formation
3	CdV-R-15-3	621	1	Intermediate	Otowi Member of Bandelier Tuff
4	CdV-R-15-3	804	2	Intermediate	Contact: Guaje Pumice Bed/Puye Formation
5	CdV-R-15-3	973	3	Intermediate	Cerros del Rio basalt
6	CdV-R-15-3	1254	4	Regional water table	Puye Formation
7	CdV-R-15-3	1350	5	Regional aquifer	Puye Formation
8	CdV-R-15-3	1640	6	Regional aquifer	Puye Formation
9	CdV-R-37-2	935	1	Intermediate	Puye fanglomerate
10	CdV-R-37-2	1200	2	Regional water table	Tschicoma Formation dacitic lavas
11	CdV-R-37-2	1359	3	Regional aquifer	Tschicoma Formation dacitic lavas
12	CdV-R-37-2	1550	4	Regional aquifer	Tschicoma Formation dacitic lavas
13	MCOBT-4.4	485	1	Intermediate	Puye fanglomerate
14	R-1	1031	1	Regional water table	Lower Puye fanglomerates
15	R-2	918	1	Regional water table	Unassigned fanglomerates
16	R-3i	215	1	Intermediate	Cerros del Rio basalt
17	R-4	792	1	Regional water table	Unassigned fanglomerates
18	R-5	329	1	Intermediate	Puye Formation
19	R-5	383	2	Intermediate	Puye Formation
20	R-5	718	3	Regional water table	Santa Fe Group basalt
21	R-5	860	4	Regional aquifer	Santa Fe Group basalt
22	R-6	1205	1	Regional water table	Unassigned fanglomerates
23	R-6i	602	1	Intermediate	Puye Formation
24	R-7	378	1	Intermediate	Upper Puye Formation
25	R-7	738	2	Intermediate	Puye Formation, pumiceous
26	R-7	915	3	Regional water table	Puye Formation pumiceous
27	R-8	711	1	Regional water table	Puye Formation
28	R-8	825	2	Regional aquifer	Puye Formation
29	R-9	684	1	Regional water table	Santa Fe Group sediments
30	R-9i	198	1	Upper Intermediate	Cerros del Rio basalt (fractured)
31	R-9i	278	2	Lower Intermediate	Cerros del Rio basalt (fractured)
32	R-10	874	1	Regional aquifer	Santa Fe Group sediments
33	R-10	1042	2	Regional aquifer	Santa Fe Group sediments
34	R-10a	690	1	Regional water table	Santa Fe Group sediments
35	R-11	855	1	Regional water table	Lower Puye Formation
36	R-12	468	1	Intermediate	Cerros del Rio basalt
37	R-12	507	2	Intermediate	Older alluvium

Table B-4 (continued)

Screen ID	Well	Port Depth (ft)	Screen #	Saturated Zone	Lithologic Unit
38	R-12	810	3	Regional water table	Santa Fe Group basalt
39	R-13	958	1	Regional water table	Puye fanglomerate/pumiceous units
40	R-14	1204	1	Regional water table	Puye Formation
41	R-14	1288	2	Regional aquifer	Puye Formation
42	R-15	958	1	Regional water table	Puye Formation
43	R-16	644	1	Intermediate	Puye Formation
44	R-16	866	2	Regional water table	Santa Fe Group sediments
45	R-16	1018	3	Regional aquifer	Santa Fe Group sediments
46	R-16	1238	4	Regional aquifer	Santa Fe Group sediments
47	R-16r	600	1	Regional water table	Totavi Lentil
48	R-17	1057	1	Regional water table	Puye Formation
49	R-17	1124	2	Regional aquifer	Puye Formation
50	R-18	1358	1	Regional water table	Puye Formation
51	R-19	835	1	Intermediate	Guaje Pumice Bed
52	R-19	909	2	Intermediate	Puye Formation
53	R-19	1190	3	Regional water table	Puye Formation (fanglomerate facies)
54	R-19	1412	4	Regional aquifer	Puye Formation (fanglomerate facies)
55	R-19	1586	5	Regional aquifer	Puye Formation (fanglomerate facies)
56	R-19	1730	6	Regional aquifer	Puye Formation (fanglomerate facies)
57	R-19	1834	7	Regional aquifer	Puye Formation (fanglomerate facies)
58	R-20	907	1	Regional water table	Puye Formation
59	R-20	1149	2	Regional aquifer	Pumiceous fanglomerates
60	R-20	1330	3	Regional aquifer	Santa Fe Group sediments
61	R-21	888	1	Regional water table	Puye Formation
62	R-22	907	1	Regional water table	Cerros del Rio basalt
63	R-22	962	2	Regional aquifer	Cerros del Rio basalt
64	R-22	1273	3	Regional aquifer	Upper Puye fanglomerates
65	R-22	1378	4	Regional aquifer	Older basalt (clay-altered)
66	R-22	1448	5	Regional aquifer	Lower Puye fanglomerates
67	R-23	816	1	Regional water table	Santa Fe Group sediments
68	R-23i	400	1	Intermediate	Cerros del Rio basalt
69	R-23i	470	2	Intermediate	Cerros del Rio basalt
70	R-23i	524	3	Intermediate	Cerros del Rio basalt—interflow sediments
71	R-24	825	1	Regional aquifer	Santa Fe Group, undivided
72	R-25	754	1	Intermediate	Otowi Member of Bandelier Tuff
73	R-25	891	2	Intermediate	Puye Formation (fanglomerate facies)
74	R-25	1063	3	Intermediate	Puye Formation (fanglomerate facies)
75	R-25	1192	4	Intermediate	Puye Formation (fanglomerate facies)

Table B-4 (continued)

Screen ID	Well	Port Depth (ft)	Screen #	Saturated Zone	Lithologic Unit
76	R-25	1303.4	5	Regional water table	Puye Formation (fanglomerate facies)
77	R-25	1406.3	6	Regional aquifer	Puye Formation (fanglomerate facies)
78	R-25	1606	7	Regional aquifer	Puye Formation (fanglomerate facies)
79	R-25	1796	8	Regional aquifer	Puye Formation (fanglomerate facies)
80	R-25	n/a*	9	Regional aquifer	Puye Formation (fanglomerate facies)
81	R-26	659	1	Intermediate	Cerro Toledo interval
82	R-26	1433	2	Regional aquifer	Puye Formation
83	R-27	852	1	Regional water table	Lower Puye Formation
84	R-28	934	1	Regional water table	Puye Formation
85	R-31	446	1	Intermediate	Cerros del Rio basalt
86	R-31	532	2	Regional water table	Cerros del Rio basalt
87	R-31	670	3	Regional aquifer	Cerros del Rio basalt
88	R-31	830	4	Regional aquifer	Totavi Lentil
89	R-31	1011	5	Regional aquifer	Puye fanglomerates and river gravels
90	R-32	870	1	Regional water table	Cerros del Rio basalt and river gravels
91	R-32	933	2	Regional aquifer	Puye Formation
92	R-32	976	3	Regional aquifer	Puye Formation
93	R-33	995	1	Regional water table	Pumiceous unit (unassigned)
94	R-33	1112	2	Regional aquifer	Pumiceous unit (unassigned)
95	R-34	895	1	Regional water table	Puye Formation

Source: Compiled from well completion reports listed at the end of this appendix.
*n/a = Not applicable (plugged off during construction).

Table B-5
Screen Construction Details, Functional Status, and Sampling Methods

Screen ID	Well	Screen #	Water Production Status[a]	Casing ID (in.)	Screen Depth (ft)			Screen Type[b]	Sample Collection Method[c]	Sample Collection SOP[d]
					Port Depth	Top	Bottom			
1	CdV-16-1(i)	1	Functional	4.5	624	624	634	Rod	Submersible	049
2	CdV-16-2(i)r	1	Functional	4.5	850	850	859.7	Rod	Submersible	049
3	CdV-R-15-3	1	Dry	4.5	621	617.7	624.5	Pipe	n/a[e]	n/a
4	CdV-R-15-3	2	Dry	4.5	804	800.8	807.8	Pipe	n/a	n/a
5	CdV-R-15-3	3	Dry	4.5	973	964.8	980.9	Pipe	n/a	n/a
6	CdV-R-15-3	4	Functional	4.5	1254.4	1235	1279	Pipe	Westbay	050
7	CdV-R-15-3	5	Functional	4.5	1350.1	1348	1355	Pipe	Westbay	050
8	CdV-R-15-3	6	Functional	4.5	1640.1	1638	1645	Pipe	Westbay	050
9	CdV-R-37-2	1	Dry	4.5	935	914.4	939.5	Pipe	n/a	n/a
10	CdV-R-37-2	2	Functional	4.5	1200.3	1189	1214	Pipe	Westbay	050
11	CdV-R-37-2	3	Functional	4.5	1359.3	1354	1377	Pipe	Westbay	050
12	CdV-R-37-2	4	Functional	4.5	1550.6	1549	1556	Pipe	Westbay	050
13	MCOBT-4.4	1	Functional[f]	4.5	485.4	482.1	524.0	Pipe	Submersible	049
14	R-1	1	Functional	4.5	1031.1	1030	1057	Rod	Westbay	050
15	R-2	1	Functional	4.5	918	906.5	929.6	Rod	Westbay	050
16	R-3i	1	Functional	4.5	215.2	215.2	220.0	Rod	Westbay	050
17	R-4	1	Functional	4.5	792.9	792.9	816	Rod	Submersible	049
18	R-5	1	Dry	4.5	329	326.4	331.5	Pipe	n/a	n/a
19	R-5	2	Functional	4.5	383.9	372.8	388.8	Pipe	Westbay	050
20	R-5	3	Functional[g]	4.5	718.6	676.9	720.3	Pipe	Westbay	050
21	R-5	4	Functional	4.5	860.9	858.7	863.7	Pipe	Westbay	050
22	R-6	1	Functional	4.5	1205	1205	1228	Rod	Submersible	049
23	R-6i	1	Functional	4.5	602	602	612	Rod	Submersible	049
24	R-7	1	Dry	4.5	378	363.2	379.2	Pipe	n/a	n/a
25	R-7	2	Dry	4.5	738.4	730.4	746.4	Pipe	n/a	n/a
26	R-7	3	Functional	4.5	915.1	895.5	937.4	Pipe	Westbay	050
27	R-8	1	Functional	4.5	711.1	705.3	755.7	Pipe	Westbay	050
28	R-8	2	Functional	4.5	825	821.3	828	Pipe	Submersible	050
29	R-9	1	Functional	4.5	684	684	704	Rod	Submersible	049
30	R-9i	1	Functional[h]	4.5	198.8	189.1	199.5	Rod	Westbay	050
31	R-9i	2	Functional	4.5	278.8	269.6	280.3	Rod	Westbay	050
32	R-10	1	Functional	4.5	874	874	897	Rod	BASKI	In prep.
33	R-10	2	Functional	4.5	1042	1042	1065	Rod	BASKI	In prep.
34	R-10a	1	Functional	4.5	690	690	700	Rod	Submersible	049
35	R-11	1	Functional	4.5	855	855	877.9	Rod	Submersible	049
36	R-12	1	Functional	4.5	468.1	459	467.5	Rod	Westbay	050
37	R-12	2	Functional[i]	4.5	507	504.5	508	Rod	Westbay	050

Table B-5 (continued)

Screen ID	Well	Screen #	Water Production Status[a]	Casing ID (in.)	Screen Depth (ft) Port Depth	Top	Bottom	Screen Type[b]	Sample Collection Method[c]	Sample Collection SOP[d]
38	R-12	3	Functional[h,j]	4.5	810.8	801	839	Rod	Westbay	050
39	R-13	1	Functional	4.5	958.3	958.3	1019	Pipe	Submersible	049
40	R-14	1	Functional	4.5	1204.5	1201	1233	Pipe	Westbay	050
41	R-14	2	Functional	4.5	1288.5	1287	1293	Pipe	Westbay	050
42	R-15	1	Functional	4.5	958.6	958.6	1020	Pipe	Submersible	049
43	R-16	1	Cased off[k]	4.5	644.8	641	648.6	Pipe	n/a	n/a
44	R-16	2	Functional	4.5	866.1	863.4	870.9	Pipe	Westbay	050
45	R-16	3	Functional	4.5	1018.4	1015	1022	Pipe	Westbay	050
46	R-16	4	Functional	4.5	1238	1237	1245	Pipe	Westbay	050
47	R-16r	1	Functional	4.5	600	600	617.6	Pipe	Submersible	049
48	R-17	1	Functional	4.5	1057	1057	1080	Rod	BASKI	In prep
49	R-17	2	Functional	4.5	1124	1124	1134	Rod	BASKI	In prep
50	R-18	1	Functional	4.5	1358	1358	1381	Rod	Submersible	049
51	R-19	1	Dry	4.5	835.4	827.2	843.6	Pipe	n/a	n/a
52	R-19	2	Functional[l]	4.5	909.3	893.3	909.6	Pipe	Westbay	050
53	R-19	3	Functional[h]	4.5	1190.7	1171	1215	Pipe	Westbay	050
54	R-19	4	Functional	4.5	1412.9	1410	1417	Pipe	Westbay	050
55	R-19	5	Functional	4.5	1586.1	1583	1590	Pipe	Westbay	050
56	R-19	6	Functional	4.5	1730.1	1727	1734	Pipe	Westbay	050
57	R-19	7	Functional	4.5	1834.7	1832	1840	Pipe	Westbay	050
58	R-20	1	Functional	4.5	907	904.6	912.2	Pipe	Westbay	050
59	R-20	2	Functional	4.5	1149.7	1147	1155	Pipe	Westbay	050
60	R-20	3	Functional	4.5	1330	1329	1337	Pipe	Westbay	050
61	R-21	1	Functional	6	888.8	887.8	907.8	Rod	Submersible	049
62	R-22	1	Functional	4.5	907.1	872.3	914.2	Pipe	Westbay	050
63	R-22	2	Functional	4.5	962.8	947	988.9	Pipe	Westbay	050
64	R-22	3	Functional	4.5	1273.5	1272	1279	Pipe	Westbay	050
65	R-22	4	Functional	4.5	1378	1378	1385	Pipe	Westbay	050
66	R-22	5	Functional	4.5	1448.2	1447	1452	Pipe	Westbay	050
67	R-23	1	Functional	4.5	816	816	873.2	Pipe	Westbay	050
68	R-23i	1	Not developed[j]	2.0	400.3	400.3	420	Rod	n/a	n/a
69	R-23i	2	Functional	4.5	470.2	470.2	480.1	Rod	BASKI	In prep.
70	R-23i	3	Functional	4.5	524	524	547	Rod	BASKI	In prep.
71	R-24	1	Functional	4.5	825	825	848	Rod	Submersible	049
72	R-25	1	Functional	5.17	754.8	737.6	758.4	Rod	Westbay	050
73	R-25	2	Functional	5.17	891.8	882.6	893.4	Rod	Westbay	050
74	R-25	3	Dry	5.17	1063	1055	1065	Rod	n/a	n/a
75	R-25	4	Functional	5.17	1192.4	1185	1195	Rod	Westbay	050

Table B-5 (continued)

Screen ID	Well	Screen #	Water Production Status[a]	Casing ID (in.)	Screen Depth (ft)			Screen Type[b]	Sample Collection Method[c]	Sample Collection SOP[d]
					Port Depth	Top	Bottom			
76	R-25	5	Functional[h]	5.17	1303.4	1295	1305	Rod	Westbay	050
77	R-25	6	Functional	5.17	1406.3	1405	1415	Rod	Westbay	050
78	R-25	7	Functional	5.17	1606	1605	1615	Rod	Westbay	050
79	R-25	8	Functional	5.17	1796	1795	1805	Rod	Westbay	050
80	R-25	9	Plugged off[k]	5.17	n/a	1895	1905	Rod	n/a	n/a
81	R-26	1	Functional	4.5	659.3	651.8	669.9	Rod	Westbay	050
82	R-26	2	Screen clogged	4.5	1433	1422	1445	Pipe	n/a	n/a
83	R-27	1	Functional	4.5	852	852	875	Rod	Submersible	049
84	R-28	1	Functional	4.5	934.3	934.3	958.1	Rod	Submersible	049
85	R-31	1	Dry	4.5	446.8	439.1	454.4	Rod	n/a	n/a
86	R-31	2	Functional[h]	4.5	532.2	515	545.7	Rod	Westbay	050
87	R-31	3	Functional[m]	4.5	670	666.3	676.3	Rod	Westbay	050
88	R-31	4	Functional[m]	4.5	830	826.6	836.6	Rod	Westbay	050
89	R-31	5	Functional[m]	4.5	1011	1007	1017	Rod	Westbay	050
90	R-32	1	Functional	4.5	870.9	867.5	875.2	Pipe	Westbay	050
91	R-32	2	Limited use[n]	4.5	933.4	931.8	934.8	Pipe	n/a	n/a
92	R-32	3	Functional	4.5	976	927.9	980.6	Pipe	Westbay	050
93	R-33	1	Functional	4.5	995.5	995.5	1018.5	Rod	Barcad	SOP TBD[o]
94	R-33	2	Functional	4.5	1112.4	1112.4	1122.3	Rod	Barcad	SOP TBD[o]
95	R-34	1	Functional	4.5	895.152	883.7	906.6	Rod	Submersible	049

[a] Water production comments were provided by A. Banar (ENV-WQH) on August 15 and 24, 2005. "Functional" indicates that the screen interval produces an adequate volume of groundwater for chemical analysis.

[b] Screen types: "Rod" = rod-based 0.020" slot screen; "Pipe"= pipe-based 0.010" slot screen.

[c] Sample collection methods: Submersible pump, Westbay multiple-screen system, BARCAD system.

[d] Sample collection standard operating procedures (SOPs):
- 048—RRES-WQH-SOP-048, Groundwater Sampling Using Bladder Pumps
- 049—RRES-WQH-SOP-049, Groundwater Sampling Using Submersible Pumps
- 050—RRES-WQH-SOP-050.3, Groundwater Sampling Using Westbay Systems

[e] n/a = Not applicable.

[f] MCOBT-4.4 went dry after removal of 6–8 gal. during the 2005 sampling event due to lowering of the water table at this location.

[g] At R-5 screen 3, port 3B is functional.

[h] Port is functional but slow to fill; at R-31 screen 2, port 2B is functional.

[i] Water from screens 2 and 3 in R-12 mixed during well rehabilitation in September–November 2006 and is suspected to have been in hydrologic contact since well development was completed in February 2000.

[j] R-23i screen 1 is in the annular space of the well and has not been developed.

[k] Screen blocked off during well construction.

[l] Functional but low pressure.

[m] Field notes for some of the R-31 sampling events at screens 3 through 5 note unstable pressure readings which probably indicate that the sampler did not successfully couple to the port in these screens, resulting in samples of distilled water from the inner casing filling the sample container rather than water from the formation.

[n] The port at screen 2 of R-32 is not designed for sample collection but is intended only for pressure readings.

[o] TBD = To be determined.

REFERENCES

The following list includes all documents cited in this appendix. 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 New Mexico Environment Department-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.

Ball, T., M. Everett, P. Longmire, D. Vaniman, W. Stone, D. Larssen, K. Greene, N. Clayton, and S. McLin (Los Alamos National Laboratory), February 2002. "Characterization Well R-22 Completion Report," Los Alamos National Laboratory report LA-13893-MS, Los Alamos, New Mexico. (LANL 2002, 071471)

Broxton, D., R. Warren, A. Crowder, M. Everett, R. Gilkeson, P. Longmire, and J. Marin, May 2001. "Characterization Well R-12 Completion Report," Los Alamos National Laboratory report LA-13822-MS, Los Alamos, New Mexico. (Broxton et al. 2001, 071252)

Broxton, D., R. Gilkeson, P. Longmire, J. Marin, R. Warren, D. Vaniman, A. Crowder, B. Newman, B. Lowry, D. Rogers, W. Stone, S. McLin, G. WoldeGabriel, D. Daymon, and D. Wycoff, May 2001. "Characterization Well R-9 Completion Report," Los Alamos National Laboratory report LA-13742-MS, Los Alamos, New Mexico. (Broxton et al. 2001, 071250)

Broxton, D., D. Vaniman, W. Stone, S. McLin, M. Everett, and A. Crowder, May 2001. "Characterization Well R-9i Completion Report," Los Alamos National Laboratory report LA-13821-MS, Los Alamos, New Mexico. (Broxton et al. 2001, 071251)

Broxton, D., D. Vaniman, W. Stone, S. McLin, J. Marin, R. Koch, R. Warren, P. Longmire, D. Rogers, and N. Tapia, May 2001. "Characterization Well R-19 Completion Report," Los Alamos National Laboratory report LA-13823-MS, Los Alamos, New Mexico. (Broxton et al. 2001, 071254)

Broxton, D., R. Warren, P. Longmire, R. Gilkeson, S. Johnson, D. Rogers, W. Stone, B. Newman, M. Everett, D. Vaniman, S. McLin, J. Skalski, and D. Larssen, March 2002. "Characterization Well R-25 Completion Report," Los Alamos National Laboratory report LA-13909-MS, Los Alamos, New Mexico. (Broxton et al. 2002, 072640)

Broxton, D., D. Vaniman, P. Longmire, B. Newman, W. Stone, A. Crowder, P. Schuh, R. Lawrence, E. Tow, M. Everett, R. Warren, N. Clayton, D. Counce, E. Kluk, and D. Bergfeld, December 2002. "Characterization Well MCOBT-4.4 and Borehole MCOBT-8.5 Completion Report," Los Alamos National Laboratory report LA-13933-MS, Los Alamos, New Mexico. (Broxton et al. 2002, 076006)

Kleinfelder, June 6, 2003. "Characterization Well R-21 Completion Report," report prepared for Los Alamos National Laboratory, Albuquerque, New Mexico. (Kleinfelder 2003, 090047)

Kleinfelder, May 7, 2004. "Final Well CdV-16-1(i) Completion Report," report prepared for Los Alamos National Laboratory, Project No. 37151/9.12, Albuquerque, New Mexico. (Kleinfelder 2004, 087844)

Kleinfelder, November 2004. "Final Completion Report, Characterization Well R-34," report prepared for Los Alamos National Laboratory, Project No. 37151, Albuquerque, New Mexico. (Kleinfelder 2004, 092199)

Kleinfelder, January 25, 2005. "Final Well R-26 Completion Report," Revision No. 1, report prepared for Los Alamos National Laboratory, Project No. 37151, Albuquerque, New Mexico. (Kleinfelder 2005, 087846)

Kleinfelder, February 2, 2005. "Revision 1, Well R-2 Completion Report," report prepared for Los Alamos National Laboratory, Project No. 37151/TASK 6.12, Albuquerque, New Mexico. (Kleinfelder 2005, 094900)

Kleinfelder, February 3, 2005. "Revision 1, Well R-1 Completion Report," report prepared for Los Alamos National Laboratory, Project No. 37151/17.12, Albuquerque, New Mexico. (Kleinfelder 2005, 090045)

Kleinfelder, February 9, 2005. "Revision 1, Well R-28 Completion Report," report prepared for Los Alamos National Laboratory, Project No. 37151/16.12, Albuquerque, New Mexico. (Kleinfelder 2005, 094042)

Kleinfelder, February 2005. "Final Completion Report, Characterization Well R-11," report prepared for Los Alamos National Laboratory, Project No. 37151, Albuquerque, New Mexico. (Kleinfelder 2005, 090044)

Kleinfelder, February 2005. "Final Completion Report, Characterization Well R-33," report prepared for Los Alamos National Laboratory, Project No. 37151, Albuquerque, New Mexico. (Kleinfelder 2005, 094041)

Kleinfelder, Inc., January 14, 2005. "Revision 1 Final Completion Report Characterization Well R-4 Los Alamos National Laboratory Los Alamos, New Mexico Project No. 37151/7.12," Albuquerque, New Mexico. (Kleinfelder 2005, 094903)

Kleinfelder, April 2005. "Final Completion Report, Characterization Wells R-6/R-6i," report prepared for Los Alamos National Laboratory, Project No. 37151, Albuquerque, New Mexico. (Kleinfelder 2005, 091693)

Kleinfelder, April 2005. "Final Completion Report, Characterization Well R-18," report prepared for Los Alamos National Laboratory, Project No. 37151, Albuquerque, New Mexico. (Kleinfelder 2005, 092415)

Kleinfelder, November 2005. "Final Completion Report, Characterization Well CdV-16-2(i)r," report prepared for Los Alamos National Laboratory, Project No. 49436, Albuquerque, New Mexico. (Kleinfelder 2005, 093665)

Kleinfelder, January 2006. "Final Completion Report, Characterization Wells R-10a/R-10," report prepared for Los Alamos National Laboratory, Project No. 49436, Albuquerque, New Mexico. (Kleinfelder 2006, 092491)

Kleinfelder, January 2006. "Final Completion Report, Characterization Well R-24," report prepared for Los Alamos National Laboratory, Project No. 49436, Albuquerque, New Mexico. (Kleinfelder 2006, 092489)

Kleinfelder, February 2006. “Final Completion Report, Characterization Well R-16r,” report prepared for Los Alamos National Laboratory, Project No. 49436, Albuquerque, New Mexico. (Kleinfelder 2006, 094131)

Kleinfelder, March 2006. “Final Completion Report, Intermediate Well R-23i,” report prepared for Los Alamos National Laboratory, Project No. 49436, Albuquerque, New Mexico. (Kleinfelder 2006, 092495)

Kleinfelder, March 2006. “Final Completion Report, Characterization Well R-27,” report prepared for Los Alamos National Laboratory, Project No. 49436, Albuquerque, New Mexico. (Kleinfelder 2006, 092488)

Kleinfelder, May 2006. “Final Completion Report, Characterization Well R-17,” report prepared for Los Alamos National Laboratory, Project No. 49436, Albuquerque, New Mexico. (Kleinfelder 2006, 092493)

Kleinfelder, January 2007. “Draft, Completion Report, Intermediate Well R-3i,” report prepared for Los Alamos National Laboratory, Project No. 49436, Albuquerque, New Mexico. (Kleinfelder 2007, 094910)

Kopp, B., A. Crowder, M. Everett, D. Vaniman, D. Hickmott, W. Stone, N. Clayton, S. Pearson, and D. Larssen, April 2002. “Well CdV-R-15-3 Completion Report,” Los Alamos National Laboratory report LA-13906-MS, Los Alamos, New Mexico. (Kopp et al. 2002, 073179)

Kopp, B., M. Everett, J.R. Lawrence, G. WoldeGabriel, D. Vaniman, J. Heikoop, W. Stone, S. McLin, N. Clayton, and D. Larssen, April 2003. “Well CdV-R-37-2 Completion Report,” Los Alamos National Laboratory report LA-14023-MS, Los Alamos, New Mexico. (Kopp et al. 2003, 088803)

LANL (Los Alamos National Laboratory), June 2003. “Characterization Well R-5 Completion Report,” Los Alamos National Laboratory document LA-UR-03-1600, Los Alamos, New Mexico. (LANL 2003, 080925)

LANL (Los Alamos National Laboratory), June 2003. “Characterization Well R-8 Completion Report,” Los Alamos National Laboratory document LA-UR-03-1162, Los Alamos, New Mexico. (LANL 2003, 079594)

LANL (Los Alamos National Laboratory), June 2003. “Characterization Well R-13 Completion Report,” Los Alamos National Laboratory document LA-UR-03-1373, Los Alamos, New Mexico. (LANL 2003, 076060)

LANL (Los Alamos National Laboratory), June 2003. “Characterization Well R-14 Completion Report,” Los Alamos National Laboratory document LA-UR-03-1664, Los Alamos, New Mexico. (LANL 2003, 076062)

LANL (Los Alamos National Laboratory), June 2003. “Characterization Well R-16 Completion Report,” Los Alamos National Laboratory document LA-UR-03-1841, Los Alamos, New Mexico. (LANL 2003, 076061)

LANL (Los Alamos National Laboratory), June 2003. “Characterization Well R-20 Completion Report,” Los Alamos National Laboratory document LA-UR-03-1839, Los Alamos, New Mexico. (LANL 2003, 079600)

LANL (Los Alamos National Laboratory), June 2003. "Characterization Well R-23 Completion Report," Los Alamos National Laboratory document LA-UR-03-2059, Los Alamos, New Mexico. (LANL 2003, 079601)

LANL (Los Alamos National Laboratory), June 2003. "Characterization Well R-32 Completion Report," Los Alamos National Laboratory document LA-UR-03-3984, Los Alamos, New Mexico. (LANL 2003, 079602)

Longmire, P., March 2002. "Characterization Well R-15 Geochemistry Report," Los Alamos National Laboratory report LA-13896-MS, Los Alamos, New Mexico. (Longmire 2002, 072614)

Longmire, P., April 2002. "Characterization Wells R-9 and R-9i Geochemistry Report," Los Alamos National Laboratory report LA-13927-MS, Los Alamos, New Mexico. (Longmire 2002, 072713)

Longmire, P., June 2002. "Characterization Well R-12 Geochemistry Report," Los Alamos National Laboratory report LA-13952-MS, Los Alamos, New Mexico. (Longmire 2002, 072800)

Longmire, P., July 2002. "Characterization Well R-19 Geochemistry Report," Los Alamos National Laboratory report LA-13964-MS, Los Alamos, New Mexico. (Longmire 2002, 073282)

Longmire, P., October 2002. "Characterization Well R-22 Geochemistry Report," Los Alamos National Laboratory report LA-13986-MS, Los Alamos, New Mexico. (Longmire 2002, 073676)

Longmire, P., May 2005. "Characterization Well R-25 Geochemistry Report," Los Alamos National Laboratory report LA-14198-MS, Los Alamos, New Mexico. (Longmire 2005, 088510)

Longmire, P., and F. Goff, December 2002. "Characterization Well R-7 Geochemistry Report," Los Alamos National Laboratory report LA-14004-MS, Los Alamos, New Mexico. (Longmire and Goff 2002, 075905)

Longmire, P., D. Broxton, W. Stone, B. Newman, R. Gilkeson, J. Marin, D. Vaniman, D. Counce, D. Rogers, R. Hull, S. McLin, and R. Warren, May 2001. "Characterization Well R-15 Completion Report," Los Alamos National Laboratory report LA-13749-MS, Los Alamos, New Mexico. (Longmire et al. 2001, 070103)

Stone, W., D. Vaniman, P. Longmire, D. Broxton, M. Everett, R. Lawrence, and D. Larssen, April 2002. "Characterization Well R-7 Completion Report," Los Alamos National Laboratory report LA-13932-MS, Los Alamos, New Mexico. (Stone et al. 2002, 072717)

Vaniman, D., J. Marin, W. Stone, B. Newman, P. Longmire, N. Clayton, R. Lewis, R. Koch, S. McLin, G. WoldeGabriel, D. Counce, D. Rogers, R. Warren, E. Kluk, S. Chipera, D. Larssen, and W. Kopp, March 2002. "Characterization Well R-31 Completion Report," Los Alamos National Laboratory report LA-13910-MS, Los Alamos, New Mexico. (Vaniman et al. 2002, 072615)

Wisconsin Department of Natural Resources, accessed December 20, 2006. "List of Approved Drilling, Grouting, Rehabilitation & Abandonment Products (DNR Bureau of Drinking Water & Groundwater)," http://www.dnr.state.wi.us/org/water/dwg/tvrdrill06.pdf. (Wisconsin Department of Natural Resources 2006, 094912)

Appendix C

Water-Quality Data Used for Screen Assessments

C-1.0 PURPOSE OF THIS APPENDIX

The tables in this appendix document the evaluation of water-quality data for each sampling event from each screen against the applicable criteria.

C-2.0 OVERVIEW OF CONTENTS

Tables C-1a through C-1c provide definitions of laboratory qualifier codes, validation flag codes, and data source codes used in the data tables.

Table C-2 indicates the sample collection method, estimated well volume, and purged volume for each sample.

Tables C-3 through C-6 compare water-quality data with each of the applicable criteria for the six categories of drilling effects. The contents of these four data tables are organized as follows:

Table	Indicators
C-3 General Water Quality Indicators	• Tritium • Field pH • Field Alkalinity • Turbidity
C-4 Organic Indicators	• Acetone • Ammonia • Total Kjehdahl Nitrogen • Total Organic Carbon
C-5 General Inorganic (Non-metal) Indicators	• Barium • Calcium • Chloride • Fluoride • Magnesium • Nitrate + Nitrite • Oxygen Reduction Potential • Oxygen, Dissolved • Phosphate • Sodium • Sulfate • Sulfide
C-6 Trace Metal Indicators	• Chromium (Filtered, Total, Total-to-Filtered Ratio) • Iron (Filtered, Total, Total-to-Filtered Ratio) • Manganese • Molybdenum • Nickel • Strontium • Uranium • Zinc

Except as noted in the tables, water-quality data are taken from the Water Quality Data Base (WQDB).

Table C-7 summarizes the test criteria that failed for each sample, listed by category of drilling effects. The outcome of the comparison determines which analytes in the screen's water samples are considered reliable and representative of groundwater conditions, and which analytes are flagged as potentially unreliable because of the effects of residual drilling fluids. Table C-7 also expresses the outcome of the evaluation as an assessment score for each water-quality sample from each screen. The score is calculated as the percent of criteria met out of the total number of criteria tested for each sample. A preliminary qualitative rating is assigned to each sample based on the score:

Rating	Score (% criteria passed)
Very Good	91–100
Good	81–90
Fair	60–80
Poor	Less than 60
Not rated	Less than 15 tests with Pass/Fail outcomes

This qualitative rating may be adjusted, if justified by site-specific conditions or other technically defensible bases.

Table C-1a
Laboratory Qualifier Codes Used in This Appendix

Laboratory Qualifier Code	Laboratory Qualifier Code Description
*	(Inorganic) - Duplicate analysis not within control limits. (Organic) - Spike recovery is equal to or outside the control criteria used.
B	(Inorganic) - Reported value was obtained from a reading that was less than the contract required detection limit (CRDL) but greater than or equal to the instrument detection limit (IDL). (Organic) - Analyte present in the blank and the sample.
E	(Inorganic) (inductively coupled plasma - atomic emissions spectroscopy) - The result for this analyte in the serial dilution analysis was outside acceptance criteria. (Inorganic) (graphite furnace atomic adsorption) - The result for this analyte failed one or more contract laboratory procedure acceptance criteria as explained in the case narrative. (Organic) - The result for this analyte exceeded the upper range of the instrument initial calibration curve.
EN	(Inorganic) - The qualifier that is used when the percent difference between the parent sample and its serial dilution's concentration exceeds 10%. The sample's concentration must be greater than 50 times the IDL/method detection limit (MDL) for inductively coupled plasma (ICP) or 100 times the absolute value of the preparation blank's concentration for ICP-mass spectroscopy (MS). However, if analyzing ILMO 4.0 (ICP-MS), the parent sample's concentration must be 20 times the CRDL before the E flag is applied. This qualifier is used to indicate that the matrix or pre-digested spike sample recovery for an analyte is not within the specified control limit.
H	Holding time exceeded.
J	(Inorganic) -The associated numerical value is an estimated quantity. (Organic) - The associated numerical value is an estimated quantity.
J*	(Inorganic) -The associated numerical value is an estimated quantity. Duplicate analysis not within control limits.
N	(Inorganic) - Spiked sample recovery not within control limits. (Organic) - Presumptive evidence based on a mass spectral library search to make a tentative identification of the analyte.
NQ	No validation qualifier flag is associated with this result, and the analyte is classified as detected.
U	The material was analyzed for, but was not detected above the level of the associated numeric value. The associated numerical value is either the sample quantitation limit or the sample detection limit.
U*	(Inorganic) - Compound was analyzed for, but was not detected. Duplicate analysis not within control limits.

Table C-1b
Validation Flag Codes used in this Appendix

Valid Flag Code	Validation Flag Description
J	The analyte is classified as detected but the reported concentration value is expected to be more uncertain than usual.
J-	The analyte is classified as detected but the reported concentration value is expected to be more uncertain than usual with a potential negative bias.
J+	The analyte is classified as detected but the reported concentration value is expected to be more uncertain than usual with a potential positive bias.
JN-	Presumptive evidence of the presence of the material at an estimated quantity with a suspected negative bias.
NQ	No validation qualifier flag is associated with this result, and the analyte is classified as detected.
R	The reported sample result is classified as rejected due to serious noncompliances regarding quality control acceptance criteria. The presence or absence of the analyte cannot be verified based on routine validation alone.
U	The analyte is classified as not detected.
UJ	The analyte is classified as not detected, with an expectation that the reported result is more uncertain than usual.

Table C-1c
Definitions of Test Outcomes

P	Pass. The measured data meet the test condition
Fail	The measured data do not meet the test condition
Reasons for Indeterminate Outcomes	
I-DL	Indeterminate because of inadequate detection or reporting limit
I-Err	Indeterminate due to suspected error or otherwise unreliable data
I-NA	Indeterminate because this test is either not applicable or is meaningless for this case
I-NoD	Indeterminate because no suitable data are available
I-Plm	Indeterminate because test is not considered reliable due to the known presence of a contaminant plume. See Table 4-21 for list of well screens and indicators to which this code applies.
I-Red	Indeterminate because this test is not reliable under the prevailing reducing conditions Note: For example, dissolved iron may be low in the presence of high sulfide concentrations. See Table 4-20 for limitations on the applicability of each indicator.
I-UF	Indeterminate because this test is not reliable when applied to data from a nonfiltered sample

Table C-2
Sample Collection Information

Sample #[a]	Well	Port depth (ft)	Screen #	Sample Collection Date	Event #	Calculated Well CV 1 CV (gal.)	3CV (gal.)	Vol. Purged Prior to Sampling (gal.)	Sample Collection Threshold
1	CdV-16-1(i)	624	1	1-Jun-05	1	76.8	230.4	85.8	1 CV + FPS
2	CdV-16-1(i)	624	1	29-Aug-05	2	61.8	185.4	63	1 CV + FPS
3	CdV-16-1(i)	624	1	7-Dec-05	3	61.92	185.76	99.37	1 CV + FPS
4	CdV-16-1(i)	624	1	9-Mar-06	4	61.42	184.26	64	1 CV + FPS
5	CdV-16-2(i)r	850	1	14-Sep-05	1	—	—	—	—
6	CdV-16-2(i)r	850	1	15-Dec-05	2	20.74	62.22	90.83	< 3 CV
7	CdV-16-2(i)r	850	1	15-Mar-06	3	21.54	64.62	106.5	< 3 CV
8	CdV-16-2(i)r	850	1	17-May-06	4	21.3	63.9	73.15	< 3 CV
45	MCOBT-4.4	485	1	28-Jan-03	1	20.8	62.4	62	3 CV
46	MCOBT-4.4	485	1	21-May-03	2	20.8	62.4	62	3 CV
47	MCOBT-4.4	485	1	29-Mar-05	2	21.7	65.1	48.3	1 CV + FPS
48	MCOBT-4.4	485	1	8-Jun-05	3	20.1	60.3	6	< 1 CV - purged dry
49	R-1	1031	1	19-May-05	1	51.2	153.6	209.8	> 3 CV
50	R-1	1031	1	12-Sep-05	2	64.29	192.87	92.4	1 CV + FPS
51	R-1	1031	1	28-Nov-05	3	64.56	193.68	226.44	> 3 CV
52	R-1	1031	1	25-Jan-06	4	63.78	191.34	258	> 3 CV
53	R-1	1031	1	19-Apr-06	5	64.36	193.08	143.19	2 CV + FPS
54	R-1	1031	1	6-Jul-06	6	63.5	190.5	175	> 2 CV + FPS
55	R-1	1031	1	26-Oct-06	7	62.14	186.43	115.6	> 1 CV + FPS
56	R-2	918	1	26-Apr-05	1	38.7	116.1	106.24	< 3 CV
57	R-2	918	1	9-Aug-05	2	37.4	113.8	107.8	< 3 CV
58	R-2	918	1	9-Nov-05	3	37.04	111.12	202	—
59	R-2	918	1	27-Feb-06	4	37.05	111.14	102.24	—
60	R-2	918	1	24-Jul-06	5	36.81	110.44	138.6	—
61	R-3i	215	1	10-Aug-06	1	4.56	13.67	6	—
62	R-4	793	1	27-Apr-05	1	81.9	245.6	282	> 3 CV
63	R-4	793	1	8-Aug-05	2	78	234	149	> 1 CV + FPS
64	R-4	793	1	14-Nov-05	3	78.83	236.49	112.5	—
65	R-4	793	1	28-Feb-06	4	79.49	238.74	153.7	—
66	R-4	793	1	25-Jul-06	5	77.58	232.7	141.47	—
79	R-6	1205	1	23-Aug-05	1	79.4	238.2	260	> 3 CV
80	R-6	1205	1	17-Nov-05	2	79.05	237.15	247.5	—
81	R-6	1205	1	1-Mar-06	3	79.42	238.26	232.5	—
82	R-6	1205	1	11-May-06	4	78.95	236.85	168	—
83	R-6	1205	1	26-Jul-06	5	78.53	235.59	234	—
84	R-6i	602	1	24-Aug-05	1	18.1	54.3	70	> 3 CV
85	R-6i	602	1	17-Nov-05	2	18.05	54.15	175	—
86	R-6i	602	1	1-Mar-06	3	18.03	54.1	128	—
87	R-6i	602	1	11-May-06	4	17.85	53.55	120	—
88	R-6i	602	1	26-Jul-06	5	18.03	54.09	104	—

Table C-2 (continued)

Sample #[a]	Well	Port depth (ft)	Screen #	Sample Collection Date	Event #	Calculated Well CV 1 CV (gal.)	3CV (gal.)	Vol. Purged Prior to Sampling (gal.)	Sample Collection Threshold
101	R-9	684	1	12-Dec-03	1	52.8	158.4	160	3 CV
102	R-9	684	1	27-May-04	2	54.7	164.1	172.5	> 3 CV
103	R-9	684	1	19-Mar-05	3	19.9	41.7	50	3 CV
104	R-9	684	1	6-Apr-05	3	13.7	41.1	30	< 3 CV
105	R-9	684	1	28-Apr-05	3	57.5	172.5	180	3 CV
106	R-9	684	1	31-Jul-06	4	52.71	158.13	190	—
115	R-10	874	1	29-Jun-06	1	210.29	630.87	233.31	> 1 CV + FPS
116	R-10	874	1	12-Oct-06	2	210.74	632.22	210	—
117	R-10	1042	2	11-Oct-05	1	—	—	—	—
118	R-10	1042	2	29-Jun-06	2	347.44	1042.32	411.07	
119	R-10	1042	2	12-Oct-06	3	342.82	1028.46	370	> 1 CV + FPS
120	R-10a	690	1	7-Sep-05	1	—	—	—	—
121	R-10a	690	1	30-Nov-05	2	69.52	208.56	216.45	> 3 CV
122	R-10a	690	1	1-Feb-06	3	66.59	199.77	190	> 1 CV + FPS
123	R-10a	690	1	17-Jul-06	4	69.25	207.76	209	> 3 CV
124	R-10a	690	1	12-Oct-06	5	66.83	200.49	80	> 1 CV + FPS
125	R-11	855	1	17-May-05	1	55.3	165.9	95	> 1 CV + FPS
126	R-11	855	1	3-Aug-05	2	54.8	164.4	57	1 CV + FPS
127	R-11	855	1	8-Nov-05	3	90.85	272.55	105	> 1 CV + FPS
128	R-11	855	1	3-Feb-06	4	54.55	163.65	170	—
129	R-11	855	1	20-Apr-06	5	55	165	72.5	> 1 CV + FPS
130	R-11	855	1	10-Jul-06	6	54.69	164.07	66	> 1 CV + FPS
131	R-11	855	1	10-Oct-06	7	54.57	163.71	92.5	> 1 CV + FPS
152	R-13	958	1	9-Dec-03	1	158.3	474.9	450	< 3 CV
153	R-13	958	1	11-Jun-04	2	156.9	470.8	475	3 CV
154	R-13	958	1	10-Mar-05	3	157.4	472.2	175	> 1 CV + FPS
155	R-13	958	1	26-May-05	3	159.2	477.6	240	> 1 CV + FPS
156	R-13	958	1	1-Sep-05	4	159.17	477.51	235	> 1 CV + FPS
157	R-13	958	1	2-Feb-06	5	155.8	467.4	525	—
158	R-13	958	1	3-Jul-06	6	158.87	476.61	185.3	> 1 CV + FPS
159	R-13	958	1	25-Oct-06	7	159.62	478.86	360	> 1 CV + FPS
172	R-15	959	1	10-Jun-04	1	—	—	—	—
173	R-15	959	1	25-May-05	2	63.1	189.3	230	> 3 CV
174	R-15	959	1	31-Aug-05	3	57.4	172.2	250	> 3 CV
175	R-15	959	1	30-Jan-06	4	50.01	150.03	200	—
176	R-15	959	1	3-Jul-06	5	63.4	190.2	300	—
177	R-15	959	1	24-Oct-06	6	62.49	187.46	372	—
207	R-16r	600	1	26-Sep-05	1	—	—	—	—
208	R-16r	600	1	17-Oct-05	2	—	—	—	—
209	R-16r	600	1	19-Dec-05	3	55.51	166.54	321.55	—
210	R-16r	600	1	8-Mar-06	4	56.3	168.9	170	—
211	R-16r	600	1	24-May-06	5	55.9	167.69	250	—
212	R-16r	600	1	17-Aug-06	6	55.98	167.94	196	—

Table C-2 (continued)

Sample #[a]	Well	Port depth (ft)	Screen #	Sample Collection Date	Event #	Calculated Well CV 1 CV (gal.)	3CV (gal.)	Vol. Purged Prior to Sampling (gal.)	Sample Collection Threshold
213	R-16r	600	1	1-Nov-06	7	55.76	167.28	100.8	> 1 CV + FPS
214	R-17	1057	1	24-Feb-06	1	—	—	—	—
215	R-17	1057	1	19-Oct-06	2	63.6	190.8	220	> 3 CV
216	R-17	1124	2	17-Oct-06	1	22.2	66.6	329	> 3 CV
217	R-18	1358	1	25-Aug-05	1	97	291	300	3 CV
218	R-18	1358	1	1-Dec-05	2	97.55	292.65	312	—
219	R-18	1358	1	7-Mar-06	3	97.5	293	198	> 1 CV + FPS
220	R-18	1358	1	16-May-06	4	96.84	290.51	173.42	> 1 CV + FPS
221	R-18	1358	1	15-Aug-06	5	—	—	—	—
222	R-18	1358	1	18-Dec-06	6	96.86	290.58	187	> 1 CV + FPS
275	R-21	889	1	23-Sep-04	1	204.7	614.1	657	> 3 CV
276	R-21	889	1	14-Dec-04	2	202	606	540.6	< 3 CV
277	R-21	889	1	6-Jun-05	3	210.6	631.8	196.5	< 1 CV
278	R-21	889	1	7-Jul-06	4	204.32	612.96	174	> 1 CV + FPS
279	R-21	889	1	6-Nov-06	5	205.1	615.3	222	> 1 CV + FPS
307	R-23	816	1	29-Jun-04	1	83.3	250	310	> 3 CV
308	R-23	816	1	24-Sep-04	2	84.6	253.8	240	< 3 CV
309	R-23	816	1	14-Jul-05	3	83.6	250.8	330	> 3 CV
310	R-23	816	1	15-Aug-06	4	—	—	na	—
311	R-23	816	1	18-Dec-06	5	30.48	91.44	140	—
312	R-23i	470	2	20-Dec-05	1	—	—	—	—
313	R-23i	470	2	3-Oct-06	2	150.3	450.9	288	> 1 CV + FPS
314	R-23i	524	3	11-Dec-05	1	—	—	—	—
315	R-23i	524	3	11-Oct-06	2	113.85	341.55	155	> 1 CV + FPS
316	R-24	825	1	20-Sep-05	1	—	—	—	—
317	R-24	825	1	15-Nov-05	2	120.95	362.85	448.35	—
318	R-24	825	1	6-Mar-06	3	122.18	366.55	425	—
319	R-24	825	1	10-May-06	4	120.51	361.53	201.16	> 1 CV + FPS
320	R-24	825	1	27-Jul-06	5	111.65	334.95	190.75	> 1 CV + FPS
349	R-27	852	1	11-Oct-05	1	—	—	—	—
350	R-27	852	1	21-Oct-05	1	—	—	—	—
351	R-27	852	1	14-Nov-05	2	—	—	—	—
352	R-27	852	1	1-Jul-06	3	—	—	24843.6	—
353	R-28	934	1	20-May-05	1	75.3	225.9	196.86	< 3 CV
354	R-28	934	1	1-Sep-05	2	74.74	224.22	115.5	> 1 CV + FPS
355	R-28	934	1	10-Nov-05	3	74.72	224.16	189.01	> 1 CV + FPS
356	R-28	934	1	26-Jan-06	4	74.5	223.5	248	—
357	R-28	934	1	19-Apr-06	5	75	225	130	> 1 CV + FPS
358	R-28	934	1	5-Jul-06	6	74.53	223.59	120	> 1 CV + FPS
359	R-28	934	1	26-Oct-06	7	74.8	224.43	108	> 1 CV + FPS
379	R-33	996	1	27-Jun-05	1	—	—	5.5	—
380	R-33	996	1	14-Sep-05	2	—	—	11	—
381	R-33	996	1	16-Feb-06	3	—	—	9	—

Table C-2 (continued)

Sample #[a]	Well	Port depth (ft)	Screen #	Sample Collection Date	Event #	Calculated Well CV		Vol. Purged Prior to Sampling (gal.)	Sample Collection Threshold
						1 CV (gal.)	3CV (gal.)		
382	R-33	996	1	31-Oct-06	4	—	—	5	—
383	R-33	1112	2	24-Jun-05	1	—	—	9.5	—
384	R-33	1112	2	15-Sep-05	2	—	—	12	—
385	R-33	1112	2	14-Feb-06	3	—	—	10	—
386	R-33	1112	2	5-Jul-06	4	—	—	6.69	—
387	R-33	1112	2	1-Nov-06	5	—	—	7	—
388	R-34	895	1	7-Jun-05	1	102.5	307.5	399	> 3 CV
389	R-34	895	1	7-Sep-05	2	104.48	313.44	408	
390	R-34	895	1	29-Nov-05	3	104.42	313.26	372	> 1 CV + FPS
391	R-34	895	1	31-Jan-06	4	103.81	311.43	405	
392	R-34	895	1	17-Jul-06	5	103.96	311.88	285	> 1 CV + FPS
393	R-34	895	1	30-Oct-06	6	103.39	310.17	328.41	—

FPS = field parameters; CV = well casing volume

— = Not available.

[a] "Sample #" corresponds to individual sampling events for which water-quality data are reported in Tables C-3 through C-7.

Table C-3
General Water-Quality Indicators

Row #	Well	Port depth (ft)	Scr #	Sample collection date	Event	Tritium (pCi/L)	Modern water?	Field pH		Low pH?	High pH?	Test Gen-1	Alkalinity (mg/L CaCO3)		Test Gen-2	Turbidity (NTU)		Test Gen-3
							>UL			>LL	<UL				<UL			<UL
							1			6.94	8.65				105			5
							1			6.73	8.80				52			5
1	CdV-16-1(i)	624	1	1-Jun-05	1	67.7	Yes	5.18		No	Yes	Fail	63		Fail	5.8		Fail
2	CdV-16-1(i)	624	1	29-Aug-05	2	67.1	Yes	6.79		Yes	Yes	P	49		P	4.9		P
3	CdV-16-1(i)	624	1	7-Dec-05	3	63.2	Yes	6.78		Yes	Yes	P	52		P	2.3		P
4	CdV-16-1(i)	624	1	9-Mar-06	4	65.8	Yes	6.80		Yes	Yes	P	38	FP	P	1.4		P
5	CdV-16-2(i)r	850	1	14-Sep-05	1	–	ND	7.23		Yes	Yes	P	61		Fail	—		ND
6	CdV-16-2(i)r	850	1	15-Dec-05	2	8.4	Yes	7.23		Yes	Yes	P	107		Fail	2.5		P
7	CdV-16-2(i)r	850	1	15-Mar-06	3	7.5	Yes	6.99		Yes	Yes	P	35	FP	P	91.2		Fail
8	CdV-16-2(i)r	850	1	17-May-06	4	6.7	Yes	6.64		No	Yes	Fail	50	CL	P	3.3		P
9	CdV-R-15-3	1254	4	19-Oct-04	1	0.2	No	8.99		Yes	No	Fail	57		P	0.4		P
10	CdV-R-15-3	1254	4	4-Apr-05	2	0.1	No	8.17		Yes	Yes	P	47		P	0.2		P
11	CdV-R-15-3	1254	4	12-Jul-05	3	0.2	No	8.46		Yes	Yes	P	57	CL	P	0.3		P
12	CdV-R-15-3	1254	4	18-Oct-05	4	0.6	No	8.39		Yes	Yes	P	50		P	0.3		P
13	CdV-R-15-3	1254	4	19-Jan-06	5	0	No	8.36		Yes	Yes	P	50	FP	P	0.5		P
14	CdV-R-15-3	1254	4	27-Mar-06	6	-0.1	No	8.44		Yes	Yes	P	52	FP	P	0.3		P
15	CdV-R-15-3	1350	5	20-Oct-04	1	0.4	No	7.79		Yes	Yes	P	75		P	0.3		P
16	CdV-R-15-3	1350	5	5-Apr-05	2	0	No	7.20		Yes	Yes	P	76		P	0.2		P
17	CdV-R-15-3	1350	5	12-Jul-05	3	0	No	7.32		Yes	Yes	P	67	CL	P	0.2		P
18	CdV-R-15-3	1350	5	18-Oct-05	4	-0.03	No	7.32		Yes	Yes	P	62		P	0.5		P
19	CdV-R-15-3	1350	5	20-Jan-06	5	-0.3	No	7.29		Yes	Yes	P	65	FP	P	0.3		P
20	CdV-R-15-3	1350	5	28-Mar-06	6	-0.2	No	6.65		No	Yes	Fail	55	FP	P	0.4		P
21	CdV-R-15-3	1640	6	21-Oct-04	1	0.4	No	7.86		Yes	Yes	P	51		P	1.1		P
22	CdV-R-15-3	1640	6	6-Apr-05	2	-0.2	No	7.11		Yes	Yes	P	60		P	0.7		P
23	CdV-R-15-3	1640	6	13-Jul-05	3	0.3	No	7.42		Yes	Yes	P	59	CL	P	1.2		P
24	CdV-R-15-3	1640	6	19-Oct-05	4	-0.35	No	7.57		Yes	Yes	P	63		P	0.6		P
25	CdV-R-15-3	1640	6	20-Jan-06	5	-0.4	No	7.41		Yes	Yes	P	66	FP	P	0.7		P
26	CdV-R-15-3	1640	6	29-Mar-06	6	-0.03	No	7.78		Yes	Yes	P	58	FP	P	0.7		P
27	CdV-R-37-2	1200	2	26-Oct-04	1	0.4	No	6.98		Yes	Yes	P	131		Fail	15	FP	Fail
28	CdV-R-37-2	1200	2	29-Mar-05	2	0.4	No	6.83		No	Yes	Fail	199	FN	Fail	12	FP	Fail
29	CdV-R-37-2	1200	2	6-Jul-05	3	0.4	No	6.83		No	Yes	Fail	106	CL	Fail	36		Fail
30	CdV-R-37-2	1200	2	12-Oct-05	4	0.2	No	6.97		Yes	Yes	P	111		Fail	5.2		Fail
31	CdV-R-37-2	1200	2	9-Jan-06	5	0.2	No	7.01		Yes	Yes	P	101	FP	P	12.9		Fail
32	CdV-R-37-2	1200	2	21-Mar-06	6	0.2	No	6.46		No	Yes	Fail	77	CL	P	3.4		P
33	CdV-R-37-2	1359	3	27-Oct-04	1	0.7	No	7.62		Yes	Yes	P	58		P	0.4	FP	P
34	CdV-R-37-2	1359	3	30-Mar-05	2	0	No	8.10	FP	Yes	Yes	P	59	FN	P	0.2	FP	P
35	CdV-R-37-2	1359	3	7-Jul-05	3	-0.1	No	7.89		Yes	Yes	P	57	CL	P	0.3		P
36	CdV-R-37-2	1359	3	12-Oct-05	4	0.5	No	7.99		Yes	Yes	P	58		P	0.5		P
37	CdV-R-37-2	1359	3	10-Jan-06	5	0.4	No	7.98		Yes	Yes	P	57	FP	P	0.4		P
38	CdV-R-37-2	1359	3	22-Mar-06	6	-0.1	No	8.02		Yes	Yes	P	55	FP	P	3.1		P
39	CdV-R-37-2	1551	4	27-Oct-04	1	0.3	No	6.86		No	Yes	Fail	53		P	1.1	FP	P
40	CdV-R-37-2	1551	4	31-Mar-05	2	0.3	No	7.16	FP	Yes	Yes	P	50	FN	P	1	FP	P
41	CdV-R-37-2	1551	4	8-Jul-05	3	0.1	No	6.90		No	Yes	Fail	55	CL	P	1.1		P
42	CdV-R-37-2	1551	4	13-Oct-05	4	-0.1	No	6.74		No	Yes	Fail	50		P	3.1		P
43	CdV-R-37-2	1551	4	11-Jan-06	5	0.2	No	7.24		Yes	Yes	P	57	FP	P	0.9		P
44	CdV-R-37-2	1551	4	22-Mar-06	6	-0.4	No	6.96		Yes	Yes	P	58	FP	P	1.1		P
45	MCOBT-4.4	485	1	28-Jan-03	1	14900	Yes	7.20		Yes	Yes	P	45		P	0.2		P
46	MCOBT-4.4	485	1	21-May-03	1.5	14900	Yes	7.50		Yes	Yes	P	46	CL	P	0.3		P
47	MCOBT-4.4	485	1	29-Mar-05	2	–	ND	7.50		Yes	Yes	P	41		P	0.6		P
48	MCOBT-4.4	485	1	8-Jun-05	3	23500	Yes	7.40		Yes	Yes	P	—		ND	0.6		P
49	R-1	1031	1	19-May-05	1	0.2	No	7.63		Yes	Yes	P	69		P	0.4		P
50	R-1	1031	1	12-Sep-05	2	-0.2	No	7.78		Yes	Yes	P	60		P	0.6		P
51	R-1	1031	1	28-Nov-05	3	0.1	No	7.71		Yes	Yes	P	54		P	4		P
52	R-1	1031	1	25-Jan-06	4	0.4	No	7.82		Yes	Yes	P	50		P	0.65		P
53	R-1	1031	1	19-Apr-06	5	–	ND	7.71		Yes	Yes	P	61		P	0.6		P

Table C-3
General Water-Quality Indicators

Row #	Well	Port depth (ft)	Scr #	Sample collection date	Event	Tritium (pCi/L)	Modern water?	Field pH		Low pH?	High pH?	Test Gen-1	Alkalinity (mg/L CaCO3)		Test Gen-2	Turbidity (NTU)		Test Gen-3
							>UL			>LL	<UL				<UL			<UL
							1			6.94	8.65				105			5
							1			6.73	8.80				52			5
54	R-1	1031	1	6-Jul-06	6	0.5	No	7.74	CL	Yes	Yes	P	63	CL	P	0.7		P
55	R-1	1031	1	26-Oct-06	7	0.03	No	7.63		Yes	Yes	P	66	CL	P	0.7		P
56	R-2	918	1	26-Apr-05	1	–	ND	6.96		Yes	Yes	P	69		P	12		Fail
57	R-2	918	1	9-Aug-05	2	27.5	Yes	7.39		Yes	Yes	P	61		P	12		Fail
58	R-2	918	1	9-Nov-05	3	0.3	No	7.43		Yes	Yes	P	56		P	8.9		Fail
59	R-2	918	1	27-Feb-06	4	0.3	No	7.46		Yes	Yes	P	103		P	4.9		P
60	R-2	918	1	24-Jul-06	5	-0.1	No	7.56		Yes	Yes	P	66	CL	P	7.6		Fail
61	R-3i	215	1	10-Aug-06	1	74	Yes	7.43		Yes	Yes	P	145		Fail	0.6		P
62	R-4	793	1	27-Apr-05	1	54.3	Yes	7.71		Yes	Yes	P	68		P	0		P
63	R-4	793	1	8-Aug-05	2	59.7	Yes	7.95		Yes	Yes	P	52		P	0.2		P
64	R-4	793	1	14-Nov-05	3	53	Yes	7.96		Yes	Yes	P	64		P	0.1		P
65	R-4	793	1	28-Feb-06	4	47	Yes	8.29		Yes	Yes	P	73		P	0.3		P
66	R-4	793	1	25-Jul-06	5	58	Yes	7.90		Yes	Yes	P	64	CL	P	0.1		P
67	R-5	384	2	28-Apr-04	1	0	No	8.02		Yes	Yes	P	98		Fail	0.1		P
68	R-5	384	2	27-Sep-04	2	0.2	No	8.27		Yes	Yes	P	98		Fail	0.2		P
69	R-5	384	2	2-May-05	3	-0.3	No	7.69		Yes	Yes	P	120	CL	Fail	0.1		P
70	R-5	384	2	25-Jul-06	4	0.2	No	7.87		Yes	Yes	P	94	CL	Fail	0.2		P
71	R-5	719	3	30-Apr-04	1	0.1	No	8.06		Yes	Yes	P	89	FP	P	0.2		P
72	R-5	719	3	28-Sep-04	2	0	No	8.22		Yes	Yes	P	88		P	0.2		P
73	R-5	719	3	3-May-05	3	0.1	No	7.87		Yes	Yes	P	95	CL	P	0.2		P
74	R-5	719	3	26-Jul-06	4	0.1	No	8.12		Yes	Yes	P	91	CL	P	0.2		P
75	R-5	861	4	3-May-04	1	0.4	No	7.56		Yes	Yes	P	105		P	2		P
76	R-5	861	4	30-Sep-04	2	0.7	No	7.76		Yes	Yes	P	114		Fail	1.7		P
77	R-5	861	4	4-May-05	3	-0.3	No	7.70		Yes	Yes	P	129	CL	Fail	0.5		P
78	R-5	861	4	27-Jul-06	4	0.03	No	7.53		Yes	Yes	P	—		ND	1.2		P
79	R-6	1205	1	23-Aug-05	1	0.9	No	8.15		Yes	Yes	P	68		P	1.7		P
80	R-6	1205	1	17-Nov-05	2	-0.1	No	8.17		Yes	Yes	P	63		P	0.9		P
81	R-6	1205	1	1-Mar-06	3	-0.4	No	8.20		Yes	Yes	P	75		P	1.35		P
82	R-6	1205	1	11-May-06	4	0.2	No	8.43		Yes	Yes	P	74		P	2.7		P
83	R-6	1205	1	26-Jul-06	5	0.2	No	8.35		Yes	Yes	P	72	CL	P	0.8		P
84	R-6i	602	1	24-Aug-05	1	4211	Yes	7.26		Yes	Yes	P	75		Fail	2.8		P
85	R-6i	602	1	17-Nov-05	2	4272	Yes	7.23		Yes	Yes	P	77		Fail	2.5		P
86	R-6i	602	1	1-Mar-06	3	4365	Yes	7.34		Yes	Yes	P	80		Fail	2		P
87	R-6i	602	1	11-May-06	4	4250	Yes	7.20		Yes	Yes	P	77		Fail	1.7		P
88	R-6i	602	1	26-Jul-06	5	4333	Yes	7.36		Yes	Yes	P	73	CL	Fail	1		P
89	R-7	915	3	18-Dec-03	1	-0.1	No	7.95		Yes	Yes	P	39	CL	P	1.6		P
90	R-7	915	3	26-May-04	2	0	No	6.80		No	Yes	Fail	38	CL	P	1.3		P
91	R-7	915	3	26-Apr-05	3	0.1	No	7.09		Yes	Yes	P	45	CL	P	1.3		P
92	R-7	915	3	31-Jul-06	4	0.3	No	6.85		No	Yes	Fail	48	E6	P	1		P
93	R-8	711	1	24-Aug-04	1	0.2	No	8.52		Yes	Yes	P	70		P	0.1		P
94	R-8	711	1	8-Dec-04	2	0.3	No	8.00		Yes	Yes	P	71		P	0.1	FN	P
95	R-8	711	1	27-Apr-05	3	0.6	No	8.30		Yes	Yes	P	60	CL	P	0.1		P
96	R-8	711	1	1-Aug-06	4	0	No	8.30		Yes	Yes	P	74	E6	P	0.15		P
97	R-8	825	2	25-Aug-04	1	0	No	9.52		Yes	No	Fail	76		P	1.9		P
98	R-8	825	2	9-Dec-04	2	0	No	9.38		Yes	No	Fail	84		P	1.3	FN	P
99	R-8	825	2	28-Apr-05	3	0.4	No	9.26		Yes	No	Fail	76	CL	P	0.8		P
100	R-8	825	2	2-Aug-06	4	0.2	No	9.09		Yes	No	Fail	95	E6	P	0.2		P
101	R-9	684	1	12-Dec-03	1	24.2	Yes	8.04		Yes	Yes	P	107	CL	Fail	1.1		P
102	R-9	684	1	27-May-04	2	16	Yes	7.96		Yes	Yes	P	100	CL	P	0.4		P
103	R-9	684	1	19-Mar-05	2.5	–	ND	8.28		Yes	Yes	P	115		Fail	0.3		P
104	R-9	684	1	6-Apr-05	2.8	–	ND	8.15		Yes	Yes	P	115		Fail	0.6	FN	P
105	R-9	684	1	28-Apr-05	3	14.9	Yes	7.80		Yes	Yes	P	111	CL	Fail	3.6		P
106	R-9	684	1	31-Jul-06	4	11.1	Yes	8.12	CL	Yes	Yes	P	110	CL	Fail	—		ND

Table C-3
General Water-Quality Indicators

Row #	Well	Port depth (ft)	Scr #	Sample collection date	Event	Tritium (pCi/L)	Modern water?	Field pH		Low pH?	High pH?	Test Gen-1	Alkalinity (mg/L CaCO3)		Test Gen-2	Turbidity (NTU)		Test Gen-3
							>UL			>LL	<UL				<UL			<UL
							1			6.94	8.65				105			5
							1			6.73	8.80				52			5
107	R-9i	199	1	6-Feb-04	1	233	Yes	7.30	CL	Yes	Yes	P	68	CL	Fail	—		ND
108	R-9i	199	1	2-Jun-04	2	249	Yes	7.35		Yes	Yes	P	78	CL	Fail	0.3		P
109	R-9i	199	1	29-Apr-05	3	249	Yes	8.03		Yes	Yes	P	64	CL	Fail	0.8		P
110	R-9i	199	1	10-Aug-06	4	179	Yes	7.23		Yes	Yes	P	63	E6	Fail	0.2		P
111	R-9i	279	2	6-Sep-01	1	130	Yes	7.18		Yes	Yes	P	35	FP	P	0.1		P
112	R-9i	279	2	29-Jul-02	2	127	Yes	7.14		Yes	Yes	P	52		P	0.9		P
113	R-9i	279	2	6-Feb-04	3	112	Yes	7.35		Yes	Yes	P	56	CL	Fail	0.8		P
114	R-9i	279	2	10-Aug-06	4	100	Yes	7.27		Yes	Yes	P	53	E6	Fail	0.5		P
115	R-10	874	1	29-Jun-06	1	0.1	No	8.06		Yes	Yes	P	103		P	1.8		P
116	R-10	874	1	12-Oct-06	2	-0.4	No	8.21		Yes	Yes	P	95	E6	P	0.9		P
117	R-10	1042	2	11-Oct-05	1	–	ND	8.04		Yes	Yes	P	89		P	—		ND
118	R-10	1042	2	29-Jun-06	2	0.2	No	8.21		Yes	Yes	P	112		Fail	—		ND
119	R-10	1042	2	12-Oct-06	3	0.03	No	8.17		Yes	Yes	P	100	E6	P	1.15		P
120	R-10a	690	1	7-Sep-05	1	–	ND	7.33		Yes	Yes	P	110		Fail	—		ND
121	R-10a	690	1	30-Nov-05	2	-0.1	No	7.61		Yes	Yes	P	128		Fail	3.9		P
122	R-10a	690	1	1-Feb-06	3	-0.5	No	7.80		Yes	Yes	P	127		Fail	3		P
123	R-10a	690	1	17-Jul-06	4	0.5	No	7.83		Yes	Yes	P	112	CL	Fail	5.9		Fail
124	R-10a	690	1	12-Oct-06	5	-0.1	No	8.06		Yes	Yes	P	121	E6	Fail	4.2		P
125	R-11	855	1	17-May-05	1	6.2	Yes	8.00		Yes	Yes	P	73		P	0.4		P
126	R-11	855	1	3-Aug-05	2	6.1	Yes	8.13		Yes	Yes	P	72		P	1.1	FN	P
127	R-11	855	1	8-Nov-05	3	7.1	Yes	8.13		Yes	Yes	P	65		P	0.3		P
128	R-11	855	1	3-Feb-06	4	8.2	Yes	7.90		Yes	Yes	P	63		P	0.6		P
129	R-11	855	1	20-Apr-06	5	–	ND	8.04		Yes	Yes	P	114		Fail	0.45		P
130	R-11	855	1	10-Jul-06	6	11.2	Yes	8.01	CL	Yes	Yes	P	71	CL	P	—		ND
131	R-11	855	1	10-Oct-06	7	9.4	Yes	7.91		Yes	Yes	P	71	CL	P	0.3		P
132	R-12	468	1	2-Feb-04	1	149	Yes	9.17		Yes	No	Fail	46	CL	P	1.8		P
133	R-12	468	1	2-Jun-04	2	–	ND	8.85		Yes	No	Fail	34	CL	P	1.6		P
134	R-12	468	1	16-Jun-05	3	–	ND	8.93		Yes	No	Fail	43	CL	P	1.2	FN	P
135	R-12	468	1	30-Jun-05	3	–	ND	8.28		Yes	Yes	P	—		ND	34		Fail
136	R-12	468	1	2-Feb-06	4	121	Yes	8.96		Yes	No	Fail	34		P	0.9		P
137	R-12	468	1	11-Jul-06	5	105	Yes	9.03		Yes	No	Fail	40	CL	P	1.1		P
138	R-12	468	1	29-Sep-06	6	118	Yes	7.88		Yes	Yes	P	169		Fail	1.8		P
139	R-12	507	2	10-Sep-01	1	78	Yes	9.41		Yes	No	Fail	29		P	2.7		P
140	R-12	507	2	1-Aug-02	2	86	Yes	9.32		Yes	No	Fail	56	FP	Fail	0.65		P
141	R-12	507	2	28-Jan-04	3	60	Yes	9.27		Yes	No	Fail	57	CL	Fail	0.22		P
142	R-12	507	2	1-Feb-06	4	14	Yes	9.10		Yes	No	Fail	64		Fail	0.5		P
143	R-12	507	2	12-Jul-06	5	13	Yes	8.96		Yes	No	Fail	69	CL	Fail	0.9		P
144	R-12	507	2	1-Oct-06	6	78	Yes	8.07		Yes	Yes	P	94		Fail	0.3		P
145	R-12	811	3	27-Jan-04	1	45	Yes	8.15		Yes	Yes	P	141	CL	Fail	1.4		P
146	R-12	811	3	3-Jun-04	2	–	ND	8.36		Yes	Yes	P	168	CL	Fail	0.9		P
147	R-12	811	3	20-Jun-05	3	–	ND	8.22		Yes	Yes	P	144	CL	Fail	0.6		P
148	R-12	811	3	31-Jan-06	4	38	Yes	8.05		Yes	Yes	P	124		Fail	0.6		P
149	R-12	811	3	12-Jul-06	5	38	Yes	8.16		Yes	Yes	P	139	CL	Fail	0.5		P
150	R-12	811	3	27-Sep-06	6	65	Yes	7.99		Yes	Yes	P	50		P	0.8		P
151	R-12	811	3	18-Oct-06	7	45	Yes	7.92		Yes	Yes	P	82		P	0.3		P
152	R-13	958	1	9-Dec-03	1	-0.3	No	8.20		Yes	Yes	P	61	CL	P	0.2		P
153	R-13	958	1	11-Jun-04	2	0	No	8.20		Yes	Yes	P	59	CL	P	0.4		P
154	R-13	958	1	10-Mar-05	2.5	–	ND	8.32		Yes	Yes	P	62		P	0.2	FN	P
155	R-13	958	1	26-May-05	3	0.6	No	8.96		Yes	No	Fail	58	CL	P	0.2		P
156	R-13	958	1	1-Sep-05	4	0.2	No	8.06		Yes	Yes	P	62		P	0.3		P
157	R-13	958	1	2-Feb-06	5	-0.03	No	8.30		Yes	Yes	P	63		P	0.4		P
158	R-13	958	1	3-Jul-06	6	0.2	No	8.17		Yes	Yes	P	61	CL	P	0.9		P
159	R-13	958	1	25-Oct-06	7	0.1	No	8.20		Yes	Yes	P	61	CL	P	4.2		P

Table C-3
General Water-Quality Indicators

Row #	Well	Port depth (ft)	Scr #	Sample collection date	Event	Tritium (pCi/L)	Modern water?	Field pH		Low pH?	High pH?	Test Gen-1	Alkalinity (mg/L CaCO3)		Test Gen-2	Turbidity (NTU)		Test Gen-3
							>UL			>LL	<UL				<UL			<UL
							1			6.94	8.65				105			5
							1			6.73	8.80				52			5
160	R-14	1205	1	12-Jul-04	1	0.3	No	7.45	FN	Yes	Yes	P	65		P	0.8	FP	P
161	R-14	1205	1	28-Oct-04	2	0.1	No	8.03		Yes	Yes	P	66		P	0.9	FN	P
162	R-14	1205	1	11-May-05	3	0.7	No	8.34		Yes	Yes	P	67		P	0.6		P
163	R-14	1205	1	24-Jan-06	4	0	No	8.40		Yes	Yes	P	72		P	0.8		P
164	R-14	1205	1	26-Jun-06	5	-0.2	No	8.44		Yes	Yes	P	68	CL	P	0.8		P
165	R-14	1205	1	23-Oct-06	6	-0.2	No	8.61		Yes	Yes	P	83	E6	P	0.6		P
166	R-14	1289	2	14-Jul-04	1	-0.1	No	7.03		Yes	Yes	P	63		P	2.2		P
167	R-14	1289	2	3-Nov-04	2	0.4	No	7.43		Yes	Yes	P	73	FP	P	2.8		P
168	R-14	1289	2	12-May-05	3	0.2	No	7.18		Yes	Yes	P	65	FP	P	4.2		P
169	R-14	1289	2	25-Jan-06	4	-0.1	No	6.97		Yes	Yes	P	75		P	1.6		P
170	R-14	1289	2	28-Jun-06	5	0.03	No	7.56		Yes	Yes	P	80		P	1.3		P
171	R-14	1289	2	23-Oct-06	6	0.3	No	7.41		Yes	Yes	P	80	E6	P	1		P
172	R-15	959	1	10-Jun-04	1	22	Yes	8.29		Yes	Yes	P	49	CL	P	2.3		P
173	R-15	959	1	25-May-05	2	30	Yes	8.00		Yes	Yes	P	54	CL	P	0.6		P
174	R-15	959	1	31-Aug-05	3	31	Yes	8.16		Yes	Yes	P	55		P	7.5		Fail
175	R-15	959	1	30-Jan-06	4	30	Yes	7.80		Yes	Yes	P	45		P	3.35		P
176	R-15	959	1	3-Jul-06	5	29	Yes	7.97		Yes	Yes	P	56	CL	P	2		P
177	R-15	959	1	24-Oct-06	6	30	Yes	8.20		Yes	Yes	P	55	CL	P	2.7		P
178	R-16	866	2	13-Oct-04	1	0.2	No	9.42		Yes	No	Fail	85	FP	P	0.4		P
179	R-16	866	2	2-Dec-04	2	-0.1	No	9.28		Yes	No	Fail	88	FP	P	0.4		P
180	R-16	866	2	13-Jun-05	3	–	ND	9.29		Yes	No	Fail	86	CL	P	0.3	FP	P
181	R-16	866	2	13-Jul-06	4	0.2	No	9.62		Yes	No	Fail	66	E6	P	0.54		P
182	R-16	866	2	20-Jul-06	5	0.1	No	9.11		Yes	No	Fail	74		P	0.5		P
183	R-16	866	2	11-Aug-06	6	-0.2	No	8.15		Yes	Yes	P	110		Fail	0.5		P
184	R-16	866	2	14-Aug-06	7	–	ND	8.20	IP	Yes	Yes	P	78	E6	P	—		ND
185	R-16	866	2	10-Oct-06	8	0	No	8.57		Yes	Yes	P	68		P	1.1		P
186	R-16	866	2	14-Nov-06	9	–	ND	7.80	IP	Yes	Yes	P	62	IP	P	0.7	IP	P
187	R-16	866	2	4-Dec-06	10	–	ND	8.61	E6	Yes	Yes	P	107	IP	Fail	—		ND
188	R-16	1018	3	14-Oct-04	1	0.3	No	8.17		Yes	Yes	P	101	FP	P	0.1		P
189	R-16	1018	3	3-Dec-04	2	-0.2	No	7.78		Yes	Yes	P	113	FP	Fail	0.4		P
190	R-16	1018	3	13-Jun-05	3	–	ND	8.10		Yes	Yes	P	103	CL	P	0.2	FP	P
191	R-16	1018	3	12-Jul-06	4	0.319	No	8.18	CL	Yes	Yes	P	99	CL	P	—		ND
192	R-16	1018	3	20-Jul-06	5	0.3	No	8.61		Yes	Yes	P	87		P	0.2		P
193	R-16	1018	3	10-Aug-06	6	-0.1	No	7.96		Yes	Yes	P	75		P	0.5		P
194	R-16	1018	3	11-Aug-06	7	–	ND	8.00	IP	Yes	Yes	P	83	E6	P	—		ND
195	R-16	1018	3	12-Oct-06	8	0.03	No	8.47		Yes	Yes	P	112	E6	Fail	0.3		P
196	R-16	1018	3	14-Nov-06	9	–	ND	8.38	IP	Yes	Yes	P	83	IP	P	0.2	IP	P
197	R-16	1018	3	5-Dec-06	10	–	ND	8.11	IP	Yes	Yes	P	105	IP	P	0.3	IP	P
198	R-16	1238	4	15-Oct-04	1	0.1	No	9.56		Yes	No	Fail	117	FP	Fail	0.4		P
199	R-16	1238	4	7-Dec-04	2	-0.1	No	9.42		Yes	No	Fail	149		Fail	0.4		P
200	R-16	1238	4	14-Jun-05	3	–	ND	9.50		Yes	No	Fail	126	CL	Fail	0.6		P
201	R-16	1238	4	13-Jul-06	4	0.9	No	9.62		Yes	No	Fail	92	E6	P	0.54		P
202	R-16	1238	4	20-Jul-06	5	0	No	9.60		Yes	No	Fail	106		Fail	0.5		P
203	R-16	1238	4	9-Aug-06	6	-0.03	No	7.87		Yes	Yes	P	123		Fail	0.6		P
204	R-16	1238	4	11-Oct-06	7	-0.03	No	8.40		Yes	Yes	P	204		Fail	1.5		P
205	R-16	1238	4	14-Nov-06	8	–	ND	8.26	IP	Yes	Yes	P	87	IP	P	1.2	IP	P
206	R-16	1238	4	5-Dec-06	9	–	ND	8.27	IP	Yes	Yes	P	126	IP	Fail	1	IP	P
207	R-16r	600	1	26-Sep-05	1	–	ND	7.37		Yes	Yes	P	68		P	—		ND
208	R-16r	600	1	17-Oct-05	2	–	ND	7.99		Yes	Yes	P	82		P	—		ND
209	R-16r	600	1	19-Dec-05	3	0.5	No	8.13		Yes	Yes	P	81	CL	P	2.5		P
210	R-16r	600	1	8-Mar-06	4	-0.2	No	7.96		Yes	Yes	P	77		P	1.3		P
211	R-16r	600	1	24-May-06	5	-0.1	No	8.15		Yes	Yes	P	70		P	1		P
212	R-16r	600	1	17-Aug-06	6	-0.2	No	8.34		Yes	Yes	P	70		P	0.9		P

Table C-3
General Water-Quality Indicators

Row #	Well	Port depth (ft)	Scr #	Sample collection date	Event	Tritium (pCi/L)	Modern water?	Field pH		Low pH?	High pH?	Test Gen-1	Alkalinity (mg/L CaCO3)		Test Gen-2	Turbidity (NTU)		Test Gen-3
							>UL			>LL	<UL				<UL			<UL
							1			6.94	8.65				105			5
							1			6.73	8.80				52			5
213	R-16r	600	1	1-Nov-06	7	0.03	No	8.20		Yes	Yes	P	88	E6	P	0.6		P
214	R-17	1057	1	24-Feb-06	1	–	ND	7.47		Yes	Yes	P	58		P	—		ND
215	R-17	1057	1	19-Oct-06	2	0.19	No	8.21		Yes	Yes	P	68		P	19.5		Fail
216	R-17	1124	2	17-Oct-06	1	0	No	7.92		Yes	Yes	P	59		P	10		Fail
217	R-18	1358	1	25-Aug-05	1	5.4	Yes	7.63		Yes	Yes	P	46		P	0.5		P
218	R-18	1358	1	1-Dec-05	2	-0.1	No	7.67		Yes	Yes	P	22		P	0.2		P
219	R-18	1358	1	7-Mar-06	3	7.3	Yes	7.62		Yes	Yes	P	45		P	1.1		P
220	R-18	1358	1	16-May-06	4	0.3	No	7.22		Yes	Yes	P	50		P	1		P
221	R-18	1358	1	15-Aug-06	5	0.03	No	7.72		Yes	Yes	P	51	CL	P	1		P
222	R-18	1358	1	18-Dec-06	6	–	ND	7.44		Yes	Yes	P	50	CL	P	1.37		P
223	R-19	909	2	15-Dec-03	1	-0.1	No	8.84		Yes	No	Fail	71	CL	Fail	0.2		P
224	R-19	909	2	10-Jun-04	2	–	ND	8.94		Yes	No	Fail	68	CL	Fail	0.2		P
225	R-19	909	2	21-Jul-05	3	–	ND	8.44		Yes	Yes	P	71	CL	Fail	0.4		P
226	R-19	909	2	18-Aug-06	4	0.1	No	8.63		Yes	Yes	P	83	E6	Fail	0.2		P
227	R-19	909	2	11-Dec-06	5	–	ND	7.94		Yes	Yes	P	86	IP	P	0.12		P
228	R-19	1191	3	15-Dec-03	1	0	No	7.83	FP	Yes	Yes	P	57	CL	P	0.4		P
229	R-19	1191	3	14-Jun-04	2	–	ND	8.20		Yes	Yes	P	53	CL	P	0.2		P
230	R-19	1191	3	21-Jul-05	3	–	ND	7.80		Yes	Yes	P	57	CL	P	0.6		P
231	R-19	1191	3	15-Aug-06	4	-0.1	No	7.86		Yes	Yes	P	62	IP	P	0.27		P
232	R-19	1191	3	16-Aug-06	4	–	ND	7.84	E6	Yes	Yes	P	62	E6	P	—		ND
233	R-19	1191	3	11-Dec-06	5	–	ND	7.78		Yes	Yes	P	66	IP	P	0.16		P
234	R-19	1413	4	16-Dec-03	1	0	No	7.97		Yes	Yes	P	48	CL	P	0.4		P
235	R-19	1413	4	15-Jun-04	2	–	ND	8.11		Yes	Yes	P	47	CL	P	0.2		P
236	R-19	1413	4	28-Jul-05	3	–	ND	7.69		Yes	Yes	P	49	CL	P	0.4		P
237	R-19	1413	4	16-Aug-06	4	0.1	No	7.50		Yes	Yes	P	49	CL	P	0.3		P
238	R-19	1413	4	17-Aug-06	4	–	ND	7.75	E6	Yes	Yes	P	53	E6	P	—		ND
239	R-19	1413	4	12-Dec-06	5	–	ND	7.58		Yes	Yes	P	56	IP	P	0.42		P
240	R-19	1586	5	20-Sep-01	1	0.2	No	7.27		Yes	Yes	P	96	GR	P	6.5		Fail
241	R-19	1586	5	23-Aug-02	2	0.1	No	6.90		No	Yes	Fail	124	FP	Fail	4		P
242	R-19	1586	5	16-Dec-03	3	0.2	No	6.90		No	Yes	Fail	125	CL	Fail	0.4		P
243	R-19	1586	5	17-Aug-06	4	0.1	No	6.81		No	Yes	Fail	129	E6	Fail	0.4		P
244	R-19	1586	5	11-Dec-06	5	–	ND	6.75		No	Yes	Fail	139	IP	Fail	2.45		P
245	R-19	1730	6	21-Sep-01	1	0.5	No	7.17		Yes	Yes	P	27		P	1.1		P
246	R-19	1730	6	27-Aug-02	2	0	No	7.12		Yes	Yes	P	50	FP	P	0.6		P
247	R-19	1730	6	16-Dec-03	3	-0.2	No	6.87		No	Yes	Fail	41	CL	P	0.3		P
248	R-19	1730	6	17-Aug-06	4	-0.03	No	6.84		No	Yes	Fail	44	E6	P	0.2		P
249	R-19	1730	6	11-Dec-06	5	–	ND	6.62		No	Yes	Fail	49	IP	P	0.16		P
250	R-19	1835	7	26-Aug-02	0.8	0.2	No	7.33		Yes	Yes	P	192	FP	Fail	10		Fail
251	R-19	1835	7	17-Dec-03	1	0.2	No	7.60		Yes	Yes	P	150	CL	Fail	41		Fail
252	R-19	1835	7	16-Jun-04	2	–	ND	7.75		Yes	Yes	P	133	CL	Fail	33		Fail
253	R-19	1835	7	28-Jul-05	3	–	ND	7.60		Yes	Yes	P	126	CL	Fail	73		Fail
254	R-19	1835	7	18-Aug-06	4	0.2	No	7.12		Yes	Yes	P	142	E6	Fail	14.9		Fail
255	R-19	1835	7	13-Dec-06	5	–	ND	7.52	E6	Yes	Yes	P	156	IP	Fail	—		ND
256	R-20	907	1	20-Sep-04	1	0.2	No	9.26		Yes	No	Fail	117		Fail	0.9		P
257	R-20	907	1	4-Nov-04	2	-0.03	No	9.29		Yes	No	Fail	109		Fail	1		P
258	R-20	907	1	20-Jul-05	3	0	No	9.01		Yes	No	Fail	103	CL	P	0.7		P
259	R-20	907	1	6-Jun-06	4	0.3	No	9.07		Yes	No	Fail	77	E6	P	0.7		P
260	R-20	907	1	6-Jul-06	5	-0.3	No	8.49		Yes	Yes	P	81		P	4.7		P
261	R-20	907	1	2-Oct-06	6	–	ND	8.26	E6	Yes	Yes	P	80	E6	P	—		ND
262	R-20	907	1	17-Oct-06	7	–	ND	–		—	—	ND	—		ND	—		ND
263	R-20	1150	2	3-Sep-04	1	0.2	No	7.53		Yes	Yes	P	214	FP	Fail	1.6		P
264	R-20	1150	2	8-Nov-04	2	0.3	No	8.00		Yes	Yes	P	220	FP	Fail	1.2		P
265	R-20	1150	2	19-Jul-05	3	–	ND	7.77		Yes	Yes	P	275	CL	Fail	1.1		P
266	R-20	1150	2	7-Jun-06	4	-0.2	No	7.84		Yes	Yes	P	249	E6	Fail	1.4		P

Table C-3
General Water-Quality Indicators

Row #	Well	Port depth (ft)	Scr #	Sample collection date	Event	Tritium (pCi/L)	Modern water?	Field pH		Low pH?	High pH?	Test Gen-1	Alkalinity (mg/L CaCO3)		Test Gen-2	Turbidity (NTU)		Test Gen-3
							>UL			>LL	<UL				<UL			<UL
							1			6.94	8.65				105			5
							1			6.73	8.80				52			5
267	R-20	1150	2	8-Jul-06	5	-0.03	No	8.01		Yes	Yes	P	49		P	0.9		P
268	R-20	1330	3	7-Sep-04	1	0.2	No	7.20		Yes	Yes	P	77	FP	P	4.7		P
269	R-20	1330	3	9-Nov-04	2	0.4	No	7.51		Yes	Yes	P	77	FP	P	3.1		P
270	R-20	1330	3	18-Jul-05	3	–	ND	7.29		Yes	Yes	P	77	CL	P	4.3		P
271	R-20	1330	3	8-Jun-06	4	0.03	No	7.00		Yes	Yes	P	85	CL	P	5.01		P
272	R-20	1330	3	7-Jul-06	5	0.6	No	6.98		Yes	Yes	P	72		P	1.4		P
273	R-20	1330	3	21-Jul-06	6	0.2	No	6.82		No	Yes	Fail	30		P	1.4		P
274	R-20	1330	3	13-Oct-06	7	0.2	No	6.83		No	Yes	Fail	47	E6	P	0.25		P
275	R-21	889	1	23-Sep-04	1	0.2	No	8.12		Yes	Yes	P	57		P	0.6		P
276	R-21	889	1	14-Dec-04	2	0.2	No	8.09		Yes	Yes	P	59		P	0.3		P
277	R-21	889	1	6-Jun-05	3	–	ND	8.06		Yes	Yes	P	58	CL	P	0.2		P
278	R-21	889	1	7-Jul-06	4	0.2	No	8.03		Yes	Yes	P	60	E6	P	0.4		P
279	R-21	889	1	6-Nov-06	5	–	ND	7.80		Yes	Yes	P	64	E6	P	0.4		P
280	R-22	907	1	18-Nov-03	1	3	Yes	6.80		No	Yes	Fail	127	CL	Fail	25		Fail
281	R-22	907	1	21-Jun-04	2	2.7	Yes	7.19		Yes	Yes	P	156	CL	Fail	20		Fail
282	R-22	907	1	27-Jun-05	3	3.1	Yes	6.94		Yes	Yes	P	342	CL	Fail	20.9	FP	Fail
283	R-22	907	1	22-Aug-06	4	2.2	Yes	6.66		No	Yes	Fail	395	E6	Fail	7.8		Fail
284	R-22	907	1	7-Dec-06	5	–	ND	6.74		No	Yes	Fail	453	IP	Fail	—		ND
285	R-22	963	2	19-Nov-03	1	-0.1	No	8.07		Yes	Yes	P	59	CL	P	0.2		P
286	R-22	963	2	22-Jun-04	2	0	No	8.47		Yes	Yes	P	76	CL	P	0.2		P
287	R-22	963	2	28-Jun-05	3	0.1	No	8.05		Yes	Yes	P	66	CL	P	0.2		P
288	R-22	963	2	28-Aug-06	4	0.3	No	8.15		Yes	Yes	P	65	E6	P	0.2		P
289	R-22	963	2	7-Dec-06	5	–	ND	8.14		Yes	Yes	P	71	IP	P	0.27		P
290	R-22	1274	3	9-Jul-02	0.5	-0.1	No	8.62		Yes	Yes	P	106		Fail	0.9		P
291	R-22	1274	3	20-Nov-03	2	0.5	No	8.87		Yes	No	Fail	280	CL	Fail	0.5		P
292	R-22	1274	3	23-Jun-04	3	0.4	No	9.10		Yes	No	Fail	79	CL	P	0.5		P
293	R-22	1274	3	29-Jun-05	4	-0.1	No	8.46		Yes	Yes	P	110	CL	Fail	0.5	FP	P
294	R-22	1274	3	22-Aug-06	5	0.2	No	8.56		Yes	Yes	P	107	E6	Fail	0.6		P
295	R-22	1274	3	8-Dec-06	6	–	ND	8.53		Yes	Yes	P	116	IP	Fail	0.49		P
296	R-22	1378	4	11-Jul-02	0.5	0.3	No	7.20		Yes	Yes	P	245		Fail	17		Fail
297	R-22	1378	4	20-Nov-03	2	0.3	No	7.30		Yes	Yes	P	217	CL	Fail	6.4		Fail
298	R-22	1378	4	23-Jun-04	3	0.3	No	7.50		Yes	Yes	P	236	CL	Fail	4.4		P
299	R-22	1378	4	1-Jul-05	4	0.4	No	7.18		Yes	Yes	P	216	CL	Fail	2.2	FP	P
300	R-22	1378	4	22-Aug-06	5	0.1	No	6.99		Yes	Yes	P	200	E6	Fail	1		P
301	R-22	1378	4	8-Dec-06	6	–	ND	7.13		Yes	Yes	P	215	IP	Fail	2.1	IP	P
302	R-22	1448	5	10-Jul-02	1	13.1	Yes	7.15		Yes	Yes	P	132		Fail	0.9		P
303	R-22	1448	5	21-Nov-03	2	12.9	Yes	7.38		Yes	Yes	P	147	CL	Fail	0.7		P
304	R-22	1448	5	5-Jul-05	3	10.8	Yes	7.23		Yes	Yes	P	171	CL	Fail	5.1	FN	Fail
305	R-22	1448	5	21-Aug-06	4	8.8	Yes	6.95		Yes	Yes	P	161	E6	Fail	1		P
306	R-22	1448	5	7-Dec-06	5	–	ND	6.66		No	Yes	Fail	174	IP	Fail	—		ND
307	R-23	816	1	29-Jun-04	1	-0.2	No	8.00		Yes	Yes	P	71		P	3.7		P
308	R-23	816	1	24-Sep-04	2	0.2	No	7.60		Yes	Yes	P	52		P	1.1		P
309	R-23	816	1	14-Jul-05	3	0.5	No	7.69		Yes	Yes	P	67	CL	P	2.2		P
310	R-23	816	1	15-Aug-06	4	0.9	No	7.84		Yes	Yes	P	67	CL	P	1.8		P
311	R-23	816	1	18-Dec-06	5	–	ND	7.92		Yes	Yes	P	68	CL	P	1.77		P
312	R-23i	470	2	20-Dec-05	1	–	ND	7.80		Yes	Yes	P	88		Fail	—		ND
313	R-23i	470	2	3-Oct-06	2	24	Yes	7.96		Yes	Yes	P	71		Fail	9.2		Fail
314	R-23i	524	3	11-Dec-05	1	–	ND	7.73		Yes	Yes	P	79		Fail	—		ND
315	R-23i	524	3	11-Oct-06	2	31.9	Yes	8.00		Yes	Yes	P	94		Fail	785		Err
316	R-24	825	1	20-Sep-05	1	–	ND	7.94		Yes	Yes	P	96		P	—		ND
317	R-24	825	1	15-Nov-05	2	-0.3	No	7.82		Yes	Yes	P	111		Fail	0.8		P
318	R-24	825	1	6-Mar-06	3	0.1	No	7.66		Yes	Yes	P	117		Fail	1		P
319	R-24	825	1	10-May-06	4	0.1	No	7.74		Yes	Yes	P	110		Fail	4.05		P

Table C-3
General Water-Quality Indicators

Row #	Well	Port depth (ft)	Scr #	Sample collection date	Event	Tritium (pCi/L)	Modern water?	Field pH		Low pH?	High pH?	Test Gen-1	Alkalinity (mg/L CaCO3)		Test Gen-2	Turbidity (NTU)		Test Gen-3
							>UL			>LL	<UL				<UL			<UL
							1			6.94	8.65				105			5
							1			6.73	8.80				52			5
320	R-24	825	1	27-Jul-06	5	-0.03	No	7.86		Yes	Yes	P	110	CL	Fail	0.7		P
321	R-25	755	1	7-Aug-02	0.5	48.2	Yes	7.30		Yes	Yes	P	74		Fail	11		Fail
322	R-25	755	1	11-Dec-03	1	41.4	Yes	6.91		Yes	Yes	P	64	CL	Fail	10		Fail
323	R-25	755	1	1-Sep-04	2	40.4	Yes	6.81		Yes	Yes	P	49	CL	P	22		Fail
324	R-25	755	1	2-Aug-05	3	39.3	Yes	6.82		Yes	Yes	P	59	CL	Fail	9.1		Fail
325	R-25	892	2	5-Feb-02	0.5	48.2	Yes	—		—	—	ND	—		ND	30.8	FP	Fail
326	R-25	892	2	8-Aug-02	1	52.2	Yes	8.22		Yes	Yes	P	202	FP	Fail	12		Fail
327	R-25	892	2	10-Dec-03	2	48.1	Yes	7.68		Yes	Yes	P	146	CL	Fail	17		Fail
328	R-25	892	2	3-Aug-05	3	38.3	Yes	7.03		Yes	Yes	P	86	CL	Fail	12		Fail
329	R-25	1192	4	8-Aug-02	1	30.4	Yes	7.22		Yes	Yes	P	52	FP	P	3.7		P
330	R-25	1192	4	10-Dec-03	2	36.9	Yes	6.89		Yes	Yes	P	75	CL	Fail	1.1		P
331	R-25	1192	4	4-Aug-05	3	33.2	Yes	7.19		Yes	Yes	P	66	CL	Fail	7.6		Fail
332	R-25	1303	5	9-Aug-02	0.5	16.2	Yes	7.47		Yes	Yes	P	108	CL	Fail	4.8		P
333	R-25	1303	5	9-Dec-03	1	15.5	Yes	7.38		Yes	Yes	P	92	CL	P	1.4		P
334	R-25	1303	5	31-Aug-04	2	15.5	Yes	7.00		Yes	Yes	P	—		ND	5		P
335	R-25	1303	5	9-Aug-05	3	–	ND	7.19		Yes	Yes	P	—		ND	3.6		P
336	R-25	1406	6	8-Feb-02	1	7.5	Yes	7.79		Yes	Yes	P	90		P	0.4		P
337	R-25	1406	6	12-Aug-02	2	5	Yes	7.79		Yes	Yes	P	74	FP	P	0.5		P
338	R-25	1406	6	9-Dec-03	3	3.7	Yes	7.93		Yes	Yes	P	67	CL	P	0.4		P
339	R-25	1606	7	11-Feb-02	1	3	Yes	7.80		Yes	Yes	P	65		P	2.6	FN	P
340	R-25	1606	7	12-Aug-02	2	1.7	Yes	8.06		Yes	Yes	P	46	FP	P	1.8		P
341	R-25	1606	7	8-Dec-03	3	0.4	No	7.96		Yes	Yes	P	51	CL	P	1.4		P
342	R-25	1796	8	14-Aug-02	1	2	Yes	8.37		Yes	Yes	P	56	FP	P	4.4		P
343	R-25	1796	8	4-Dec-03	2	0.4	No	8.62		Yes	Yes	P	54	CL	P	3.6		P
344	R-25	1796	8	10-Aug-05	3	0.5	No	8.48		Yes	Yes	P	61	CL	P	5.1		Fail
345	R-26	659	1	13-Apr-05	1	-0.3	No	7.70		Yes	Yes	P	46		P	0.1		P
346	R-26	659	1	27-Jul-05	2	0.2	No	7.77		Yes	Yes	P	46		P	0.1		P
347	R-26	659	1	2-Nov-05	3	0.1	No	7.67		Yes	Yes	P	41		P	0.1		P
348	R-26	659	1	22-Feb-06	4	-0.1	No	7.68		Yes	Yes	P	48		P	0.2	FP	P
349	R-27	852	1	11-Oct-05	1	–	ND	7.81		Yes	Yes	P	55		P	—		ND
350	R-27	852	1	21-Oct-05	1.1	–	ND	6.86		No	Yes	Fail	53		P	—		ND
351	R-27	852	1	14-Nov-05	2	–	ND	7.57		Yes	Yes	P	48		P	—		ND
352	R-27	852	1	1-Jul-06	3	0.1	No	7.63		Yes	Yes	P	45		P	0.8		P
353	R-28	934	1	20-May-05	1	152	Yes	7.67		Yes	Yes	P	51		P	39		Fail
354	R-28	934	1	1-Sep-05	2	178	Yes	7.85		Yes	Yes	P	55		P	0.3		P
355	R-28	934	1	10-Nov-05	3	181	Yes	7.84		Yes	Yes	P	62		P	0.4		P
356	R-28	934	1	26-Jan-06	4	181	Yes	7.90		Yes	Yes	P	42		P	1.6		P
357	R-28	934	1	19-Apr-06	5	–	ND	7.65		Yes	Yes	P	64		P	1.3		P
358	R-28	934	1	5-Jul-06	6	174	Yes	7.81		Yes	Yes	P	67	CL	P	0.7		P
359	R-28	934	1	26-Oct-06	7	195	Yes	7.90		Yes	Yes	P	70	CL	P	0.4		P
360	R-31	532	2	18-Mar-04	1	0.4	No	7.49		Yes	Yes	P	264	FP	Fail	7.4		Fail
361	R-31	532	2	17-Aug-05	2	–	ND	7.57		Yes	Yes	P	268		Fail	6.3		Fail
362	R-31	532	2	28-Nov-06	3	–	ND	–		–	–	ND	251	CL	Fail	1.86		P
363	R-31	670	3	19-Aug-05	1	–	ND	7.20		Yes	Yes	P	135	CL	Fail	2.24		P
364	R-31	670	3	30-Nov-06	2	–	ND	7.20		Yes	Yes	P	81	CL	P	1		P
365	R-31	831	4	23-Aug-05	1	–	ND	8.79		Yes	No	Fail	63	CL	P	0.7		P
366	R-31	831	4	6-Dec-06	2	–	ND	8.43		Yes	Yes	P	57	CL	P	0.33		P
367	R-31	1011	5	24-Aug-05	1	–	ND	8.86		Yes	No	Fail	59	CL	P	0.3		P
368	R-31	1011	5	6-Dec-06	2	–	ND	–		–	–	ND	53	CL	P	0.22		P
369	R-32	871	1	21-Sep-04	1	0.4	No	8.50		Yes	Yes	P	64	FP	P	0.2		P
370	R-32	871	1	15-Nov-04	2	0.5	No	8.70		Yes	No	Fail	64	FP	P	0.2		P
371	R-32	871	1	22-Jun-05	3	–	ND	8.14		Yes	Yes	P	79	CL	P	0.4	FP	P
372	R-32	871	1	29-Aug-06	4	0.5	No	8.44		Yes	Yes	P	73	CL	P	0.4		P

Table C-3
General Water-Quality Indicators

Row #	Well	Port depth (ft)	Scr #	Sample collection date	Event	Tritium (pCi/L)	Modern water?	Field pH		Low pH?	High pH?	Test Gen-1	Alkalinity (mg/L CaCO3)		Test Gen-2	Turbidity (NTU)		Test Gen-3
							>UL			>LL	<UL				<UL			<UL
							1			6.94	8.65				105			5
							1			6.73	8.80				52			5
373	R-32	871	1	12-Dec-06	5	−	ND	8.59		Yes	Yes	P	74	CL	P	0.2		P
374	R-32	976	3	22-Sep-04	1	0.1	No	7.36		Yes	Yes	P	60	FP	P	0.6		P
375	R-32	976	3	16-Nov-04	2	0.4	No	7.49		Yes	Yes	P	57	FP	P	0.5		P
376	R-32	976	3	24-Jun-05	3	−	ND	7.07		Yes	Yes	P	60	CL	P	0.5		P
377	R-32	976	3	30-Aug-06	4	1.3	Yes	7.41		Yes	Yes	P	57	CL	P	0.35		P
378	R-32	976	3	13-Dec-06	5	−	ND	7.34		Yes	Yes	P	58	CL	P	1.6		P
379	R-33	996	1	27-Jun-05	1	3.2	Yes	8.00		Yes	Yes	P	65	CL	P	1.6		P
380	R-33	996	1	14-Sep-05	2	0.2	No	7.91		Yes	Yes	P	57	CL	P	0.6		P
381	R-33	996	1	16-Feb-06	3	-0.2	No	7.75		Yes	Yes	P	74		P	0.6		P
382	R-33	996	1	31-Oct-06	4	0.1	No	7.50		Yes	Yes	P	69	E6	P	1.6		P
383	R-33	1112	2	24-Jun-05	1	-0.7	No	7.47		Yes	Yes	P	65		P	24		Fail
384	R-33	1112	2	15-Sep-05	2	0.1	No	7.70		Yes	Yes	P	132	CL	Fail	1.6		P
385	R-33	1112	2	14-Feb-06	3	0.1	No	7.71		Yes	Yes	P	64		P	1.2		P
386	R-33	1112	2	5-Jul-06	4	0.2	No	7.53		Yes	Yes	P	78	E6	P	5.9		Fail
387	R-33	1112	2	1-Nov-06	5	0.2	No	7.48		Yes	Yes	P	70	E6	P	2.05		P
388	R-34	895	1	7-Jun-05	1	0.1	No	8.06		Yes	Yes	P	59		P	11		Fail
389	R-34	895	1	7-Sep-05	2	0.8	No	8.12		Yes	Yes	P	67		P	8.4		Fail
390	R-34	895	1	29-Nov-05	3	0.1	No	8.24		Yes	Yes	P	64		P	9.25		Fail
391	R-34	895	1	31-Jan-06	4	0.2	No	8.40		Yes	Yes	P	64		P	10.2		Fail
392	R-34	895	1	17-Jul-06	5	0.4	No	8.22		Yes	Yes	P	73	CL	P	8.9		Fail
393	R-34	895	1	30-Oct-06	6	-0.1	No	8.24		Yes	Yes	P	64	CL	P	22.3		Fail
Pass/Fail outcomes																		
	Pass (or Yes)						214			364	352	327			264			314
	Fail (or No)						101			25	37	62			122			51
	Total outcomes						315			389	389	389			386			365
	% Pass (or Yes)						68			94	90	84			68			86
Indeterminate outcomes (defined in Table C-1c)																		
ND=no data							78			0	0	4			7			27
Err=suspected error							0			0	0	0			0			0
Plm=unreliable due to contaminant plume							0			0	0	0			0			0
DL=inadequate detection limit							0			0	0	0			0			0
UF=test unreliable for UF sample							0			0	0	0			0			0
Red=test unreliable, reducing conditions							0			0	0	0			0			0
—=test not applicable							0			0	0	0			0			0

Data source: WQDB except where indicated otherwise
−=no data, LL=lower limit, UL=upper limit, SU=standard (pH) units; P=pass; UF=unfiltered
CL=pH and alkalinity analyzed by off-site contract laboratory
E6=pH and alkalinity data measured by EES-6 on-site laboratory
FN=field data from field notebooks and/or data forms
FP=field parameter database in WQDB
IP=data in process of submission by EES-6 to WQDB
Notes: Pass and fail outcomes for each sample are determined by comparison against test threshold criteria.
In the above column headers, the indicator name and associated test identifier, type of test threshold (>LL or <UL),
and threshold values for the regional aquifer and perched intermediate aquifer are listed from top to bottom.
If reliable field data are available, these are used in lieu of pH and alkalinity data measured off-site.

Table C-4. Organic Indicators

Row #	Well	Port depth (ft)	Scr #	Sample collection date (start)		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
									ug/L				mg/L				mg/L				mg/L
									<UL				<UL				<UL				<UL
									5				0.05				0.28				1
									5				0.05				0.28				1
1	CdV-16-1(i)	624	1	1-Jun-05	1	<	64		Fail	<	0.01	U	P	<	0.01	U	P		1.30		Fail
2	CdV-16-1(i)	624	1	29-Aug-05	2	<	3	J	P	<	0.04	U	P		0.444		Fail		0.80	J	P
3	CdV-16-1(i)	624	1	7-Dec-05	3	<	5	U	P	<	0.01	U	P		0.52		Fail	<	1.04		P
4	CdV-16-1(i)	624	1	9-Mar-06	4	<	5	U	P	<	0.01	U	P		0.036	J	P		0.83	J	P
5	CdV-16-2(i)r	850	1	14-Sep-05	1		—		ND		—		ND		—		ND		—		ND
6	CdV-16-2(i)r	850	1	15-Dec-05	2		7.81		Fail	<	0.01	U	P	<	0.744		Fail	<	0.84	J	P
7	CdV-16-2(i)r	850	1	15-Mar-06	3	<	1.62	J	P	<	0.01	U	P	<	0.057	J	P		0.58	J	P
8	CdV-16-2(i)r	850	1	17-May-06	4	<	3.89	J	P	<	0.1	U	DL		0.011	J	P		0.46	J	P
9	CdV-R-15-3	1254	4	19-Oct-04	1		—		ND	<	0.02	U	P		0.074	J	P	<	0.30		P
10	CdV-R-15-3	1254	4	4-Apr-05	2	<	5	U	P	<	0.01	U	P	<	0.123		P		0.40		P
11	CdV-R-15-3	1254	4	12-Jul-05	3	<	5	U	P	<	0.01	U	P		0.061	J	P	<	0.30		P
12	CdV-R-15-3	1254	4	18-Oct-05	4	<	5	U	P	<	0.01	U	P	<	0.22	J	P		0.95	J	P
13	CdV-R-15-3	1254	4	19-Jan-06	5	<	5	U	P	<	0.05	U	P	<	0.01	U	P		—		ND
14	CdV-R-15-3	1254	4	27-Mar-06	6	<	2.4	J	P	<	0.01	U	P		26.7		Fail	<	0.33	U	P
15	CdV-R-15-3	1350	5	20-Oct-04	1		—		ND		0.12		Fail		0.274		P		4.40		Fail
16	CdV-R-15-3	1350	5	5-Apr-05	2		16		Fail		0.12		Fail		0.297		Fail		4.90		Fail
17	CdV-R-15-3	1350	5	12-Jul-05	3		6		Fail		0.14		Fail		0.287		Fail		1.40		Fail
18	CdV-R-15-3	1350	5	18-Oct-05	4		3.4	J	P		0.133		Fail	<	0.085	J	P		1.48		Fail
19	CdV-R-15-3	1350	5	20-Jan-06	5	<	5	U	P		0.089		Fail		0.251		P		—		ND
20	CdV-R-15-3	1350	5	28-Mar-06	6	<	9.72		Fail		0.075		Fail	<	0.138		P		1.56		Fail
21	CdV-R-15-3	1640	6	21-Oct-04	1		—		ND	<	0.02	U	P		0.137		P	<	0.50		P
22	CdV-R-15-3	1640	6	6-Apr-05	2	<	5	U	P	<	0.01	U	P		0.141		P		0.60		P
23	CdV-R-15-3	1640	6	13-Jul-05	3	<	5	U	P	<	0.01	U	P		0.058	J	P		—		ND
24	CdV-R-15-3	1640	6	19-Oct-05	4	<	5	U	P		0.015	J	P	<	0.01	U	P		1.11		Fail
25	CdV-R-15-3	1640	6	20-Jan-06	5	<	5	U	P	<	0.01	U	P		0.135		P		—		ND
26	CdV-R-15-3	1640	6	29-Mar-06	6	<	2.99	J	P	<	0.01	U	P	<	0.069	J	P		0.44	J	P
27	CdV-R-37-2	1200	2	26-Oct-04	1		—		ND		0.54		Fail		0.593		Fail		4.60		Fail
28	CdV-R-37-2	1200	2	29-Mar-05	2	<	5	U	P		0.39		Fail		0.482		Fail		5.70		Fail
29	CdV-R-37-2	1200	2	6-Jul-05	3	<	5	U	P		0.29		Fail		0.484		Fail		4.70		Fail
30	CdV-R-37-2	1200	2	12-Oct-05	4	<	5	U	P		0.299		Fail		0.264		P		4.78		Fail
31	CdV-R-37-2	1200	2	9-Jan-06	5	<	5	U	P		0.232		Fail	<	0.225		P		4.76		Fail
32	CdV-R-37-2	1200	2	21-Mar-06	6	<	2.99	J	P		0.204		Fail		0.305		Fail		4.17		Fail
33	CdV-R-37-2	1359	3	27-Oct-04	1		—		ND	<	0.02	U	P	<	0.044	U	P	<	0.30		P
34	CdV-R-37-2	1359	3	30-Mar-05	2	<	5	U	P	<	0.01	U	P		0.083	J	P	<	0.50		P
35	CdV-R-37-2	1359	3	7-Jul-05	3	<	5	U	P	<	0.01	U	P	<	0.01	U	P		0.20		P
36	CdV-R-37-2	1359	3	12-Oct-05	4	<	5	U	P	<	0.01	U	P		0.071	J	P	<	0.61	J	P
37	CdV-R-37-2	1359	3	10-Jan-06	5	<	5	U	P	<	0.01	U	P		0.94	J	Fail	<	0.62	J	P
38	CdV-R-37-2	1359	3	22-Mar-06	6	<	2.56	J	P	<	0.01	U	P	<	0.045	J	P	<	0.33	J	P
39	CdV-R-37-2	1551	4	27-Oct-04	1		—		ND		0.09		Fail		0.099	J	P		0.80		P
40	CdV-R-37-2	1551	4	31-Mar-05	2	<	5	U	P		0.08		Fail		0.331		Fail		1.40		Fail
41	CdV-R-37-2	1551	4	8-Jul-05	3	<	5	U	P		0.08		Fail		0.176		P		0.80		P
42	CdV-R-37-2	1551	4	13-Oct-05	4	<	5	U	P		0.074		Fail		0.087	J	P		1.46		Fail
43	CdV-R-37-2	1551	4	11-Jan-06	5	<	5	U	P		0.039	J	P	<	0.01	U	P	<	0.90	J	P
44	CdV-R-37-2	1551	4	22-Mar-06	6	<	2.22	J	P	<	0.029	J	P	<	0.088	J	P	<	0.68	J	P
45	MCOBT-4.4	485	1	28-Jan-03	1	<	5	U	P	<	0.05	U	P		0.23		P		0.79		P
46	MCOBT-4.4	485	1	21-May-03	2		—		ND	<	0.05	U	P		0.17		P		0.66		P
47	MCOBT-4.4	485	1	29-Mar-05	2		—		ND		—		ND		—		ND		—		ND
48	MCOBT-4.4	485	1	8-Jun-05	3		—		ND		—		ND	<	0.01	U	P		1.03		Fail
49	R-1	1031	1	19-May-05	1	<	1	J	P	<	0.01	U	P	<	0.01	U	P		0.20		P
50	R-1	1031	1	12-Sep-05	2	<	5	U	P	<	0.01	U	P	<	0.536		Fail	<	0.85	J	P
51	R-1	1031	1	28-Nov-05	3	<	5	U	P	<	0.01	U	P	<	0.524		Fail	<	0.80	J	P
52	R-1	1031	1	25-Jan-06	4	<	5	U	P	<	0.05	U	P	<	0.085	J	P		—		ND
53	R-1	1031	1	19-Apr-06	5	<	5	U	P		—		ND		—		ND		—		ND
54	R-1	1031	1	6-Jul-06	6	<	5	U	P	<	0.02	J	P	<	0.01	U	P	<	0.33	U	P
55	R-1	1031	1	26-Oct-06	7		3.02	J	P	<	0.01	U	P		0.032	J	P	<	0.33	U	P

Table C-4. Organic Indicators

Row #	Well	Port depth (ft)	Scr #	Sample collection date (start)			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
									ug/L				mg/L				mg/L				mg/L
									<UL				<UL				<UL				<UL
									5				0.05				0.28				1
									5				0.05				0.28				1
56	R-2	918	1	26-Apr-05	1	<	5	J	P	<	0.01	J	P	<	0.01	U	P		1.70		Fail
57	R-2	918	1	9-Aug-05	2	<	2	J	P	<	0.01	U	P		0.16		P		1.00		P
58	R-2	918	1	9-Nov-05	3	<	5	U	P	<	0.01	U	P	<	0.058	J	P		0.75	J	P
59	R-2	918	1	27-Feb-06	4	<	5	U	P	<	0.01	U	P	<	0.05	U	P		—		ND
60	R-2	918	1	24-Jul-06	5	<	5	U	P	<	0.054		Fail	<	0.01	U	P		0.56	J	P
61	R-3i	215	1	10-Aug-06	1	<	5	U	P		0.154		Fail		0.07	J	P		0.95	J	P
62	R-4	793	1	27-Apr-05	1	<	5	U	P	<	0.01	U	P	<	0.01	U	P		0.50		P
63	R-4	793	1	8-Aug-05	2	<	5	U	P	<	0.01	U	P		0.15		P		0.30		P
64	R-4	793	1	14-Nov-05	3	<	5	U	P	<	0.01	U	P		0.564		Fail		0.34	J	P
65	R-4	793	1	28-Feb-06	4		27.7		Fail	<	0.01	U	P	<	0.01	U	P		—		ND
66	R-4	793	1	25-Jul-06	5	<	5	U	P	<	0.066		Fail	<	0.01	U	P	<	0.33	U	P
67	R-5	384	2	28-Apr-04	1	<	5	U	P	<	0.02	U	P		0.068	J	P		0.30		P
68	R-5	384	2	27-Sep-04	2	<	5	U	P	<	0.02	U	P		0.115		P		0.30		P
69	R-5	384	2	2-May-05	3	<	5	U	P		—		ND	<	0.01	U	P		0.50		P
70	R-5	384	2	25-Jul-06	4	<	5	U	P	<	0.07		Fail	<	0.01	U	P	<	0.33	U	P
71	R-5	719	3	30-Apr-04	1	<	5	U	P	<	0.02	U	P		0.078	J	P		0.30		P
72	R-5	719	3	28-Sep-04	2	<	5	U	P	<	0.02	U	P		0.068	J	P		0.30		P
73	R-5	719	3	3-May-05	3	<	5	U	P		—		ND	<	0.01	U	P		0.40		P
74	R-5	719	3	26-Jul-06	4	<	5	U	P	<	0.116		Fail		0.216		P		0.39	J	P
75	R-5	861	4	3-May-04	1	<	5	U	P	<	0.02	U	P		0.296		Fail		0.90		P
76	R-5	861	4	30-Sep-04	2	<	5	U	P	<	0.02	U	P		0.069	J	P		0.80		P
77	R-5	861	4	4-May-05	3	<	5	U	P		—		ND	<	0.01	U	P		0.80		P
78	R-5	861	4	27-Jul-06	4		—		ND		—		ND		—		ND		—		ND
79	R-6	1205	1	23-Aug-05	1	<	5	U	P	<	0.04	U	P	<	0.02	U	P		1.40		Fail
80	R-6	1205	1	17-Nov-05	2	<	5	U	P	<	0.01	U	P	<	0.01	U	P	<	0.34	J	P
81	R-6	1205	1	1-Mar-06	3	<	5	U	P	<	0.01	U	P	<	0.01	U	P		—		ND
82	R-6	1205	1	11-May-06	4	<	5.33		Fail	<	0.019	J	P	<	0.01	U	P		—		ND
83	R-6	1205	1	26-Jul-06	5	<	5	UH	P		0.091		Fail	<	0.01	U	P	<	0.33	U	P
84	R-6i	602	1	24-Aug-05	1	<	1	J	P	<	0.04	U	P		0.136	J	P		4.40		Fail
85	R-6i	602	1	17-Nov-05	2	<	5	U	P	<	0.01	U	P		0.069	J	P		2.38		Fail
86	R-6i	602	1	1-Mar-06	3	<	5	U	P	<	0.01	U	P	<	0.01	U	P		—		ND
87	R-6i	602	1	11-May-06	4	<	7.96		Fail	<	0.023	J	P	<	0.016	J	P		—		ND
88	R-6i	602	1	26-Jul-06	5	<	5	UH	P		0.059		Fail		0.074	J	P		1.29		Fail
89	R-7	915	3	18-Dec-03	1	<	5	U	P	<	0.02	U	P		—		ND		1.20		Fail
90	R-7	915	3	26-May-04	2	<	5	U	P		—		ND		—		ND		—		ND
91	R-7	915	3	26-Apr-05	3	<	5	U	P		—		ND		0.215		P		1.30		Fail
92	R-7	915	3	31-Jul-06	4	<	2.36		P		—		ND		—		ND		—		ND
93	R-8	711	1	24-Aug-04	1	<	5	U	P	<	0.02	U	P		0.073	U	P		0.10		P
94	R-8	711	1	8-Dec-04	2	<	5	U	P	<	0.02	U	P	<	0.044	U	P		0.20		P
95	R-8	711	1	27-Apr-05	3	<	5	U	P		—		ND	<	0.01	U	P		0.30		P
96	R-8	711	1	1-Aug-06	4	<	5	U	P		0.117		Fail	<	0.01	U	P	<	0.33	U	P
97	R-8	825	2	25-Aug-04	1	<	5	U	P	<	0.02	U	P		0.0778	J	P		0.60		P
98	R-8	825	2	9-Dec-04	2	<	5	U	P	<	0.02	U	P	<	0.044	U	P		0.50		P
99	R-8	825	2	28-Apr-05	3		—		ND		—		ND	<	0.01	U	P		0.60		P
100	R-8	825	2	2-Aug-06	4		—		ND		—		ND		—		ND		—		ND
101	R-9	684	1	12-Dec-03	1		—		ND	<	0.02	U	P		—		ND		0.40		P
102	R-9	684	1	27-May-04	2	<	5	U	P		—		ND		—		ND		—		ND
103	R-9	684	1	19-Mar-05	3		—		ND		—		ND		—		ND		—		ND
104	R-9	684	1	6-Apr-05	3		—		ND		—		ND		—		ND		—		ND
105	R-9	684	1	28-Apr-05	3	<	5	U	P		—		ND	<	0.01	U	P		0.50		P
106	R-9	684	1	31-Jul-06	4	<	2.36	J	P	<	0.027	J	P	<	0.013	J	P	<	0.64	J	P
107	R-9i	199	1	6-Feb-04	1		—		ND	<	0.02	U	P		—		ND		3.20		Fail
108	R-9i	199	1	2-Jun-04	2	<	5	U	P		—		ND		—		ND		—		ND
109	R-9i	199	1	29-Apr-05	3	<	5	U	P		—		ND		0.23		P		3.40		Fail
110	R-9i	199	1	10-Aug-06	4		—		ND		—		ND		—		ND		—		ND

Table C-4. Organic Indicators

Row #	Well	Port depth (ft)	Scr #	Sample collection date (start)			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
									ug/L				mg/L				mg/L				mg/L
									<UL				<UL				<UL				<UL
									5				0.05				0.28				1
									5				0.05				0.28				1
111	R-9i	279	2	6-Sep-01	1	<	6	B	Fail	<	0.02	U	P		0.2		P		2.60		Fail
112	R-9i	279	2	29-Jul-02	2		—		ND	<	0.02	U	P		—		ND		1.80		Fail
113	R-9i	279	2	6-Feb-04	3		—		ND	<	0.02	U	P		—		ND		1.40		Fail
114	R-9i	279	2	10-Aug-06	4		—		ND		—		ND		—		ND		—		ND
115	R-10	874	1	29-Jun-06	1	<	1.99	J	P		0.716		Fail	<	0.02	J	P		0.42	J	P
116	R-10	874	1	12-Oct-06	2		3.06	J	P	<	0.01	U	P	<	0.1	U	P		1.18		Fail
117	R-10	1042	2	11-Oct-05	1		—		ND		—		ND		—		ND		—		ND
118	R-10	1042	2	29-Jun-06	2	<	5	U	P		0.02	J	P	<	0.01	U	P		0.49	J	P
119	R-10	1042	2	12-Oct-06	3		3.56	J	P	<	0.01	U	P	<	0.1	U	P		1.28		Fail
120	R-10a	690	1	7-Sep-05	1		—		ND		—		ND		—		ND		—		ND
121	R-10a	690	1	30-Nov-05	2	<	5	U	P	<	0.04	U	P		0.188	J	P	<	1.24		Fail
122	R-10a	690	1	1-Feb-06	3		2.7	J	P	<	0.01	U	P	<	0.01	U	P		—		ND
123	R-10a	690	1	17-Jul-06	4	<	5	U	P	<	0.019	J	P		0.118		P		0.49	J	P
124	R-10a	690	1	12-Oct-06	5		3.49	J	P	<	0.01	U	P	<	0.1	U	P		0.83	J	P
125	R-11	855	1	17-May-05	1	<	2	J	P	<	0.01	U	P	<	0.01	U	P	<	0.30		P
126	R-11	855	1	3-Aug-05	2	<	5	U	P		0.02	J	P	<	0.01	U	P	<	0.50		P
127	R-11	855	1	8-Nov-05	3	<	5	U	P	<	0.01	U	P	<	0.119		P	<	0.57	J	P
128	R-11	855	1	3-Feb-06	4	<	5	U	P	<	0.05	U	P		0.131		P		—		ND
129	R-11	855	1	20-Apr-06	5		—		ND		—		ND		—		ND		—		ND
130	R-11	855	1	10-Jul-06	6	<	5	U	P	<	0.05		P	<	0.01	U	P		0.45	J	P
131	R-11	855	1	10-Oct-06	7		1.99	J	P	<	0.01	U	P	<	0.02	U	P	<	0.33	U	P
132	R-12	468	1	2-Feb-04	1		—		ND		1.66		Fail		—		ND		5.30		Fail
133	R-12	468	1	2-Jun-04	2	<	5	U	P		—		ND		—		ND		—		ND
134	R-12	468	1	16-Jun-05	3	<	5	U	P		1.40		Fail		1.54		Fail		—		ND
135	R-12	468	1	30-Jun-05	3		—		ND		—		ND		—		ND		—		ND
136	R-12	468	1	2-Feb-06	4		2.15	J	P		1.37		Fail		1.49		Fail		—		ND
137	R-12	468	1	11-Jul-06	5		1.59	J	P		1.24		Fail		1.27		Fail		3.50		Fail
138	R-12	468	1	29-Sep-06	6		8.86		Fail	<	0.039	J	P	<	0.01	U	P		1.21		Fail
139	R-12	507	2	10-Sep-01	1		19.1		Fail		0.27		Fail		0.49		Fail		1.77		Fail
140	R-12	507	2	1-Aug-02	2		—		ND		0.4		Fail		—		ND		1.66		Fail
141	R-12	507	2	28-Jan-04	3		—		ND		0.22		Fail		—		ND		0.87		P
142	R-12	507	2	1-Feb-06	4	<	5	U	P		0.058		Fail		0.127		P		—		ND
143	R-12	507	2	12-Jul-06	5	<	5	U	P		0.127		Fail	<	0.113		P		0.93	J	P
144	R-12	507	2	1-Oct-06	6		7.11		Fail	<	0.01	U	P	<	0.015	J	P		0.89	J	P
145	R-12	811	3	27-Jan-04	1		—		ND	<	0.02	U	P		—		ND		1.00		P
146	R-12	811	3	3-Jun-04	2	<	5	U	P		—		ND		—		ND		—		ND
147	R-12	811	3	20-Jun-05	3		—		ND	<	0.01	U	P	<	0.01	U	P		—		ND
148	R-12	811	3	31-Jan-06	4	<	5	U	P	<	0.01	U	P	<	0.01	U	P		—		ND
149	R-12	811	3	12-Jul-06	5	<	2.92	BJ	P	<	0.034	J	P	<	0.027	J	P		1.02		Fail
150	R-12	811	3	27-Sep-06	6	<	5	U	P	<	0.01	U	P	<	0.033	J	P		0.80	J	P
151	R-12	811	3	18-Oct-06	7		1.75	J	P	<	0.01	U	P		0.032	J	P		0.88	J	P
152	R-13	958	1	9-Dec-03	1		—		ND	<	0.02	U	P		—		ND		0.20		P
153	R-13	958	1	11-Jun-04	2	<	5	U	P		—		ND		—		ND		—		ND
154	R-13	958	1	10-Mar-05	3		—		ND		—		ND		—		ND		—		ND
155	R-13	958	1	26-May-05	3		—		ND		—		ND	<	0.01	U	P		0.20		P
156	R-13	958	1	1-Sep-05	4		—		ND		—		ND	<	0.058	J	P	<	0.84	J	P
157	R-13	958	1	2-Feb-06	5	<	5	U	P	<	0.05	U	P	<	0.01	U	P		—		ND
158	R-13	958	1	3-Jul-06	6	<	1.85	J	P		0.028	J	P		0.066	J	P	<	0.33	U	P
159	R-13	958	1	25-Oct-06	7		4.88	J	P	<	0.01	U	P	<	0.01	U	P		0.34	J	P
160	R-14	1205	1	12-Jul-04	1	<	5	U	P	<	0.02	U	P	<	0.044	U	P	<	0.50		P
161	R-14	1205	1	28-Oct-04	2	<	5	U	P	<	0.02	U	P	<	0.044	U	P		0.40		P
162	R-14	1205	1	11-May-05	3		3	J	P	<	0.02	U	P		0.026	J	P	<	0.50		P
163	R-14	1205	1	24-Jan-06	4	<	5	U	P	<	0.1	U	DL		0.1	J	P		—		ND
164	R-14	1205	1	26-Jun-06	5	<	5	U	P	<	0.06		Fail		0.098	J	P		0.35	J	P
165	R-14	1205	1	23-Oct-06	6	<	2.86	BJ	P	<	0.01	U	P	<	0.017	J	P		0.52	J	P

Table C-4. Organic Indicators

Row #	Well	Port depth (ft)	Scr #	Sample collection date (start)			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
									ug/L				mg/L				mg/L				mg/L
									<UL				<UL				<UL				<UL
									5				0.05				0.28				1
									5				0.05				0.28				1
166	R-14	1289	2	14-Jul-04	1	<	5	U	P		0.06		Fail		0.066	J	P		1.90		Fail
167	R-14	1289	2	3-Nov-04	2	<	5	U	P		0.08		Fail		0.066	J	P		2.20		Fail
168	R-14	1289	2	12-May-05	3		4	J	P		0.08		Fail		0.114		P		2.10		Fail
169	R-14	1289	2	25-Jan-06	4	<	5	U	P		0.044	J	P	<	0.074	J	P		—		ND
170	R-14	1289	2	28-Jun-06	5	<	5	U	P		—		ND		—		ND		—		ND
171	R-14	1289	2	23-Oct-06	6		—		ND		—		ND		—		ND		—		ND
172	R-15	959	1	10-Jun-04	1	<	5	U	P		—		ND		—		ND		—		ND
173	R-15	959	1	25-May-05	2	<	5	U	P		—		ND	<	0.01	U	P		0.40		P
174	R-15	959	1	31-Aug-05	3	<	5	U	P		—		ND	<	0.01	U	P		0.20	J	P
175	R-15	959	1	30-Jan-06	4	<	5	U	P	<	0.05	U	P	<	0.123		P		—		ND
176	R-15	959	1	3-Jul-06	5	<	5	U	P		0.08		Fail		0.032	J	P	<	0.33	U	P
177	R-15	959	1	24-Oct-06	6	<	3.09	J	P	<	0.01	U	P	<	0.01	U	P	<	0.48	J	P
178	R-16	866	2	13-Oct-04	1	<	5	U	P		0.02	J	P		0.111		P	<	1.50		Fail
179	R-16	866	2	2-Dec-04	2	<	5	U	P		0.02	J	P		0.062	J	P		1.80		Fail
180	R-16	866	2	13-Jun-05	3	<	5	U	P	<	0.01	U	P		0.046	J	P		—		ND
181	R-16	866	2	13-Jul-06	4	<	2.9	BJ	P		—		ND		—		ND		—		ND
182	R-16	866	2	20-Jul-06	5	<	5	U	P	<	0.106		Fail		0.246		P		2.12		Fail
183	R-16	866	2	11-Aug-06	6	<	5	U	P	<	0.087		Fail		0.15	J	P		0.61	J	P
184	R-16	866	2	14-Aug-06	7		—		ND		—		ND		—		ND		—		ND
185	R-16	866	2	10-Oct-06	8		1.92	J	P	<	0.01	U	P	<	0.01	U	P		0.76	J	P
186	R-16	866	2	14-Nov-06	9		—		ND		—		ND		—		ND		—		ND
187	R-16	866	2	4-Dec-06	10		—		ND		—		ND		—		ND		—		ND
188	R-16	1018	3	14-Oct-04	1	<	5	U	P		0.58		Fail		1.3		Fail		0.80		P
189	R-16	1018	3	3-Dec-04	2	<	5	U	P		0.39		Fail		1.1		Fail		0.80		P
190	R-16	1018	3	13-Jun-05	3	<	5	U	P		0.04	J	P		0.314		Fail		—		ND
191	R-16	1018	3	12-Jul-06	4	<	2.64	BJ	P	<	0.018	J	P	<	0.197		P		1.06		Fail
192	R-16	1018	3	20-Jul-06	5		—		ND		—		ND		—		ND		—		ND
193	R-16	1018	3	10-Aug-06	6		2.58	J	P		0.12		Fail	<	0.01	U	P		2.20		Fail
194	R-16	1018	3	11-Aug-06	7		—		ND		—		ND		—		ND		—		ND
195	R-16	1018	3	12-Oct-06	8	<	5	U	P	<	0.01	U	P	<	0.058	J	P		0.80	J	P
196	R-16	1018	3	14-Nov-06	9		—		ND		—		ND		—		ND		—		ND
197	R-16	1018	3	5-Dec-06	10		—		ND		—		ND		—		ND		—		ND
198	R-16	1238	4	15-Oct-04	1	<	5	U	P		0.84		Fail		0.675		Fail		1.70		Fail
199	R-16	1238	4	7-Dec-04	2	<	5	U	P		0.84		Fail		0.916		Fail	<	3.10		Fail
200	R-16	1238	4	14-Jun-05	3	<	5	U	P		0.95		Fail		1.1		Fail		—		ND
201	R-16	1238	4	13-Jul-06	4	<	3.4	BJ	P		—		ND		—		ND		—		ND
202	R-16	1238	4	20-Jul-06	5	<	5	U	P		0.763		Fail		0.984		Fail		2.60		Fail
203	R-16	1238	4	9-Aug-06	6	<	5	U	P		0.137		Fail		0.279		P		0.69	J	P
204	R-16	1238	4	11-Oct-06	7	<	5	U	P		0.296		Fail	<	0.281		Fail		1.19		Fail
205	R-16	1238	4	14-Nov-06	8		—		ND		—		ND		—		ND		—		ND
206	R-16	1238	4	5-Dec-06	9		—		ND		—		ND		—		ND		—		ND
207	R-16r	600	1	26-Sep-05	1		—		ND		—		ND		—		ND		—		ND
208	R-16r	600	1	17-Oct-05	2		—		ND		—		ND		—		ND		—		ND
209	R-16r	600	1	19-Dec-05	3	<	5	U	P	<	0.04	U	P		0.576		Fail		—		ND
210	R-16r	600	1	8-Mar-06	4	<	5	U	P	<	0.01	U	P	<	0.01	U	P		—		ND
211	R-16r	600	1	24-May-06	5	<	3.11	J	P	<	0.033	J	P	<	0.01	U	P		—		ND
212	R-16r	600	1	17-Aug-06	6	<	1.84	J	P		0.023	J	P	<	0.01	U	P		0.55	J	P
213	R-16r	600	1	1-Nov-06	7	<	1.85	J	P	<	0.1	U	DL	<	0.01	U	P		0.34	J	P
214	R-17	1057	1	24-Feb-06	1		—		ND		—		ND		—		ND		0.34		P
215	R-17	1057	1	19-Oct-06	2	<	3.84	J	P	<	0.01	U	P	<	0.1	U	P		0.96	J	P
216	R-17	1124	2	17-Oct-06	1	<	5	U	P	<	0.01	U	P	<	0.01	U	P		0.39	J	P
217	R-18	1358	1	25-Aug-05	1	<	5	U	P	<	0.04	U	P	<	0.02	U	P		0.60	J	P
218	R-18	1358	1	1-Dec-05	2	<	5	U	P	<	0.01	U	P		0.488		Fail	<	1.03		Fail
219	R-18	1358	1	7-Mar-06	3	<	5	U	P	<	0.01	U	P		0.996		Fail		—		ND
220	R-18	1358	1	16-May-06	4	<	2.46	J	P	<	0.01	U	P	<	0.01	U	P		—		ND

Table C-4. Organic Indicators																					
Row #	Well	Port depth (ft)	Scr #	Sample collection date (start)			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
									ug/L				mg/L				mg/L				mg/L
									<UL				<UL				<UL				<UL
									5				0.05				0.28				1
									5				0.05				0.28				1
221	R-18	1358	1	15-Aug-06	5	<	5	U	P		0.047	J	P	<	0.1	U	P		0.78	J	P
222	R-18	1358	1	18-Dec-06	6	<	5	U	P		0.593		Err	<	0.1	U	P		0.36		P
223	R-19	909	2	15-Dec-03	1		—		ND	<	0.02	U	P		—		ND		0.30		P
224	R-19	909	2	10-Jun-04	2		—		ND		—		ND		—		ND		—		ND
225	R-19	909	2	21-Jul-05	3		—		ND	<	0.01	U	P		0.324		Fail		—		ND
226	R-19	909	2	18-Aug-06	4		—		ND		—		ND		—		ND		—		ND
227	R-19	909	2	11-Dec-06	5		—		ND		—		ND		—		ND		—		ND
228	R-19	1191	3	15-Dec-03	1		—		ND	<	0.02	U	P		—		ND		0.20		P
229	R-19	1191	3	14-Jun-04	2	<	5	U	P		—		ND		—		ND		—		ND
230	R-19	1191	3	21-Jul-05	3	<	5	U	P	<	0.01	U	P		22.9		Fail		—		ND
231	R-19	1191	3	15-Aug-06	4		—		ND		—		ND		—		ND		—		ND
232	R-19	1191	3	16-Aug-06	4		—		ND		—		ND		—		ND		—		ND
233	R-19	1191	3	11-Dec-06	5		—		ND		—		ND		—		ND		—		ND
234	R-19	1413	4	16-Dec-03	1		—		ND	<	0.02	U	P		—		ND		0.20	J	P
235	R-19	1413	4	15-Jun-04	2	<	5	U	P		—		ND		—		ND		—		ND
236	R-19	1413	4	28-Jul-05	3	<	5	U	P	<	0.05		P		0.021	J	P		—		ND
237	R-19	1413	4	16-Aug-06	4	<	5	U	P		0.021	J	P	<	0.1	U	P		0.53	J	P
238	R-19	1413	4	17-Aug-06	4		—		ND		—		ND		—		ND		—		ND
239	R-19	1413	4	12-Dec-06	5	<	5	U	P	<	0.01	U	P	<	0.1	U	P		0.53	J	P
240	R-19	1586	5	20-Sep-01	1		—		ND		—		ND		0.96		Fail		6.40		Fail
241	R-19	1586	5	23-Aug-02	2	<	5	U	P		0.88		Fail		—		ND		7.60		Fail
242	R-19	1586	5	16-Dec-03	3		—		ND		0.76		Fail		—		ND		6.40		Fail
243	R-19	1586	5	17-Aug-06	4		—		ND		—		ND		—		ND		—		ND
244	R-19	1586	5	11-Dec-06	5		—		ND		—		ND		—		ND		—		ND
245	R-19	1730	6	21-Sep-01	1		—		ND		—		ND		0.92		Fail		3.00		Fail
246	R-19	1730	6	27-Aug-02	2	<	5	U	P		0.31		Fail		—		ND		1.40		Fail
247	R-19	1730	6	16-Dec-03	3		—		ND		0.37		Fail		—		ND		0.60		P
248	R-19	1730	6	17-Aug-06	4		—		ND		—		ND		—		ND		—		ND
249	R-19	1730	6	11-Dec-06	5		—		ND		—		ND		—		ND		—		ND
250	R-19	1835	7	26-Aug-02	1	<	5	U	P		0.37		Fail		—		ND		3.60		Fail
251	R-19	1835	7	17-Dec-03	1		—		ND		0.23		Fail		—		ND		2.30		Fail
252	R-19	1835	7	16-Jun-04	2	<	5	U	P		—		ND		—		ND		—		ND
253	R-19	1835	7	28-Jul-05	3	<	5	U	P		0.33		Fail		0.6		Fail		—		ND
254	R-19	1835	7	18-Aug-06	4		—		ND		—		ND		—		ND		—		ND
255	R-19	1835	7	13-Dec-06	5		—		ND		—		ND		—		ND		—		ND
256	R-20	907	1	20-Sep-04	1		164		Fail		0.36		Fail		0.531		Fail		17.10		Fail
257	R-20	907	1	4-Nov-04	2		55		Fail		0.28		Fail		0.342		Fail		12.30		Fail
258	R-20	907	1	20-Jul-05	3	<	12		Fail		0.26		Fail		0.406		Fail		—		ND
259	R-20	907	1	6-Jun-06	4		3.34	J	P		0.243		Fail		0.203		P		8.24		Fail
260	R-20	907	1	6-Jul-06	5		6.23		Fail		0.083		Fail	<	0.099	J	P		2.93		Fail
261	R-20	907	1	2-Oct-06	6		—		ND		—		ND		—		ND		—		ND
262	R-20	907	1	17-Oct-06	7	<	4.56	BJ	P		—		ND		—		ND		—		ND
263	R-20	1150	2	3-Sep-04	1	<	5	U	P		0.68		Fail		0.893	H	Fail		38.30		Fail
264	R-20	1150	2	8-Nov-04	2	<	5	U	P		0.57		Fail		0.84		Fail		35.20		Fail
265	R-20	1150	2	19-Jul-05	3	<	5	U	P		0.51		Fail		0.827		Fail		—		ND
266	R-20	1150	2	7-Jun-06	4		1.58	J	P		0.46		Fail		0.788		Fail		49.30		Fail
267	R-20	1150	2	8-Jul-06	5	<	3.94	J	P	<	0.034	J	P	<	0.01	U	P		1.08		Fail
268	R-20	1330	3	7-Sep-04	1	<	5	U	P		0.32		Fail		0.46	H	Fail		2.90		Fail
269	R-20	1330	3	9-Nov-04	2	<	5	U	P		0.31		Fail		0.411		Fail		2.40		Fail
270	R-20	1330	3	18-Jul-05	3	<	5	U	P		0.29		Fail		0.367		Fail		—		ND
271	R-20	1330	3	8-Jun-06	4		2.68	J	P		0.308		Fail		0.176		P		2.30		Fail
272	R-20	1330	3	7-Jul-06	5	<	4.46	J	P	<	0.07		Fail	<	0.01	U	P		1.35		Fail
273	R-20	1330	3	21-Jul-06	6	<	5	U	P	<	0.077		Fail	<	0.055	J	P		0.60	J	P
274	R-20	1330	3	13-Oct-06	7		—		ND		—		ND		—		ND		—		ND
275	R-21	889	1	23-Sep-04	1	<	5	U	P	<	0.02	U	P		0.05	J	P	<	0.40		P

Table C-4. Organic Indicators

Row #	Well	Port depth (ft)	Scr #	Sample collection date (start)			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
									ug/L				mg/L				mg/L				mg/L
									<UL				<UL				<UL				<UL
									5				0.05				0.28				1
									5				0.05				0.28				1
276	R-21	889	1	14-Dec-04	2	<	5	U	P	<	0.02	U	P	<	0.044	U	P	<	0.40		P
277	R-21	889	1	6-Jun-05	3		3	J	P	<	0.01	U	P	<	0.01	U	P		—		ND
278	R-21	889	1	7-Jul-06	4	<	2.79	J	P	<	0.047	J	P	<	0.01	U	P		0.63	J	P
279	R-21	889	1	6-Nov-06	5	<	5	U	P	<	0.01	U	P		0.09	J	P		0.47	J	P
280	R-22	907	1	18-Nov-03	1	<	5	U	P		0.82		Fail		—		ND		6.40		Fail
281	R-22	907	1	21-Jun-04	2	<	5	U	P		—		ND		—		ND		—		ND
282	R-22	907	1	27-Jun-05	3		1	J	P		0.53		Fail		0.81		Fail		—		ND
283	R-22	907	1	22-Aug-06	4		—		ND		—		ND		—		ND		—		ND
284	R-22	907	1	7-Dec-06	5		—		ND		—		ND		—		ND		—		ND
285	R-22	963	2	19-Nov-03	1	<	5	U	P	<	0.02	U	P		—		ND		0.20	J	P
286	R-22	963	2	22-Jun-04	2	<	5	U	P		—		ND		—		ND		—		ND
287	R-22	963	2	28-Jun-05	3	<	5	U	P	<	0.01	U	P	<	0.01	U	P		—		ND
288	R-22	963	2	28-Aug-06	4	<	5	U	P		0.494		Fail	<	0.01	U	P		0.89	J	P
289	R-22	963	2	7-Dec-06	5	<	5	U	P	<	0.01	U	P	<	0.01	U	P	<	0.33	U	P
290	R-22	1274	3	9-Jul-02	1		—		ND		—		ND		—		ND		—		ND
291	R-22	1274	3	20-Nov-03	2	<	5	U	P	<	0.02	U	P		—		ND		1.30		Fail
292	R-22	1274	3	23-Jun-04	3		—		ND		—		ND		—		ND		—		ND
293	R-22	1274	3	29-Jun-05	4	<	5	U	P	<	0.01	U	P		0.294		Fail		—		ND
294	R-22	1274	3	22-Aug-06	5	<	5	U	P		0.021	J	P		0.098	J	P		1.85		Fail
295	R-22	1274	3	8-Dec-06	6	<	2.83	J	P	<	0.01	U	P		0.234		P		1.17		Fail
296	R-22	1378	4	11-Jul-02	1		—		ND		—		ND		—		ND		—		ND
297	R-22	1378	4	20-Nov-03	2	<	5	U	P		0.4		Fail		—		ND		16.70		Fail
298	R-22	1378	4	23-Jun-04	3		—		ND		—		ND		—		ND		—		ND
299	R-22	1378	4	1-Jul-05	4	<	5	U	P		0.28		Fail	<	0.062	J	P		—		ND
300	R-22	1378	4	22-Aug-06	5		—		ND		—		ND		—		ND		—		ND
301	R-22	1378	4	8-Dec-06	6		—		ND		—		ND		—		ND		—		ND
302	R-22	1448	5	10-Jul-02	1	<	5	U	P		0.54		Fail		—		ND		4.00		Fail
303	R-22	1448	5	21-Nov-03	2	<	5	U	P		0.35		Fail		—		ND		2.60		Fail
304	R-22	1448	5	5-Jul-05	3	<	5	U	P		0.23		Fail		0.36		Fail		—		ND
305	R-22	1448	5	21-Aug-06	4		—		ND		—		ND		—		ND		—		ND
306	R-22	1448	5	7-Dec-06	5		—		ND		—		ND		—		ND		—		ND
307	R-23	816	1	29-Jun-04	1	<	5	U	P	<	0.02	U	P	<	0.044	U	P	<	0.60		P
308	R-23	816	1	24-Sep-04	2	<	5	U	P	<	0.02	U	P		0.222		P		0.70		P
309	R-23	816	1	14-Jul-05	3	<	5	U	P	<	0.01	U	P		0.018	J	P		—		ND
310	R-23	816	1	15-Aug-06	4	<	5	U	P	<	0.045	J	P		0.111		P		0.95	J	P
311	R-23	816	1	18-Dec-06	5	<	5	U	P		0.035	J	P		0.117		P	<	0.33	U	P
312	R-23i	470	2	20-Dec-05	1		—		ND		—		ND		—		ND		—		ND
313	R-23i	470	2	3-Oct-06	2	<	5	U	P	<	0.01	U	P	<	0.01	U	P		0.89	J	P
314	R-23i	524	3	11-Dec-05	1		—		ND		—		ND		—		ND		2.26		Fail
315	R-23i	524	3	11-Oct-06	2	<	5	U	P	<	0.01	U	P		0.016	J	P		1.12		Fail
316	R-24	825	1	20-Sep-05	1		—		ND		—		ND		—		ND		1.01		Fail
317	R-24	825	1	15-Nov-05	2	<	5	U	P	<	0.01	U	P		0.588		Err		1.13		Fail
318	R-24	825	1	6-Mar-06	3	<	5	U	P	<	0.01	U	P		0.039	J	P		—		ND
319	R-24	825	1	10-May-06	4	<	2.29	J	P	<	0.051		Fail	<	0.01	U	P		—		ND
320	R-24	825	1	27-Jul-06	5	<	5	U	P	<	0.08		Fail	<	0.01	U	P		0.54	J	P
321	R-25	755	1	7-Aug-02	1		—		ND		—		ND		—		ND		—		ND
322	R-25	755	1	11-Dec-03	1	<	5	U	P	<	0.02	U	P		—		ND		0.90		P
323	R-25	755	1	1-Sep-04	2	<	5	U	P		—		ND		—		ND		—		ND
324	R-25	755	1	2-Aug-05	3		1	J	P	<	0.04	J	P	<	0.01	U	P		—		ND
325	R-25	892	2	5-Feb-02	1		3	J	P	<	0.05	U	P		0.24		P		2.90		Fail
326	R-25	892	2	8-Aug-02	1	<	5	U	P	<	0.02	U	P		—		ND		2.70		Fail
327	R-25	892	2	10-Dec-03	2	<	5	U	P		0.05		P		—		ND		2.40		Fail
328	R-25	892	2	3-Aug-05	3	<	5	U	P		0.15		Fail		0.227		P		—		ND
329	R-25	1192	4	8-Aug-02	1	<	5	U	P	<	0.02	U	P		0.29		Fail		1.60		Fail
330	R-25	1192	4	10-Dec-03	2	<	5	U	P		0.56		Fail		—		ND		1.00		P

Table C-4. Organic Indicators

Row #	Well	Port depth (ft)	Scr #	Sample collection date (start)			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
									ug/L				mg/L				mg/L				mg/L
									<UL				<UL				<UL				<UL
									5				0.05				0.28				1
									5				0.05				0.28				1
331	R-25	1192	4	4-Aug-05	3	<	5	U	P	<	0.01	U	P		0.171		P		—		ND
332	R-25	1303	5	9-Aug-02	1		—		ND		—		ND		—		ND		—		ND
333	R-25	1303	5	9-Dec-03	1	<	5	U	P		0.08		Fail		—		ND		10.30		Fail
334	R-25	1303	5	31-Aug-04	2	<	5	U	P		—		ND		—		ND		—		ND
335	R-25	1303	5	9-Aug-05	3	<	5	U	P		—		ND		—		ND		—		ND
336	R-25	1406	6	8-Feb-02	1	<	5	U	P	<	0.05	U	P	<	0.1	U	P		0.70		P
337	R-25	1406	6	12-Aug-02	2	<	5	U	P	<	0.02	U	P		—		ND	<	0.50		P
338	R-25	1406	6	9-Dec-03	3	<	5	U	P	<	0.02	U	P		—		ND		0.30		P
339	R-25	1606	7	11-Feb-02	1	<	5	U	P	<	0.05	U	P	<	0.1	U	P		0.30		P
340	R-25	1606	7	12-Aug-02	2	<	5	U	P	<	0.02	U	P		—		ND		0.30		P
341	R-25	1606	7	8-Dec-03	3	<	5	U	P	<	0.02	U	P		—		ND		0.20		P
342	R-25	1796	8	14-Aug-02	1	<	5	U	P	<	0.02	U	P		—		ND		0.30		P
343	R-25	1796	8	4-Dec-03	2	<	5	U	P	<	0.03	J	P		—		ND	<	0.50		P
344	R-25	1796	8	10-Aug-05	3	<	5	U	P	<	0.01	U	P		0.229		P		—		ND
345	R-26	659	1	13-Apr-05	1	<	5	U	P	<	0.01	U	P	<	0.01	U	P	<	0.20		P
346	R-26	659	1	27-Jul-05	2	<	5	U	P		0.04	J	P		0.039	J	P		0.20		P
347	R-26	659	1	2-Nov-05	3	<	5	U	P	<	0.01	U	P		0.616		Fail	<	0.13	J	P
348	R-26	659	1	22-Feb-06	4	<	5	U	P	<	0.01	U	P	<	0.01	U	P		—		ND
349	R-27	852	1	11-Oct-05	1		—		ND		—		ND		—		ND		—		ND
350	R-27	852	1	21-Oct-05	1		—		ND		—		ND		—		ND		—		ND
351	R-27	852	1	14-Nov-05	2		—		ND		—		ND		—		ND		—		ND
352	R-27	852	1	1-Jul-06	3	<	1.53	J	P		0.034	J	P	<	0.01	U	P	<	0.33	U	P
353	R-28	934	1	20-May-05	1	<	5	U	P	<	0.01	U	P		0.194		P		0.50		P
354	R-28	934	1	1-Sep-05	2	<	5	U	P	<	0.04	U	P	<	0.055	J	P		0.42	J	P
355	R-28	934	1	10-Nov-05	3	<	5	U	P	<	0.01	U	P	<	0.078	J	P		0.69	J	P
356	R-28	934	1	26-Jan-06	4	<	5	U	P	<	0.05	U	P	<	0.092	J	P		—		ND
357	R-28	934	1	19-Apr-06	5		—		ND		—		ND		—		ND		—		ND
358	R-28	934	1	5-Jul-06	6	<	5	U	P	<	0.034	J	P	<	0.01	U	P		0.54	J	P
359	R-28	934	1	26-Oct-06	7		1.76	J	P	<	0.01	U	P		0.137		P		0.57	J	P
360	R-31	532	2	18-Mar-04	1	<	5	U	P		0.42		Fail		1.28		Fail		6.20		Fail
361	R-31	532	2	17-Aug-05	2	<	5	U	P		1.21		Fail		0.311		Fail		—		ND
362	R-31	532	2	28-Nov-06	3		2.04	J	P		0.278		Fail		0.446		Fail		4.98		Fail
363	R-31	670	3	19-Aug-05	1		4.2	J	P		0.41		Fail		0.32		Fail		—		ND
364	R-31	670	3	30-Nov-06	2		4.22	J	P		0.131		Fail		0.305		Fail		3.43		Fail
365	R-31	831	4	23-Aug-05	1		3.1	J	P	<	0.01	U	P		0.08	J	P		—		ND
366	R-31	831	4	6-Dec-06	2	<	5	U	P	<	0.01	U	P		0.245		Err		0.48	J	P
367	R-31	1011	5	24-Aug-05	1		1.9	J	P	<	0.01	U	P		0.14	J	P		—		ND
368	R-31	1011	5	6-Dec-06	2	<	5	U	P	<	0.01	U	P	<	0.079	J	P	<	0.33		P
369	R-32	871	1	21-Sep-04	1	<	5	U	P		0.08		Fail		0.08	J	P	<	0.40		P
370	R-32	871	1	15-Nov-04	2	<	5	U	P	<	0.02	U	P	<	0.044	U	P		0.40		P
371	R-32	871	1	22-Jun-05	3	<	5	U	P	<	0.01	U	P	<	0.01	U	P		—		ND
372	R-32	871	1	29-Aug-06	4	<	1.97	HJ	P	<	0.01	U	P	<	0.01	U	P		—		ND
373	R-32	871	1	12-Dec-06	5	<	5	U	P	<	0.01	U	P	<	0.01	U	P		0.50	J	P
374	R-32	976	3	22-Sep-04	1	<	5	U	P		0.22		Fail		0.401		Fail		0.70		P
375	R-32	976	3	16-Nov-04	2	<	5	U	P		0.19		Fail		0.41		Fail		0.60		P
376	R-32	976	3	24-Jun-05	3	<	5	U	P		0.18		Fail		0.264		P		—		ND
377	R-32	976	3	30-Aug-06	4	<	1.59	J	P	<	0.101		Fail		0.055	J	P	<	0.84	J	P
378	R-32	976	3	13-Dec-06	5	<	5	U	P		0.085		Fail		0.114		P		0.61	J	P
379	R-33	996	1	27-Jun-05	1	<	5	U	P		—		ND	<	0.01	U	P		0.30		P
380	R-33	996	1	14-Sep-05	2	<	5	U	P		—		ND		0.608		Fail		1.17		Fail
381	R-33	996	1	16-Feb-06	3	<	5	U	P	<	0.05	U	P	<	0.05	U	P		—		ND
382	R-33	996	1	31-Oct-06	4		—		ND		—		ND		—		ND		—		ND
383	R-33	1112	2	24-Jun-05	1	<	5	U	P		—		ND	<	0.01	U	P		0.30		P
384	R-33	1112	2	15-Sep-05	2	<	5	U	P		—		ND		0.496		Fail	<	0.82	J	P
385	R-33	1112	2	14-Feb-06	3	<	5	U	P	<	0.05	U	P	<	0.05	U	P		—		ND

Table C-4. Organic Indicators

Row #	Well	Port depth (ft)	Scr #	Sample collection date (start)			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
									ug/L				mg/L				mg/L				mg/L
									<UL				<UL				<UL				<UL
									5				0.05				0.28				1
									5				0.05				0.28				1
386	R-33	1112	2	5-Jul-06	4	<	5	U	P		—		ND		—		ND		0.74		P
387	R-33	1112	2	1-Nov-06	5		—		ND		—		ND		—		ND		—		ND
388	R-34	895	1	7-Jun-05	1	<	3	J	P	<	0.01	U	P	<	0.01	U	P	<	0.50		P
389	R-34	895	1	7-Sep-05	2	<	5	U	P		0.046	J	P		0.06	J	P		0.51	J	P
390	R-34	895	1	29-Nov-05	3	<	5	U	P	<	0.01	U	P		0.508		Fail	<	0.88	J	P
391	R-34	895	1	31-Jan-06	4	<	5	U	P	<	0.033	J	P	<	0.01	U	P		—		ND
392	R-34	895	1	17-Jul-06	5	<	5	U	P	<	0.01	U	P	<	0.086	J	P	<	0.33	U	P
393	R-34	895	1	30-Oct-06	6	<	5	U	P	<	0.1	U	DL		0.071	J	P	<	0.33	U	P
Pass/Fail outcomes																					
	Pass (or Yes)								285				189				210				162
	Fail (or No)								16				96				61				89
	Total outcomes								301				285				271				251
	% Pass (or Yes)								95				66				77				65
Indeterminate outcomes																					
ND=no data									92				103				120				142
Err=suspected error									0				1				2				0
Plm=unreliable due to contaminant plume									0				0				0				0
DL=inadequate detection limit									0				4				0				0
UF=test unreliable for UF sample									0				0				0				0
Red=test unreliable, reducing conditions									0				0				0				0
—=test not applicable									0				0				0				0

Data source: WQDB except where indicated otherwise

LL=lower limit, UL=upper limit, P=pass; UF=unfiltered

Notes: Pass and fail outcomes for each sample are determined by comparison against test threshold criteria.

From top to bottom in the column headers above are listed the indicator name and associated test identifier, units of measurement, type of test threshold, and threshold values for the regional aquifer and perched intermediate aquifer, respectively.

Table C-5. Inorganic Nonmetal Indicators

Row #	Well	Port depth (ft)	Scr #	Sample collection date (start)		Ba mg/L		Test D3	Test E2	Ca mg/L		Test E1a	Test E1b	E1	Cl mg/L	Test A1		F mg/L	Lab Qual Code	Test A2	Mg mg/L		Test E4		NO3-N mg/L	Lab Qual Code	Test C11	ORP	Test C3	DO	Test C12
								mg/L	mg/L			mg/L	mg/L	Within		mg/L				mg/L			mg/L				mg/L		mV		mg/L
								>LL	<UL			>LL	<UL	range		<UL				<UL			<UL				>LL		>LL		>LL
								4.6	70			8.66	24.1			3.75				0.53			4.81				0.1		0		2
								1.4	72			4.39	17.3			1.75				0.23			6.12				0.1		0		2
1	CdV-16-1(i)	624	1	1-Jun-05	1	17		P	P	13.0		Yes	Yes	P	5.78	Plm	<	0.03	U	P	5.5		P		0.60		P	67	P	8.0	P
2	CdV-16-1(i)	624	1	29-Aug-05	2	17		P	P	13.5		Yes	Yes	P	6.64	Plm		0.09	J	P	5.6		P		0.61		P	149	P	4.8	P
3	CdV-16-1(i)	624	1	7-Dec-05	3	17		P	P	13.4		Yes	Yes	P	6.75	Plm		0.08	J	P	5.6		P		0.52		P	129.8	P	20.4	Err
4	CdV-16-1(i)	624	1	9-Mar-06	4	17		P	P	13.5		Yes	Yes	P	6.71	Plm		0.12		P	5.7		P		0.74		P	252.3	P	4.7	P
5	CdV-16-2(i)r	850	1	14-Sep-05	1	6.0	UF	P	P	—		—	—	ND	2.31	Plm		0.15		P	1.6	UF	P		0.57		P	—	ND	—	ND
6	CdV-16-2(i)r	850	1	15-Dec-05	2	5.2		P	P	7.7		Yes	Yes	P	2.67	Plm		0.28		Fail	2.0		P		0.64		P	212.6	P	5.1	P
7	CdV-16-2(i)r	850	1	15-Mar-06	3	7.0		P	P	9.6		Yes	Yes	P	2.17	Plm		0.20		P	2.3		P		0.57		P	226.4	P	5.6	P
8	CdV-16-2(i)r	850	1	17-May-06	4	3.8		P	P	8.1		Yes	Yes	P	2.03	Plm	<	0.24		Fail	2.1		P		0.54		P	164	P	5.3	P
9	CdV-R-15-3	1254	4	19-Oct-04	1	23		P	P	10.8		Yes	Yes	P	1.37	P		0.08	J	P	3.4		P		0.23		P	—	ND	7.6	P
10	CdV-R-15-3	1254	4	4-Apr-05	2	22		P	P	10.5		Yes	Yes	P	1.30	P		0.09	J	P	3.4		P		0.15		P	-10	Fail	1.2	Fail
11	CdV-R-15-3	1254	4	12-Jul-05	3	22		P	P	10.4		Yes	Yes	P	1.37	P	<	0.03	U	P	3.3		P		0.18		P	208	P	4.5	P
12	CdV-R-15-3	1254	4	18-Oct-05	4	21		P	P	10.4		Yes	Yes	P	1.34	P		0.16		P	3.4		P		0.15		P	—	ND	4.8	P
13	CdV-R-15-3	1254	4	19-Jan-06	5	22		P	P	10.2		Yes	Yes	P	1.38	P		0.12		P	3.3		P		0.20		P	—	ND	—	ND
14	CdV-R-15-3	1254	4	27-Mar-06	6	23		P	P	10.6		Yes	Yes	P	1.34	P	<	0.19		P	3.4		P		0.21		P	—	ND	—	ND
15	CdV-R-15-3	1350	5	20-Oct-04	1	108		P	Fail	15.2		Yes	Yes	P	1.56	P		0.19		P	1.9		P	<	0.003	U	Fail	—	ND	13.3	P
16	CdV-R-15-3	1350	5	5-Apr-05	2	124		P	Fail	18.3		Yes	Yes	P	1.89	P		0.58		Fail	1.9		P	<	0.003	U	Fail	-99	Fail	7.4	P
17	CdV-R-15-3	1350	5	12-Jul-05	3	107		P	Fail	13.9		Yes	Yes	P	3.09	P		0.24		P	2.2		P	<	0.017	U	Fail	-59	Fail	4.3	P
18	CdV-R-15-3	1350	5	18-Oct-05	4	99		P	Fail	13.4		Yes	Yes	P	1.49	P		0.29		P	2.3		P	<	0.02	U	Fail	—	ND	4.1	P
19	CdV-R-15-3	1350	5	20-Jan-06	5	98		P	Fail	13.2		Yes	Yes	P	1.65	P		0.29		P	2.3		P	<	0.02	U	Fail	—	ND	—	ND
20	CdV-R-15-3	1350	5	28-Mar-06	6	92		P	Fail	13.0		Yes	Yes	P	1.54	P		0.35		P	2.2		P		0.37		P	—	ND	—	ND
21	CdV-R-15-3	1640	6	21-Oct-04	1	34		P	P	10.2		Yes	Yes	P	1.31	P		0.09	J	P	2.8		P	<	0.003	U	Fail	-63	Fail	13.0	P
22	CdV-R-15-3	1640	6	6-Apr-05	2	21		P	P	9.1		Yes	Yes	P	1.34	P		0.15		P	2.9		P	<	0.003	U	Fail	-85	Fail	11.0	P
23	CdV-R-15-3	1640	6	13-Jul-05	3	21		P	P	9.3		Yes	Yes	P	1.45	P	<	0.03	U	P	2.8		P		0.036	J	Fail	28	P	5.9	P
24	CdV-R-15-3	1640	6	19-Oct-05	4	20		P	P	9.3		Yes	Yes	P	1.35	P		0.21		P	2.9		P	<	0.02	U	Fail	—	ND	5.5	P
25	CdV-R-15-3	1640	6	20-Jan-06	5	22		P	P	9.4		Yes	Yes	P	1.61	P		0.24		P	2.9		P	<	0.02	U	Fail	—	ND	—	ND
26	CdV-R-15-3	1640	6	29-Mar-06	6	20		P	P	9.0		Yes	Yes	P	1.34	P	<	0.24		P	2.8		P	<	0.01	U	Fail	—	ND	—	ND
27	CdV-R-37-2	1200	2	26-Oct-04	1	249		P	Fail	22.9		Yes	Yes	P	2.42	P		0.21		P	7.1		Fail	<	0.003	U	Fail	—	ND	6.1	P
28	CdV-R-37-2	1200	2	29-Mar-05	2	238		P	Fail	20.0		Yes	Yes	P	2.41	P		0.16		P	6.1		Fail	<	0.003	U	Fail	-67	Fail	8.4	P
29	CdV-R-37-2	1200	2	6-Jul-05	3	205		P	Fail	17.2		Yes	Yes	P	2.75	P		0.25		P	5.0		Fail	<	0.017	U	Fail	-70	Fail	3.1	P
30	CdV-R-37-2	1200	2	12-Oct-05	4	188		P	Fail	16.0		Yes	Yes	P	2.75	P		0.20		P	4.5		P	<	0.017	U	Fail	—	ND	1.9	Fail
31	CdV-R-37-2	1200	2	9-Jan-06	5	186		P	Fail	15.0		Yes	Yes	P	2.78	P		0.21		P	4.2		P	<	0.017	U	Fail	—	ND	—	ND
32	CdV-R-37-2	1200	2	21-Mar-06	6	173		P	Fail	13.7		Yes	Yes	P	2.73	P		0.23		P	3.9		P	<	0.017	U	Fail	—	ND	—	ND
33	CdV-R-37-2	1359	3	27-Oct-04	1	10		P	P	9.6		Yes	Yes	P	1.74	P		0.23		P	2.8		P		0.36		P	—	ND	9.1	P
34	CdV-R-37-2	1359	3	30-Mar-05	2	17		P	P	10.1		Yes	Yes	P	1.49	P		0.18		P	3.0		P		0.25		P	4.4	P	12.1	P
35	CdV-R-37-2	1359	3	7-Jul-05	3	11		P	P	10.1		Yes	Yes	P	1.56	P	<	0.03	U	P	3.0		P		0.26		P	264	P	11.4	P
36	CdV-R-37-2	1359	3	12-Oct-05	4	10		P	P	9.9		Yes	Yes	P	1.65	P		0.21		P	2.9		P		0.30		P	—	ND	6.3	P
37	CdV-R-37-2	1359	3	10-Jan-06	5	9.4		P	P	9.5		Yes	Yes	P	1.70	P		0.23		P	2.9		P		0.30		P	—	ND	—	ND
38	CdV-R-37-2	1359	3	22-Mar-06	6	11		P	P	9.9		Yes	Yes	P	1.69	P		0.24		P	2.9		P		0.28		P	—	ND	—	ND
39	CdV-R-37-2	1551	4	27-Oct-04	1	14		P	P	8.1		No	Yes	Fail	1.75	P		0.22		P	2.6		P	<	0.003	U	Fail	—	ND	12.6	P
40	CdV-R-37-2	1551	4	31-Mar-05	2	14		P	P	8.3		No	Yes	Fail	1.62	P		0.26		P	2.7		P	<	0.003	U	Fail	14	P	> 13	P
41	CdV-R-37-2	1551	4	8-Jul-05	3	15		P	P	8.3		No	Yes	Fail	1.40	P	<	0.03	U	P	2.7		P		0		Fail	16	P	8.8	P
42	CdV-R-37-2	1551	4	13-Oct-05	4	12		P	P	8.8		Yes	Yes	P	1.61	P		0.19		P	2.8		P	<	0.017	U	Fail	—	ND	4.3	P
43	CdV-R-37-2	1551	4	11-Jan-06	5	12		P	P	8.8		Yes	Yes	P	1.61	P		0.22		P	2.8		P	<	0.017	U	Fail	—	ND	—	ND

Table C-5. Inorganic Nonmetal Indicators

Row #	Well	Port depth (ft)	Scr #	Sample collection date (start)		Ba mg/L		Test D3	Test E2	Ca mg/L		Test E1a	Test E1b	E1	Cl mg/L	Test A1		F mg/L	Lab Qual Code	Test A2	Mg mg/L		Test E4		NO3-N mg/L	Lab Qual Code	Test C11	ORP	Test C3	DO	Test C12
								mg/L	mg/L			mg/L	mg/L	Within		mg/L				mg/L			mg/L				mg/L		mV		mg/L
								>LL	<UL			>LL	<UL	range		<UL				<UL			<UL				>LL		>LL		>LL
								4.6	70			8.66	24.1			3.75				0.53			4.81				0.1		0		2
								1.4	72			4.39	17.3			1.75				0.23			6.12				0.1		0		2
44	CdV-R-37-2	1551	4	22-Mar-06	6	13		P	P	8.7		Yes	Yes	P	1.60	P		0.23		P	2.8		P	<	0.017	U	Fail	—	ND	—	ND
45	MCOBT-4.4	485	1	28-Jan-03	1	13		P	P	32.2		Yes	No	Plm	16.90	Plm		0.40		Plm	5.4		P		14.8		Plm	—	ND	—	ND
46	MCOBT-4.4	485	1	21-May-03	1.5	14		P	P	32.4		Yes	No	Plm	16.70	Plm		0.42		Plm	5.6		P		15.8		Plm	—	ND	—	ND
47	MCOBT-4.4	485	1	29-Mar-05	2	15	UF	P	P	38.0	UF	Yes	No	Plm	17.30	Plm		0.35		Plm	5.4	UF	P		20.2	U	Plm	—	ND	6.3	P
48	MCOBT-4.4	485	1	8-Jun-05	3	—		ND	ND	—		—	—	ND	—	ND		—		ND	—		ND		15.5		Plm	54	P	7.2	P
49	R-1	1031	1	19-May-05	1	18		P	P	12.2		Yes	Yes	P	1.84	P		0.26		P	4.2		P		0.25		P	29	P	4.5	P
50	R-1	1031	1	12-Sep-05	2	16		P	P	11.4		Yes	Yes	P	1.96	P		0.20		P	4.0		P		0.25		P	-113	Fail	4.4	P
51	R-1	1031	1	28-Nov-05	3	15		P	P	10.9		Yes	Yes	P	1.97	P		0.20		P	3.9		P		0.24		P	111.4	P	4.3	P
52	R-1	1031	1	25-Jan-06	4	17		P	P	11.7		Yes	Yes	P	2.23	P		0.23		P	4.1		P		0.27		P	106.2	P	4.1	P
53	R-1	1031	1	19-Apr-06	5	—		ND	ND	—		—	—	ND	—	ND		—		ND	—		ND		—		ND	-2.5	Fail	4.8	P
54	R-1	1031	1	6-Jul-06	6	16		P	P	11.6		Yes	Yes	P	1.90	P		0.23		P	4.0		P		0.26		P	38.5	P	4.5	P
55	R-1	1031	1	26-Oct-06	7	17		P	P	11.5		Yes	Yes	P	1.93	P		0.19		P	4.1		P		0.22		P	110.7	P	2.5	P
56	R-2	918	1	26-Apr-05	1	13		P	P	8.2		No	Yes	Fail	2.35	P		0.33		P	2.3		P		0.30		P	0.1	P	4.9	P
57	R-2	918	1	9-Aug-05	2	14		P	P	9.2		Yes	Yes	P	2.16	P		0.20		P	2.4		P		0.32		P	65	P	4.8	P
58	R-2	918	1	9-Nov-05	3	15		P	P	10.0		Yes	Yes	P	2.09	P		0.29		P	2.7		P		0.38		P	45.8	P	4.7	P
59	R-2	918	1	27-Feb-06	4	16		P	P	10.3		Yes	Yes	P	2.15	P		0.32		P	2.8		P		0.46		P	108.2	P	3.1	P
60	R-2	918	1	24-Jul-06	5	14		P	P	10.2		Yes	Yes	P	2.15	P		0.29		P	2.7		P		0.40		P	146.9	P	3.1	P
61	R-3i	215	1	10-Aug-06	1	97		P	Fail	57.0		Yes	No	Fail	34.40	Plm		0.33		Fail	15.5		Fail		4.47		Plm	89.5	P	6.3	P
62	R-4	793	1	27-Apr-05	1	34		P	P	16.9		Yes	Yes	P	4.92	Plm		0.79		Fail	3.5		P		1.61		Plm	131	P	6.3	P
63	R-4	793	1	8-Aug-05	2	34		P	P	17.3		Yes	Yes	P	5.29	Plm		0.55		Fail	3.4		P		1.78		Plm	43	P	3.6	P
64	R-4	793	1	14-Nov-05	3	35		P	P	17.6		Yes	Yes	P	4.99	Plm		0.76		Fail	3.4		P		1.14		Plm	93.2	P	4.0	P
65	R-4	793	1	28-Feb-06	4	39		P	P	18.9		Yes	Yes	P	4.67	Plm		0.76		Fail	3.7		P		1.22		Plm	3.57	P	1.5	Fail
66	R-4	793	1	25-Jul-06	5	32		P	P	15.9		Yes	Yes	P	5.16	Plm		0.77		Fail	3.1		P		1.97		Plm	180.9	P	5.1	P
67	R-5	384	2	28-Apr-04	1	204		P	Fail	31.9		Yes	No	Fail	6.72	Plm		1.03		Fail	3.2		P		2.31		Plm	46	P	7.2	P
68	R-5	384	2	27-Sep-04	2	193		P	Fail	31.5		Yes	No	Fail	7.27	Plm		1.12		Fail	3.1		P		3.28		Plm	88	P	9.7	P
69	R-5	384	2	2-May-05	3	197	UF	P	Fail	31.9	UF	Yes	No	Fail	7.39	Plm		1.06		Fail	3.0	UF	P		2.66		Plm	154	P	5.2	P
70	R-5	384	2	25-Jul-06	4	196		P	Fail	30.5		Yes	No	Fail	7.37	Plm		1.06		Fail	2.9		P		3.11		Plm	—	ND	—	ND
71	R-5	719	3	30-Apr-04	1	102		P	Fail	26.8		Yes	No	Fail	7.89	Plm		0.63		Fail	4.6		P		1.79		Plm	165	P	5.6	P
72	R-5	719	3	28-Sep-04	2	93		P	Fail	25.4		Yes	No	Fail	7.98	Plm		0.70		Fail	4.4		P		2.44		Plm	59	P	6.9	P
73	R-5	719	3	3-May-05	3	94	UF	P	Fail	25.4	UF	Yes	No	Fail	7.33	Plm		0.45		P	4.3	UF	P		2.09		Plm	256	P	5.0	P
74	R-5	719	3	26-Jul-06	4	95		P	Fail	25.6		Yes	No	Fail	8.02	Plm		0.65		Fail	4.3		P		2.22		Plm	—	ND	—	ND
75	R-5	861	4	3-May-04	1	176		P	Fail	25.0		Yes	No	Fail	5.31	Fail		0.35		P	4.1		P	<	0.01	U	Fail	21	P	10.5	P
76	R-5	861	4	30-Sep-04	2	176		P	Fail	25.9		Yes	No	Fail	5.26	Fail		0.38		P	4.4		P	<	0.015	U	Fail	85	P	9.0	P
77	R-5	861	4	4-May-05	3	144	UF	P	Fail	27.1	UF	Yes	No	Fail	4.80	Fail		0.24		P	4.6	UF	P		0.12		P	65	P	6.6	P
78	R-5	861	4	27-Jul-06	4	—		ND	ND	—	—	—	—	ND	—	ND		—		ND	—		ND		—		ND	—	ND	—	ND
79	R-6	1205	1	23-Aug-05	1	27		P	P	14.1		Yes	Yes	P	2.49	P		0.48		P	4.0		P		0.27		P	140	P	3.5	P
80	R-6	1205	1	17-Nov-05	2	27		P	P	14.5		Yes	Yes	P	2.32	P		0.44		P	4.0		P		0.28		P	154.4	P	3.5	P
81	R-6	1205	1	1-Mar-06	3	28		P	P	14.3		Yes	Yes	P	2.42	P		0.47		P	4.0		P		0.29		P	252.1	P	2.9	P
82	R-6	1205	1	11-May-06	4	25		P	P	13.3		Yes	Yes	P	2.25	P		0.48		P	3.4		P		0.26		P	232.6	P	2.3	P
83	R-6	1205	1	26-Jul-06	5	22		P	P	13.2		Yes	Yes	P	2.22	P		0.45		P	3.5		P		0.28		P	225.9	P	3.8	P
84	R-6i	602	1	24-Aug-05	1	32		P	P	29.7		Yes	No	Fail	16.70	Plm		0.63		Fail	5.3		P		3.53		Plm	116	P	6.1	P
85	R-6i	602	1	17-Nov-05	2	35		P	P	29.9		Yes	No	Fail	17.10	Plm		0.58		Fail	5.4		P		3.77		Plm	100.8	P	5.8	P
86	R-6i	602	1	1-Mar-06	3	33		P	P	28.4		Yes	No	Fail	17.70	Plm		0.61		Fail	5.1		P		4.87		Plm	120.1	P	5.2	P

Table C-5. Inorganic Nonmetal Indicators

Row #	Well	Port depth (ft)	Scr #	Sample collection date (start)		Ba mg/L		Test D3	Test E2	Ca mg/L		Test E1a	Test E1b	E1	Cl mg/L	Test A1		F mg/L	Lab Qual Code	Test A2	Mg mg/L		Test E4		NO3-N mg/L	Lab Qual Code	Test C11	ORP	Test C3	DO	Test C12
								mg/L	mg/L			mg/L	mg/L	Within		mg/L				mg/L			mg/L				mg/L		mV		mg/L
								>LL	<UL			>LL	<UL	range		<UL				<UL			<UL				>LL		>LL		>LL
								4.6	70			8.66	24.1			3.75				0.53			4.81				0.1		0		2
								1.4	72			4.39	17.3			1.75				0.23			6.12				0.1		0		2
87	R-6i	602	1	11-May-06	4	29		P	P	28.4		Yes	No	Fail	17.60	Plm		0.62		Fail	5.0		P		3.45		Plm	90.6	P	5.4	P
88	R-6i	602	1	26-Jul-06	5	26		P	P	26.0		Yes	No	Fail	17.40	Plm		0.63		Fail	4.6		P		4.97		Plm	120.8	P	6.3	P
89	R-7	915	3	18-Dec-03	1	82	UF	P	Fail	8.0	UF	No	Yes	Fail	1.52	P		0.43		P	2.8	UF	P	<	0.01	U	Fail	—	ND	—	ND
90	R-7	915	3	26-May-04	2	81	UF	P	Fail	7.9	UF	No	Yes	Fail	1.72	P		0.52		P	2.7	UF	P	<	0.01	U	Fail	—	ND	—	ND
91	R-7	915	3	26-Apr-05	3	78	UF	P	Fail	7.9	UF	No	Yes	Fail	1.53	P		0.38		P	2.8	UF	P		0.019	J	Fail	0.5	P	5.3	P
92	R-7	915	3	31-Jul-06	4	76		P	Fail	7.8		No	Yes	Fail	2.24	P		0.54		Fail	2.9		P		0.004		Fail	—	ND	—	ND
93	R-8	711	1	24-Aug-04	1	22		P	P	16.9		Yes	Yes	P	1.35	P		0.53		P	2.8		P		0.37		P	110	P	11.0	P
94	R-8	711	1	8-Dec-04	2	25		P	P	17.5		Yes	Yes	P	1.52	P		0.57		Fail	2.9		P		0.36		P	—	ND	9.1	P
95	R-8	711	1	27-Apr-05	3	24	UF	P	P	17.1	UF	Yes	Yes	P	1.38	P		0.54		Fail	2.8	UF	P		—		ND	121.7	P	7.5	P
96	R-8	711	1	1-Aug-06	4	23		P	P	17.0		Yes	Yes	P	1.49	P		0.57		Fail	2.7		P		0.37		P	—	ND	—	ND
97	R-8	825	2	25-Aug-04	1	119		P	Fail	8.4		No	Yes	Fail	2.88	P		0.35		P	2.6		P		0.34	H	P	217	P	6.5	P
98	R-8	825	2	9-Dec-04	2	139		P	Fail	7.9		No	Yes	Fail	3.13	P		0.34		P	4.6		P		0.32		P	—	ND	9.9	P
99	R-8	825	2	28-Apr-05	3	121	UF	P	Fail	9.0	UF	Yes	Yes	P	3.25	P		0.37		P	3.8	UF	P		0.23		P	-22	Fail	8.7	P
100	R-8	825	2	2-Aug-06	4	74		P	Fail	9.6		Yes	Yes	P	4.54	Fail		0.42		P	4.1		P		0.42		P	—	ND	—	ND
101	R-9	684	1	12-Dec-03	1	172	UF	P	Fail	25.3	UF	Yes	No	Fail	6.39	Plm		0.27		P	6.1	UF	Fail		0.78		Plm	—	ND	—	ND
102	R-9	684	1	27-May-04	2	179	UF	P	Fail	24.7	UF	Yes	No	Fail	6.51	Plm		0.36		P	6.0	UF	Fail		0.67		Plm	—	ND	—	ND
103	R-9	684	1	19-Mar-05	2.5	180	UF	P	Fail	24.7	UF	Yes	No	Fail	6.57	Plm		0.29		P	5.2	UF	Fail		0.62		Plm	133	P	4.2	P
104	R-9	684	1	6-Apr-05	2.8	150	UF	P	Fail	24.5	UF	Yes	No	Fail	6.53	Plm		0.29		P	5.0	UF	Fail		0.70		Plm	—	ND	4.2	P
105	R-9	684	1	28-Apr-05	3	170	UF	P	Fail	25.2	UF	Yes	No	Fail	5.99	Plm		0.35		P	6.4	UF	Fail		0.58		Plm	—	ND	6.2	P
106	R-9	684	1	31-Jul-06	4	185		P	Fail	24.3		Yes	No	Fail	5.90	Plm		0.33		P	6.4		Fail		0.72		Plm	—	ND	—	ND
107	R-9i	199	1	6-Feb-04	1	77	UF	P	Fail	19.9	UF	Yes	No	Fail	24.10	Plm		0.56		Fail	6.8	UF	Fail	<	0.01	U	Fail	—	ND	—	ND
108	R-9i	199	1	2-Jun-04	2	75	UF	P	Fail	20.7	UF	Yes	No	Fail	29.50	Plm		0.59		Fail	7.0	UF	Fail	<	0.01	U	Fail	—	ND	—	ND
109	R-9i	199	1	29-Apr-05	3	65	UF	P	P	23.2	UF	Yes	No	Fail	39.20	Plm		0.38		Fail	7.8	UF	Fail		0.071		Fail	127	P	8.2	P
110	R-9i	199	1	10-Aug-06	4	64		P	P	20.7		Yes	No	Fail	39.80	Plm		0.57		Fail	7.5		Fail		0.006		Fail	—	ND	—	ND
111	R-9i	279	2	6-Sep-01	1	49		P	P	14.4		Yes	Yes	P	14.90	Plm		0.29		Fail	4.6		P		0.020	J	Fail	—	ND	—	ND
112	R-9i	279	2	29-Jul-02	2	47	UF	P	P	14.7	UF	Yes	Yes	P	12.30	Plm		0.24		Fail	4.8	UF	P	<	0.01	U	Fail	-96	Fail	2.3	P
113	R-9i	279	2	6-Feb-04	3	43	UF	P	P	14.7	UF	Yes	Yes	P	10.50	Plm		0.27		Fail	4.8	UF	P	<	0.01	U	Fail	—	ND	—	ND
114	R-9i	279	2	10-Aug-06	4	28		P	P	13.1		Yes	Yes	P	12.00	Plm		0.24		Fail	4.1		P		0.157		Plm	—	ND	—	ND
115	R-10	874	1	29-Jun-06	1	53	UF	P	P	19.6	UF	Yes	Yes	P	2.80	P		0.36		P	4.1	UF	P		0.51		P	—	ND	—	ND
116	R-10	874	1	12-Oct-06	2	51		P	P	19.5	UF	Yes	Yes	P	2.92	P	<	0.39		P	4.1		P		0.34		P	—	ND	—	ND
117	R-10	1042	2	11-Oct-05	1	37	UF	P	P	19.3	UF	Yes	Yes	P	3.59	P		0.24		P	4.3	UF	P		0.53		P	—	ND	—	ND
118	R-10	1042	2	29-Jun-06	2	51		P	P	21.5		Yes	Yes	P	3.10	P		0.35		P	4.3		P		0.47		P	—	ND	—	ND
119	R-10	1042	2	12-Oct-06	3	45		P	P	20.8		Yes	Yes	P	3.22	P	<	0.34		P	4.3		P		0.31		P	—	ND	—	ND
120	R-10a	690	1	7-Sep-05	1	370	UF	P	Fail	—		—	—	ND	6.80	Plm		0.40		P	4.1	UF	P		0.58		Plm	—	ND	—	ND
121	R-10a	690	1	30-Nov-05	2	104		P	Fail	34.8		Yes	No	Fail	6.29	Plm		0.44		P	4.8		P		0.96		Plm	207.6	P	4.9	P
122	R-10a	690	1	1-Feb-06	3	103		P	Fail	35.2		Yes	No	Fail	5.83	Plm		0.39		P	4.8		Fail		1.12		Plm	208.8	P	3.9	P
123	R-10a	690	1	17-Jul-06	4	92		P	Fail	32.1		Yes	No	Fail	5.89	Plm		0.33		P	4.3		P		1.40		Plm	119.8	P	3.9	P
124	R-10a	690	1	12-Oct-06	5	87		P	Fail	30.5		Yes	No	Fail	5.98	Plm	<	0.46		P	4.4		P		1.33		Plm	35.7	P	3.2	P
125	R-11	855	1	17-May-05	1	37		P	P	21.3		Yes	Yes	P	3.43	P		0.29		P	5.6		Fail		3.68		Plm	153	P	6.2	P
126	R-11	855	1	3-Aug-05	2	36		P	P	20.9		Yes	Yes	P	3.63	P		0.24		P	5.5		Fail		3.41		Plm	99	P	0.8	Fail
127	R-11	855	1	8-Nov-05	3	37		P	P	20.4		Yes	Yes	P	3.75	P		0.47		P	5.5		Fail		3.72		Plm	66.1	P	5.8	P
128	R-11	855	1	3-Feb-06	4	38		P	P	20.5		Yes	Yes	P	4.07	Plm		0.47		P	5.7		Fail		4.06		Plm	238.6	P	6.9	P
129	R-11	855	1	20-Apr-06	5	—		ND	ND	—		—	—	ND	—	ND		—		ND	—		ND		—		ND	262.3	P	6.4	P

Table C-5. Inorganic Nonmetal Indicators

Row #	Well	Port depth (ft)	Scr #	Sample collection date (start)		Ba mg/L		Test D3	Test E2	Ca mg/L		Test E1a	Test E1b	E1	Cl mg/L	Test A1		F mg/L	Lab Qual Code	Test A2	Mg mg/L		Test E4		NO3-N mg/L	Lab Qual Code	Test C11	ORP	Test C3	DO	Test C12
								mg/L	mg/L			mg/L	mg/L	Within		mg/L				mg/L			mg/L				mg/L		mV		mg/L
								>LL	<UL			>LL	<UL	range		<UL				<UL			<UL				>LL		>LL		>LL
								4.6	70			8.66	24.1			3.75				0.53			4.81				0.1		0		2
								1.4	72			4.39	17.3			1.75				0.23			6.12				0.1		0		2
130	R-11	855	1	10-Jul-06	6	42		P	P	21.6		Yes	Yes	P	4.30	Plm		0.43		P	5.6		Fail		5.07		Plm	—	ND	—	ND
131	R-11	855	1	10-Oct-06	7	36		P	P	20.5		Yes	Yes	P	4.16	Plm		0.42		P	5.6		Fail		3.98		Plm	147.7	P	6.3	P
132	R-12	468	1	2-Feb-04	1	43	UF	P	P	3.6	UF	No	Yes	Fail	9.85	Plm		0.65		Fail	0.5	UF	P	<	0.01	U	Fail	—	ND	—	ND
133	R-12	468	1	2-Jun-04	2	34	UF	P	P	3.6	UF	No	Yes	Fail	10.30	Plm		0.66		Fail	0.5	UF	P	<	0.01	U	Fail	—	ND	—	ND
134	R-12	468	1	16-Jun-05	3	34		P	P	4.0		No	Yes	Fail	10.10	Plm		0.67		Fail	0.5		P	<	0.003	U	Fail	91	P	4.8	P
135	R-12	468	1	30-Jun-05	3	—		ND	ND	—		—	—	ND	—	ND		—		ND	—		ND		—		ND	—	ND	—	ND
136	R-12	468	1	2-Feb-06	4	38		P	P	3.5		No	Yes	Fail	9.52	Plm		0.62		Fail	0.4		P	<	0.017	U	Fail	—	ND	3.1	P
137	R-12	468	1	11-Jul-06	5	37		P	P	3.6		No	Yes	Fail	9.52	Plm		0.60		Fail	0.4		P	<	0.014	U	Fail	—	ND	—	ND
138	R-12	468	1	29-Sep-06	6	46		P	P	47.6		Yes	No	Fail	34.20	Plm		0.34		Fail	13.5		Fail		4.20		Plm	134	P	3.5	P
139	R-12	507	2	10-Sep-01	1	13		P	P	15.0		Yes	Yes	P	4.63	Plm		0.36		Fail	1.9		P		0.07		Fail	—	ND	—	ND
140	R-12	507	2	1-Aug-02	2	15	UF	P	P	16.4	UF	Yes	Yes	P	5.61	Plm		0.27		Fail	2.1	UF	P		0.03	J	Fail	-19.8	Fail	3.6	P
141	R-12	507	2	28-Jan-04	3	15	UF	P	P	16.3	UF	Yes	Yes	P	4.57	Plm		0.37		Fail	2.0	UF	P		0.06		Fail	—	ND	—	ND
142	R-12	507	2	1-Feb-06	4	12		P	P	14.9		Yes	Yes	P	2.23	Plm		0.67		Fail	1.6		P	<	0.034	U	Fail	—	ND	3.0	P
143	R-12	507	2	12-Jul-06	5	14		P	P	15.4		Yes	Yes	P	2.41	Plm		0.64		Fail	1.7		P	<	0.014	U	Fail	—	ND	—	ND
144	R-12	507	2	1-Oct-06	6	8.9		P	P	16.6		Yes	Yes	P	6.70	Plm		0.30		Fail	4.1		P		1.17		Plm	200.1	P	5.6	P
145	R-12	811	3	27-Jan-04	1	130	UF	P	Fail	32.7	UF	Yes	No	Fail	8.84	Plm		0.37		P	9.1	UF	Fail	<	0.01	U	Fail	—	ND	—	ND
146	R-12	811	3	3-Jun-04	2	141	UF	P	Fail	32.9	UF	Yes	No	Fail	9.19	Plm		0.39		P	9.2	UF	Fail	<	0.01	U	Fail	—	ND	—	ND
147	R-12	811	3	20-Jun-05	3	120		P	Fail	30.6		Yes	No	Fail	8.50	Plm		0.23		P	9.0		Fail	<	0.017	U	Fail	190	P	3.7	P
148	R-12	811	3	31-Jan-06	4	126		P	Fail	29.6		Yes	No	Fail	8.47	Plm		0.39		P	8.8		Fail		0.044	J	Fail	—	ND	2.8	P
149	R-12	811	3	12-Jul-06	5	137		P	Fail	31.1		Yes	No	Fail	8.48	Plm		0.36		P	8.7		Fail		0.022	J	Fail	—	ND	—	ND
150	R-12	811	3	27-Sep-06	6	39		P	P	19.2		Yes	Yes	P	7.90	Plm		0.34		P	4.4		P		1.08		Plm	—	ND	6.2	P
151	R-12	811	3	18-Oct-06	7	84		P	Fail	25.7		Yes	No	Fail	8.35	Plm	<	0.41		P	5.9		Fail		1.38		Plm	228.6	P	6.7	P
152	R-13	958	1	9-Dec-03	1	27	UF	P	P	14.2	UF	Yes	Yes	P	2.22	P		0.30		P	3.5	UF	P		0.79		P	—	ND	—	ND
153	R-13	958	1	11-Jun-04	2	27	UF	P	P	13.4	UF	Yes	Yes	P	2.52	P		0.45		P	3.2	UF	P		0.76		P	—	ND	—	ND
154	R-13	958	1	10-Mar-05	2.5	32	UF	P	P	13.2	UF	Yes	Yes	P	2.41	P		0.29		P	3.4	UF	P		0.75		P	—	ND	4.5	P
155	R-13	958	1	26-May-05	3	—		ND	ND	—		—	—	ND	2.14	P		0.34		P	—		ND		0.61		P	123	P	6.0	P
156	R-13	958	1	1-Sep-05	4	310	UF	Err	Err	—		—	—	ND	2.27	P		0.33		P	3.3	UF	P		0.62		P	150.4	P	5.3	P
157	R-13	958	1	2-Feb-06	5	26		P	P	13.3		Yes	Yes	P	2.22	P		0.33		P	3.4		P		0.59		P	189.8	P	4.8	P
158	R-13	958	1	3-Jul-06	6	26		P	P	13.5		Yes	Yes	P	2.24	P		0.35		P	3.3		P		0.72		P	51.5	P	5.7	P
159	R-13	958	1	25-Oct-06	7	25		P	P	13.2		Yes	Yes	P	2.25	P		0.29		P	3.3		P		0.69		P	214.3	P	5.8	P
160	R-14	1205	1	12-Jul-04	1	49		P	P	11.5		Yes	Yes	P	1.72	P		0.24		P	3.4		P		0.030	J	Fail	205	P	3.5	P
161	R-14	1205	1	28-Oct-04	2	47		P	P	11.6		Yes	Yes	P	1.71	P		0.21		P	3.3		P		0.076		Fail	—	ND	5.8	P
162	R-14	1205	1	11-May-05	3	46		P	P	12.0		Yes	Yes	P	1.45	P		0.13		P	3.5		P		0.056		Fail	-40	Fail	5.7	P
163	R-14	1205	1	24-Jan-06	4	48		P	P	11.3		Yes	Yes	P	1.77	P		0.27		P	3.4		P		0.034	J	Fail	—	ND	4.5	P
164	R-14	1205	1	26-Jun-06	5	54		P	P	11.9		Yes	Yes	P	1.62	P		0.25		P	3.4		P		0.047		Fail	—	ND	—	ND
165	R-14	1205	1	23-Oct-06	6	55		P	P	12.6		Yes	Yes	P	1.61	P	<	0.27		P	3.7		P	<	0.103		P	—	ND	—	ND
166	R-14	1289	2	14-Jul-04	1	40		P	P	10.2		Yes	Yes	P	1.94	P		0.39		P	2.6		P	<	0.01	U	Fail	-42	Fail	5.1	P
167	R-14	1289	2	3-Nov-04	2	45		P	P	12.3		Yes	Yes	P	2.05	P		0.33		P	3.1		P		0.007	J	Fail	—	ND	7.2	P
168	R-14	1289	2	12-May-05	3	46		P	P	11.0		Yes	Yes	P	1.78	P		0.30		P	2.9		P	<	0.003	U	Fail	-63	Fail	3.9	P
169	R-14	1289	2	25-Jan-06	4	68		P	P	11.3		Yes	Yes	P	2.00	P		0.30		P	2.9		P	<	0.017	U	Fail	—	ND	3.2	P
170	R-14	1289	2	28-Jun-06	5	79		P	Fail	10.4		Yes	Yes	P	2.73	P		0.30		P	2.6		P		0.003		Fail	—	ND	—	ND
171	R-14	1289	2	23-Oct-06	6	103		P	Fail	12.2		Yes	Yes	P	4.43	Fail		0.41		P	3.1		P		0.0104		Fail	—	ND	—	ND
172	R-15	959	1	10-Jun-04	1	33	UF	P	P	14.0	UF	Yes	Yes	P	4.77	Plm		0.26		P	3.7	UF	P		2.25		Plm	—	ND	—	ND

Table C-5. Inorganic Nonmetal Indicators

Row #	Well	Port depth (ft)	Scr #	Sample collection date (start)		Ba mg/L		Test D3	Test E2	Ca mg/L		Test E1a	Test E1b	E1	Cl mg/L	Test A1		F mg/L	Lab Qual Code	Test A2	Mg mg/L		Test E4		NO3-N mg/L	Lab Qual Code	Test C11	ORP	Test C3	DO	Test C12
								mg/L	mg/L			mg/L	mg/L	Within		mg/L				mg/L			mg/L				mg/L		mV		mg/L
								>LL	<UL			>LL	<UL	range		<UL				<UL			<UL				>LL		>LL		>LL
								4.6	70			8.66	24.1			3.75				0.53			4.81				0.1		0		2
								1.4	72			4.39	17.3			1.75				0.23			6.12				0.1		0		2
173	R-15	959	1	25-May-05	2	30		P	P	14.1		Yes	Yes	P	4.34	Plm		0.20		P	3.9		P		2.30		Plm	78	P	7.2	P
174	R-15	959	1	31-Aug-05	3	30		P	P	14.2		Yes	Yes	P	4.43	Plm		0.21		P	3.9		P		2.43		Plm	78	P	5.5	P
175	R-15	959	1	30-Jan-06	4	31		P	P	14.6		Yes	Yes	P	4.38	Plm		0.25		P	4.1		P		2.26		Plm	219.9	P	3.9	P
176	R-15	959	1	3-Jul-06	5	30		P	P	14.2		Yes	Yes	P	4.12	Plm		0.24		P	3.9		P		2.48		Plm	112.6	P	4.9	P
177	R-15	959	1	24-Oct-06	6	28		P	P	13.1		Yes	Yes	P	4.42	Plm		0.25		P	3.6		P		2.49		Plm	397.9	Err	7.8	P
178	R-16	866	2	13-Oct-04	1	22		P	P	9.2		Yes	Yes	P	2.40	P		0.36		P	2.9		P		0.004	J	Fail	—	ND	13.0	P
179	R-16	866	2	2-Dec-04	2	34		P	P	17.3		Yes	Yes	P	2.71	P		0.38		P	1.4		P		0.015	J	Fail	—	ND	12.9	P
180	R-16	866	2	13-Jun-05	3	30		P	P	15.3		Yes	Yes	P	2.50	P		0.27		P	1.3		P	<	0.017	U	Fail	-12	Fail	5.3	P
181	R-16	866	2	13-Jul-06	4	31		P	P	12.1		Yes	Yes	P	3.83	Fail		0.51		P	1.0		P		0.028		Fail	—	ND	—	ND
182	R-16	866	2	20-Jul-06	5	30		P	P	13.9		Yes	Yes	P	2.49	P		0.34		P	1.2		P		0.042	J	Fail	—	ND	4.1	P
183	R-16	866	2	11-Aug-06	6	17		P	P	18.7		Yes	Yes	P	2.56	P		0.41		P	1.6		P		0.35		P	177.2	P	5.8	P
184	R-16	866	2	14-Aug-06	7	16		P	P	17.7		Yes	Yes	P	3.91	Fail		0.52		P	1.6		P		0.53		P	—	ND	—	ND
185	R-16	866	2	10-Oct-06	8	33		P	P	19.7		Yes	Yes	P	2.61	P		0.37		P	1.8		P		0.034	J	Fail	—	ND	5.6	P
186	R-16	866	2	14-Nov-06	9	35		P	P	18.8		Yes	Yes	P	4.09	Fail		0.50		P	1.7		P	<	0.002	U	Fail	—	ND	4.2	P
187	R-16	866	2	4-Dec-06	10	37		P	P	18.2		Yes	Yes	P	4.97	Fail		0.50		P	1.7		P	<	0.002		Fail	—	ND	—	ND
188	R-16	1018	3	14-Oct-04	1	66		P	P	28.6		Yes	No	Fail	3.45	P		0.31		P	2.0		P		0.093		Fail	—	ND	11.3	P
189	R-16	1018	3	3-Dec-04	2	65		P	P	28.7		Yes	No	Fail	3.49	P		0.43		P	1.9		P		0.19		P	—	ND	12.0	P
190	R-16	1018	3	13-Jun-05	3	60		P	P	25.1		Yes	No	Fail	2.85	P		0.45		P	1.5		P		0.21		P	-23	Fail	5.4	P
191	R-16	1018	3	12-Jul-06	4	65		P	P	25.9		Yes	No	Fail	2.47	P		0.46		P	1.4		P		0.31		P	—	ND	—	ND
192	R-16	1018	3	20-Jul-06	5	65		P	P	25.9		Yes	No	Fail	2.47	P		—		ND	—		ND		—		ND	—	ND	2.5	P
193	R-16	1018	3	10-Aug-06	6	33		P	P	21.0		Yes	Yes	P	2.56	P		0.44		P	1.5		P		0.35		P	67.8	P	2.5	P
194	R-16	1018	3	11-Aug-06	7	32		P	P	20.0		Yes	Yes	P	3.60	P		0.48		P	1.5		P		0.53		P	—	ND	—	ND
195	R-16	1018	3	12-Oct-06	8	40		P	P	24.5		Yes	No	Fail	2.59	P	<	0.44		P	1.9		P		0.17		P	—	ND	—	ND
196	R-16	1018	3	14-Nov-06	9	50		P	P	22.8		Yes	Yes	P	3.98	Fail		0.57		Fail	1.7		P		0.16		P	—	ND	5.0	P
197	R-16	1018	3	5-Dec-06	10	56		P	P	23.3		Yes	Yes	P	5.26	Fail		0.55		Fail	1.7		P		0.24		P	—	ND	6.0	P
198	R-16	1238	4	15-Oct-04	1	85		P	Fail	46.6		Yes	No	Fail	5.80	Fail		0.38		P	0.7		P		0.009	J	Fail	—	ND	8.4	P
199	R-16	1238	4	7-Dec-04	2	89		P	Fail	50.0		Yes	No	Fail	5.57	Fail		0.41		P	0.7		P	<	0.003	U	Fail	—	ND	10.3	P
200	R-16	1238	4	14-Jun-05	3	67		P	P	37.1		Yes	No	Fail	5.07	Fail		0.43		P	0.3		P	<	0.017	U	Fail	-160	Fail	5.0	P
201	R-16	1238	4	13-Jul-06	4	55		P	P	29.2		Yes	No	Fail	6.07	Fail		0.61		Fail	0.2		P	<	0.003	U	Fail	—	ND	—	ND
202	R-16	1238	4	20-Jul-06	5	53		P	P	28.1		Yes	No	Fail	3.74	P		0.38		P	0.3		P	<	0.019	J	Fail	—	ND	5.8	P
203	R-16	1238	4	9-Aug-06	6	59		P	P	19.8		Yes	Yes	P	2.54	P		0.45		P	1.0		P		0.27		P	27	P	2.4	P
204	R-16	1238	4	11-Oct-06	7	45		P	P	25.6		Yes	No	Fail	2.75	P	<	0.42		P	1.8		P	<	0.014	U	Fail	—	ND	3.5	P
205	R-16	1238	4	14-Nov-06	8	53		P	P	26.9		Yes	No	Fail	4.28	Fail		0.49		P	2.2		P	<	0.003		Fail	—	ND	4.2	P
206	R-16	1238	4	5-Dec-06	9	56		P	P	28.1		Yes	No	Fail	5.49	Fail		0.53		P	2.3		P	<	0.002		Fail	—	ND	7.1	P
207	R-16r	600	1	26-Sep-05	1	240	UF	P	Fail	—		—	—	ND	2.36	P		0.44		P	—		ND		0.44		P	—	ND	—	ND
208	R-16r	600	1	17-Oct-05	2	340	UF	P	Fail	—		—	—	ND	2.39	P		0.43		P	—		ND		0.45		P	—	ND	—	ND
209	R-16r	600	1	19-Dec-05	3	77		P	Fail	21.1		Yes	Yes	P	2.38	P		0.40		P	0.9		P		0.29		P	198.6	P	4.3	P
210	R-16r	600	1	8-Mar-06	4	70		P	P	19.7		Yes	Yes	P	2.30	P		0.45		P	0.8		P		0.35		P	256.9	P	3.2	P
211	R-16r	600	1	24-May-06	5	71		P	Fail	20.1		Yes	Yes	P	2.38	P		0.45		P	0.8		P		0.36		P	220.8	P	4.4	P
212	R-16r	600	1	17-Aug-06	6	58		P	P	16.8		Yes	Yes	P	2.35	P		0.44		P	0.7		P		0.35		P	34.3	P	4.5	P
213	R-16r	600	1	1-Nov-06	7	70		P	Fail	20.5		Yes	Yes	P	2.40	P		0.45		P	0.8		P		0.37		P	137.6	P	3.2	P
214	R-17	1057	1	24-Feb-06	1	35	UF	P	P	8.5	UF	No	Yes	Fail	2.54	P		0.21		P	2.5	UF	P		0.19		P	—	ND	—	ND
215	R-17	1057	1	19-Oct-06	2	21		P	P	10.4		Yes	Yes	P	1.99	P	<	0.31		P	2.9		P		0.15		P	224.5	P	3.2	P

Table C-5. Inorganic Nonmetal Indicators

Row #	Well	Port depth (ft)	Scr #	Sample collection date (start)		Ba mg/L		Test D3	Test E2	Ca mg/L		Test E1a	Test E1b	E1	Cl mg/L	Test A1		F mg/L	Lab Qual Code	Test A2	Mg mg/L		Test E4		NO3-N mg/L	Lab Qual Code	Test C11	ORP	Test C3	DO	Test C12
								mg/L	mg/L			mg/L	mg/L	Within		mg/L				mg/L			mg/L				mg/L		mV		mg/L
								>LL	<UL			>LL	<UL	range		<UL				<UL			<UL				>LL		>LL		>LL
								4.6	70			8.66	24.1			3.75				0.53			4.81				0.1		0		2
								1.4	72			4.39	17.3			1.75				0.23			6.12				0.1		0		2
216	R-17	1124	2	17-Oct-06	1	19		P	P	9.1		Yes	Yes	P	1.76	P	<	0.29		P	2.6		P		0.25		P	204	P	3.2	P
217	R-18	1358	1	25-Aug-05	1	20		P	P	9.6		Yes	Yes	P	1.21	P		0.17		P	3.2		P		0.39		P	156	P	4.6	P
218	R-18	1358	1	1-Dec-05	2	20		P	P	9.4		Yes	Yes	P	1.29	P		0.16		P	3.1		P		0.40		P	195	P	4.6	P
219	R-18	1358	1	7-Mar-06	3	21		P	P	9.8		Yes	Yes	P	1.20	P	<	0.14		P	3.3		P		0.49		P	226.4	P	4.7	P
220	R-18	1358	1	16-May-06	4	21		P	P	9.3		Yes	Yes	P	1.22	P	<	0.15		P	3.0		P		0.54		P	229.8	P	4.3	P
221	R-18	1358	1	15-Aug-06	5	21		P	P	9.6		Yes	Yes	P	1.27	P		0.10		P	3.1		P		0.57		P	267.2	P	4.4	P
222	R-18	1358	1	18-Dec-06	6	19		P	P	9.4		Yes	Yes	P	1.33	P		0.10		P	3.1		P		0.633		P	65.7	P	5.4	P
223	R-19	909	2	15-Dec-03	1	24	UF	P	P	17.7	UF	Yes	No	Fail	2.70	Fail		0.56		Fail	3.0	UF	P		0.38		P	—	ND	—	ND
224	R-19	909	2	10-Jun-04	2	27	UF	P	P	16.8	UF	Yes	No	P	3.07	Fail		0.67		Fail	2.7	UF	P		0.36		P	—	ND	—	ND
225	R-19	909	2	21-Jul-05	3	22		P	P	14.9		Yes	Yes	P	2.42	Fail		0.41		Fail	2.5		P		0.27		P	245	P	—	ND
226	R-19	909	2	18-Aug-06	4	25		P	P	16.1		Yes	No	P	3.76	Fail		0.64		Fail	2.7		P		0.24		P	—	ND	—	ND
227	R-19	909	2	11-Dec-06	5	25		P	P	14.3		Yes	Yes	P	5.19	Fail		0.79		Fail	2.5		P		0.24		P	—	ND	—	ND
228	R-19	1191	3	15-Dec-03	1	19	UF	P	P	12.3	UF	Yes	Yes	P	1.93	P		0.34		P	3.1	UF	P		0.28		P	—	ND	—	ND
229	R-19	1191	3	14-Jun-04	2	18	UF	P	P	11.9	UF	Yes	Yes	P	1.96	P		0.44		P	2.9	UF	P		0.25		P	—	ND	—	ND
230	R-19	1191	3	21-Jul-05	3	19		P	P	11.5		Yes	Yes	P	1.70	P		0.19		P	2.9		P		0.23		P	174	P	—	ND
231	R-19	1191	3	15-Aug-06	4	20		P	P	11.9		Yes	Yes	P	2.74	P		0.41		P	3.0		P	<	0.002		Fail	—	ND	—	ND
232	R-19	1191	3	16-Aug-06	4	20		P	P	11.9		Yes	Yes	P	2.74	P		0.41		P	3.0		P	<	0.00		Fail	—	ND	—	ND
233	R-19	1191	3	11-Dec-06	5	19		P	P	11.4		Yes	Yes	P	3.89	Fail		0.52		P	2.8		P		0.02		Fail	—	ND	—	ND
234	R-19	1413	4	16-Dec-03	1	28	UF	P	P	9.0	UF	Yes	Yes	P	1.70	P		0.18		P	2.8	UF	P		0.35		P	—	ND	—	ND
235	R-19	1413	4	15-Jun-04	2	28	UF	P	P	9.1	UF	Yes	Yes	P	1.53	P	<	0.06	U	P	2.7	UF	P		0.26		P	—	ND	—	ND
236	R-19	1413	4	28-Jul-05	3	28		P	P	9.0		Yes	Yes	P	1.55	P		0.23		P	2.7		P		0.24		P	208	P	5.5	P
237	R-19	1413	4	16-Aug-06	4	24.7		P	P	8.2		No	Yes	Fail	1.66	P		0.226		P	2.44		P		0.34		P	—	ND	—	ND
238	R-19	1413	4	17-Aug-06	4	27		P	P	8.7		Yes	Yes	P	2.35	P		0.21		P	2.7		P		0.07		Fail	—	ND	—	ND
239	R-19	1413	4	12-Dec-06	5	28		P	P	8.9		Yes	Yes	P	1.64	P		0.19		P	2.7		P		0.332		P	—	ND	—	ND
240	R-19	1586	5	20-Sep-01	1	110		P	Fail	31.6		Yes	No	Fail	1.91	P		0.32		P	4.9		Fail		0.01	J	Fail	—	ND	—	ND
241	R-19	1586	5	23-Aug-02	2	118	UF	P	Fail	31.2	UF	Yes	No	Fail	2.26	P		0.29		P	5.0	UF	Fail	<	0.01	U	Fail	-114	Fail	3.0	P
242	R-19	1586	5	16-Dec-03	3	103	UF	P	Fail	29.7	UF	Yes	No	Fail	2.25	P		0.22		P	4.5	UF	P	<	0.01	U	Fail	—	ND	—	ND
243	R-19	1586	5	17-Aug-06	4	91		P	Fail	28.9		Yes	No	Fail	2.88	P		0.25		P	4.1		P		0.012		Fail	—	ND	—	ND
244	R-19	1586	5	11-Dec-06	5	93		P	Fail	28.1		Yes	No	Fail	4.10	Fail		0.36		P	4.0		P	<	0.002		Fail	—	ND	—	ND
245	R-19	1730	6	21-Sep-01	1	14		P	P	5.1		No	Yes	Fail	1.70	P		0.28		P	1.4		P	<	0.007	U	Fail	—	ND	—	ND
246	R-19	1730	6	27-Aug-02	2	13	UF	P	P	5.1	UF	No	Yes	Fail	1.95	P		0.23		P	1.6	UF	P	<	0.01	U	Fail	-76	Fail	6.2	P
247	R-19	1730	6	16-Dec-03	3	11	UF	P	P	4.7	UF	No	Yes	Fail	2.03	P		0.21		P	1.5	UF	P	<	0.01	U	Fail	—	ND	—	ND
248	R-19	1730	6	17-Aug-06	4	20		P	P	6.5		No	Yes	Fail	2.72	P		0.20		P	1.9		P	<	0.002		Fail	—	ND	—	ND
249	R-19	1730	6	11-Dec-06	5	13		P	P	5.0		No	Yes	Fail	3.79	Fail		0.27		P	1.6		P	<	0.002		Fail	—	ND	—	ND
250	R-19	1835	7	26-Aug-02	0.8	15	UF	P	P	3.4	UF	No	Yes	Fail	2.74	P		0.61		Fail	0.9	UF	P	<	0.01	J	Fail	-2	Fail	6.6	P
251	R-19	1835	7	17-Dec-03	1	28	UF	P	P	3.7	UF	No	Yes	Fail	2.63	P		0.55		Fail	1.6	UF	P		0.020	J	Fail	—	ND	—	ND
252	R-19	1835	7	16-Jun-04	2	15	UF	P	P	3.3	UF	No	Yes	Fail	2.34	P		0.48		P	1.0	UF	P		0.030	J	Fail	—	ND	—	ND
253	R-19	1835	7	28-Jul-05	3	6.9		P	P	2.3		No	Yes	Fail	2.16	P		0.49		P	0.7		P		0.034	J	Fail	154	P	4.4	P
254	R-19	1835	7	18-Aug-06	4	9		P	P	2.8		No	Yes	Fail	3.42	P		0.57		Fail	0.9		P	<	0.002		Fail	—	ND	—	ND
255	R-19	1835	7	13-Dec-06	5	7.9		P	P	2.6		No	Yes	Fail	4.78	Fail		0.70		Fail	0.8		P	<	0.002		Fail	—	ND	—	ND
256	R-20	907	1	20-Sep-04	1	25		P	P	3.8		No	Yes	Fail	3.67	P		0.44		P	0.5		P	<	0.003	U	Fail	-21	Fail	8.0	P
257	R-20	907	1	4-Nov-04	2	27		P	P	4.1		No	Yes	Fail	2.94	P		0.44		P	0.6		P	<	0.003	U	Fail	—	ND	3.3	P
258	R-20	907	1	20-Jul-05	3	31		P	P	3.9		No	Yes	Fail	2.86	P		0.26		P	0.5		P	<	0.017	U	Fail	-245	Fail	5.5	P

Table C-5. Inorganic Nonmetal Indicators

Row #	Well	Port depth (ft)	Scr #	Sample collection date (start)		Ba mg/L		Test D3	Test E2	Ca mg/L		Test E1a	Test E1b	E1	Cl mg/L	Test A1		F mg/L	Lab Qual Code	Test A2	Mg mg/L		Test E4		NO3-N mg/L	Lab Qual Code	Test C11	ORP	Test C3	DO	Test C12
								mg/L	mg/L			mg/L	mg/L	Within		mg/L				mg/L			mg/L				mg/L		mV		mg/L
								>LL	<UL			>LL	<UL	range		<UL				<UL			<UL				>LL		>LL		>LL
								4.6	70			8.66	24.1			3.75				0.53			4.81				0.1		0		2
								1.4	72			4.39	17.3			1.75				0.23			6.12				0.1		0		2
259	R-20	907	1	6-Jun-06	4	28		P	P	4.2		No	Yes	Fail	2.37	P		0.44		P	0.5		P		0.018	J	Fail	—	ND	3.4	P
260	R-20	907	1	6-Jul-06	5	47		P	P	9.2		Yes	Yes	P	2.10	P		0.34		P	2.3		P		0.15		P	-27.8	Fail	1.1	Fail
261	R-20	907	1	2-Oct-06	6	42		P	P	8.4		No	Yes	Fail	3.40	P		0.36		P	2.3		P		0.148		P	—	ND	—	ND
262	R-20	907	1	17-Oct-06	7	—		ND	ND	—		—	—	ND	—	ND		—		ND	—		ND		—		ND	—	ND	—	ND
263	R-20	1150	2	3-Sep-04	1	227		P	Fail	39.7		Yes	No	Fail	6.79	Fail		0.83		Fail	3.9		P	<	0.015	J	Fail	27	P	3.9	P
264	R-20	1150	2	8-Nov-04	2	227		P	Fail	41.3		Yes	No	Fail	6.71	Fail		0.71		Fail	4.0		P	<	0.003	U	Fail	—	ND	12.0	P
265	R-20	1150	2	19-Jul-05	3	253		P	Fail	42.2		Yes	No	Fail	6.29	Fail		0.50		P	4.0		P	<	0.017	U	Fail	35	P	—	ND
266	R-20	1150	2	7-Jun-06	4	230		P	Fail	36.8		Yes	No	Fail	4.78	Fail		0.79		Fail	3.9		P	<	0.016	J	Fail	—	ND	5.7	P
267	R-20	1150	2	8-Jul-06	5	47		P	P	10.1		Yes	Yes	P	1.75	P		0.32		P	2.5		P		0.27		P	3.61	P	6.4	P
268	R-20	1330	3	7-Sep-04	1	93		P	Fail	12.6		Yes	Yes	P	1.43	P		1.31		Fail	3.4		P	<	0.003	U	Fail	8	P	11.1	P
269	R-20	1330	3	9-Nov-04	2	85		P	Fail	11.8		Yes	Yes	P	1.65	P		1.21		Fail	3.3		P	<	0.003	U	Fail	—	ND	13.1	P
270	R-20	1330	3	18-Jul-05	3	84		P	Fail	10.6		Yes	Yes	P	1.30	P		0.87		Fail	2.9		P	<	0.017	U	Fail	—	ND	—	ND
271	R-20	1330	3	8-Jun-06	4	76		P	Fail	10.2		Yes	Yes	P	1.38	P		1.24		Fail	2.7		P	<	0.014	J	Fail	—	ND	6.4	P
272	R-20	1330	3	7-Jul-06	5	47		P	P	8.2		No	Yes	Fail	4.11	Fail		0.63		Fail	2.0		P	<	0.052		Fail	14.2	P	0.4	Fail
273	R-20	1330	3	21-Jul-06	6	32		P	P	5.2		No	Yes	Fail	1.79	P		0.49		P	1.4		P		0.21		P	175.3	P	2.8	P
274	R-20	1330	3	13-Oct-06	7	32		P	P	4.9		No	Yes	Fail	2.60	P		0.70		Fail	1.3		P		0.297		P	73.3	P	1.1	Fail
275	R-21	889	1	23-Sep-04	1	15		P	P	12.1		Yes	Yes	P	1.75	P		0.34		P	3.1		P		0.36		P	—	ND	5.2	P
276	R-21	889	1	14-Dec-04	2	14		P	P	11.4		Yes	Yes	P	1.88	P		0.28		P	3.1		P		0.31		P	29	P	4.8	P
277	R-21	889	1	6-Jun-05	3	15		P	P	11.5		Yes	Yes	P	1.76	P		0.19		P	2.9		P		0.25		P	627	Err	4.3	P
278	R-21	889	1	7-Jul-06	4	14		P	P	11.2		Yes	Yes	P	1.86	P		0.28		P	2.8		P		0.28		P	65.2	P	4.3	P
279	R-21	889	1	6-Nov-06	5	14		P	P	12.0		Yes	Yes	P	1.95	P		0.30		P	3.0		P		0.28	J+	P	49.4	P	4.0	P
280	R-22	907	1	18-Nov-03	1	238	UF	P	Fail	74.9	UF	Yes	No	Fail	4.10	Fail		0.30		P	21.7	UF	Fail	<	0.01	U	Fail	—	ND	—	ND
281	R-22	907	1	21-Jun-04	2	239	UF	P	Fail	74.4	UF	Yes	No	Fail	3.69	P		0.25		P	21.8	UF	Fail	<	0.01	U	Fail	—	ND	—	ND
282	R-22	907	1	27-Jun-05	3	198		P	Fail	71.7		Yes	No	Fail	3.73	P		0.29		P	21.3		Fail	<	0.017	U	Fail	-88	Fail	3.4	P
283	R-22	907	1	22-Aug-06	4	286		P	Fail	77.9		Yes	No	Fail	6.31	Fail		0.36		P	24.6		Fail		0.011		Fail	—	ND	—	ND
284	R-22	907	1	7-Dec-06	5	307		P	Fail	78.9		Yes	No	Fail	8.13	Fail		0.52		P	25.6		Fail		0.01		Fail	—	ND	—	ND
285	R-22	963	2	19-Nov-03	1	14	UF	P	P	11.0	UF	Yes	Yes	P	2.70	P		0.29		P	4.9	UF	Fail		0.64		P	—	ND	—	ND
286	R-22	963	2	22-Jun-04	2	14	UF	P	P	11.1	UF	Yes	Yes	P	2.53	P		0.23		P	4.8	UF	P		0.61		P	—	ND	—	ND
287	R-22	963	2	28-Jun-05	3	14		P	P	11.4		Yes	Yes	P	2.43	P		0.32		P	4.6		P		0.58		P	225	P	7.3	P
288	R-22	963	2	28-Aug-06	4	15		P	P	11.5		Yes	Yes	P	2.64	P		0.31		P	4.5		P		0.71		P	—	ND	—	ND
289	R-22	963	2	7-Dec-06	5	14		P	P	11.8		Yes	Yes	P	2.67	P		0.30		P	4.6		P		0.736		P	—	ND	—	ND
290	R-22	1274	3	9-Jul-02	0.5	96	UF	P	Fail	15.4	UF	Yes	Yes	P	4.29	Fail		0.48		P	4.5	UF	P		0.28		P	—	ND	3.5	P
291	R-22	1274	3	20-Nov-03	2	94	UF	P	Fail	11.4	UF	Yes	Yes	P	4.66	Fail		0.44		P	3.1	UF	P		0.34		P	—	ND	—	ND
292	R-22	1274	3	23-Jun-04	3	112	UF	P	Fail	11.3	UF	Yes	Yes	P	4.47	Fail		0.40		P	2.9	UF	P		0.44		P	—	ND	—	ND
293	R-22	1274	3	29-Jun-05	4	146		P	Fail	16.9		Yes	Yes	P	4.34	Fail		0.47		P	4.6		P		0.38		P	199	P	6.6	P
294	R-22	1274	3	22-Aug-06	5	175		P	Fail	19.3		Yes	Yes	P	4.36	Fail		0.47		P	5.4		Fail		0.65		P	—	ND	—	ND
295	R-22	1274	3	8-Dec-06	6	175		P	Fail	19.5		Yes	Yes	P	4.52	Fail		0.47		P	5.5		Fail		0.648		P	—	ND	—	ND
296	R-22	1378	4	11-Jul-02	0.5	351	UF	P	Fail	43.9	UF	Yes	No	Fail	7.76	Fail		0.59		Fail	11.4	UF	Fail	<	0.020	J	Fail	—	ND	3.9	P
297	R-22	1378	4	20-Nov-03	2	362	UF	P	Fail	39.8	UF	Yes	No	Fail	9.08	Fail		0.63		Fail	10.9	UF	Fail	<	0.01	U	Fail	—	ND	—	ND
298	R-22	1378	4	23-Jun-04	3	320	UF	P	Fail	33.5	UF	Yes	No	Fail	8.43	Fail		0.59		Fail	9.2	UF	Fail	<	0.020	J	Fail	—	ND	—	ND
299	R-22	1378	4	1-Jul-05	4	292		P	Fail	32.7		Yes	No	Fail	7.84	Fail		0.70		Fail	9.1		Fail		0.024	J	Fail	-9	Fail	4.0	P
300	R-22	1378	4	22-Aug-06	5	239		P	Fail	29.2		Yes	No	Fail	10.30	Fail		0.79		Fail	7.6		Fail	<	0.002	U	Fail	—	ND	—	ND
301	R-22	1378	4	8-Dec-06	6	344		P	Fail	34.0		Yes	No	Fail	12.60	Fail		0.91		Fail	9.4		Fail	<	0.002		Fail	—	ND	—	ND

Table C-5. Inorganic Nonmetal Indicators

Row #	Well	Port depth (ft)	Scr #	Sample collection date (start)		Ba mg/L		Test D3	Test E2	Ca mg/L		Test E1a	Test E1b	E1	Cl mg/L	Test A1		F mg/L	Lab Qual Code	Test A2	Mg mg/L		Test E4		NO3-N mg/L	Lab Qual Code	Test C11	ORP	Test C3	DO	Test C12
								mg/L	mg/L			mg/L	mg/L	Within		mg/L				mg/L			mg/L				mg/L		mV		mg/L
								>LL	<UL			>LL	<UL	range		<UL				<UL			<UL				>LL		>LL		>LL
								4.6	70			8.66	24.1			3.75				0.53			4.81				0.1		0		2
								1.4	72			4.39	17.3			1.75				0.23			6.12				0.1		0		2
302	R-22	1448	5	10-Jul-02	1	133	UF	P	Fail	33.6	UF	Yes	No	Fail	2.86	P		0.30		P	6.1	UF	Fail	<	0.020	J	Fail	—	ND	3.4	P
303	R-22	1448	5	21-Nov-03	2	137	UF	P	Fail	34.6	UF	Yes	No	Fail	2.97	P		0.28		P	6.0	UF	Fail	<	0.01	U	Fail	—	ND	—	ND
304	R-22	1448	5	5-Jul-05	3	123		P	Fail	34.6		Yes	No	Fail	3.01	P		0.20		P	6.7		Fail	<	0.017	U	Fail	70	P	5.1	P
305	R-22	1448	5	21-Aug-06	4	148		P	Fail	42.9		Yes	No	Fail	4.80	Fail		0.37		P	7.9		Fail		0		Fail	—	ND	—	ND
306	R-22	1448	5	7-Dec-06	5	136		P	Fail	33.2		Yes	No	Fail	6.53	Fail		0.51		P	6.5		Fail	<	0.002		Fail	—	ND	—	ND
307	R-23	816	1	29-Jun-04	1	29		P	P	17.8		Yes	Yes	P	4.00	Fail		0.39		P	4.4		P		0.94		Plm	—	ND	3.9	P
308	R-23	816	1	24-Sep-04	2	29		P	P	17.7		Yes	Yes	P	3.70	P		0.43		P	4.3		P		1.36		Plm	152	P	4.3	P
309	R-23	816	1	14-Jul-05	3	27		P	P	16.9		Yes	Yes	P	3.95	Fail		0.23		P	4.1		P		1.02		Plm	2	P	3.6	P
310	R-23	816	1	15-Aug-06	4	25		P	P	16.2		Yes	Yes	P	3.64	P		0.38		P	3.9		P		1.36		Plm	25.3	P	6.1	P
311	R-23	816	1	18-Dec-06	5	22		P	P	15.1		Yes	Yes	P	3.75	P		0.35		P	3.7		P		1.34		Plm	365	Err	6.5	P
312	R-23i	470	2	20-Dec-05	1	5.8	UF	P	P	19.7	UF	Yes	No	Fail	9.47	Fail		0.25		Fail	5.7	UF	P		0.59		P	—	ND	—	ND
313	R-23i	470	2	3-Oct-06	2	8.6		P	P	19.8		Yes	No	Fail	6.68	Fail		0.20		P	5.6		P		801		Err	8.9	P	3.7	P
314	R-23i	524	3	11-Dec-05	1	13	UF	P	P	19.2	UF	Yes	No	Fail	10.40	Fail		0.25		Fail	5.7	UF	P		0.82		P	—	ND	—	ND
315	R-23i	524	3	11-Oct-06	2	10		P	P	21.1		Yes	No	Fail	8.29	Fail		0.24		Fail	5.8		P		0.78		P	-137	Fail	4.4	P
316	R-24	825	1	20-Sep-05	1	99	UF	P	Fail	16.4	UF	Yes	Yes	P	6.66	Fail		0.30		P	3.5	UF	P		0.37		P	—	ND	—	ND
317	R-24	825	1	15-Nov-05	2	96		P	Fail	17.4		Yes	Yes	P	6.96	Fail		0.37		P	3.6	UF	P		0.31		P	70.3	P	2.3	P
318	R-24	825	1	6-Mar-06	3	105		P	Fail	17.9		Yes	Yes	P	7.27	Fail		0.40		P	3.6		P		0.30		P	71.1	P	1.3	Fail
319	R-24	825	1	10-May-06	4	106		P	Fail	19.6		Yes	Yes	P	7.59	Fail		0.40		P	3.7		P		0.21		P	203.4	P	1.8	Fail
320	R-24	825	1	27-Jul-06	5	88		P	Fail	20.5		Yes	Yes	P	7.53	Fail		0.34		P	3.8		P		0.31		P	-10.9	Fail	10.3	P
321	R-25	755	1	7-Aug-02	0.5	10	UF	P	P	26.1	UF	Yes	No	Fail	12.20	Plm		0.15		P	5.9	UF	P		1.07		Plm	165	P	5.0	P
322	R-25	755	1	11-Dec-03	1	10	UF	P	P	21.5	UF	Yes	No	Fail	12.10	Plm		0.09		P	5.6	UF	P		1.15		Plm	—	ND	—	ND
323	R-25	755	1	1-Sep-04	2	10	UF	P	P	17.9	UF	Yes	No	Fail	16.60	Plm		0.13		P	5.2	UF	P		1.06		Plm	—	ND	—	ND
324	R-25	755	1	2-Aug-05	3	7.8		P	P	18.2		Yes	No	Fail	13.50	Plm		0.12		P	6.1		P		1.04		Plm	255	P	5.2	P
325	R-25	892	2	5-Feb-02	0.5	—		ND	ND	—		—	—	ND	—	ND		0.07	J	P	—		ND		—		ND	—	ND	—	ND
326	R-25	892	2	8-Aug-02	1	5.3	UF	P	P	10.1	UF	Yes	Yes	P	10.70	Plm	<	0.06	U	P	1.7	UF	P	<	0.030	J	Fail	131	P	4.5	P
327	R-25	892	2	10-Dec-03	2	6.7	UF	P	P	10.9	UF	Yes	Yes	P	13.00	Plm	<	0.06	U	P	1.4	UF	P	<	0.01	U	Fail	—	ND	—	ND
328	R-25	892	2	3-Aug-05	3	1.0		Fail	P	15.1		Yes	Yes	P	13.40	Plm	<	0.03	U	P	2.4		P		0.083		Fail	-9	Fail	4.0	P
329	R-25	1192	4	8-Aug-02	1	19	UF	P	P	27.0	UF	Yes	No	Fail	5.06	Plm	<	0.06	U	P	4.4	UF	P		0.75		P	-52	Fail	5.7	P
330	R-25	1192	4	10-Dec-03	2	20	UF	P	P	19.0	UF	Yes	No	Fail	6.33	Plm	<	0.06	U	P	4.8	UF	P	<	0.01	U	Fail	—	ND	—	ND
331	R-25	1192	4	4-Aug-05	3	21		P	P	106.0		Yes	No	Fail	6.52	Plm		0.10		P	4.9		P		0.70		P	320	P	4.6	P
332	R-25	1303	5	9-Aug-02	0.5	22	UF	P	P	22.7	UF	Yes	Yes	P	2.92	P		0.11		P	4.7	UF	P		0.030	J	Fail	76	P	4.1	P
333	R-25	1303	5	9-Dec-03	1	82	UF	P	Fail	23.6	UF	Yes	Yes	P	3.24	P		0.12		P	4.2	UF	P		0.01	J	Fail	—	ND	—	ND
334	R-25	1303	5	31-Aug-04	2	56	UF	P	P	22.4	UF	Yes	Yes	P	—	ND		—		ND	4.0	UF	P	<	0.016	J	Fail	—	ND	—	ND
335	R-25	1303	5	9-Aug-05	3	5.3		P	P	18.5		Yes	Yes	P	—	ND		—		ND	2.3		P		—		ND	—	ND	2.8	P
336	R-25	1406	6	8-Feb-02	1	19		P	P	19.0		Yes	Yes	P	4.82	Fail		0.17		P	3.7		P		0.28		P	—	ND	6.5	P
337	R-25	1406	6	12-Aug-02	2	23	UF	P	P	18.4	UF	Yes	Yes	P	1.68	P	<	0.06	U	P	3.6	UF	P		0.28		P	233	P	6.3	P
338	R-25	1406	6	9-Dec-03	3	28	UF	P	P	17.7	UF	Yes	Yes	P	1.44	P	<	0.06	U	P	3.5	UF	P		0.29		P	—	ND	—	ND
339	R-25	1606	7	11-Feb-02	1	34		P	P	11.2		Yes	Yes	P	1.59	P		0.15		P	2.9		P		0.28		P	—	ND	8.1	P
340	R-25	1606	7	12-Aug-02	2	42	UF	P	P	11.1	UF	Yes	Yes	P	1.49	P		0.12		P	2.9	UF	P		0.31		P	206	P	6.3	P
341	R-25	1606	7	8-Dec-03	3	55	UF	P	P	10.8	UF	Yes	Yes	P	1.42	P		0.09		P	2.9	UF	P		0.30		P	—	ND	—	ND
342	R-25	1796	8	14-Aug-02	1	21	UF	P	P	11.5	UF	Yes	Yes	P	1.54	P		0.12		P	2.8	UF	P		0.30		P	170	P	8.5	P
343	R-25	1796	8	4-Dec-03	2	25	UF	P	P	11.8	UF	Yes	Yes	P	1.50	P		0.10	J	P	2.9	UF	P		0.30		P	—	ND	—	ND
344	R-25	1796	8	10-Aug-05	3	25		P	P	12.0		Yes	Yes	P	1.37	P		0.15		P	2.9		P		0.25		P	—	ND	6.6	P

Table C-5. Inorganic Nonmetal Indicators

Row #	Well	Port depth (ft)	Scr #	Sample collection date (start)		Ba mg/L		Test D3	Test E2	Ca mg/L		Test E1a	Test E1b	E1	Cl mg/L	Test A1		F mg/L	Lab Qual Code	Test A2	Mg mg/L		Test E4		NO3-N mg/L	Lab Qual Code	Test C11	ORP	Test C3	DO	Test C12
								mg/L	mg/L			mg/L	mg/L	Within		mg/L				mg/L			mg/L				mg/L		mV		mg/L
								>LL	<UL			>LL	<UL	range		<UL				<UL			<UL				>LL		>LL		>LL
								4.6	70			8.66	24.1			3.75				0.53			4.81				0.1		0		2
								1.4	72			4.39	17.3			1.75				0.23			6.12				0.1		0		2
345	R-26	659	1	13-Apr-05	1	8.4		P	P	7.4		Yes	Yes	P	1.17	P		0.11		P	2.9		P		0.26		P	-0.4	Fail	8.9	P
346	R-26	659	1	27-Jul-05	2	7.6		P	P	7.4		Yes	Yes	P	1.06	P	<	0.03	U	P	2.9		P		0.30		P	173	P	5.7	P
347	R-26	659	1	2-Nov-05	3	7.4		P	P	7.3		Yes	Yes	P	1.13	P		0.14		P	2.8		P		0.26		P	—	ND	6.8	P
348	R-26	659	1	22-Feb-06	4	8.0		P	P	7.6		Yes	Yes	P	1.12	P	<	0.17		P	3.0		P		0.31		P	—	ND	6.6	P
349	R-27	852	1	11-Oct-05	1	160	UF	P	Fail	7.9	UF	No	Yes	Fail	1.91	P		0.17		P	2.0	UF	P		0.10		P	—	ND	—	ND
350	R-27	852	1	21-Oct-05	1.1	240	UF	P	Fail	4.5	UF	No	Yes	Fail	1.58	P		0.21		P	2.7	UF	P		0.29		P	—	ND	—	ND
351	R-27	852	1	14-Nov-05	2	23	UF	P	P	9.3	UF	Yes	Yes	P	1.64	P		0.20		P	2.7	UF	P		0.17		P	—	ND	—	ND
352	R-27	852	1	1-Jul-06	3	26		P	P	10.2		Yes	Yes	P	1.54	P		0.27		P	2.9		P		0.26		P	160.6	P	5.6	P
353	R-28	934	1	20-May-05	1	53		P	P	34.5		Yes	No	Fail	21.10	Plm		0.33		P	8.7		Fail		3.10		Plm	58	P	6.1	P
354	R-28	934	1	1-Sep-05	2	54		P	P	35.2		Yes	No	Fail	24.40	Plm		0.35		P	8.9		Fail		4.76		Plm	136.4	P	5.5	P
355	R-28	934	1	10-Nov-05	3	56		P	P	35.7		Yes	No	Fail	23.50	Plm		0.36		P	9.0		Fail		4.15		Plm	141.2	P	5.8	P
356	R-28	934	1	26-Jan-06	4	55		P	P	36.4		Yes	No	Fail	28.70	Plm		0.34		P	9.3		Fail		4.52		Plm	230.3	P	5.8	P
357	R-28	934	1	19-Apr-06	5	—		ND	ND	—		—	—	ND	—	ND		—		ND	—		ND		—		ND	78.1	P	5.7	P
358	R-28	934	1	5-Jul-06	6	63		P	P	40.1		Yes	No	Fail	26.80	Plm		0.39		P	10.0		Fail		4.18		Plm	5.38	P	5.2	P
359	R-28	934	1	26-Oct-06	7	59		P	P	37.7		Yes	No	Fail	25.60	Plm		0.31		P	9.5		Fail		4.50		Plm	85.4	P	6.6	P
360	R-31	532	2	18-Mar-04	1	322		P	Fail	56.3		Yes	No	Fail	2.33	P		0.35		P	16.7		Fail	<	0.01	U	Fail	-93	Fail	11.0	P
361	R-31	532	2	17-Aug-05	2	277		P	Fail	53.4		Yes	No	Fail	2.11	P		0.29		P	16.3		Fail	<	0.017	U	Fail	—	ND	4.8	P
362	R-31	532	2	28-Nov-06	3	262		P	Fail	54.2		Yes	No	Fail	2.17	P		0.29		P	17.2		Fail	<	0.014	U	Fail		ND		ND
363	R-31	670	3	19-Aug-05	1	87		P	Fail	11.8		Yes	Yes	P	3.44	P		0.43		P	3.6		P		0.020	J	Fail	—	ND	4.2	P
364	R-31	670	3	30-Nov-06	2	65		P	P	11.0		Yes	Yes	P	2.22	P		0.32		P	3.4		P	<	0.024	J	Fail		ND		ND
365	R-31	831	4	23-Aug-05	1	39		P	P	13.0		Yes	Yes	P	1.75	P		0.24		P	2.1		P		0.180		P	—	ND	140.0	Err
366	R-31	831	4	6-Dec-06	2	40		P	P	10.8		Yes	Yes	P	1.72	P		0.23		P	2.3		P		0.282		P		ND		ND
367	R-31	1011	5	24-Aug-05	1	30		P	P	9.4		Yes	Yes	P	1.32	P		0.16		P	2.4		P		0.160		P	—	ND	6.6	P
368	R-31	1011	5	6-Dec-06	2	32		P	P	9.0		Yes	Yes	P	1.52	P		0.18		P	2.6		P		0.270		P		ND		ND
369	R-32	871	1	21-Sep-04	1	81		P	Fail	16.1		Yes	Yes	P	2.85	P		0.30		P	4.9		Fail		0.85		P	169	P	7.2	P
370	R-32	871	1	15-Nov-04	2	77		P	Fail	16.5		Yes	Yes	P	3.04	P		0.32		P	5.0		Fail		0.89		P	0	P	8.6	P
371	R-32	871	1	22-Jun-05	3	58		P	P	16.2		Yes	Yes	P	2.88	P		0.32		P	5.0		Fail		0.66		P	252	P	4.0	P
372	R-32	871	1	29-Aug-06	4	50		P	P	16.7		Yes	Yes	P	2.83	P		0.38		P	5.0		Fail		0.89		P	—	ND	—	ND
373	R-32	871	1	12-Dec-06	5	49		P	P	16.6		Yes	Yes	P	2.88	P		0.29		P	5.1		Fail		0.99		P	—	ND	—	ND
374	R-32	976	3	22-Sep-04	1	91		P	Fail	11.4		Yes	Yes	P	1.94	P		0.70		Fail	3.3		P		0.004	J	Fail	-52	Fail	4.7	P
375	R-32	976	3	16-Nov-04	2	81		P	Fail	11.2		Yes	Yes	P	2.12	P		0.79		Fail	3.3		P	<	0.003	U	Fail	—	ND	10.5	P
376	R-32	976	3	24-Jun-05	3	84		P	Fail	11.0		Yes	Yes	P	1.88	P		0.52		P	3.3		P	<	0.017	U	Fail	-48	Fail	4.4	P
377	R-32	976	3	30-Aug-06	4	79		P	Fail	10.8		Yes	Yes	P	1.97	P		0.65		Fail	3.1		P	<	0.014	U	Fail	—	ND	—	ND
378	R-32	976	3	13-Dec-06	5	77		P	Fail	10.6		Yes	Yes	P	1.97	P		0.50		P	3.0		P		0.0399	J	Fail		ND		ND
379	R-33	996	1	27-Jun-05	1	34		P	P	12.0		Yes	Yes	P	2.08	P		0.24		P	3.8		P		0.35		P	-20	Fail	—	ND
380	R-33	996	1	14-Sep-05	2	31		P	P	11.2		Yes	Yes	P	2.19	P		0.25		P	3.6		P		0.44		P	223.5	P	—	ND
381	R-33	996	1	16-Feb-06	3	36		P	P	12.5		Yes	Yes	P	2.31	P		0.29		P	4.2		P		0.50		P	305.7	P	5.5	P
382	R-33	996	1	31-Oct-06	4	33		P	P	11.4		Yes	Yes	P	5.04	Fail		0.37		P	3.7		P		0.62		P	—	ND	—	ND
383	R-33	1112	2	24-Jun-05	1	32		P	P	11.3		Yes	Yes	P	1.90	P		0.11		P	4.1		P		0.26		P	176	P	5.3	P
384	R-33	1112	2	15-Sep-05	2	35		P	P	11.0		Yes	Yes	P	2.01	P		0.24		P	4.0		P		0.28		P	265.9	P	2.3	P
385	R-33	1112	2	14-Feb-06	3	27		P	P	10.8		Yes	Yes	P	2.13	P		0.30		P	3.6		P		0.43		P	256.5	P	2.8	P
386	R-33	1112	2	5-Jul-06	4	31		P	P	11.2		Yes	Yes	P	3.40	P		0.26		P	4.0		P		0.66		P	—	ND	—	ND
387	R-33	1112	2	1-Nov-06	5	31		P	P	10.5		Yes	Yes	P	5.00	Fail		0.37		P	3.8		P		0.63		P	—	ND	—	ND

Table C-5. Inorganic Nonmetal Indicators

Row #	Well	Port depth (ft)	Scr #	Sample collection date (start)		Ba mg/L		Test D3	Test E2	Ca mg/L		Test E1a	Test E1b	E1	Cl mg/L	Test A1		F mg/L	Lab Qual Code	Test A2	Mg mg/L		Test E4		NO3-N mg/L	Lab Qual Code	Test C11	ORP	Test C3	DO	Test C12
								mg/L	mg/L			mg/L	mg/L	Within		mg/L				mg/L			mg/L				mg/L		mV		mg/L
								>LL	<UL			>LL	<UL	range		<UL				<UL			<UL				>LL		>LL		>LL
								4.6	70			8.66	24.1			3.75				0.53			4.81				0.1		0		2
								1.4	72			4.39	17.3			1.75				0.23			6.12				0.1		0		2
388	R-34	895	1	7-Jun-05	1	42		P	P	17.3		Yes	Yes	P	2.22	P		0.25		P	3.8		P		0.29		P	-60	Fail	2.8	P
389	R-34	895	1	7-Sep-05	2	41		P	P	16.6		Yes	Yes	P	2.46	P		0.41		P	3.8		P		0.31		P	106.9	P	3.8	P
390	R-34	895	1	29-Nov-05	3	40		P	P	16.1		Yes	Yes	P	2.42	P		0.37		P	3.6		P		0.31		P	125.7	P	4.1	P
391	R-34	895	1	31-Jan-06	4	39		P	P	16.5		Yes	Yes	P	2.28	P		0.41		P	3.8		P		0.27		P	204.2	P	4.0	P
392	R-34	895	1	17-Jul-06	5	38		P	P	16.3		Yes	Yes	P	2.32	P		0.34		P	3.7		P		0.34		P	-88.9	Fail	3.6	P
393	R-34	895	1	30-Oct-06	6	38		P	P	16.1		Yes	Yes	P	2.39	P		0.38		P	3.7		P		0.35		P	92.2	P	3.0	P
Pass/Fail outcomes																															
	Pass (or Yes)							382	269			341	276	240		228				302			318				171		149		236
	Fail (or No)							1	114			38	103	136		62				78			63				145		37		9
	Total outcomes							383	383			379	379	376		290				380			381				316		186		245
	% Pass (or Yes)							100	70			90	73	64		79				79			83				54		80		96
Indeterminate outcomes																															
ND=no data								9	9			0	0	14		10				10			12				10		204		146
Err=suspected error								1	1			0	0	0		0				0			0				1		3		2
Plm=unreliable due to contaminant plume								0	0			0	0	3		93				3			0				66		0		0
DL=inadequate detection limit								0	0			0	0	0		0				0			0				0		0		0
UF=test unreliable for UF sample								0	0			0	0	0		0				0			0				0		0		0
Red=test unreliable, reducing conditions								0	0			0	0	0		0				0			0				0		0		0
—=test not applicable								0	0			0	0	0		0				0			0				0		0		0

Data source: WQDB except where indicated otherwise

LL=lower limit, UL=upper limit, P=pass; UF=unfiltered

Notes: Pass and fail outcomes for each sample are determined by comparison against test threshold criteria. From top to bottom in the column headers above are listed the indicator name and associated test identifier, units of measurement, type of test threshold, and threshold values for the regional aquifer and perched intermediate aquifer, respectively. The user should assume that the measurements of dissolved oxygen (DO) and oxidation reduction potential (ORP) reported in this table are uncertain and potentially biased on the high (oxidizing) side relative to in-situ conditions, to the extent that the sample may have been exposed to the atmosphere prior to the analysis.

Table C-5. Inorganic Nonmetal Indicators

Row #	Well	Port depth (ft)	Scr #	Sample collection date (start)			ClO4 ug/L	Lab Qual Code	Test C6		PO4-P	Lab Qual Code	Test A3	Na mg/L		Test A4		SO4 mg/L	Lab Qual Code	Test C1	Test A5	Sulfide	Test C2
									ug/L				mg/L			mg/L				mg/L	mg/L		mg/L
									>LL				<UL			<UL				>LL	<UL		<UL
									0.17				0.3			28.55				0.8	6.22		0.01
									0.17				0.08			12.19				1.07	4.48		0.01
1	CdV-16-1(i)	624	1	1-Jun-05	1		0.489		P		0.049	J	P	10.3		P		10.30		P	Plm	0.057	Fail
2	CdV-16-1(i)	624	1	29-Aug-05	2		0.488	H	P		0.107		Fail	11.4		P		12.50		P	Plm	0.006	P
3	CdV-16-1(i)	624	1	7-Dec-05	3		0.531		P		0.041	J	P	12.7		Fail		11.90		P	Plm	0.001	P
4	CdV-16-1(i)	624	1	9-Mar-06	4		0.487		P	<	0.051		P	12.7		Fail		12.20		P	Plm	—	ND
5	CdV-16-2(i)r	850	1	14-Sep-05	1		—		ND		—		ND	22.3	UF	Fail		6.89		P	Fail	—	ND
6	CdV-16-2(i)r	850	1	15-Dec-05	2		0.288		P		0.154		Fail	19.3		Fail		7.08		P	Fail	0.193	Fail
7	CdV-16-2(i)r	850	1	15-Mar-06	3		0.252		P	<	0.042	J	P	15.1		Fail		3.75		P	P	—	ND
8	CdV-16-2(i)r	850	1	17-May-06	4		0.249		P	<	0.039	J	P	13.6		Fail		4.32		P	P	—	ND
9	CdV-R-15-3	1254	4	19-Oct-04	1		0.262		P	<	0.033	J	P	10.5		P		1.47		P	P	0.001	P
10	CdV-R-15-3	1254	4	4-Apr-05	2		0.231		P	<	0.047	J	P	10.2		P		1.31		P	P	0	P
11	CdV-R-15-3	1254	4	12-Jul-05	3		0.277		P	<	0.076		P	10		P		1.25		P	P	—	ND
12	CdV-R-15-3	1254	4	18-Oct-05	4		0.254		P		0.129		P	10.2		P		1.53		P	P	0	P
13	CdV-R-15-3	1254	4	19-Jan-06	5		0.226		P	<	0.038	UH	P	9.95		P		1.53		P	P	0	P
14	CdV-R-15-3	1254	4	27-Mar-06	6		0.232		P	<	0.028	J	P	10		P	<	1.65		P	P	0	P
15	CdV-R-15-3	1350	5	20-Oct-04	1	<	0.05	U	Fail	<	0.055		P	14.9		P		0.31		Fail	Red	0.232	Fail
16	CdV-R-15-3	1350	5	5-Apr-05	2	<	0.05	U	Fail		0.08		P	18.3		P		0.95		P	P	0.28	Fail
17	CdV-R-15-3	1350	5	12-Jul-05	3	<	0.05	U	Fail	<	0.094		P	12		P		7.82		P	Fail	—	ND
18	CdV-R-15-3	1350	5	18-Oct-05	4	<	0.05	U	Fail		0.16		P	10.6		P		1.20		P	P	0.031	Fail
19	CdV-R-15-3	1350	5	20-Jan-06	5	<	0.05	U	Fail	<	0.038	UH	P	10.7		P		1.12		P	P	0.056	Fail
20	CdV-R-15-3	1350	5	28-Mar-06	6	<	0.05	U	Fail		0.035	J	P	10.5		P	<	1.37		P	P	0.09	Fail
21	CdV-R-15-3	1640	6	21-Oct-04	1	<	0.05	U	Fail	<	0.024	J	P	12.3		P		1.07		P	P	0.005	P
22	CdV-R-15-3	1640	6	6-Apr-05	2	<	0.05	U	Fail	<	0.031	J	P	12.3		P		1.01		P	P	0.014	Fail
23	CdV-R-15-3	1640	6	13-Jul-05	3	<	0.05	U	Fail	<	0.051		P	12.5		P		1.05		P	P	—	ND
24	CdV-R-15-3	1640	6	19-Oct-05	4	<	0.05	U	Fail	<	0.072		P	12.1		P		1.27		P	P	0.012	Fail
25	CdV-R-15-3	1640	6	20-Jan-06	5	<	0.05	U	Fail	<	0.038	UH	P	12.4		P		1.42		P	P	0.009	P
26	CdV-R-15-3	1640	6	29-Mar-06	6	<	0.05	U	Fail	<	0.01	U	P	10.8		P	<	1.48		P	P	0.005	P
27	CdV-R-37-2	1200	2	26-Oct-04	1	<	0.05	U	Fail	<	0.015	J	P	16.8		P		0.48		Fail	Red	0.001	P
28	CdV-R-37-2	1200	2	29-Mar-05	2	<	0.05	U	Fail	<	0.029	J	P	15.5		P		0.16		Fail	Red	0.004	P
29	CdV-R-37-2	1200	2	6-Jul-05	3	<	0.05	U	Fail	<	0.08		P	13.7		P		0.38		Fail	Red	—	ND
30	CdV-R-37-2	1200	2	12-Oct-05	4	<	0.05	U	Fail		0.168		P	12.5		P		0.38		Fail	Red	0.005	P
31	CdV-R-37-2	1200	2	9-Jan-06	5	<	0.05	U	Fail		0.171		P	12.7		P		0.41		Fail	Red	0.011	Fail
32	CdV-R-37-2	1200	2	21-Mar-06	6	<	0.05	U	Fail	<	0.072		P	12.8		P		0.49		Fail	Red	—	ND
33	CdV-R-37-2	1359	3	27-Oct-04	1		0.277		P	<	0.036	J	P	11.1		P		2.02		P	P	0.01	P
34	CdV-R-37-2	1359	3	30-Mar-05	2		0.289		P	<	0.052		P	11.2		P		1.42		P	P	0	P
35	CdV-R-37-2	1359	3	7-Jul-05	3		0.306		P	<	0.069		P	11.3		P		1.40		P	P	—	ND
36	CdV-R-37-2	1359	3	12-Oct-05	4		0.265		P		0.218		P	11.6		P		1.62		P	P	0.006	P
37	CdV-R-37-2	1359	3	10-Jan-06	5		0.265		P		0.126		P	11.1		P		1.68		P	P	0	P
38	CdV-R-37-2	1359	3	22-Mar-06	6		0.308		P	<	0.038	J	P	11.4		P		1.74		P	P	0.031	Fail
39	CdV-R-37-2	1551	4	27-Oct-04	1	<	0.05	U	Fail	<	0.035	J	P	10.4		P		1.95		P	P	0.002	P
40	CdV-R-37-2	1551	4	31-Mar-05	2	<	0.05	U	Fail	<	0.034	J	P	10.1		P		1.79		P	P	0.006	P
41	CdV-R-37-2	1551	4	8-Jul-05	3	<	0.05	U	Fail	<	0.079		P	10.7		P		1.46		P	P	—	ND
42	CdV-R-37-2	1551	4	13-Oct-05	4	<	0.05	U	Fail		0.137		P	10.7		P		1.81		P	P	0.008	P
43	CdV-R-37-2	1551	4	11-Jan-06	5	<	0.05	U	Fail		0.071		P	11.3		P		1.84		P	P	0.032	Fail
44	CdV-R-37-2	1551	4	22-Mar-06	6	<	0.05	U	Fail	<	0.036	J	P	10.7		P		1.96		P	P	0.006	P
45	MCOBT-4.4	485	1	28-Jan-03	1		170		P		0.06		P	21.7		Fail		25.80		P	Plm	—	ND
46	MCOBT-4.4	485	1	21-May-03	2		178		P		0.05		P	21.1		Fail		25.50		P	Plm	—	ND
47	MCOBT-4.4	485	1	29-Mar-05	2		210		P		—		ND	23.2	UF	Fail		27.30		P	Plm	—	ND
48	MCOBT-4.4	485	1	8-Jun-05	3		256		P	<	0.01	U	P	—		ND		—		ND	ND	—	ND
49	R-1	1031	1	19-May-05	1		0.314		P	<	0.062		P	12.9		P		3.65		P	P	0.003	P
50	R-1	1031	1	12-Sep-05	2		0.33		P	<	0.072		P	12.5		P		3.27		P	P	0.002	P
51	R-1	1031	1	28-Nov-05	3		0.334		P	<	0.04	J	P	11.4		P		3.22		P	P	0	P
52	R-1	1031	1	25-Jan-06	4		0.304		P		0.096		P	12.3		P		3.37		P	P	0.003	P
53	R-1	1031	1	19-Apr-06	5		—		ND		—		ND	—		ND		—		ND	ND	—	ND
54	R-1	1031	1	6-Jul-06	6		0.317		P		0.01	J	P	12.6		P		2.90		P	P	—	ND
55	R-1	1031	1	26-Oct-06	7		0.282		P	<	0.023	J	P	13		P		2.98		P	P	—	ND
56	R-2	918	1	26-Apr-05	1		0.334		P	<	0.07		P	21.5		P		3.36		P	P	—	ND
57	R-2	918	1	9-Aug-05	2		0.373		P		0.054		P	19.4		P		2.36		P	P	0.028	Fail
58	R-2	918	1	9-Nov-05	3		0.44		P	<	0.06		P	16.9		P		2.51		P	P	0.019	Fail
59	R-2	918	1	27-Feb-06	4		0.376		P	<	0.072		P	17.4		P		2.48		P	P	0.024	Fail
60	R-2	918	1	24-Jul-06	5		0.375		P		0.02	J	P	16.1		P		2.59		P	P	—	ND
61	R-3i	215	1	10-Aug-06	1		0.104	J	Fail	<	0.033	J	P	19.6		Fail		22.70		P	Plm	0.052	Fail
62	R-4	793	1	27-Apr-05	1		3.79		P	<	0.034	J	P	13.3		P		4.69		P	P	—	ND
63	R-4	793	1	8-Aug-05	2		5.02		P		0.08		P	12		P		4.27		P	P	0	P
64	R-4	793	1	14-Nov-05	3		4.33		P	<	0.029	J	P	12.4		P		4.38		P	P	0	P
65	R-4	793	1	28-Feb-06	4		3.19		P	<	0.034	J	P	14.1		P		4.39		P	P	0.001	P

Table C-5. Inorganic Nonmetal Indicators

Row #	Well	Port depth (ft)	Scr #	Sample collection date (start)			ClO4 ug/L	Lab Qual Code	Test C6		PO4-P	Lab Qual Code	Test A3	Na mg/L		Test A4		SO4 mg/L	Lab Qual Code	Test C1	Test A5	Sulfide	Test C2
									ug/L				mg/L			mg/L				mg/L	mg/L		mg/L
									>LL				<UL			<UL				>LL	<UL		<UL
									0.17				0.3			28.55				0.8	6.22		0.01
									0.17				0.08			12.19				1.07	4.48		0.01
66	R-4	793	1	25-Jul-06	5		4.51		P	<	0.01	U	P	11.3		P		4.15		P	P	—	ND
67	R-5	384	2	28-Apr-04	1		0.995		P	<	0.023	J	P	15.3		Fail		8.03		P	Plm	0.001	P
68	R-5	384	2	27-Sep-04	2		1.09		P	<	0.011	U	P	15.5		Fail		8.76		P	Plm	0	P
69	R-5	384	2	2-May-05	3		1.56		P	<	0.018	J	P	15.7	UF	Fail		8.22		P	Plm	—	ND
70	R-5	384	2	25-Jul-06	4		1.65		P		0.016	J	P	14.6		Fail		7.99		P	Plm	—	ND
71	R-5	719	3	30-Apr-04	1		1.15		P	<	0.023	J	P	21.3		P		16.00		P	Plm	-0.001	P
72	R-5	719	3	28-Sep-04	2		1.24		P	<	0.016	J	P	20.7		P		17.20		P	Plm	0.001	P
73	R-5	719	3	3-May-05	3		1.45		P	<	0.03	J	P	20.9	UF	P		16.10		P	Plm	—	ND
74	R-5	719	3	26-Jul-06	4		1.21		P	<	0.01	U	P	20.6		P		16.50		P	Plm	—	ND
75	R-5	861	4	3-May-04	1		0.101	J	Fail		0.023	J	P	18.5		P		4.36		P	P	0.017	Fail
76	R-5	861	4	30-Sep-04	2		0.09	J	Fail	<	0.011	U	P	18.7		P		4.75		P	P	0.005	P
77	R-5	861	4	4-May-05	3		0.194	J	P	<	0.016	J	P	18.4	UF	P		4.15		P	P	—	ND
78	R-5	861	4	27-Jul-06	4		0.256		P		—		ND	—		ND		—		ND	ND	—	ND
79	R-6	1205	1	23-Aug-05	1		0.358	H	P	<	0.01	U	P	15.4		P		3.20		P	P	0.012	Fail
80	R-6	1205	1	17-Nov-05	2		0.279		P	<	0.032	J	P	15.9		P		2.79		P	P	0.003	P
81	R-6	1205	1	1-Mar-06	3		0.306		P	<	0.028	J	P	14.7		P		2.82		P	P	0.002	P
82	R-6	1205	1	11-May-06	4		0.314		P		0.012	J	P	15.5		P		2.76		P	P	0.003	P
83	R-6	1205	1	26-Jul-06	5		0.371		P		0.015	J	P	15.6		P		2.69		P	P	—	ND
84	R-6i	602	1	24-Aug-05	1		8.15	H	P	<	0.081		Fail	20		Fail		13.20		P	Plm	0.011	Fail
85	R-6i	602	1	17-Nov-05	2		7.4		P	<	0.059		P	20.8		Fail		12.30		P	Plm	—	ND
86	R-6i	602	1	1-Mar-06	3		7.28		P	<	0.069		P	19.8		Fail		12.00		P	Plm	0.029	Fail
87	R-6i	602	1	11-May-06	4		6.59		P		0.053		P	19.7		Fail		11.00		P	Plm	0.005	P
88	R-6i	602	1	26-Jul-06	5		8.32		P		0.016	J	P	20.2		Fail		9.86		P	Plm	—	ND
89	R-7	915	3	18-Dec-03	1	<	4	U	DL		—		ND	7.88	UF	P		0.69		Fail	Red	—	ND
90	R-7	915	3	26-May-04	2	<	0.05	U	Fail		—		ND	8.64	UF	P		1.00		P	P	—	ND
91	R-7	915	3	26-Apr-05	3	<	0.05	U	Fail	<	0.042	J	P	8.06	UF	P		0.60		Fail	Red	—	ND
92	R-7	915	3	31-Jul-06	4	<	0.5	U	DL	<	0.01		P	8.7		P		1.41		P	P	—	ND
93	R-8	711	1	24-Aug-04	1		0.315		P	<	0.015	J	P	8.83		P		1.93		P	P	0	P
94	R-8	711	1	8-Dec-04	2		0.301		P	<	0.011	U	P	9.78		P		2.23		P	P	0	P
95	R-8	711	1	27-Apr-05	3		0.291		P		—		ND	9.74	UF	P		2.03		P	P	—	ND
96	R-8	711	1	1-Aug-06	4		0.289		P	<	0.013	J	P	9.48		P		2.14		P	P	—	ND
97	R-8	825	2	25-Aug-04	1		0.214		P	<	0.044	J	P	23.1		P		3.30		P	P	0.001	P
98	R-8	825	2	9-Dec-04	2		0.253		P	<	0.011	U	P	22.8		P		3.35		P	P	0.002	P
99	R-8	825	2	28-Apr-05	3		0.291		P	<	0.03	J	P	24.2	UF	P		3.21		P	P	—	ND
100	R-8	825	2	2-Aug-06	4	<	0.5	U	DL	<	0.01		P	19.4		P		4.48		P	P	—	ND
101	R-9	684	1	12-Dec-03	1	<	4		DL		—		ND	19	UF	P		6.05		P	P	—	ND
102	R-9	684	1	27-May-04	2		1.04		P		—		ND	18.7	UF	P		6.42		P	Fail	—	ND
103	R-9	684	1	19-Mar-05	3	<	5E-04	U	Fail		—		ND	18.7	UF	P		6.48		P	Fail	—	ND
104	R-9	684	1	6-Apr-05	3	<	5E-04	U	Fail		—		ND	16.6	UF	P		6.49		P	Fail	—	ND
105	R-9	684	1	28-Apr-05	3		0.984		P	<	0.024	J	P	18.5	UF	P		5.79		P	P	—	ND
106	R-9	684	1	31-Jul-06	4		0.884		P	<	0.013	J	P	18.1		P		5.76		P	P	—	ND
107	R-9i	199	1	6-Feb-04	1	<	4	U	DL		—		ND	18.2	UF	Fail		17.40		P	Plm	—	ND
108	R-9i	199	1	2-Jun-04	2	<	0.05	U	Fail		—		ND	20.3	UF	Fail		20.60		P	Plm	—	ND
109	R-9i	199	1	29-Apr-05	3		0.2		P	<	0.048	J	P	23.3	UF	Fail		17.10		P	Plm	—	ND
110	R-9i	199	1	10-Aug-06	4	<	0.5	U	DL		0.101	eUO	Fail	21		Fail		20.90		P	Plm	—	ND
111	R-9i	279	2	6-Sep-01	1		—		ND		—		ND	13.8		Fail		7.27		P	Plm	—	ND
112	R-9i	279	2	29-Jul-02	2	<	1.45	U	DL		—		ND	11.9	UF	P		8.87		P	Plm	—	ND
113	R-9i	279	2	6-Feb-04	3	<	4	U	DL		—		ND	10.2	UF	P		9.18		P	Plm	—	ND
114	R-9i	279	2	10-Aug-06	4		0.7		P		0.33	eUO	Fail	9.16		P		13.00		P	Plm	—	ND
115	R-10	874	1	29-Jun-06	1		0.569		P	<	0.014	J	P	13.7	UF	P		5.64		P	P	—	ND
116	R-10	874	1	12-Oct-06	2		0.465		P		0.023	J	P	12.2		P		5.48		P	P	—	ND
117	R-10	1042	2	11-Oct-05	1	<	0.5	U	DL		—		ND	13.2	UF	P		4.15		P	P	—	ND
118	R-10	1042	2	29-Jun-06	2		0.493		P	<	0.024	J	P	14.4		P		3.97		P	P	—	ND
119	R-10	1042	2	12-Oct-06	3		0.439		P		0.012	J	P	13		P		3.83		P	P	—	ND
120	R-10a	690	1	7-Sep-05	1		—		ND		—		ND	19.8	UF	P		13.60		P	Fail	—	ND
121	R-10a	690	1	30-Nov-05	2		0.617		P	<	0.01	U	P	18.4		P		12.90		P	Fail	0.009	P
122	R-10a	690	1	1-Feb-06	3		0.6		P	<	0.108		P	18.3		P		11.90		P	Fail	0.028	Fail
123	R-10a	690	1	17-Jul-06	4		0.753		P	<	0.01	U	P	16.7		P		10.80		P	Fail	—	ND
124	R-10a	690	1	12-Oct-06	5		0.617		P	<	0.01	U	P	16.1		P		10.40		P	Fail	—	ND
125	R-11	855	1	17-May-05	1		0.715		P	<	0.01	U	P	12.1		P		5.95		P	P	0.001	P
126	R-11	855	1	3-Aug-05	2		0.766		P	<	0.036	J	P	11.7		P		6.29		P	Fail	0	P
127	R-11	855	1	8-Nov-05	3		0.742		P	<	0.046	J	P	11.3		P		6.61		P	Fail	0.001	P
128	R-11	855	1	3-Feb-06	4		0.716		P	<	0.113		P	11.6		P		7.09		P	Fail	0.001	P
129	R-11	855	1	20-Apr-06	5		—		ND		—		ND	—		ND		—		ND	ND	—	ND
130	R-11	855	1	10-Jul-06	6		0.807		P	<	0.019	J	P	12.5		P		8.04		P	Fail	—	ND

Table C-5. Inorganic Nonmetal Indicators

Row #	Well	Port depth (ft)	Scr #	Sample collection date (start)			ClO4 ug/L	Lab Qual Code	Test C6		PO4-P	Lab Qual Code	Test A3	Na mg/L		Test A4		SO4 mg/L	Lab Qual Code	Test C1	Test A5	Sulfide	Test C2
									ug/L				mg/L			mg/L				mg/L	mg/L		mg/L
									>LL				<UL			<UL				>LL	<UL		<UL
									0.17				0.3			28.55				0.8	6.22		0.01
									0.17				0.08			12.19				1.07	4.48		0.01
131	R-11	855	1	10-Oct-06	7		0.691		P	<	0.01	U	P	11.3		P		7.84		P	Fail	—	ND
132	R-12	468	1	2-Feb-04	1	<	4	U	DL		—		ND	20.3	UF	Fail		0.38	J	Fail	Red	—	ND
133	R-12	468	1	2-Jun-04	2	<	0.05	U	Fail		—		ND	20.8	UF	Fail	<	0.19	U	Fail	Red	—	ND
134	R-12	468	1	16-Jun-05	3	<	0.05	U	Fail		0.324		Fail	20.6		Fail		1.27		P	P	—	ND
135	R-12	468	1	30-Jun-05	3		—		ND		—		ND	—		ND		—		ND	ND	—	ND
136	R-12	468	1	2-Feb-06	4	<	0.05	U	Fail		0.367		Fail	19.1		Fail		1.34		P	P	—	ND
137	R-12	468	1	11-Jul-06	5	<	0.05	U	Fail		0.194		Fail	17.2		Fail		1.60		P	P	—	ND
138	R-12	468	1	29-Sep-06	6		1.49		P	<	0.059	J-	P	18.8		Fail		22.30		P	Plm	<0.003	P
139	R-12	507	2	10-Sep-01	1		—		ND		0.09		Fail	11.1		P		7.51		P	Plm	—	ND
140	R-12	507	2	1-Aug-02	2	<	1.45	U	DL		—		ND	10.4	UF	P		7.77		P	Plm	—	ND
141	R-12	507	2	28-Jan-04	3	<	4	U	DL		—		ND	10.6	UF	P		8.11		P	Plm	—	ND
142	R-12	507	2	1-Feb-06	4	<	0.05	U	Fail	<	0.098		Fail	13		Fail		3.30		P	P	—	ND
143	R-12	507	2	12-Jul-06	5	<	0.05	U	Fail	<	0.01	U	P	13.7		Fail		3.59		P	P	—	ND
144	R-12	507	2	1-Oct-06	6		1.08		P	<	0.067		P	10		P		7.89		P	Plm	<0.003	P
145	R-12	811	3	27-Jan-04	1	<	4	U	DL		—		ND	19.2	UF	P		8.40		P	Plm	—	ND
146	R-12	811	3	3-Jun-04	2		0.051	J	Fail		—		ND	20.4	UF	P		9.15		P	Plm	—	ND
147	R-12	811	3	20-Jun-05	3	<	0.05	U	Fail		0.1		P	20.6		P		8.86		P	Plm	—	ND
148	R-12	811	3	31-Jan-06	4		0.098	J	Fail		0.231		P	19		P		8.49		P	Plm	—	ND
149	R-12	811	3	12-Jul-06	5		0.069	J	Fail	<	0.01	U	P	20		P		8.59		P	Plm	—	ND
150	R-12	811	3	27-Sep-06	6		1.46		P	<	0.048	J	P	11.3		P		8.68		P	Plm	<0.003	P
151	R-12	811	3	18-Oct-06	7		1.17		P	<	0.01	U	P	13.7		P		7.99		P	Plm	<0.003	P
152	R-13	958	1	9-Dec-03	1	<	4	U	DL		—		ND	10.6	UF	P		2.81		P	P	—	ND
153	R-13	958	1	11-Jun-04	2		0.404		P		—		ND	10	UF	P		3.36		P	P	—	ND
154	R-13	958	1	10-Mar-05	3	<	4	U	DL		—		ND	9.83	UF	P		3.19		P	P	—	ND
155	R-13	958	1	26-May-05	3		0.414		P	<	0.031	J	P	—		ND		3.14		P	P	—	ND
156	R-13	958	1	1-Sep-05	4	<	0.408	H	P		0.095		P	11.7	UF	P		3.07		P	P	—	ND
157	R-13	958	1	2-Feb-06	5		0.341		P	<	0.1		P	9.78		P		3.00		P	P	—	ND
158	R-13	958	1	3-Jul-06	6		0.394		P	<	0.039		P	10.1		P		2.93		P	P	—	ND
159	R-13	958	1	25-Oct-06	7		0.372		P	<	0.044	J	P	9.78		P		2.92		P	P	—	ND
160	R-14	1205	1	12-Jul-04	1		0.12	J	Fail		0.195		P	10.8		P		1.85		P	P	0.001	P
161	R-14	1205	1	28-Oct-04	2		0.198	J	P		0.136		P	11.5		P		1.92		P	P	0.001	P
162	R-14	1205	1	11-May-05	3		0.188	J	P		0.136		P	11.1		P		1.44		P	P	0.001	P
163	R-14	1205	1	24-Jan-06	4		0.212		P	<	0.158		P	10.7		P		1.91		P	P	—	ND
164	R-14	1205	1	26-Jun-06	5		0.163	J	Fail	<	0.128		P	11		P		1.81		P	P	—	ND
165	R-14	1205	1	23-Oct-06	6		0.175	J	P		0.084		P	11.1		P		1.74		P	P	—	ND
166	R-14	1289	2	14-Jul-04	1	<	0.05	U	Fail		0.668		Fail	15		P		1.41		P	P	0.016	Fail
167	R-14	1289	2	3-Nov-04	2	<	0.05	U	Fail		0.795		Fail	14		P		0.38		Fail	Red	0.03	Fail
168	R-14	1289	2	12-May-05	3	<	0.05	U	Fail		0.629		Fail	14.2		P		1.00		P	P	0.013	Fail
169	R-14	1289	2	25-Jan-06	4	<	0.05	U	Fail		0.72		Fail	15.2		P		1.43		P	P	—	ND
170	R-14	1289	2	28-Jun-06	5	<	0.5	U	DL		0.645		Fail	14.18		P		3.09		P	P	—	ND
171	R-14	1289	2	23-Oct-06	6	<	2	U	DL		1.21		Fail	14.1		P		2.46		P	P	—	ND
172	R-15	959	1	10-Jun-04	1		6.03		P		—		ND	10.7	UF	P		6.89		P	Plm	—	ND
173	R-15	959	1	25-May-05	2		6.39		P	<	0.035	J	P	11.3		P		6.64		P	Plm	—	ND
174	R-15	959	1	31-Aug-05	3		6.82	H	P		0.143		P	10.6		P		6.43		P	Plm	—	ND
175	R-15	959	1	30-Jan-06	4		5.47		P	<	0.111		P	11.1		P		6.40		P	Plm	—	ND
176	R-15	959	1	3-Jul-06	5		6.08		P	<	0.044	J	P	10.9		P		5.97		P	P	—	ND
177	R-15	959	1	24-Oct-06	6		6.5		P	<	0.028	J	P	10.1		P		6.20		P	P	—	ND
178	R-16	866	2	13-Oct-04	1	<	0.05	U	Fail		0.041	J	P	12		P		2.93		P	P	0.567	Fail
179	R-16	866	2	2-Dec-04	2		0.073	J	Fail	<	0.053		P	19.8		P		2.79		P	P	0.564	Fail
180	R-16	866	2	13-Jun-05	3		0.067	J	Fail	<	0.01	U	P	22.3		P		2.47		P	P	—	ND
181	R-16	866	2	13-Jul-06	4	<	1	U	DL		0.058	eUO	P	22.1		P		5.08		P	P	—	ND
182	R-16	866	2	20-Jul-06	5		0.132	J	Fail	<	0.01	U	P	20.2		P		2.60		P	P	0.29	Fail
183	R-16	866	2	11-Aug-06	6	<	0.05	U	Fail	<	0.028	J	P	12.9		P		3.68		P	P	<0.003	P
184	R-16	866	2	14-Aug-06	7	<	0.05	U	Fail	<	0.01	eUO	P	13.2		P		5.37		P	P	—	ND
185	R-16	866	2	10-Oct-06	8		0.119	J	Fail	<	0.01	U	P	13.5		P		3.90		P	P	—	ND
186	R-16	866	2	14-Nov-06	9	<	2	U	DL	<	0.01	eUO	P	14.8		P		5.36		P	P	0.013	Fail
187	R-16	866	2	4-Dec-06	10	<	1	U	DL		0.0189		P	15.7		P		6.32		P	Fail	0.009	P
188	R-16	1018	3	14-Oct-04	1		0.227		P		0.163		P	18.4		P		7.47		P	Fail	0.005	P
189	R-16	1018	3	3-Dec-04	2		0.256		P		0.166		P	19.2		P		6.73		P	Fail	0.007	P
190	R-16	1018	3	13-Jun-05	3		0.281		P		0.165		P	17		P		4.90		P	P	—	ND
191	R-16	1018	3	12-Jul-06	4		0.299		P		0.073		P	17		P		3.65		P	P	—	ND
192	R-16	1018	3	20-Jul-06	5		—		ND		—		ND	—		ND		3.65		P	P	0.005	P
193	R-16	1018	3	10-Aug-06	6		0.103	J	Fail		0.082		P	14.1		P		3.93		P	P	<0.003	P
194	R-16	1018	3	11-Aug-06	7	<	0.5	U	DL		0.26		P	14.1		P		5.46		P	P	—	ND
195	R-16	1018	3	12-Oct-06	8		0.196	J	P		0.04	J	P	13.7		P		3.60		P	P	—	ND

Table C-5. Inorganic Nonmetal Indicators

Row #	Well	Port depth (ft)	Scr #	Sample collection date (start)			ClO4 ug/L	Lab Qual Code	Test C6		PO4-P	Lab Qual Code	Test A3	Na mg/L		Test A4		SO4 mg/L	Lab Qual Code	Test C1	Test A5	Sulfide	Test C2
									ug/L				mg/L			mg/L				mg/L	mg/L		mg/L
									>LL				<UL			<UL				>LL	<UL		<UL
									0.17				0.3			28.55				0.8	6.22		0.01
									0.17				0.08			12.19				1.07	4.48		0.01
196	R-16	1018	3	14-Nov-06	9	<	1	U	DL		0.16		P	14.5		P		5.46		P	P	0.007	P
197	R-16	1018	3	5-Dec-06	10	<	2	U	DL		0.122		P	15.2		P		6.39		P	Fail	0.004	P
198	R-16	1238	4	15-Oct-04	1	<	0.05	U	Fail		0.245		P	29.7		Fail		48.90		P	Fail	> 0.6	Fail
199	R-16	1238	4	7-Dec-04	2	<	0.05	U	Fail		0.338		Fail	27.9		P		40.20		P	Fail	> 0.6	Fail
200	R-16	1238	4	14-Jun-05	3	<	0.05	U	Fail		0.278		P	27.2		P		28.80		P	Fail	—	ND
201	R-16	1238	4	13-Jul-06	4	<	2	U	DL		0.64		Fail	26.9		P		15.10		P	Fail	—	ND
202	R-16	1238	4	20-Jul-06	5	<	0.05	U	Fail		0.307		Fail	23.7		P		8.11		P	Fail	1.36	Fail
203	R-16	1238	4	9-Aug-06	6		0.364		P		0.194		P	14.2		P		4.27		P	P	<0.003	P
204	R-16	1238	4	11-Oct-06	7	<	0.05	U	Fail		0.08		P	13.1		P		3.18		P	P	—	ND
205	R-16	1238	4	14-Nov-06	8	<	2	U	DL		0.32		Fail	15.9		P		0.98		P	P	0.019	Fail
206	R-16	1238	4	5-Dec-06	9	<	2	U	DL		0.477		Fail	16.2		P		1.34		P	P	0.01	P
207	R-16r	600	1	26-Sep-05	1		2.1		P		—		ND	20.9	UF	P		4.49		P	P	—	ND
208	R-16r	600	1	17-Oct-05	2		—		ND		—		ND	16.4	UF	P		4.57		P	P	—	ND
209	R-16r	600	1	19-Dec-05	3		0.366		P		—		ND	16.6		P		4.39		P	P	—	ND
210	R-16r	600	1	8-Mar-06	4		0.345		P	<	0.033	J	P	16.6		P		4.33		P	P	0.023	Fail
211	R-16r	600	1	24-May-06	5	<	0.364		P	<	0.021	J	P	16.5		P		4.35		P	P	0.029	Fail
212	R-16r	600	1	17-Aug-06	6		0.341		P	<	0.013	J	P	14.1		P		4.39		P	P	0.058	Fail
213	R-16r	600	1	1-Nov-06	7		0.363		P	<	0.022	J	P	17.4		P		4.79		P	P	—	ND
214	R-17	1057	1	24-Feb-06	1		—		ND		0.024		P	11.7	UF	P		3.25		P	P	—	ND
215	R-17	1057	1	19-Oct-06	2		0.223		P	<	0.028	J	P	12		P		2.35		P	P	0.021	Fail
216	R-17	1124	2	17-Oct-06	1		0.21		P		0.043	J	P	10.7		P		1.97		P	P	0.01	P
217	R-18	1358	1	25-Aug-05	1		0.268	H	P	<	0.047	J	P	8.58		P		1.73		P	P	0.005	P
218	R-18	1358	1	1-Dec-05	2		0.218		P		0.022		P	8.4		P		1.74		P	P	0	P
219	R-18	1358	1	7-Mar-06	3		0.243		P	<	0.055		P	8.98		P	<	1.60		P	P	0	P
220	R-18	1358	1	16-May-06	4		0.242		P		0.019	J	P	8.43		P		1.67		P	P	0.002	P
221	R-18	1358	1	15-Aug-06	5		0.243		P	<	0.034	J	P	8.88		P		1.72		P	P	—	ND
222	R-18	1358	1	18-Dec-06	6		0.237		P		0.071		P	8.38		P		1.80		P	P		ND
223	R-19	909	2	15-Dec-03	1	<	4	U	DL		—		ND	14.8	UF	Fail		3.07		P	P	—	ND
224	R-19	909	2	10-Jun-04	2		0.299		P		—		ND	14.2	UF	Fail		3.29		P	P	—	ND
225	R-19	909	2	21-Jul-05	3		0.325		P	<	0.051		P	13.1		Fail		2.57		P	P	—	ND
226	R-19	909	2	18-Aug-06	4	<	0.5	U	DL	<	0.01		P	15.5		Fail		4.18		P	P	—	ND
227	R-19	909	2	11-Dec-06	5	<	1	U	DL	<	0.01		P	14.3		Fail		5.69		P	Fail	—	ND
228	R-19	1191	3	15-Dec-03	1	<	4	U	DL		—		ND	10.6	UF	P		1.91		P	P	—	ND
229	R-19	1191	3	14-Jun-04	2		0.225		P		—		ND	10.4	UF	P		2.07		P	P	—	ND
230	R-19	1191	3	21-Jul-05	3		0.229		P		0.091		P	9.89		P	<	0.06	U	Fail	Red	—	ND
231	R-19	1191	3	15-Aug-06	4		—		ND	<	0.01		P	10.6		P		2.43		P	P	—	ND
232	R-19	1191	3	16-Aug-06	4	<	0.5	U	DL	<	0.01		P	10.6		P		2.43		P	P	—	ND
233	R-19	1191	3	11-Dec-06	5	<	1	U	DL	<	0.01		P	10.3		P		3.38		P	P	—	ND
234	R-19	1413	4	16-Dec-03	1	<	4	U	DL		—		ND	9.54	UF	P		1.54		P	P	—	ND
235	R-19	1413	4	15-Jun-04	2		0.257		P		—		ND	10.6	UF	P		1.23		P	P	—	ND
236	R-19	1413	4	28-Jul-05	3		0.257		P	<	0.053		P	9.6		P		1.44		P	P	—	ND
237	R-19	1413	4	16-Aug-06	4		0.229		P	<	0.049	J	P	9.74		P		1.50		P	P	—	ND
238	R-19	1413	4	17-Aug-06	4	<	0.5	U	DL	<	0.01		P	9.9		P		1.89		P	P	—	ND
239	R-19	1413	4	12-Dec-06	5		0.233		P	<	0.01		P	9.7		P		1.40		P	P	—	ND
240	R-19	1586	5	20-Sep-01	1	<	0.958	U	DL		0.06		P	14.8		P	<	0.06	U	Fail	Red	—	ND
241	R-19	1586	5	23-Aug-02	2	<	1.45	U	DL		—		ND	15.9	UF	P	<	0.19	U	Fail	Red	—	ND
242	R-19	1586	5	16-Dec-03	3	<	4	U	DL		—		ND	13.2	UF	P		0.38	J	Fail	Red	—	ND
243	R-19	1586	5	17-Aug-06	4	<	1	U	DL	<	0.01		P	15.1		P		0.50		Fail	Red	—	ND
244	R-19	1586	5	11-Dec-06	5	<	2	U	DL	<	0.01		P	15.6		P		0.58		Fail	Red	—	ND
245	R-19	1730	6	21-Sep-01	1	<	0.958	U	DL		0.1		P	20.2		P	<	0.06	U	Fail	Red	—	ND
246	R-19	1730	6	27-Aug-02	2	<	1.45	U	DL		—		ND	15.4	UF	P	<	0.19	U	Fail	Red	—	ND
247	R-19	1730	6	16-Dec-03	3	<	4	U	DL		—		ND	11.6	UF	P		0.78		Fail	Red	—	ND
248	R-19	1730	6	17-Aug-06	4	<	0.5	U	DL	<	0.01		P	13.7		P		2.71		P	P	—	ND
249	R-19	1730	6	11-Dec-06	5	<	1	U	DL	<	0.01		P	11.6		P		3.68		P	P	—	ND
250	R-19	1835	7	26-Aug-02	1	<	1.45	U	DL		—		ND	131	UF	Fail		43.60		P	Fail	—	ND
251	R-19	1835	7	17-Dec-03	1	<	4	U	DL		—		ND	87.3	UF	Fail		38.80		P	Fail	—	ND
252	R-19	1835	7	16-Jun-04	2		0.063	J	Fail		—		ND	86.1	UF	Fail		34.10		P	Fail	—	ND
253	R-19	1835	7	28-Jul-05	3	<	0.05	U	Fail	<	0.138		P	68		Fail		23.40		P	Fail	—	ND
254	R-19	1835	7	18-Aug-06	4	<	0.5	U	DL	<	0.01		P	72.9		Fail		30.30		P	Fail	—	ND
255	R-19	1835	7	13-Dec-06	5	<	2	U	DL		0.334		Fail	71.8		Fail		31.60		P	Fail	—	ND
256	R-20	907	1	20-Sep-04	1	<	0.05	U	Fail		0.267		P	52		Fail		3.76		P	P	>0.6	Fail
257	R-20	907	1	4-Nov-04	2	<	0.05	U	Fail		0.185		P	48.2		Fail		3.69		P	P	>0.6	Fail
258	R-20	907	1	20-Jul-05	3	<	0.05	U	Fail		0.233		P	50.9		Fail	<	0.06	U	Fail	Red	—	ND
259	R-20	907	1	6-Jun-06	4		0.053	J	Fail	<	0.087		P	43.6		Fail		3.79		P	P	0.98	Fail
260	R-20	907	1	6-Jul-06	5		0.198	J	P		0.013	J	P	20.8		P		3.29		P	P	0.006	P

Table C-5. Inorganic Nonmetal Indicators

Row #	Well	Port depth (ft)	Scr #	Sample collection date (start)			ClO4 ug/L	Lab Qual Code	Test C6		PO4-P	Lab Qual Code	Test A3	Na mg/L		Test A4		SO4 mg/L	Lab Qual Code	Test C1	Test A5	Sulfide	Test C2
									ug/L				mg/L			mg/L				mg/L	mg/L		mg/L
									>LL				<UL			<UL				>LL	<UL		<UL
									0.17				0.3			28.55				0.8	6.22		0.01
									0.17				0.08			12.19				1.07	4.48		0.01
261	R-20	907	1	2-Oct-06	6		—		ND				ND	22.3		P		5.46		P	P	—	ND
262	R-20	907	1	17-Oct-06	7		—		ND		—		ND	—		ND		—		ND	ND	—	ND
263	R-20	1150	2	3-Sep-04	1	<	0.05	U	Fail		0.693		Fail	93.6		Fail		0.43		Fail	Red	0.092	Fail
264	R-20	1150	2	8-Nov-04	2	<	0.05	U	Fail		0.655		Fail	83.5		Fail	<	0.19	U	Fail	Red	0.036	Fail
265	R-20	1150	2	19-Jul-05	3	<	0.05	U	Fail		0.61		Fail	84		Fail	<	0.06	U	Fail	Red	—	ND
266	R-20	1150	2	7-Jun-06	4	<	0.05	U	Fail		0.667		Fail	71.3		Fail	<	0.51		Fail	Red	0.121	Fail
267	R-20	1150	2	8-Jul-06	5		0.257		P	<	0.01	U	P	11.3		P		1.81		P	P	<0.003	P
268	R-20	1330	3	7-Sep-04	1	<	0.05	U	Fail		1.55		Fail	20.6		P	<	0.19	U	Fail	Red	0.034	Fail
269	R-20	1330	3	9-Nov-04	2	<	0.05	U	Fail		1.5		Fail	20.4		P	<	0.19	U	Fail	Red	0.007	P
270	R-20	1330	3	18-Jul-05	3	<	0.05	U	Fail		1.67		Fail	19.8		P	<	0.06	U	Fail	Red	—	ND
271	R-20	1330	3	8-Jun-06	4	<	0.05	U	Fail		1.76		Fail	18.3		P	<	0.31		Fail	Red	0.103	Fail
272	R-20	1330	3	7-Jul-06	5		0.196	J	P		0.527		Fail	16.1		P		4.98		P	P	< 0.003	P
273	R-20	1330	3	21-Jul-06	6		0.28		P		0.323		Fail	13		P		2.12		P	P	< 0.003	P
274	R-20	1330	3	13-Oct-06	7	<	1	U	DL		0.99		Fail	12.5		P		2.52		P	P	0.004	P
275	R-21	889	1	23-Sep-04	1		0.27		P	<	0.011	U	P	11		P		2.04		P	P	0.003	P
276	R-21	889	1	14-Dec-04	2		0.26		P		0.126		P	10.2		P		2.29		P	P	0	P
277	R-21	889	1	6-Jun-05	3		0.292		P	<	0.046	J	P	10.8		P		1.96		P	P	—	ND
278	R-21	889	1	7-Jul-06	4		0.269		P	<	0.012	J	P	10.4		P		2.10		P	P	—	ND
279	R-21	889	1	6-Nov-06	5		0.273		P	<	0.01		P	10.5		P		2.50		P	P	—	ND
280	R-22	907	1	18-Nov-03	1	<	4	U	DL		—		ND	26.2	UF	P		0.43		Fail	Red	—	ND
281	R-22	907	1	21-Jun-04	2	<	0.05	U	Fail		—		ND	25.6	UF	P		0.39	J	Fail	Red	—	ND
282	R-22	907	1	27-Jun-05	3	<	0.05	U	Fail	<	0.046	J	P	25		P		0.35	J	Fail	Red	—	ND
283	R-22	907	1	22-Aug-06	4	<	1	U	DL	<	0.01	U	P	25.3		P		0.53		Fail	Red	—	ND
284	R-22	907	1	7-Dec-06	5	<	5	U	DL	<	0.01		P	26.4		P		0.70		Fail	Red	—	ND
285	R-22	963	2	19-Nov-03	1	<	4	U	DL		—		ND	11.3	UF	P		3.37		P	P	—	ND
286	R-22	963	2	22-Jun-04	2		0.317		P		—		ND	11.3	UF	P		3.16		P	P	—	ND
287	R-22	963	2	28-Jun-05	3		0.385		P	<	0.055		P	10.5		P		3.47		P	P	—	ND
288	R-22	963	2	28-Aug-06	4		0.357		P	<	0.01	U	P	10.9		P		3.45		P	P	—	ND
289	R-22	963	2	7-Dec-06	5		0.314		P	<	0.01		P	11.8		P		3.41		P	P	—	ND
290	R-22	1274	3	9-Jul-02	1	<	1.45	U	DL		—		ND	26.1	UF	P		6.14		P	P	—	ND
291	R-22	1274	3	20-Nov-03	2	<	4	U	DL		—		ND	22.4	UF	P		6.03		P	P	—	ND
292	R-22	1274	3	23-Jun-04	3		0.205		P		—		ND	19.7	UF	P		5.98		P	P	—	ND
293	R-22	1274	3	29-Jun-05	4		0.285		P	<	0.087		P	21.5		P		9.13		P	Fail	—	ND
294	R-22	1274	3	22-Aug-06	5		0.339		P	<	0.01	U	P	16.9		P		7.42		P	Fail	—	ND
295	R-22	1274	3	8-Dec-06	6		0.3		P	<	0.01		P	17.5		P		7.14		P	Fail	—	ND
296	R-22	1378	4	11-Jul-02	1	<	1.45	U	DL		—		ND	48.7	UF	Fail		1.32		P	P	—	ND
297	R-22	1378	4	20-Nov-03	2	<	4	U	DL		—		ND	55.7	UF	Fail		1.67		P	P	—	ND
298	R-22	1378	4	23-Jun-04	3	<	0.05	U	Fail		—		ND	49.3	UF	Fail		1.15		P	P	—	ND
299	R-22	1378	4	1-Jul-05	4	<	0.05	U	Fail	<	0.077		P	42.8		Fail		2.04		P	P	—	ND
300	R-22	1378	4	22-Aug-06	5	<	1	U	DL	<	0.01	U	P	36.2		Fail		2.22		P	P	—	ND
301	R-22	1378	4	8-Dec-06	6	<	2	U	DL	<	0.01		P	45.1		Fail		3.35		P	P	—	ND
302	R-22	1448	5	10-Jul-02	1	<	1.45	U	DL		—		ND	19.5	UF	P		0.69		Fail	Red	—	ND
303	R-22	1448	5	21-Nov-03	2	<	4	U	DL		—		ND	19.7	UF	P		0.47		Fail	Red	—	ND
304	R-22	1448	5	5-Jul-05	3	<	0.05	U	Fail	<	0.053		P	21.7		P		0.71		Fail	Red	—	ND
305	R-22	1448	5	21-Aug-06	4	<	1	U	DL	<	0.01	U	P	26.7		P		0.99		P	P	—	ND
306	R-22	1448	5	7-Dec-06	5	<	2	U	DL	<	0.01		P	21.8		P		1.46		P	P	—	ND
307	R-23	816	1	29-Jun-04	1		0.352		P	<	0.028	J	P	11.8		P		6.11		P	P	0.001	P
308	R-23	816	1	24-Sep-04	2		0.409		P	<	0.011	U	P	11.7		P		5.56		P	P	0.272	Fail
309	R-23	816	1	14-Jul-05	3		0.419		P	<	0.102		P	11.5		P		5.39		P	P	—	ND
310	R-23	816	1	15-Aug-06	4		0.467		P	<	0.023	J	P	10.8		P		5.33		P	P	—	ND
311	R-23	816	1	18-Dec-06	5		0.455		P		0.067		P	10.2		P		5.46		P	P		ND
312	R-23i	470	2	20-Dec-05	1		—		ND		—		ND	14.8	UF	Fail		12.80		P	Fail	—	ND
313	R-23i	470	2	3-Oct-06	2		0.198	J	P	<	0.054		P	14		Fail		7.52		P	Fail	0.057	Fail
314	R-23i	524	3	11-Dec-05	1		—		ND		—		ND	13.3	UF	Fail		12.40		P	Fail	—	ND
315	R-23i	524	3	11-Oct-06	2		0.186	J	P	<	0.01	U	P	12.6		Fail		8.27		P	Fail	0.053	Fail
316	R-24	825	1	20-Sep-05	1		—		ND		—		ND	25	UF	P		6.64		P	Fail	—	ND
317	R-24	825	1	15-Nov-05	2		0.347		P	<	0.03	J	P	33.1		Fail		10.90		P	Fail	—	ND
318	R-24	825	1	6-Mar-06	3		0.29		P	<	0.042	J	P	37.9		Fail		12.40		P	Fail	0.015	Fail
319	R-24	825	1	10-May-06	4		0.23		P	<	0.01	U	P	32.7		Fail		12.30		P	Fail	0.079	Fail
320	R-24	825	1	27-Jul-06	5		0.323		P	<	0.01	U	P	30.9		Fail		9.03		P	Fail	—	ND
321	R-25	755	1	7-Aug-02	1	<	1.45	U	DL		—		ND	9.8	UF	P		9.51		P	Plm	—	ND
322	R-25	755	1	11-Dec-03	1	<	4	U	DL		—		ND	10.1	UF	P		8.32		P	Plm	—	ND
323	R-25	755	1	1-Sep-04	2		0.645		P		—		ND	8.85	UF	P		10.70		P	Plm	—	ND
324	R-25	755	1	2-Aug-05	3		0.577		P	<	0.041	J	P	9.77		P		8.48		P	Plm	—	ND
325	R-25	892	2	5-Feb-02	1		—		ND		18.1		Fail	—		ND		—		ND	ND	—	ND

Table C-5. Inorganic Nonmetal Indicators

Row #	Well	Port depth (ft)	Scr #	Sample collection date (start)			ClO4 ug/L	Lab Qual Code	Test C6		PO4-P	Lab Qual Code	Test A3	Na mg/L		Test A4		SO4 mg/L	Lab Qual Code	Test C1	Test A5	Sulfide	Test C2
									ug/L				mg/L			mg/L				mg/L	mg/L		mg/L
									>LL				<UL			<UL				>LL	<UL		<UL
									0.17				0.3			28.55				0.8	6.22		0.01
									0.17				0.08			12.19				1.07	4.48		0.01
326	R-25	892	2	8-Aug-02	1	<	1.45	U	DL		—		ND	112	UF	Fail		9.63		P	Fail	—	ND
327	R-25	892	2	10-Dec-03	2	<	4	U	DL		—		ND	102	UF	Fail		8.94		P	Fail	—	ND
328	R-25	892	2	3-Aug-05	3		0.138	J	Fail		7.38		Fail	36.9		Fail		7.79		P	Fail	—	ND
329	R-25	1192	4	8-Aug-02	1	<	1.45	U	DL		—		ND	9.26	UF	P		27.20		P	Fail	—	ND
330	R-25	1192	4	10-Dec-03	2	<	4	U	DL		—		ND	9.74	UF	P		11.80		P	Fail	—	ND
331	R-25	1192	4	4-Aug-05	3		0.511		P		0.092		Fail	9.51		P		207.00		Err	Err	—	ND
332	R-25	1303	5	9-Aug-02	1	<	1.45	U	DL		—		ND	20.8	UF	P		9.16		P	Fail	—	ND
333	R-25	1303	5	9-Dec-03	1	<	4	U	DL		—		ND	1640	UF	Err		9.96		P	Fail	—	ND
334	R-25	1303	5	31-Aug-04	2	<	0.05	U	Fail		—		ND	19.7	UF	P		—		ND	ND	—	ND
335	R-25	1303	5	9-Aug-05	3		—		ND		—		ND	1910		Err		—		ND	ND	—	ND
336	R-25	1406	6	8-Feb-02	1	<	1.07	U	DL		4.2		Fail	12.6		P		3.91		P	P	—	ND
337	R-25	1406	6	12-Aug-02	2	<	1.45	U	DL		—		ND	12.6	UF	P		3.26		P	P	—	ND
338	R-25	1406	6	9-Dec-03	3	<	4	U	DL		—		ND	534	UF	Err		2.89		P	P	—	ND
339	R-25	1606	7	11-Feb-02	1	<	4	U	DL		0.49		Fail	10.9		P		2.19		P	P	—	ND
340	R-25	1606	7	12-Aug-02	2	<	1.45	U	DL		—		ND	10.6	UF	P		1.87		P	P	—	ND
341	R-25	1606	7	8-Dec-03	3	<	4	U	DL		—		ND	10.2	UF	P		1.76		P	P	—	ND
342	R-25	1796	8	14-Aug-02	1	<	1.45	U	DL		—		ND	12.5	UF	P		2.23		P	P	—	ND
343	R-25	1796	8	4-Dec-03	2	<	4	U	DL		—		ND	11.1	UF	P		1.92		P	P	—	ND
344	R-25	1796	8	10-Aug-05	3		0.238		P		0.339		Fail	10.5		P		1.82		P	P	—	ND
345	R-26	659	1	13-Apr-05	1		0.21		P	<	0.04	J	P	8.55		P		1.12		P	P	0.001	P
346	R-26	659	1	27-Jul-05	2		0.22		P		0.111		Fail	8.33		P		0.80		Fail	Red	—	ND
347	R-26	659	1	2-Nov-05	3		0.244		P		0.11		Fail	8.55		P		1.07		P	P	0	P
348	R-26	659	1	22-Feb-06	4		0.239		P	<	0.06		P	8.82		P		1.12		P	P	—	ND
349	R-27	852	1	11-Oct-05	1		—		ND		—		ND	13.8	UF	P		1.21		P	P	—	ND
350	R-27	852	1	21-Oct-05	1		7.6		P		—		ND	16.8	UF	P		21.40		Err	Err	—	ND
351	R-27	852	1	14-Nov-05	2		—		ND		—		ND	10.7	UF	P		1.48		P	P	—	ND
352	R-27	852	1	1-Jul-06	3		0.219		P	<	0.01	U	P	10.1		P		1.52		P	P	0.001	P
353	R-28	934	1	20-May-05	1		0.995		P	<	0.011	J	P	13.7		P		38.10		P	Plm	0.005	P
354	R-28	934	1	1-Sep-05	2		1.13	H	P		0.06		P	14.1		P		38.30		P	Plm	0	P
355	R-28	934	1	10-Nov-05	3		1.01		P	<	0.014	J	P	14.2		P		39.40		P	Plm	0.001	P
356	R-28	934	1	26-Jan-06	4		0.962		P		0.112		P	15.2		P		42.50		P	Plm	0.0022	P
357	R-28	934	1	19-Apr-06	5		—		ND		—		ND	—		ND		—		ND	ND	—	ND
358	R-28	934	1	5-Jul-06	6		1.04		P	<	0.01	U	P	15.5		P		41.10		P	Plm	—	ND
359	R-28	934	1	26-Oct-06	7		0.956		P	<	0.028	J	P	14.5		P		39.80		P	Plm	—	ND
360	R-31	532	2	18-Mar-04	1	<	0.05	U	Fail		0.338	H	Fail	26.9		P		0.09		Fail	Red	0.004	P
361	R-31	532	2	17-Aug-05	2	<	0.05	U	Fail	<	0.067		P	26.1		P		0.35		Fail	Red	0.001	P
362	R-31	532	2	28-Nov-06	3	<	0.05	U	Fail				ND	26.7		P	<	0.10		Fail	Red		ND
363	R-31	670	3	19-Aug-05	1		0.06	HJ	Fail		0.141		P	44.2		Fail		1.26		P	P	—	ND
364	R-31	670	3	30-Nov-06	2		0.064	J	Fail				ND	21.1		P		1.53		P	P		ND
365	R-31	831	4	23-Aug-05	1		0.23	HJ	P		0.071		P	10.4		P		1.82		P	P	—	ND
366	R-31	831	4	6-Dec-06	2		0.225		P				ND	10.6		P		1.52		P	P		ND
367	R-31	1011	5	24-Aug-05	1	<	0.19	HJ	P		0.039	J	P	10.8		P		1.23		P	P	—	ND
368	R-31	1011	5	6-Dec-06	2		0.219		P				ND	11.5		P		1.28		P	P		ND
369	R-32	871	1	21-Sep-04	1		0.293		P	<	0.051		P	11.1		P		5.72		P	P	0.005	P
370	R-32	871	1	15-Nov-04	2		0.315		P	<	0.057		P	10.9		P		5.69		P	P	0	P
371	R-32	871	1	22-Jun-05	3		0.299		P	<	0.088		P	11.4		P		5.66		P	P	—	ND
372	R-32	871	1	29-Aug-06	4		0.314		P		0.019	J	P	11.8		P		4.81		P	P	—	ND
373	R-32	871	1	12-Dec-06	5		0.279		P				ND	11.1		P		4.97		P	P		ND
374	R-32	976	3	22-Sep-04	1	<	0.05	U	Fail		2.29		Fail	11		P		1.54		P	P	0.072	Fail
375	R-32	976	3	16-Nov-04	2	<	0.05	U	Fail		2.4		Fail	10		P		1.89		P	P	0.132	Fail
376	R-32	976	3	24-Jun-05	3	<	0.05	U	Fail		2.02		Fail	10.5		P		1.52		P	P	—	ND
377	R-32	976	3	30-Aug-06	4	<	0.05	U	Fail		1.72		Fail	10.5		P		1.52		P	P	—	ND
378	R-32	976	3	13-Dec-06	5	<	0.05	U	Fail				ND	10.1		P		1.80		P	P		ND
379	R-33	996	1	27-Jun-05	1	<	4	U	DL	<	0.056		P	11.1		P		2.74		P	P	—	ND
380	R-33	996	1	14-Sep-05	2		0.384		P	<	0.049	J	P	11.2		P		2.79		P	P	—	ND
381	R-33	996	1	16-Feb-06	3		0.424		P	<	0.057		P	11.4		P		2.73		P	P	0.05	Fail
382	R-33	996	1	31-Oct-06	4	<	1	U	DL		0.07		P	12		P		5.73		P	P	—	ND
383	R-33	1112	2	24-Jun-05	1		0.361		P	<	0.01	U	P	12		P		2.06		P	P	—	ND
384	R-33	1112	2	15-Sep-05	2		0.373		P	<	0.058		P	12		P		2.43		P	P	—	ND
385	R-33	1112	2	14-Feb-06	3		0.391		P	<	0.051		P	10.5		P		2.58		P	P	0.032	Fail
386	R-33	1112	2	5-Jul-06	4	<	0.408	X	P		0.074		P	11.8		P		4.25		P	P	—	ND
387	R-33	1112	2	1-Nov-06	5	<	1	U	DL		0.0675		P	11.8		P		5.81		P	P	—	ND
388	R-34	895	1	7-Jun-05	1	<	0.295		P	<	0.022	J	P	10.9		P		2.49		P	P	0.031	Fail
389	R-34	895	1	7-Sep-05	2		0.287	H	P		0.077		P	11		P		2.57		P	P	0.014	Fail
390	R-34	895	1	29-Nov-05	3		0.302		P	<	0.027	J	P	10.9		P		2.72		P	P	0.013	Fail

Table C-5. Inorganic Nonmetal Indicators

Row #	Well	Port depth (ft)	Scr #	Sample collection date (start)			ClO4 ug/L	Lab Qual Code	Test C6		PO4-P	Lab Qual Code	Test A3	Na mg/L		Test A4		SO4 mg/L	Lab Qual Code	Test C1	Test A5	Sulfide	Test C2
									ug/L				mg/L			mg/L				mg/L	mg/L		mg/L
									>LL				<UL			<UL				>LL	<UL		<UL
									0.17				0.3			28.55				0.8	6.22		0.01
									0.17				0.08			12.19				1.07	4.48		0.01
391	R-34	895	1	31-Jan-06	4		0.288		P	<	0.144		P	11.2		P		2.74		P	P	0.014	Fail
392	R-34	895	1	17-Jul-06	5		0.334		P	<	0.01	U	P	11.2		P		3.03		P	P	—	ND
393	R-34	895	1	30-Oct-06	6		0.276		P		0.015	J	P	11.2		P		2.84		P	P	—	ND
Pass/Fail outcomes																							
	Pass (or Yes)								198				256			310				339	233		88
	Fail (or No)								92				46			70				42	51		57
	Total outcomes								290				302			380				381	284		145
	% Pass (or Yes)								68				85			82				89	82		61
Indeterminate outcomes																							
ND=no data									21				91			10				10	10		248
Err=suspected error									0				0			3				2	2		0
Plm=unreliable due to contaminant plume									0				0			0				0	55		0
DL=inadequate detection limit									82				0			0				0	0		0
UF=test unreliable for UF sample									0				0			0				0	0		0
Red=test unreliable, reducing conditions									0				0			0				0	42		0
—=test not applicable									0				0			0				0	0		0

Data source: WQDB except where indicated otherwise

LL=lower limit, UL=upper limit, P=pass; UF=unfiltered

Notes: Pass and fail outcomes for each sample are determined by comparison against test threshold criteria. From top to bottom in the column headers above are listed the indicator name and associated test identifier, units of measurement, type of test threshold, and threshold values for the regional aquifer and perched intermediate aquifer, respectively. The user should assume that the sulfide (S) measurements reported in this table are uncertain and potentially biased on the low (oxidizing) side relative to in-situ conditions, to the extent that the sample may have been exposed to the atmosphere prior to analysis.

Table C-6. Trace Metal Indicators

Row #	Well	Port depth (ft)	Scr #	Sample collection date (start)			Cr (F) ug/L	Lab Qual Code		Test C10		Cr (NF) ug/L	Lab Qual Code	Test F3	Ratio Cr (NF/F)	Test F4		Fe (F) ug/L	Lab Qual Code		Test C4		Fe (NF) ug/L	Lab Qual Code	Test F1	Ratio Fe(NF/F)	Test F2		Mn (F) ug/L	Lab Qual Code		Test C5
										ug/L				ug/L		Ratio					ug/L				ug/L		Ratio					ug/L
										>LL				<UL		<UL					<UL				<UL		<UL					<UL
										1				10		5					102				500		10					16
										1				5		5					102				500		10					16
1	CdV-16-1(i)	624	1	1-Jun-05	1	<	1	U		Fail	<	2.2	J	P	2.2	NA		29.4	J		P		488		Yes	16.6	NA		5.5			P
2	CdV-16-1(i)	624	1	29-Aug-05	2	<	1	U		Fail		3.7	J	P	3.7	NA		41.5	J		P		2750		No	66.3	Fail		10.8			P
3	CdV-16-1(i)	624	1	7-Dec-05	3	<	1	U		Fail		1.5	J	P	1.5	NA	<	18	U		P		333		Yes	18.5	NA		8.4			P
4	CdV-16-1(i)	624	1	9-Mar-06	4	<	1	U		Fail	<	1	U	P	1.0	NA	<	42.3	J		P		110		Yes	2.6	NA		3	J		P
5	CdV-16-2(i)r	850	1	14-Sep-05	1	<	1	U	UF	Fail	<	1	U	P	—	NA	<	10	U	UF	P	<	10	U	Yes	—	NA		15		UF	P
6	CdV-16-2(i)r	850	1	15-Dec-05	2	<	1	U		Fail		6.5		Fail	6.5	Fail		24.2	J		P		836		No	34.5	Fail		8.7			P
7	CdV-16-2(i)r	850	1	15-Mar-06	3	<	1	U		Fail		20.6		Fail	20.6	Fail		20.2	J		P		2010		No	99.5	Fail		13			P
8	CdV-16-2(i)r	850	1	17-May-06	4	<	1	U		Fail		15.3		Fail	15.3	Fail		23.5	J		P		506		No	21.5	Fail		5.7	J		P
9	CdV-R-15-3	1254	4	19-Oct-04	1		2	J		P		1.8	J	P	0.9	NA	<	12.6	U		P		17.2	J	Yes	1.37	NA		1.8	J		P
10	CdV-R-15-3	1254	4	4-Apr-05	2	<	1.6	J		P	<	1.9	J	P	1.2	NA	<	18	U		P	<	18	U	Yes	1	NA		1.8	J		P
11	CdV-R-15-3	1254	4	12-Jul-05	3	<	2.4	J		P	<	2.4	J	P	1.0	NA	<	18	U	UF	P	<	18	U	Yes	—	NA		2.9	J		P
12	CdV-R-15-3	1254	4	18-Oct-05	4		1.7	J		P		6.4		P	3.8	NA	<	18	U		P		25.8	J	Yes	1.43	NA		1	J		P
13	CdV-R-15-3	1254	4	19-Jan-06	5		1.2	J		P		2.1	J	P	1.8	NA		23.3	J		P	<	18	U	Yes	0.77	NA	<	2	U		P
14	CdV-R-15-3	1254	4	27-Mar-06	6		1.6	J		P		4	J	P	2.5	NA	<	18	U		P		23.1	J	Yes	1.28	NA	<	2	U		P
15	CdV-R-15-3	1350	5	20-Oct-04	1	<	0.5	U		Fail		2.6	J	P	5.2	NA		146			Fail		174		Yes	1.19	NA		187			Fail
16	CdV-R-15-3	1350	5	5-Apr-05	2	<	1	U		Fail		1.5	J	P	1.5	NA		145			Fail		133		Yes	0.92	NA		141			Fail
17	CdV-R-15-3	1350	5	12-Jul-05	3	<	1	U		Fail		3.9	J	P	3.9	NA		123			Fail		247		Yes	2.01	NA		214	E		Fail
18	CdV-R-15-3	1350	5	18-Oct-05	4	<	1	U		Fail		6.6		P	6.6	NA		131			Fail		166		Yes	1.27	NA		208			Fail
19	CdV-R-15-3	1350	5	20-Jan-06	5	<	1	U		Fail		8.6		P	8.6	NA		148			Fail		170		Yes	1.15	NA		295			Fail
20	CdV-R-15-3	1350	5	28-Mar-06	6	<	1	U		Fail		5.5		P	5.5	NA		148			Fail		166		Yes	1.12	NA		295			Fail
21	CdV-R-15-3	1640	6	21-Oct-04	1	<	0.78	J		Fail	<	0.5	U	P	0.6	NA		17.1	J		Err		341		Yes	—	NA		26.2			Fail
22	CdV-R-15-3	1640	6	6-Apr-05	2	<	1	U		Fail		2.2	J	P	2.2	NA		178			Fail		271		Yes	1.52	NA		151			Fail
23	CdV-R-15-3	1640	6	13-Jul-05	3	<	1	U		Fail		3.2	J	P	3.2	NA		157			Fail		234		Yes	1.49	NA		137	E		Fail
24	CdV-R-15-3	1640	6	19-Oct-05	4	<	1	U		Fail		18.3		Fail	18.3	Fail		149			Fail		243		Yes	1.63	NA		126	E		Fail
25	CdV-R-15-3	1640	6	20-Jan-06	5	<	1	U		Fail	<	1	U	P	1.0	NA		125			Fail		161		Yes	1.29	NA		137			Fail
26	CdV-R-15-3	1640	6	29-Mar-06	6	<	1	U		Fail		1.4	J	P	1.4	NA		102			P		162		Yes	1.59	NA		129			Fail
27	CdV-R-37-2	1200	2	26-Oct-04	1	<	0.5	U		Fail	<	0.5	U	P	1.0	NA		7910	EN		Fail		13000	EN	No	1.64	P		2930			Fail
28	CdV-R-37-2	1200	2	29-Mar-05	2		1.4	J		P		1	U	P	0.7	NA		13400			Fail		16800		No	1.25	P		2290			Fail
29	CdV-R-37-2	1200	2	6-Jul-05	3		1.3	J		P		6.1		P	4.7	NA		15800			Fail		17100		No	1.08	P		2200			Fail
30	CdV-R-37-2	1200	2	12-Oct-05	4	<	1	U		Fail		10		P	10.0	NA		14800			Fail		16500		No	1.11	P		2250			Fail
31	CdV-R-37-2	1200	2	9-Jan-06	5	<	1	U		Fail	<	1.4	J	P	1.4	NA		16100			Fail		16200		No	1.01	P		2020			Fail
32	CdV-R-37-2	1200	2	21-Mar-06	6	<	1	U		Fail		13.1		Fail	13.1	Fail		14800			Fail		15000		No	1.01	P		1860			Fail
33	CdV-R-37-2	1359	3	27-Oct-04	1	<	2.6	J		P		7.2		P	2.8	NA	<	12.6	U		P		49	J	Yes	3.89	NA		4.6	J		P
34	CdV-R-37-2	1359	3	30-Mar-05	2		2.3	J		P		1.8	J	P	0.8	NA	<	18	U		P	<	18	U	Yes	1	NA		2.8	J		P
35	CdV-R-37-2	1359	3	7-Jul-05	3		1.8	J		P		4.7	J	P	2.6	NA	<	18	U		P		84.3	J	Yes	4.68	NA		2.5	J		P
36	CdV-R-37-2	1359	3	12-Oct-05	4		2	J		P		3.1	J	P	1.6	NA	<	18	U		P	<	18	U	Yes	1	NA		3.6	J		P
37	CdV-R-37-2	1359	3	10-Jan-06	5	<	1.7	J		P	<	1.5	J	P	0.9	NA	<	18	U		P	<	18	U	Yes	1	NA		2.3	J		P
38	CdV-R-37-2	1359	3	22-Mar-06	6	<	2.5	J		P		28.3		Fail	11.3	Fail	<	18	U		P		159		Yes	8.83	NA	<	2	U		P
39	CdV-R-37-2	1551	4	27-Oct-04	1	<	1.4	J		P	<	3.9	J	P	2.8	NA		2070			Fail		2280		No	1.1	P		71			Fail
40	CdV-R-37-2	1551	4	31-Mar-05	2	<	1	U		Fail	<	1.1	J	P	1.1	NA		1740			Fail		2010		No	1.16	P		60.8			Fail
41	CdV-R-37-2	1551	4	8-Jul-05	3	<	1	U		Fail		3.3	J	P	3.3	NA		1450			Fail		1920		No	1.32	P		55.9			Fail
42	CdV-R-37-2	1551	4	13-Oct-05	4	<	1	U		Fail		4.1	J	P	4.1	NA		1260			Fail		1460		No	1.16	P		42.7			Fail
43	CdV-R-37-2	1551	4	11-Jan-06	5	<	1	U		Fail	<	1	U	P	1.0	NA		1160			Fail		1250		No	1.08	P		43			Fail
44	CdV-R-37-2	1551	4	22-Mar-06	6	<	1	U		Fail		15.6		Fail	15.6	Fail		972			Fail		1340		No	1.38	P		41.3			Fail

Table C-6. Trace Metal Indicators

Row #	Well	Port depth (ft)	Scr #	Sample collection date (start)			Cr (F) ug/L	Lab Qual Code		Test C10		Cr (NF) ug/L	Lab Qual Code	Test F3	Ratio Cr (NF/F)	Test F4		Fe (F) ug/L	Lab Qual Code		Test C4		Fe (NF) ug/L	Lab Qual Code	Test F1	Ratio Fe(NF/F)	Test F2		Mn (F) ug/L	Lab Qual Code		Test C5
										ug/L				ug/L		Ratio					ug/L				ug/L		Ratio					ug/L
										>LL				<UL		<UL					<UL				<UL		<UL					<UL
										1				10		5					102				500		10					16
										1				5		5					102				500		10					16
45	MCOBT-4.4	485	1	28-Jan-03	1		41.7			P		41.5		Plm	1.0	NA	<	100	U		DL	<	100	U	Yes	1	NA	<	5	U		P
46	MCOBT-4.4	485	1	21-May-03	2		37.4			P		41.4		Plm	1.1	NA	<	100	U		DL	<	100	U	Yes	1	NA	<	5	U		P
47	MCOBT-4.4	485	1	29-Mar-05	2		15		UF	UF		15		Plm	—	ND	<	10	U	UF	P	<	10	U	Yes	—	NA		1.6		UF	P
48	MCOBT-4.4	485	1	8-Jun-05	3		—			ND		—		ND		ND		—			ND		—		ND		ND		—			ND
49	R-1	1031	1	19-May-05	1	<	4.5	J		P	<	4.6	J	P	1.0	NA		78.8	J		P		74.5	J	Yes	0.95	NA	<	1	U		P
50	R-1	1031	1	12-Sep-05	2		5.6			P		4.8	J	P	0.9	NA	<	23.1	J		P		54.4	J	Yes	2.35	NA	<	2	U		P
51	R-1	1031	1	28-Nov-05	3		4.9	J		P		5.2		P	1.1	NA	<	18	U		P	<	58.6	J	Yes	3.26	NA		4.2	J		P
52	R-1	1031	1	25-Jan-06	4		4.5	J		P		4.6	J	P	1.0	NA	<	18	U		P		18.2	J	Yes	1.01	NA	<	2	U		P
53	R-1	1031	1	19-Apr-06	5		5.2			P		5.3		P	1.0	NA		—			ND		—		ND	—	ND		—			ND
54	R-1	1031	1	6-Jul-06	6		7.2	J		P		7.4		P	1.0	NA	<	19	J		P		525		Err	—	Err	<	2	U		P
55	R-1	1031	1	26-Oct-06	7		4.2			P		4.5		P	1.1	NA	<	18	U		P		45.1	J	Yes	2.51	NA	<	2	U		P
56	R-2	918	1	26-Apr-05	1		1.6	J		P		6.2		P	3.9	NA		59.8	J		P		59.8		Yes	1	NA		35.2			Fail
57	R-2	918	1	9-Aug-05	2		3.7	J		P		10.9	J	Fail	2.9	P	<	18	U*		P	<	18		Yes	1	NA		22.9			Fail
58	R-2	918	1	9-Nov-05	3		4.7	J		P		12.4		Fail	2.6	P	<	18	U		P		374		Yes	20.8	NA		19.9			Fail
59	R-2	918	1	27-Feb-06	4		4.3	J		P		6.5		P	1.5	NA		20.5	J		P		151		Yes	7.37	NA		14.9			P
60	R-2	918	1	24-Jul-06	5		6.9			P		9.3		P	1.3	NA		46.6	J		P		314		Yes	6.74	NA		9.1	J		P
61	R-3i	215	1	10-Aug-06	1	<	1	U		Fail	<	1	U	P	1.0	NA	<	18	U		P	<	18	U	Yes	1	NA	<	2	U		P
62	R-4	793	1	27-Apr-05	1		4.9	J		P		4.8	J	P	1.0	NA	<	18	U		P	<	18	U	Yes	1	NA	<	1	U		P
63	R-4	793	1	8-Aug-05	2		4.5	J		P		5.2	J	P	1.2	NA	<	18	U		P		20.3	J	Yes	1.13	NA	<	1	U		P
64	R-4	793	1	14-Nov-05	3		4	J		P		4.2	J	P	1.1	NA	<	18	U		P		26.1	J	Yes	1.45	NA	<	1	U		P
65	R-4	793	1	28-Feb-06	4		3.2	J		P		2.2	J	P	0.7	NA	<	18	U		P	<	18	U	Yes	1	NA	<	2	U		P
66	R-4	793	1	25-Jul-06	5	<	6.2			P	<	6		P	1.0	NA	<	18	U		P	<	18	U	Yes	1	NA	<	2	U		P
67	R-5	384	2	28-Apr-04	1		4.4	B		P		5.5		Plm	1.3	NA	<	12.6	U		P	<	12.6	U	Yes	1	NA		6			P
68	R-5	384	2	27-Sep-04	2	<	4.3	J		P	<	5.9	J	Plm	1.4	NA	<	12.6	U		P	<	12.6	U	Yes	1	NA		6.7			P
69	R-5	384	2	2-May-05	3		4.5	J	UF	UF		4.5	J	P	—	NA	<	18	U	UF	P	<	18	U	Yes	—	NA		1.4	J	UF	P
70	R-5	384	2	25-Jul-06	4		3.7			P		5		P	1.4	NA	<	18	U		P	<	18	U	Yes	1	NA	<	2	U		P
71	R-5	719	3	30-Apr-04	1		7.9			P		8.9		P	1.1	NA	<	12.6	U		P		31.8	B	Yes	2.52	NA		5.5			P
72	R-5	719	3	28-Sep-04	2		9.1			P		13.3		Plm	1.5	NA	<	12.6	U		P		41.5	J	Yes	3.29	NA		4.9	J		P
73	R-5	719	3	3-May-05	3		7.8		UF	UF		7.8		P	—	NA		23.6	J	UF	P		23.6	J	Yes	—	NA		1.3	J	UF	P
74	R-5	719	3	26-Jul-06	4		9.5			P		12.4		Plm	1.3	NA	<	18	U		P	<	18	U	Yes	1	NA	<	2	U		P
75	R-5	861	4	3-May-04	1	<	1.3	B		P	<	2.2	B	P	1.7	NA		383			Fail		330		Yes	0.86	NA		442			Fail
76	R-5	861	4	30-Sep-04	2	<	0.5	U		Fail		3.1	J	P	6.2	NA		158			Fail		328		Yes	2.08	NA		382			Fail
77	R-5	861	4	4-May-05	3	<	1	U	UF	Fail	<	1	U	P	—	NA		202		UF	Fail		202		Yes	—	NA		110		UF	Fail
78	R-5	861	4	27-Jul-06	4		—			ND		—		ND		ND		—			ND		—		ND	—	ND		—			ND
79	R-6	1205	1	23-Aug-05	1		4	J		P		4.2	J	P	1.1	NA	<	18	U		P		39.5		Yes	2.19	NA		59.8			Fail
80	R-6	1205	1	17-Nov-05	2		3.4	J		P		3.4	J	P	1.0	NA	<	18	U		P		34.9	J	Yes	1.94	NA		36.9			Fail
81	R-6	1205	1	1-Mar-06	3		4.5	J		P		4.6	J	P	1.0	NA	<	18	U		P	<	40.1	J	Yes	2.23	NA		40.4			Fail
82	R-6	1205	1	11-May-06	4		3.5	J		P		2.8	J	P	0.8	NA		49.4	J		P		187		Yes	3.79	NA		28.2			Fail
83	R-6	1205	1	26-Jul-06	5		6.4			P		7		P	1.1	NA	<	89.7	J		P		146		Yes	1.63	NA		16			P
84	R-6i	602	1	24-Aug-05	1		2.2	J		P		8.9	J	Fail	4.0	P		33.8	J		P		304		Yes	8.99	NA		5.6			P
85	R-6i	602	1	17-Nov-05	2	<	1	U		Fail		2.5	J	P	2.5	NA		244			Fail		432		Yes	1.77	NA		18.9			Fail
86	R-6i	602	1	1-Mar-06	3		1.8	J		P		7		Fail	3.9	P	<	51.7	J		P		1190		No	23	Fail		6.7	J		P
87	R-6i	602	1	11-May-06	4		2.4	J		P		4	J	P	1.7	NA		52.8	J		P		93.9	J	Yes	1.78	NA		6.4	J		P
88	R-6i	602	1	26-Jul-06	5		3.6			P		4.3		P	1.2	NA		144			Fail		164		Yes	1.14	NA		4.5	J		P

Table C-6. Trace Metal Indicators

Row #	Well	Port depth (ft)	Scr #	Sample collection date (start)			Cr (F) ug/L	Lab Qual Code		Test C10		Cr (NF) ug/L	Lab Qual Code	Test F3	Ratio Cr (NF/F)	Test F4		Fe (F) ug/L	Lab Qual Code		Test C4		Fe (NF) ug/L	Lab Qual Code	Test F1	Ratio Fe(NF/F)	Test F2		Mn (F) ug/L	Lab Qual Code		Test C5
										ug/L				ug/L		Ratio					ug/L				ug/L		Ratio					ug/L
										>LL				<UL		<UL					<UL				<UL		<UL					<UL
										1				10		5					102				500		10					16
										1				5		5					102				500		10					16
89	R-7	915	3	18-Dec-03	1		2.55	B	UF	UF		2.55	B	P	—	NA		2360		UF	Fail		2360		No	—	ND		637		UF	Fail
90	R-7	915	3	26-May-04	2		4.06	B	UF	UF		4.06	B	P	—	NA		2200		UF	Fail		2200		No	—	ND		587		UF	Fail
91	R-7	915	3	26-Apr-05	3		2.3	J	UF	UF		2.3	J	P	—	NA		2120		UF	Fail		2120		No	—	ND		504	E	UF	Fail
92	R-7	915	3	31-Jul-06	4		1.32			P		1.92		P	1.5	NA		1175			Fail		1260		No	1.07	P		451			Fail
93	R-8	711	1	24-Aug-04	1	<	2.5	B		P		5		P	2.0	NA	<	12.6	U		P		14.6	B	Yes	1.16	NA	<	1.61	U		P
94	R-8	711	1	8-Dec-04	2		2.9	J		P		10.9		Fail	3.8	P	<	12.6	U		P	<	12.6	U	Yes	1	NA		3.1	J		P
95	R-8	711	1	27-Apr-05	3		7.4		UF	UF		7.4		P	—	NA		20.5	J	UF	P		20.5		Yes	—	NA		1.8	J	UF	P
96	R-8	711	1	1-Aug-06	4		3.8			P		3.2		P	0.8	NA	<	18	U		P	<	18	U	Yes	1	NA	<	2	U		P
97	R-8	825	2	25-Aug-04	1		3.5	B		P		10.9		Fail	3.1	P		17.8	B		P		139		Yes	7.81	NA	<	1.61	U		P
98	R-8	825	2	9-Dec-04	2		3.7	J		P		7.3		P	2.0	NA	<	12.6	U		P	<	12.6	U	Yes	1	NA	<	1.61	U		P
99	R-8	825	2	28-Apr-05	3		3.1	J	UF	UF		3.1	J	P	—	NA		26.5	J	UF	P		26.5		Yes	—	NA		2.7	J	UF	P
100	R-8	825	2	2-Aug-06	4		5			P		6.16		P	1.2	NA	<	10	U		P	<	10	U	Yes	1	NA		2.5			P
101	R-9	684	1	12-Dec-03	1	<	2.95	B	UF	UF	<	2.95	B	P	—	NA	<	61.5	B	UF	P	<	61.5		Yes	—	NA		83.6		UF	Fail
102	R-9	684	1	27-May-04	2		2.63	B	UF	UF		2.63	B	P	—	NA		255		UF	Fail		255		Yes	—	NA		113		UF	Fail
103	R-9	684	1	19-Mar-05	3		3.1		UF	UF		3.1		P	—	NA	<	10	U	UF	P	<	10		Yes	—	NA		89		UF	Fail
104	R-9	684	1	6-Apr-05	3		3		UF	UF		3		P	—	NA	<	10	U	UF	P	<	10		Yes	—	NA		67		UF	Fail
105	R-9	684	1	28-Apr-05	3		2.4	J	UF	UF		2.4	J	P	—	NA	<	18	U	UF	P	<	18		Yes	—	NA		54.4		UF	Fail
106	R-9	684	1	31-Jul-06	4		2.3	J		P		2.4	J	P	1.0	NA	<	18	U		P		35	J	Yes	1.94	NA		30.6			Fail
107	R-9i	199	1	6-Feb-04	1		9.63		UF	UF		9.63		Fail	—	ND		672		UF	Fail		672		No	—	ND		767		UF	Fail
108	R-9i	199	1	2-Jun-04	2		3.17	B	UF	UF		3.17	B	P	—	NA		453		UF	Fail		453		Yes	—	NA		663		UF	Fail
109	R-9i	199	1	29-Apr-05	3	<	3.8	J	UF	UF	<	3.8	J	P	—	NA		54.8	J	UF	P		54.8		Yes	—	NA		284	E	UF	Fail
110	R-9i	199	1	10-Aug-06	4		1.27			P		1.4		P	1.1	NA	<	10	U		P	<	10	U	Yes	1	NA		399			Fail
111	R-9i	279	2	6-Sep-01	1	<	0.57	U		Fail		3.12	B	P	5.5	NA	<	10	U		P		706		No	70.6	Fail		487			Fail
112	R-9i	279	2	29-Jul-02	2		0.94	B	UF	Fail		0.94	B	P	—	NA	<	10	U		P		429		Yes	42.9	NA		382		UF	Fail
113	R-9i	279	2	6-Feb-04	3		3.7	B	UF	UF		3.7	B	P	—	NA	<	10	U		P	<	180		Yes	18	NA		222		UF	Fail
114	R-9i	279	2	10-Aug-06	4	<	1	U		Fail		1.2		P	1.2	NA	<	10	U		P		51.5		Yes	5.15	NA		61			Fail
115	R-10	874	1	29-Jun-06	1		3.3		UF	UF		3.3		P	—	NA		152		UF	Fail		152		Yes	—	NA		2.6	J	UF	P
116	R-10	874	1	12-Oct-06	2		3.6			P		4.9		P	1.4	NA	<	18	U		P		134		Yes	7.44	NA	<	2	U		P
117	R-10	1042	2	11-Oct-05	1		3		UF	UF		3		P	—	NA		30		UF	P		30		Yes	—	NA		2.4		UF	P
118	R-10	1042	2	29-Jun-06	2	<	3.8			P	<	3.8		P	1.0	NA		27.8	J		P		134		Yes	4.82	NA	<	2	U		P
119	R-10	1042	2	12-Oct-06	3		4			P		3.5		P	0.9	NA		28.1	J		P		46.9	J	Yes	1.67	NA	<	2	U		P
120	R-10a	690	1	7-Sep-05	1		3.9		UF	UF		3.9		P	—	NA		50		UF	P		50		Yes	—	NA		11		UF	P
121	R-10a	690	1	30-Nov-05	2		4.5	J		P		6.5		P	1.4	NA		28	J		P		216		Yes	7.71	NA		18.9		UF	Fail
122	R-10a	690	1	1-Feb-06	3	<	4.4	J		P		5.9		P	1.3	NA	<	76.9	J		P		151		Yes	1.96	NA		5.2	J		P
123	R-10a	690	1	17-Jul-06	4		6.2			P		7.1		P	1.1	NA		79.8	J		P		353		Yes	4.42	NA	<	2	U		P
124	R-10a	690	1	12-Oct-06	5		5.5			P		6.6		P	1.2	NA		51.2	J		P		362		Yes	7.07	NA	<	2	U		P
125	R-11	855	1	17-May-05	1		18.4			P		22.3		Plm	1.2	NA		28.9	J		P		59.3	J	Yes	2.05	NA	<	1	U		P
126	R-11	855	1	3-Aug-05	2		20.5			P		20.4		Plm	1.0	NA	<	18	U		P	<	18	U	Yes	1	NA	<	1	U		P
127	R-11	855	1	8-Nov-05	3		20.7			P		21.8		Plm	1.1	NA	<	18	U		P		51.7	J	Yes	2.87	NA	<	1	U		P
128	R-11	855	1	3-Feb-06	4		25.5			P		25.1		Plm	1.0	NA	<	18	U		P	<	18	U	Yes	1	NA	<	2	U		P
129	R-11	855	1	20-Apr-06	5		28.1			P		25.2		Plm	0.9	NA		—			ND		—		ND	—	ND		—			ND
130	R-11	855	1	10-Jul-06	6		27.9			P		30.9		Plm	1.1	NA	<	62.3	J		P	<	39.6	J	Yes	0.64	NA		2.4	J		P
131	R-11	855	1	10-Oct-06	7		29.4			P		28.5		Plm	1.0	NA	<	18	U		P	<	18	U	Yes	1	NA	<	2	U		P
132	R-12	468	1	2-Feb-04	1		6.03	JN-	UF	UF		6.03	JN-	Fail	—	ND		209		UF	Fail		209		Yes	—	NA		95.2		UF	Fail

Table C-6. Trace Metal Indicators

Row #	Well	Port depth (ft)	Scr #	Sample collection date (start)			Cr (F) ug/L	Lab Qual Code		Test C10		Cr (NF) ug/L	Lab Qual Code	Test F3	Ratio Cr (NF/F)	Test F4		Fe (F) ug/L	Lab Qual Code		Test C4		Fe (NF) ug/L	Lab Qual Code	Test F1	Ratio Fe(NF/F)	Test F2		Mn (F) ug/L	Lab Qual Code		Test C5
										ug/L				ug/L		Ratio					ug/L				ug/L		Ratio					ug/L
										>LL				<UL		<UL					<UL				<UL		<UL					<UL
										1				10		5					102				500		10					16
										1				5		5					102				500		10					16
133	R-12	468	1	2-Jun-04	2		0.53	B	UF	Fail		0.53	B	P	—	NA		205		UF	Fail		205		Yes	—	NA		68.1		UF	Fail
134	R-12	468	1	16-Jun-05	3	<	1	U		Fail	<	1	U	P	1.0	NA		113	*		Fail		107		Yes	0.95	NA		54.3			Fail
135	R-12	468	1	30-Jun-05	3		—			ND		—		ND		ND		—			ND		—		ND	—	ND		—			ND
136	R-12	468	1	2-Feb-06	4	<	1.2	J		P	<	1	J	P	0.8	NA		54.1	J		P		260		Yes	4.81	NA		35.8			Fail
137	R-12	468	1	11-Jul-06	5	<	1	U		Fail	<	1	U	P	1.0	NA		58.6	J		P		106		Yes	1.81	NA		37.2			Fail
138	R-12	468	1	29-Sep-06	6	<	1.1	J		P	<	4.8		P	4.4	NA		62.3	J		P		578		No	9.28	P		109			Fail
139	R-12	507	2	10-Sep-01	1	<	0.57	U		Fail	<	0.57	U	P	1.0	NA	<	2.24	U		P	<	2.24	U	Yes	1	NA		43.5			Fail
140	R-12	507	2	1-Aug-02	2		7.61		UF	UF		7.61		Fail	1.0	ND		48.3	B	UF	P		48.3		Yes	—	NA		42.9		UF	Fail
141	R-12	507	2	28-Jan-04	3	<	0.5	U	UF	Fail	<	0.5	U	P	—	NA		13.2	B	UF	P		13.2		Yes	—	NA		29		UF	Fail
142	R-12	507	2	1-Feb-06	4	<	1	U		Fail	<	1	U	P	1.0	NA	<	18	U		P	<	18	U	Yes	1	NA		23.6			Fail
143	R-12	507	2	12-Jul-06	5	<	3.4			P	<	3.2		P	0.9	NA	<	18	U		P	<	18	U	Yes	1	NA		29.1			Fail
144	R-12	507	2	1-Oct-06	6	<	2.8	J		P	<	2.9	J	P	1.0	NA		112			Fail		134		Yes	1.2	NA		10	J		P
145	R-12	811	3	27-Jan-04	1		2.39	B	UF	UF		2.39	B	P	—	NA		406		UF	Fail		406		Yes	—	NA		283		UF	Fail
146	R-12	811	3	3-Jun-04	2		2.98	B	UF	UF		2.98	B	P	—	NA		316		UF	Fail		316		Yes	—	NA		201		UF	Fail
147	R-12	811	3	20-Jun-05	3	<	1	U		Fail	<	1	U	P	1.0	NA		147			Fail		134		Yes	0.91	NA		119			Fail
148	R-12	811	3	31-Jan-06	4		1	J		P		3.3	J	P	3.3	NA		151			Fail		162		Yes	1.07	NA		122			Fail
149	R-12	811	3	12-Jul-06	5		1.1	J		P		2.3	J	P	2.1	NA		109			Fail		91.3	J	Yes	0.84	NA		132			Fail
150	R-12	811	3	27-Sep-06	6		1.8	J		P		2.3	J	P	1.3	NA		205			Fail		296		Yes	1.44	NA		13.8			P
151	R-12	811	3	18-Oct-06	7		2.8	J		P		3.3		P	1.2	NA	<	37.2	J		P	<	39.7	J	Yes	1.07	NA		2.3	J		P
152	R-13	958	1	9-Dec-03	1		4.58	B	UF	UF		4.58	B	P	—	NA	<	12.6	U	UF	P	<	12.6	U	Yes	—	NA	<	1.75	B	UF	P
153	R-13	958	1	11-Jun-04	2		3.49	B	UF	UF		3.49	B	P	—	NA		31.6	B	UF	P		31.6		Yes	—	NA	<	1.25	B	UF	P
154	R-13	958	1	10-Mar-05	3		4.4		UF	UF		4.4		P	—	NA	<	10	U	UF	P	<	10		Yes	—	NA	<	1	U	UF	P
155	R-13	958	1	26-May-05	3		—			ND		—		ND		ND		—			ND		—		ND	—	ND		—			ND
156	R-13	958	1	1-Sep-05	4		5.9		UF	UF		5.9		P	—	NA	<	10	U	UF	P	<	10	U	Yes	—	NA	<	1	U	UF	P
157	R-13	958	1	2-Feb-06	5	<	4.6	J		P	<	4.2	J	P	0.9	NA	<	18	U		P	<	18	U	Yes	1	NA	<	2	U		P
158	R-13	958	1	3-Jul-06	6		5.1			P		4.6		P	0.9	NA	<	18	U		P	<	18	U	Yes	1	NA	<	2	U		P
159	R-13	958	1	25-Oct-06	7		3.8			P		4.7		P	1.2	NA	<	18	U		P		39.5	J	Yes	2.19	NA	<	2	U		P
160	R-14	1205	1	12-Jul-04	1		1.91	B		P		6.73		P	3.5	NA		105			Fail		170		Yes	1.62	NA		78.1			Fail
161	R-14	1205	1	28-Oct-04	2		0.97	J		Fail		7.7		P	7.9	NA		83.2	J		P		126		Yes	1.51	NA		79.7	N		Fail
162	R-14	1205	1	11-May-05	3		1.6	J		P		6.5		P	4.1	NA		64.3	J		P		98.5	J	Yes	1.53	NA		44.3			Fail
163	R-14	1205	1	24-Jan-06	4	<	2.4	J		P	<	2.5	J	P	1.0	NA		57.9	J		P		59.4	J	Yes	1.03	NA		35			Fail
164	R-14	1205	1	26-Jun-06	5		2.7	J		P		7.9		P	2.9	NA		47.4	J		P		51.8	J	Yes	1.09	NA		30.6			Fail
165	R-14	1205	1	23-Oct-06	6		2.1	J		P		2.6	J	P	1.2	NA		36.1	J		P		49.1	J	Yes	1.36	NA		28			Fail
166	R-14	1289	2	14-Jul-04	1	<	0.6	B		Fail	<	2.64	B	P	4.4	NA		2640			Fail		4450		No	1.69	P		356			Fail
167	R-14	1289	2	3-Nov-04	2	<	0.93	J		Fail	<	0.56	J	P	0.6	NA		2780			Fail		4170		No	1.5	P		393	E		Fail
168	R-14	1289	2	12-May-05	3	<	1	U		Fail		2.1	J	P	2.1	NA		2330	E		Fail		4240	E	No	1.82	P		350			Fail
169	R-14	1289	2	25-Jan-06	4	<	1	U		Fail		4.3	J	P	4.3	NA		1880			Fail		2180		No	1.16	P		295			Fail
170	R-14	1289	2	28-Jun-06	5		7.82			P		7.72		P	1.0	NA		1546			Fail		1475		No	0.95	P		239.3			Fail
171	R-14	1289	2	23-Oct-06	6		0.4			Fail		0.45		P	1.1	NA		1711			Fail		1739		No	1.02	P		295			Fail
172	R-15	959	1	10-Jun-04	1		9.2		UF	UF		9.2		P	—	NA		200		UF	Fail		200		Yes	—	NA		3.03	B	UF	P
173	R-15	959	1	25-May-05	2		7.3			P		7.5		P	1.0	NA	<	18	U		P		20.5	J	Yes	1.14	NA	<	1	U		P
174	R-15	959	1	31-Aug-05	3	<	7.9			P	<	7.2		P	0.9	NA	<	39.2	J		P	<	84.7	J	Yes	2.16	NA	<	2	U		P
175	R-15	959	1	30-Jan-06	4		7.7	N*		P		6.9	N*	P	0.9	NA	<	18	UE*		P		36.5	EJ*	Yes	2.03	NA	<	2	U		P
176	R-15	959	1	3-Jul-06	5		8.1			P		8.6		P	1.1	NA	<	18	U		P		72.8	J	Yes	4.04	NA	<	2	U		P

Table C-6. Trace Metal Indicators

Row #	Well	Port depth (ft)	Scr #	Sample collection date (start)			Cr (F) ug/L	Lab Qual Code		Test C10		Cr (NF) ug/L	Lab Qual Code	Test F3	Ratio Cr (NF/F)	Test F4		Fe (F) ug/L	Lab Qual Code		Test C4		Fe (NF) ug/L	Lab Qual Code	Test F1	Ratio Fe(N F/F)	Test F2		Mn (F) ug/L	Lab Qual Code		Test C5
										ug/L				ug/L		Ratio					ug/L				ug/L		Ratio					ug/L
										>LL				<UL		<UL					<UL				<UL		<UL					<UL
										1				10		5					102				500		10					16
										1				5		5					102				500		10					16
177	R-15	959	1	24-Oct-06	6		7.2			P		7.5		P	1.0	NA	<	18	U		P		33.1	J	Yes	1.84	NA	<	2	U		P
178	R-16	866	2	13-Oct-04	1	<	0.5	U		Fail	<	0.5	U	P	1.0	NA		74.8	J		P		28	J	Yes	0.37	NA		146			Fail
179	R-16	866	2	2-Dec-04	2	<	0.78	J		Fail	<	4.4	J	P	5.6	NA	<	12.6	U		P		29.7	J	Yes	2.36	NA		25.1			Fail
180	R-16	866	2	13-Jun-05	3	<	1	U		Fail		4.1	J	P	4.1	NA	<	18	U		P		28	J	Yes	1.56	NA		19.4			Fail
181	R-16	866	2	13-Jul-06	4		2.1			P		2.27		P	1.1	NA	<	10	U		P	<	10	U	Yes	1	NA		6.2			P
182	R-16	866	2	20-Jul-06	5		1.3	J		P		2.9	J	P	2.2	NA	<	18	U		P	<	18	U	Yes	1	NA		12.8			P
183	R-16	866	2	11-Aug-06	6		3.5			P		4.3		P	1.2	NA		61	J		P		60.9	J	Yes	1	NA		3	J		P
184	R-16	866	2	14-Aug-06	7		2.8			P		3.09		P	1.1	NA		68.6			P		2747		No	40	Fail		3.7			P
185	R-16	866	2	10-Oct-06	8		1.1	J		P		1.5	J	P	1.4	NA		30.8	J		P		63.4	J	Yes	2.06	NA		24.1			Fail
186	R-16	866	2	14-Nov-06	9		3.6			P	<	1	U	P	0.3	NA		13.9			P		2637		No	190	Fail		20			Fail
187	R-16	866	2	4-Dec-06	10		3.2			P		3.76		P	1.2	NA		15.5			P		43.7		Yes	2.82	NA		36.7			Fail
188	R-16	1018	3	14-Oct-04	1		0.93	J		Fail		1.3	J	P	1.4	NA		247			Fail	<	12.6	U	Yes	0.05	NA		68.2			Fail
189	R-16	1018	3	3-Dec-04	2	<	0.78	J		Fail		5		P	6.4	NA	<	12.6	U		P		27.7	J	Yes	2.2	NA		66.5			Fail
190	R-16	1018	3	13-Jun-05	3	<	1	U		Fail		2.5	J	P	2.5	NA	<	18	U		P		49.4	J	Yes	2.74	NA		19.2			Fail
191	R-16	1018	3	12-Jul-06	4		2	J		P		2.5	J	P	1.3	NA	<	18	U		P	<	18	U	Yes	1	NA	<	2	U		P
192	R-16	1018	3	20-Jul-06	5		—			ND		—		ND		ND		—			ND		—		ND	—	ND		—			ND
193	R-16	1018	3	10-Aug-06	6		3.1			P		3.3		P	1.1	NA		76.1	J		P		80.7	J	Yes	1.06	NA		3.7	J		P
194	R-16	1018	3	11-Aug-06	7		1.7			P		2.03		P	1.2	NA		77.1			P		94.6		Yes	1.23	NA		4.7			P
195	R-16	1018	3	12-Oct-06	8		2.2	J		P		1.6	J	P	0.7	NA	<	18	U		P	<	18	U	Yes	1	NA		3.4	J		P
196	R-16	1018	3	14-Nov-06	9		2.15			P		2.71		P	1.3	NA		6.1			P		14.1		Yes	2.31	NA		16.8			Fail
197	R-16	1018	3	5-Dec-06	10		5.64			P		6.01		P	1.1	NA	<	10	U		P	<	10	U	Yes	1	NA		8.5			P
198	R-16	1238	4	15-Oct-04	1	<	0.5	U		Fail	<	0.5	U	P	1.0	NA		14.1	J		P		14.1	J	Yes	1	NA		9.4			P
199	R-16	1238	4	7-Dec-04	2		0.97	J		Fail		3.2	J	P	3.3	NA	<	12.6	U		P	<	12.6	U	Yes	1	NA		13			P
200	R-16	1238	4	14-Jun-05	3	<	1	U		Fail	<	1	U	P	1.0	NA	<	18	U		P	<	18	U	Yes	1	NA		5.1	J		P
201	R-16	1238	4	13-Jul-06	4		1.73			P		2.31		P	1.3	NA	<	10	U		P	<	10	U	Yes	1	NA		4.3			P
202	R-16	1238	4	20-Jul-06	5	<	1.6	J		P	<	1.2	J	P	0.8	NA	<	18	U		P	<	18	U	Yes	1	NA		5.4	J		P
203	R-16	1238	4	9-Aug-06	6		2.1	J		P		2.1	J	P	1.0	NA		138			Fail		153		Yes	1.11	NA		14.4			P
204	R-16	1238	4	11-Oct-06	7		1.1	J		P		1.4	J	P	1.3	NA		49.8	J		P		61.3	J	Yes	1.23	NA		34.3			Fail
205	R-16	1238	4	14-Nov-06	8	<	1	U		Fail	<	1	U	P	1.0	NA		39.8			P		95.1		Yes	2.39	NA		47			Fail
206	R-16	1238	4	5-Dec-06	9		5.42			P		6.64		P	1.2	NA		38.8			P		42.3		Yes	1.09	NA		45.7			Fail
207	R-16r	600	1	26-Sep-05	1		1.2		UF	UF		1.2		P	—	NA	<	10	U	UF	P	<	10	U	Yes	—	NA		55		UF	Fail
208	R-16r	600	1	17-Oct-05	2		3.8		UF	UF		3.8		P	—	NA	<	10	U	UF	P	<	10	U	Yes	—	NA		17		UF	Fail
209	R-16r	600	1	19-Dec-05	3		4.7	J		P		5.3		P	1.1	NA	<	18	U		P		68.1	J	Yes	3.78	NA		3.4	J		P
210	R-16r	600	1	8-Mar-06	4		4.5	J		P		6.3		P	1.4	NA	<	18	U		P		44.3	J	Yes	2.46	NA	<	2	U		P
211	R-16r	600	1	24-May-06	5		5.2			P		5.5		P	1.1	NA	<	18	U		P	<	18	U	Yes	1	NA	<	2	U		P
212	R-16r	600	1	17-Aug-06	6		6.9			P		7.4		P	1.1	NA		374			Fail		57.2	J	Yes	0.15	NA		2.8	J		P
213	R-16r	600	1	1-Nov-06	7		4.1			P		4.4		P	1.1	NA	<	18	U		P		22.8	J	Yes	1.27	NA	<	2	U		P
214	R-17	1057	1	24-Feb-06	1		1.6		UF	UF		1.6		P	—	NA		140		UF	Fail		140		Yes	—	NA		17		UF	Fail
215	R-17	1057	1	19-Oct-06	2		1.7	J		P		3.8		P	2.2	NA		1510	N		Fail		4740	N	No	3.14	P		22.5			Fail
216	R-17	1124	2	17-Oct-06	1		2	J		P		2.7	J	P	1.4	NA		370			Fail		1250		No	3.38	P		16.2			Fail
217	R-18	1358	1	25-Aug-05	1		1.5	J		P		1.9	J	P	1.3	NA	<	18	U		P	<	18	U	Yes	1	NA	<	1	U		P
218	R-18	1358	1	1-Dec-05	2	<	1	U		Fail		1.3		P	1.3	NA	<	18	U		P	<	18	U	Yes	1	NA	<	1	U		P
219	R-18	1358	1	7-Mar-06	3	<	1	U		Fail	<	1	U	P	1.0	NA	<	18	U		P	<	18	U	Yes	1	NA	<	2	U		P
220	R-18	1358	1	16-May-06	4		1.1	J		P		4.6	J	P	4.2	NA		18.9	J		P		56.7	J	Yes	3	NA	<	2	U		P

Table C-6. Trace Metal Indicators

Row #	Well	Port depth (ft)	Scr #	Sample collection date (start)			Cr (F) ug/L	Lab Qual Code		Test C10		Cr (NF) ug/L	Lab Qual Code	Test F3	Ratio Cr (NF/F)	Test F4		Fe (F) ug/L	Lab Qual Code		Test C4		Fe (NF) ug/L	Lab Qual Code	Test F1	Ratio Fe(NF/F)	Test F2		Mn (F) ug/L	Lab Qual Code		Test C5
										ug/L				ug/L		Ratio					ug/L				ug/L		Ratio					ug/L
										>LL				<UL		<UL					<UL				<UL		<UL					<UL
										1				10		5					102				500		10					16
										1				5		5					102				500		10					16
221	R-18	1358	1	15-Aug-06	5		2.5	J		P		4.6		P	1.8	NA		33.7	J		P		46	J	Yes	1.36	NA	<	2	U		P
222	R-18	1358	1	18-Dec-06	6	<	5	U		DL	<	5	U	P		NA	<	18	U		P	<	18	U	Yes		NA	<	2	U		P
223	R-19	909	2	15-Dec-03	1		4.02	B	UF	UF		4.02	B	P	—	NA	<	52.4	B	UF	P	<	52.4	B	Yes	—	NA	<	1.89	B	UF	P
224	R-19	909	2	10-Jun-04	2		1.5	B	UF	UF		1.5	B	P	—	NA	<	12.6	U	UF	P	<	12.6	U	Yes	—	NA	<	1	B	UF	P
225	R-19	909	2	21-Jul-05	3	<	1	U		Fail		4.7	J	P	4.7	NA		26	J		P		25.9	J	Yes	1	NA	<	2	U		P
226	R-19	909	2	18-Aug-06	4		1.47			P		1.44		P	1.0	NA	<	10	U		P	<	10	U	Yes	1	NA		3.1			P
227	R-19	909	2	11-Dec-06	5		—			ND		—		ND		ND	<	10	U		P		17.4		Yes	1.74	NA		13.9			P
228	R-19	1191	3	15-Dec-03	1		5.01		UF	UF		5.01		P	—	NA	<	16.6	B	UF	P	<	16.6	B	Yes	—	NA		4.39	B	UF	P
229	R-19	1191	3	14-Jun-04	2		4.79	B	UF	UF		4.79	B	P	—	NA		39.2	B	UF	P		39.2	B	Yes	—	NA		2.8	B	UF	P
230	R-19	1191	3	21-Jul-05	3		2	J		P		4.1	J	P	2.1	NA	<	18	U		P	<	18	U	Yes	1	NA		9	J		P
231	R-19	1191	3	15-Aug-06	4		1.72			P		1.75		P	1.0	NA	<	10	U		P	<	10	U	Yes	1	NA		9.3			P
232	R-19	1191	3	16-Aug-06	4		1.72			P		1.75		P	1.0	NA	<	10	U		P	<	10	U	Yes	1	NA		9.3			P
233	R-19	1191	3	11-Dec-06	5		—			ND		—		ND		ND	<	10	U		P		14.95		Yes	1.5	NA		5			P
234	R-19	1413	4	16-Dec-03	1		8.54		UF	UF		8.54		P	—	NA	<	35.4	B	UF	P	<	35.4		Yes	—	NA		1.36	B	UF	P
235	R-19	1413	4	15-Jun-04	2		22		UF	UF		22		Fail	—	ND		87.6	B	UF	P		87.6		Yes	—	NA		1.75	B	UF	P
236	R-19	1413	4	28-Jul-05	3		2.7	J		P		7.9		P	2.9	NA	<	18	U		P		24.8	J	Yes	1.38	NA		3.8	J		P
237	R-19	1413	4	16-Aug-06	4		4			P		37.3		Fail	9.3	Fail		35.4	J		P		107		Yes	3.02	NA		10.5			P
238	R-19	1413	4	17-Aug-06	4		3.27			P		4.17		P	1.3	NA	<	10	U		P	<	10	U	Yes	1	NA		1.2			P
239	R-19	1413	4	12-Dec-06	5		2.9	J		P		9.1		P	3.1	NA	<	18	U		P		37	J	Yes	2.06	NA	<	2	U		P
240	R-19	1586	5	20-Sep-01	1	<	0.57	U		Fail	<	2.01	B	P	3.5	NA		5180			Fail		7190		No	1.39	P		850			Fail
241	R-19	1586	5	23-Aug-02	2		4.92	B	UF	UF		4.92	B	P	—	NA		5840		UF	Fail		5840		No	—	ND		1050		UF	Fail
242	R-19	1586	5	16-Dec-03	3		3.6	B	UF	UF		3.6	B	P	—	NA		992		UF	Fail		992		No	—	ND		1020		UF	Fail
243	R-19	1586	5	17-Aug-06	4		2.79			P		2.37		P	0.8	NA		361			Fail		296		Yes	0.82	NA		894			Fail
244	R-19	1586	5	11-Dec-06	5		—			ND		—		ND		ND		305.5			Fail		376.3		Yes	1.23	NA		903			Fail
245	R-19	1730	6	21-Sep-01	1	<	0.57	U		Fail	<	1.31	B	P	2.3	NA		4080			Fail		4100		No	1	P		409			Fail
246	R-19	1730	6	27-Aug-02	2	<	0.5	U	UF	Fail	<	0.5	U	P	—	NA		3430		UF	Fail		3430		No	—	ND		421		UF	Fail
247	R-19	1730	6	16-Dec-03	3	<	2.98	B	UF	UF	<	2.98	B	P	—	NA		1140		UF	Fail		1140		No	—	ND		303		UF	Fail
248	R-19	1730	6	17-Aug-06	4		1.11			P	<	1	U	P	0.9	NA		359			Fail		463		Yes	1.29	NA		169			Fail
249	R-19	1730	6	11-Dec-06	5		—			ND		—		ND		ND		270.4			Fail		339.7		Yes	1.26	NA		152			Fail
250	R-19	1835	7	26-Aug-02	1	<	1.09	B	UF	UF	<	1.09	B	P	—	NA		327		UF	Fail		327		Yes	—	NA		99.3		UF	Fail
251	R-19	1835	7	17-Dec-03	1		5.99		UF	UF		5.99		P	—	NA		1680		UF	Fail		1680		No	—	ND		116		UF	Fail
252	R-19	1835	7	16-Jun-04	2	<	0.55	B	UF	Fail	<	0.55	B	P	—	NA		413		UF	Fail		413		Yes	—	NA		95.6		UF	Fail
253	R-19	1835	7	28-Jul-05	3	<	1	U*		Fail		14.5	*	Fail	14.5	Fail		43.8	J		P		1600		No	36.5	Fail		60.6			Fail
254	R-19	1835	7	18-Aug-06	4	<	1	U		Fail	<	1	U	P	1.0	NA		229			Fail		720		No	3.14	P		69.5			Fail
255	R-19	1835	7	13-Dec-06	5		—			ND		—		ND		ND		81.99			Fail		387.3		Yes	4.72	NA		66.9			Fail
256	R-20	907	1	20-Sep-04	1	<	0.5	U		Fail	<	0.5	U	P	1.0	NA		123			Fail		141		Yes	1.15	NA		16			P
257	R-20	907	1	4-Nov-04	2	<	0.5	U		Fail	<	1.7	J	P	3.4	NA		94.9	J		P		118		Yes	1.24	NA		28.5			Fail
258	R-20	907	1	20-Jul-05	3	<	1	U		Fail	<	1	U	P	1.0	NA		123			Fail		102		Yes	0.83	NA		14.3			P
259	R-20	907	1	6-Jun-06	4		1.7	J		P		2.2	J	P	1.3	NA		75.6	J		P		78.6	J	Yes	1.04	NA		15.7			P
260	R-20	907	1	6-Jul-06	5		2.6	J		P		4.5		P	1.7	NA		243			Fail		734		No	3.02	P		29.3			Fail
261	R-20	907	1	2-Oct-06	6		1.24			P		4.14		P	3.3	NA		229			Fail		1119		No	4.89	P		35.3			Fail
262	R-20	907	1	17-Oct-06	7		—			ND		—		ND		ND		—			ND		—		ND	—	ND		—			ND
263	R-20	1150	2	3-Sep-04	1	<	1.3	J		P	<	2	J	P	1.5	NA		246			Fail		1090		No	4.43	P		346			Fail
264	R-20	1150	2	8-Nov-04	2		0.85	J		Fail		3.8	J	P	4.5	NA		187			Fail		919		No	4.91	P		332	E		Fail

Table C-6. Trace Metal Indicators

Row #	Well	Port depth (ft)	Scr #	Sample collection date (start)			Cr (F) ug/L	Lab Qual Code		Test C10		Cr (NF) ug/L	Lab Qual Code	Test F3	Ratio Cr (NF/F)	Test F4		Fe (F) ug/L	Lab Qual Code		Test C4		Fe (NF) ug/L	Lab Qual Code	Test F1	Ratio Fe(N F/F)	Test F2		Mn (F) ug/L	Lab Qual Code		Test C5
										ug/L				ug/L		Ratio					ug/L				ug/L		Ratio					ug/L
										>LL				<UL		<UL					<UL				<UL		<UL					<UL
										1				10		5					102				500		10					16
										1				5		5					102				500		10					16
265	R-20	1150	2	19-Jul-05	3	<	1	U		Fail	<	1	U	P	1.0	NA		141			Fail	<	666		No	4.72	P		368			Fail
266	R-20	1150	2	7-Jun-06	4		1.8	J		P		12.7		Fail	7.1	Fail		423			Fail		560		No	1.32	P		341			Fail
267	R-20	1150	2	8-Jul-06	5		3.1			P		2.9	J	P	0.9	NA		185			Fail		171		Yes	0.92	NA		37.1			Fail
268	R-20	1330	3	7-Sep-04	1	<	0.6	J		Fail	<	1.1	J	P	1.8	NA		7750			Fail		8560		No	1.1	P		680			Fail
269	R-20	1330	3	9-Nov-04	2		0.84	J		Fail		2.9	J	P	3.5	NA		7170			Fail		7190		No	1	P		587	E		Fail
270	R-20	1330	3	18-Jul-05	3		3.7	J		P	<	1	U	P	0.3	NA		6060			Fail		5980		No	0.99	P		645			Fail
271	R-20	1330	3	8-Jun-06	4		1.5	J		P		4.5		P	3.0	NA		4870			Fail		5110		No	1.05	P		605			Fail
272	R-20	1330	3	7-Jul-06	5		1	J		P		3.7		P	3.7	NA		193			Fail		292		Yes	1.51	NA		165			Fail
273	R-20	1330	3	21-Jul-06	6	<	6			Err	<	1.6	J	P	0.3	NA		193			Fail		227		Yes	1.18	NA		170			Fail
274	R-20	1330	3	13-Oct-06	7		1.7			P		1.2		P	0.7	NA		376			Fail		333		Yes	0.89	NA		204			Fail
275	R-21	889	1	23-Sep-04	1	<	3.9	J		P	<	2.8	J	P	0.7	NA	<	21.7	J		P	<	14.2	J	Yes	0.65	NA		8.3	E		P
276	R-21	889	1	14-Dec-04	2		3	J		P		2.8	J	P	0.9	NA	<	12.6	U		P	<	12.6	U	Yes	1	NA		8			P
277	R-21	889	1	6-Jun-05	3		2.4	J		P	<	3.2	J	P	1.3	NA		24.8	J		P		19.5	J	Yes	0.79	NA		10.6			P
278	R-21	889	1	7-Jul-06	4		3.1			P		3	J	P	1.0	NA		29.6	J		P		33.4	J	Yes	1.13	NA		11.2			P
279	R-21	889	1	6-Nov-06	5		3.6			P		2.4	J	P	0.7	NA	<	25	JN		P	<	28.3	JN	Yes	1.13	NA		10.5			P
280	R-22	907	1	18-Nov-03	1		1.09	B	UF	UF		1.09	B	P	—	NA		21100		UF	Fail		21100		No	—	ND		370		UF	Fail
281	R-22	907	1	21-Jun-04	2	<	1.86	B	UF	UF	<	1.86	B	P	—	NA		18400		UF	Fail		18400		No	—	ND		3560		UF	Fail
282	R-22	907	1	27-Jun-05	3		1.8	J		P		31.4		Fail	17.4	Fail		11200			Fail		13100		No	1.17	P		3160			Fail
283	R-22	907	1	22-Aug-06	4		2.15			P		3.22		P	1.5	NA		26826			Fail		28227		No	1.05	P		4024			Fail
284	R-22	907	1	7-Dec-06	5		2.52			P		—		ND		ND		29623			Fail		31491		No	1.06	P		4332			Fail
285	R-22	963	2	19-Nov-03	1		2.59	B	UF	UF		2.59	B	P	—	NA	<	12.6	U	UF	P	<	12.6		Yes	—	NA		2.57	B	UF	P
286	R-22	963	2	22-Jun-04	2	<	2.03	B	UF	UF	<	2.03	B	P	—	NA	<	12.6	U	UF	P	<	12.6		Yes	—	NA		1.33	B	UF	P
287	R-22	963	2	28-Jun-05	3		3	J		P		2.4	J	P	0.8	NA	<	18	U		P	<	18	U	Yes	1	NA	<	2	U		P
288	R-22	963	2	28-Aug-06	4		1.9	J		P		1.8	J	P	0.9	NA	<	18	U		P	<	18	U	Yes	1	NA	<	2	U		P
289	R-22	963	2	7-Dec-06	5	<	3.2			P	<	5.2		P	1.6	NA	<	18	U		P		37.9		Yes	2.11	NA	<	2	U		P
290	R-22	1274	3	9-Jul-02	1	<	7.07	*	UF	UF	<	7.07	*	P	—	NA		105	*	UF	Fail		105		Yes	—	NA		17.7		UF	Fail
291	R-22	1274	3	20-Nov-03	2		10.8	*	UF	UF		10.8	*	Fail	—	ND		92.9	B	UF	P		92.9		Yes	—	NA		6.81	B	UF	P
292	R-22	1274	3	23-Jun-04	3	<	2.46	B	UF	UF	<	2.46	B	P	—	NA		13.1	B	UF	P		13.1		Yes	—	NA		3.01	B	UF	P
293	R-22	1274	3	29-Jun-05	4		3	J		P		5.6		P	1.9	NA		26.6	J		P		150		Yes	5.64	NA	<	2	U		P
294	R-22	1274	3	22-Aug-06	5		7			P		8.9		P	1.3	NA		48.5	J		P		26	J	Yes	0.54	NA	<	2	U		P
295	R-22	1274	3	8-Dec-06	6	<	3.6			P	<	4.4		P	1.2	NA	<	18	U		P		19.6	J	Yes	1.09	NA	<	2	U		P
296	R-22	1378	4	11-Jul-02	1	<	1.23	B*	UF	UF	<	1.23	B*	P	—	NA		5040	*	UF	Fail		5040		No	—	ND		1090		UF	Fail
297	R-22	1378	4	20-Nov-03	2		5.24	*	UF	UF		5.24	*	P	—	NA		3680		UF	Fail		3680		No	—	ND		847		UF	Fail
298	R-22	1378	4	23-Jun-04	3	<	0.5	U	UF	Fail	<	0.5	U	P	—	NA		2940		UF	Fail		2940		No	—	ND		703		UF	Fail
299	R-22	1378	4	1-Jul-05	4	<	1	U		Fail	<	1	U	P	1.0	NA		927			Fail		2550		No	2.75	P		642			Fail
300	R-22	1378	4	22-Aug-06	5	<	1	U		Fail	<	1	U	P	1.0	NA		467.5			Fail		2201		No	4.71	P		512			Fail
301	R-22	1378	4	8-Dec-06	6		—			ND		—		ND		ND		1458			Fail		2201		No	1.51	P		642			Fail
302	R-22	1448	5	10-Jul-02	1	<	2.38	B*	UF	UF	<	2.38	B*	P	—	NA		1350	*	UF	Fail		1350		No	—	ND		469		UF	Fail
303	R-22	1448	5	21-Nov-03	2		2.23	B	UF	UF		2.23	B	P	—	NA		1170		UF	Fail		1170		No	—	ND		483		UF	Fail
304	R-22	1448	5	5-Jul-05	3	<	1	U*		Fail	<	1.7	J*	P	1.7	NA		73.3	J		P		980		No	13.4	Fail		439			Fail
305	R-22	1448	5	21-Aug-06	4	<	1	U		Fail	<	1	U	P	1.0	NA		1231			Fail		1498		No	1.22	P		649			Fail
306	R-22	1448	5	7-Dec-06	5		1.77			P		5.62		P	3.2	NA		1133			Fail		1728		No	1.53	P		525			Fail
307	R-23	816	1	29-Jun-04	1		1.99	B		P		2.01	B	P	1.0	NA	<	12.6	U		P		49.1	B	Yes	3.9	NA		9.96			P
308	R-23	816	1	24-Sep-04	2	<	2.2	J		P	<	2.3	J	P	1.0	NA	<	12.6	U		P	<	28.9	J	Yes	2.29	NA		7.8	E		P

Table C-6. Trace Metal Indicators

Row #	Well	Port depth (ft)	Scr #	Sample collection date (start)			Cr (F) ug/L	Lab Qual Code		Test C10		Cr (NF) ug/L	Lab Qual Code	Test F3	Ratio Cr (NF/F)	Test F4		Fe (F) ug/L	Lab Qual Code		Test C4		Fe (NF) ug/L	Lab Qual Code	Test F1	Ratio Fe(N F/F)	Test F2		Mn (F) ug/L	Lab Qual Code		Test C5
										ug/L				ug/L		Ratio					ug/L				ug/L		Ratio					ug/L
										>LL				<UL		<UL					<UL				<UL		<UL					<UL
										1				10		5					102				500		10					16
										1				5		5					102				500		10					16
309	R-23	816	1	14-Jul-05	3		1.8	J		P		3	J	P	1.7	NA	<	18	U		P		22	J	Yes	1.22	NA		3.3	J*		P
310	R-23	816	1	15-Aug-06	4		2.9	J		P		5.1		P	1.8	NA	<	18	U		P		46.6	J	Yes	2.59	NA	<	2	U		P
311	R-23	816	1	18-Dec-06	5	<	5	U		DL	<	5	U	P		NA	<	18	U		P		24.7	J	Yes	1.37	NA	<	2	U		P
312	R-23i	470	2	20-Dec-05	1		1.6	UF		P		1.6		P	1.0	NA	<	10	U	UF	P	<	10	U	Yes	—	NA	<	1	U	UF	P
313	R-23i	470	2	3-Oct-06	2	<	1	U		Fail	<	1	U	P	1.0	NA		49.3	J		P		667		No	13.5	Fail		18.4			Fail
314	R-23i	524	3	11-Dec-05	1	<	1	U	UF	Fail	<	1	U	P	—	NA		60		UF	P		60		Yes	—	NA		3.1		UF	P
315	R-23i	524	3	11-Oct-06	2		2	J		P		82.4		Fail	41.2	Fail		211			Fail		8890		No	42.1	Fail		13.7			P
316	R-24	825	1	20-Sep-05	1		7.1		UF	UF		7.1		P	—	NA		60		UF	P		60		Yes	—	NA		72		UF	Fail
317	R-24	825	1	15-Nov-05	2		3.5	J		P		3.2	J	P	0.9	NA	<	18	U		P		27.4	J	Yes	1.52	NA		107			Fail
318	R-24	825	1	6-Mar-06	3		1.5	J		P		1.2	J	P	0.8	NA	<	32.5	J		P	<	34.3	J	Yes	1.06	NA		122			Fail
319	R-24	825	1	10-May-06	4		2.4	J		P		2.9	J	P	1.2	NA	<	18	U		P		43.1	J	Yes	2.39	NA		90.5			Fail
320	R-24	825	1	27-Jul-06	5		5			P		4.7		P	0.9	NA	<	18	U		P		49.7	J	Yes	2.76	NA		6.6	J		P
321	R-25	755	1	7-Aug-02	1		30.7		UF	UF		30.7		Fail	—	ND		1100	*	UF	Fail		1100	*	No	—	ND		188		UF	Fail
322	R-25	755	1	11-Dec-03	1		23		UF	UF		23		Fail	—	ND		1080		UF	Fail		1080		No	—	ND		237		UF	Fail
323	R-25	755	1	1-Sep-04	2		44.8		UF	UF		44.8		Fail	—	ND		4410		UF	Fail		4410		No	—	ND		409		UF	Fail
324	R-25	755	1	2-Aug-05	3		6.2			P		153		Fail	24.7	Fail		192			Fail		3770		No	19.6	Fail		183			Fail
325	R-25	892	2	5-Feb-02	1		23		UF	UF		22.7		Fail	—	ND		117			Fail		1810		No	15.5	Fail		—			ND
326	R-25	892	2	8-Aug-02	1		11		UF	UF		11		Fail	—	ND		635		UF	Fail		635		No	—	ND		31.5		UF	Fail
327	R-25	892	2	10-Dec-03	2		35.5		UF	UF		35.5		Fail	—	ND		1570		UF	Fail		1570		No	—	ND		47.5		UF	Fail
328	R-25	892	2	3-Aug-05	3		1.9	J		P		70.5	J	Fail	37.1	Fail		2310			Fail		4370		No	1.89	P		150			Fail
329	R-25	1192	4	8-Aug-02	1		4.43	B	UF	UF		4.43	B	P	—	NA		444		UF	Fail		444		Yes	—	NA		27.5		UF	Fail
330	R-25	1192	4	10-Dec-03	2	<	1.3	B	UF	UF	<	1.3	B	P	—	NA		210		UF	Fail		210		Yes	—	NA		7.77	B	UF	P
331	R-25	1192	4	4-Aug-05	3	<	1	U		Fail		4	J	P	4.0	NA	<	18	U		P		153		Yes	8.5	NA		8	J		P
332	R-25	1303	5	9-Aug-02	1		139		UF	UF		139		Fail	—	ND		1400		UF	Fail		1400		No	—	ND		264		UF	Fail
333	R-25	1303	5	9-Dec-03	1	<	1.9	B	UF	UF	<	1.9	B	P	—	NA		2780		UF	Fail		2780		No	—	ND		177		UF	Fail
334	R-25	1303	5	31-Aug-04	2		0.58	B	UF	Fail		0.58	B	P	—	NA		2030		UF	Fail		2030		No	—	ND		204		UF	Fail
335	R-25	1303	5	9-Aug-05	3		1.1	J		P		1.1	J	P	1.0	NA		664			Fail		1670		No	2.52	P		125			Fail
336	R-25	1406	6	8-Feb-02	1		0.88	B		Fail		6.88		P	7.8	NA		32.3	B		P		32.3	B	Yes	1	NA		1.01	B		P
337	R-25	1406	6	12-Aug-02	2		34.3		UF	UF		34.3		Fail	—	ND		184		UF	Fail		184		Yes	—	NA		6.27	B	UF	P
338	R-25	1406	6	9-Dec-03	3		10.1		UF	UF		10.1		Fail	—	ND	<	61.9	B	UF	P	<	61.9	B	Yes	—	NA	<	1.63	B	UF	P
339	R-25	1606	7	11-Feb-02	1		1.39	B		P		9.57		P	6.9	NA		22.9	B		P		22.9		Yes	1	NA		1.71	B		P
340	R-25	1606	7	12-Aug-02	2		9.16		UF	UF		9.16		P	—	NA		145		UF	Fail		145		Yes	—	NA		2.65	B	UF	P
341	R-25	1606	7	8-Dec-03	3	<	4.45	B	UF	UF	<	4.45	B	P	—	NA		127		UF	Fail		127		Yes	—	NA	<	1.55	B	UF	P
342	R-25	1796	8	14-Aug-02	1	<	1.91	B	UF	UF	<	1.91	B	P	—	NA		307		UF	Fail		307		Yes	—	NA		2.9	B	UF	P
343	R-25	1796	8	4-Dec-03	2	<	3.66	B	UF	UF	<	3.66	B	P	—	NA		204		UF	Fail		204		Yes	—	NA	<	2.53	B	UF	P
344	R-25	1796	8	10-Aug-05	3		1.8	J		P		2.8	J	P	1.6	NA		24.4	J		P		90.3	J	Yes	3.7	NA		12.2			P
345	R-26	659	1	13-Apr-05	1	<	1	U		Fail		1.8	J	P	1.8	NA	<	18	U		P	<	18	U	Yes	1	NA	<	1	U		P
346	R-26	659	1	27-Jul-05	2		1.6	J		P		1.8	J	P	1.1	NA	<	18	U		P	<	18	U	Yes	1	NA		1.5	J		P
347	R-26	659	1	2-Nov-05	3		2	J		P		7.6		Fail	3.8	P	<	18	U		P		24.8	J	Yes	1.38	NA		2.5	J		P
348	R-26	659	1	22-Feb-06	4	<	2	J		P	<	3.2	J	P	1.6	NA	<	18	U		P	<	18	U	Yes	1	NA	<	2	U		P
349	R-27	852	1	11-Oct-05	1		1.6		UF	UF		1.6		P	—	NA		10		UF	P		10		Yes	—	NA		11		UF	P
350	R-27	852	1	21-Oct-05	1		2		UF	UF		2		P	—	NA		20		UF	P		20		Yes	—	NA		10		UF	P
351	R-27	852	1	14-Nov-05	2	<	1	U	UF	Fail	<	1	U	P	—	NA		10		UF	P		10		Yes	—	NA		2.3		UF	P
352	R-27	852	1	1-Jul-06	3		3.8			P		3.9		P	1.0	NA		36	J		P		35.9	J	Yes	1	NA	<	2	U		P

Table C-6. Trace Metal Indicators

Row #	Well	Port depth (ft)	Scr #	Sample collection date (start)			Cr (F) ug/L	Lab Qual Code		Test C10		Cr (NF) ug/L	Lab Qual Code	Test F3	Ratio Cr (NF/F)	Test F4		Fe (F) ug/L	Lab Qual Code		Test C4		Fe (NF) ug/L	Lab Qual Code	Test F1	Ratio Fe(N F/F)	Test F2		Mn (F) ug/L	Lab Qual Code		Test C5
										ug/L				ug/L		Ratio					ug/L				ug/L		Ratio					ug/L
										>LL				<UL		<UL					<UL				<UL		<UL					<UL
										1				10		5					102				500		10					16
										1				5		5					102				500		10					16
353	R-28	934	1	20-May-05	1		375			P		389		Plm	1.0	NA	<	18	U		P		21.3	J	Yes	1.18	NA		3.5	J		P
354	R-28	934	1	1-Sep-05	2		397			P		404		Plm	1.0	NA	<	18	U		P	<	10	U	Yes	0.56	NA	<	3.4	J		P
355	R-28	934	1	10-Nov-05	3		404			P		416		Plm	1.0	NA	<	18	U		P		24.8	J	Yes	1.38	NA	<	1	U		P
356	R-28	934	1	26-Jan-06	4		414			P		421		Plm	1.0	NA	<	18	U		P		21.3	J	Yes	1.18	NA		4.2	J		P
357	R-28	934	1	19-Apr-06	5		413			P		398		Plm	1.0	NA		—			ND		—		ND	—	ND		—			ND
358	R-28	934	1	5-Jul-06	6		344			P		428	E	Plm	1.2	NA		30.4	J		P		41.5	J	Yes	1.37	NA	<	2	U		P
359	R-28	934	1	26-Oct-06	7		310			P		323		Plm	1.0	NA	<	18	U		P		50.5	J	Yes	2.81	NA	<	2	U		P
360	R-31	532	2	18-Mar-04	1	<	0.5	U		Fail		0.85	J	P	1.7	NA		746			Fail		2530		No	3.39	P		1760	E		Fail
361	R-31	532	2	17-Aug-05	2		1.1	J		P		1.8	J	P	1.6	NA		628			Fail		1720		No	2.74	P		1610			Fail
362	R-31	532	2	28-Nov-06	3		1.2	J		P		3.1		P	2.6	NA		892			Fail		1420		No	1.59	P		1490			Fail
363	R-31	670	3	19-Aug-05	1	<	1.4	J		P	<	2.9	J	P	2.1	NA		4170			Fail		5190		No	1.24	P		397			Fail
364	R-31	670	3	30-Nov-06	2	<	3	J		P	<	3.5		P	1.2	NA		2840			Fail		3090		No	1.09	P		276			Fail
365	R-31	831	4	23-Aug-05	1		1.9	J		P		3.1	J	P	1.6	NA	<	18	U		P		22.5	J	Yes	1.25	NA	<	2	U		P
366	R-31	831	4	6-Dec-06	2		3.1	N		P		3	JN	P	1.0	NA		19.3	J		P	<	18	U	Yes	0.93	NA	<	2	U		P
367	R-31	1011	5	24-Aug-05	1		1.7	J		P		1.9	J	P	1.1	NA		18.6	J		P		22.3	J	Yes	1.2	NA		7.7	J		P
368	R-31	1011	5	6-Dec-06	2		1.9	J		P		1.8	J	P	0.9	NA	<	18	U		P	<	18	U	Yes	1	NA	<	2	U		P
369	R-32	871	1	21-Sep-04	1	<	0.51	U		Fail	<	0.5	U	P	1.0	NA	<	12.6	U		P	<	14.4	J	Yes	1.14	NA		11			P
370	R-32	871	1	15-Nov-04	2	<	1.4	J		P	<	1.4	J	P	1.0	NA	<	12.6	U		P		40		Yes	3.17	NA		5.7			P
371	R-32	871	1	22-Jun-05	3	<	1	U		Fail		2.6	J	P	2.6	NA	<	18	U		P	<	24.9	J	Yes	1.38	NA		2.6	J		P
372	R-32	871	1	29-Aug-06	4	<	2.4	J		P	<	7.4		P	3.1	NA		27.6	J		P	<	18	U	Yes	0.65	NA	<	2	U		P
373	R-32	871	1	12-Dec-06	5		1.9	J		P		2.6	J	P	1.4	NA	<	18	U		P	<	18	U	Yes	1	NA	<	2	U		P
374	R-32	976	3	22-Sep-04	1	<	0.7	J		Fail	<	0.5	U	P	0.7	NA		748			Fail		846		No	1.13	P		1610	E		Fail
375	R-32	976	3	16-Nov-04	2	<	0.5	U		Fail	<	0.76	J	P	1.5	NA		813			Fail		805		No	0.99	P		200			Fail
376	R-32	976	3	24-Jun-05	3	<	2	J		P		7.3	J	P	3.7	NA		701			Fail		708		No	1.01	P		2060			Fail
377	R-32	976	3	30-Aug-06	4	<	1.5	J		P		10.4		Fail	6.9	Fail		543			Fail		594		No	1.09	P		1850			Fail
378	R-32	976	3	13-Dec-06	5	<	1	U		Fail		1.6		P	1.6	NA		382			Fail		405		Yes	1.06	NA		1580			Fail
379	R-33	996	1	27-Jun-05	1		6			P		12.2		Fail	2.0	P		213			Fail		402		Yes	1.89	NA		3.5	J		P
380	R-33	996	1	14-Sep-05	2		8.2			P		12.3		Fail	1.5	P		263			Fail		274		Yes	1.04	NA		4.2	J		P
381	R-33	996	1	16-Feb-06	3		4.1	J		P		5.3		P	1.3	NA	<	18	U		P		28	J	Yes	1.56	NA	<	2	U		P
382	R-33	996	1	31-Oct-06	4		6.7			P		8.75		P	1.3	NA		563			Fail		674		No	1.2	P		11.2			P
383	R-33	1112	2	24-Jun-05	1		5.5			P		7.6		P	1.4	NA		163			Fail		251		Yes	1.54	NA		6			P
384	R-33	1112	2	15-Sep-05	2		5.5			P		6.1		P	1.1	NA	<	111			Fail	<	112		Yes	1.01	NA		2	J		P
385	R-33	1112	2	14-Feb-06	3		4.9			P		5.1		P	1.0	NA		25	J		P		21.1	J	Yes	0.84	NA		2.4	J		P
386	R-33	1112	2	5-Jul-06	4		8.2			P		8.16		P	1.0	NA		263			Fail		29		Err	0.11	Err		11			P
387	R-33	1112	2	1-Nov-06	5		8.49			P		7.88		P	0.9	NA		958			Fail		1146		No	1.2	P		10.7			P
388	R-34	895	1	7-Jun-05	1	<	3.8	J		P		8.3		P	2.2	NA	<	18	U		P		419		Yes	23.3	NA		42.6			Fail
389	R-34	895	1	7-Sep-05	2		3.8	J		P		4.4	J	P	1.2	NA	<	18	U		P		440		Yes	24.4	NA		18.5			Fail
390	R-34	895	1	29-Nov-05	3		4	J		P		6.9		P	1.7	NA	<	18	U		P		524		No	29.1	Fail		9.8			P
391	R-34	895	1	31-Jan-06	4	<	4.6	J		P	<	5.2		P	1.1	NA	<	18	U		P		138		Yes	7.67	NA		6.7	J		P
392	R-34	895	1	17-Jul-06	5		5.2			P		7.4		P	1.4	NA	<	18	U		P		500		No	27.8	Fail		6.7	J		P
393	R-34	895	1	30-Oct-06	6		6.4			P		5.6		P	0.9	NA	<	18	U		P		442		Yes	24.6	NA		6.8	J		P
LL=lower limit, UL=upper limit, UF=unfiltered, F=filtered, P=pass																																
	Pass/Fail outcomes																															
	Pass (or Yes)									212				321		9					238				286		56					206

Table C-6. Trace Metal Indicators

Row #	Well	Port depth (ft)	Scr #	Sample collection date (start)	Cr (F) ug/L	Lab Qual Code	Test C10	Cr (NF) ug/L	Lab Qual Code	Test F3	Ratio Cr (NF/F)	Test F4	Fe (F) ug/L	Lab Qual Code	Test C4	Fe (NF) ug/L	Lab Qual Code	Test F1	Ratio Fe(NF/F)	Test F2	Mn (F) ug/L	Lab Qual Code	Test C5
							ug/L			ug/L		Ratio			ug/L			ug/L		Ratio			ug/L
							>LL			<UL		<UL			<UL			<UL		<UL			<UL
							1			10		5			102			500		10			16
							1			5		5			102			500		10			16
	Fail (or No)						93			38		15			143			96		16			177
	Total outcomes						305			359		24			381			382		72			383
	% Pass (or Yes)						70			89		38			62			75		78			54
	Indeterminate outcomes																						
ND=no data							12			13		28			9			9		33			10
Err=suspected error							1			0		0			1			2		2			0
Plm=unreliable due to contaminant plume							0			21		0			0			0		0			0
DL=inadequate detection limit							2			0		0			2			0		0			0
UF=test unreliable for UF sample							73			0		0			0			0		0			0
Red=test unreliable, reducing conditions							0			0		0			0			0		0			0
—=test not applicable							0			0		341			0			0		286			0
	Checksum						393			393		393			393			393		393			393

Data source: WQDB except where indicated otherwise

LL=lower limit, UL=upper limit, P=pass; UF=unfiltered

Notes: Pass and fail outcomes for each sample are determined by comparison against test threshold criteria. From top to bottom in the column headers above are listed the indicator name and associated test identifier, units of measurement, type of test threshold, and threshold values for the regional aquifer and perched intermediate aquifer, respectively.

Table C-6. Trace Metal Indicators

Row #	Well	Port depth (ft)	Scr #	Sample collection date (start)			Mo (F) ug/L	Lab Qual Code		Test C9		Ni (F) ug/L	Lab Qual Code		Test C8	Test F5	Sr ug/L		Test D1	Test E3		U ug/L	Lab Qual Code		Test C7, D2	Test E5		Zn ug/L	Lab Qual Code		Test D4	Test F6
										ug/L					ug/L	ug/L			ug/L	ug/L					ug/L	ug/L					ug/L	ug/L
										<UL					<UL	<UL			>LL	<UL					>LL	<UL					>LL	<UL
										4					2	50			44.88	179.8					0.2	1.52					1	40
										4					2	50			19.1	154.8					0.1	0.72					1	20
1	CdV-16-1(i)	624	1	1-Jun-05	1		2.6			P		4.6	J		Fail	P	93.5		P	P		0.32			P	P		12.3			P	P
2	CdV-16-1(i)	624	1	29-Aug-05	2		3			P		5.9			Fail	P	95.9		P	P		0.36			P	P		10	J		P	P
3	CdV-16-1(i)	624	1	7-Dec-05	3		3.5			P		3.2	J		Fail	P	96.5		P	P		0.34			P	P		7.5			P	P
4	CdV-16-1(i)	624	1	9-Mar-06	4		3.4	J		P		4.4			Fail	P	97.2		P	P		0.43			P	P	<	13.1			P	P
5	CdV-16-2(i)r	850	1	14-Sep-05	1		2.7		UF	P		1.5		UF	P	P	46	UF	P	P		0.3		UF	P	P		610		UF	NA	UF
6	CdV-16-2(i)r	850	1	15-Dec-05	2		3.5			P		1.8	J		P	P	49.4		P	P		0.58			P	P		17			NA	P
7	CdV-16-2(i)r	850	1	15-Mar-06	3		2.3	J		P		1.7	J		P	P	61.7		P	P	<	0.28			P	P		10.2			P	P
8	CdV-16-2(i)r	850	1	17-May-06	4		2.9	J		P	<	0.5	U		P	P	49		P	P		0.53			P	P		5.6	J		P	P
9	CdV-R-15-3	1254	4	19-Oct-04	1	<	1.43	U		P		1.31	J		P	P	59.4		P	P		0.6			P	P		4.2	J		P	P
10	CdV-R-15-3	1254	4	4-Apr-05	2		0.51			P		1.5	J		P	P	55.7		P	P		0.54			P	P		3.1	J		P	P
11	CdV-R-15-3	1254	4	12-Jul-05	3	<	0.48	J		P	<	1	U		P	P	56		P	P		0.52			P	P		4.3	J		P	P
12	CdV-R-15-3	1254	4	18-Oct-05	4	<	0.54			P	<	1	U		P	P	55.8		P	P		0.48			P	P		2.2	J		P	P
13	CdV-R-15-3	1254	4	19-Jan-06	5	<	2	U		P	<	0.5	U		P	P	56		P	P		0.41			P	P		4.3	J		P	P
14	CdV-R-15-3	1254	4	27-Mar-06	6	<	2	U		P		0.53	J		P	P	56.2		P	P		0.48			P	P	<	4.4	J		P	P
15	CdV-R-15-3	1350	5	20-Oct-04	1	<	1.43	U		P	<	0.69	U		P	P	632		P	Fail		0.029			Fail	Red		2	J		P	P
16	CdV-R-15-3	1350	5	5-Apr-05	2		0.97			P	<	1.7	J		P	P	931		P	Fail	<	0.05			Fail	Red		2.5	J		P	P
17	CdV-R-15-3	1350	5	12-Jul-05	3		1.4			P	<	1.6	J		P	P	278		P	Fail	<	0.05	U		Fail	Red		3.4	J		P	P
18	CdV-R-15-3	1350	5	18-Oct-05	4	<	1.3			P	<	1	U		P	P	247		P	Fail	<	0.05	U		Fail	Red	<	2	U		DL	P
19	CdV-R-15-3	1350	5	20-Jan-06	5	<	2	U		P		0.52	J		P	P	226		P	Fail	<	0.05	U		Fail	Red		3	J		P	P
20	CdV-R-15-3	1350	5	28-Mar-06	6	<	2	U		P	<	0.5	U		P	P	233		P	Fail	<	0.05	U		Fail	Red	<	3.8	J		P	P
21	CdV-R-15-3	1640	6	21-Oct-04	1		1.9	J		P	<	0.69	U		P	P	57		P	P		0.22			P	P		1.5	J		P	P
22	CdV-R-15-3	1640	6	6-Apr-05	2		1.4			P	<	1	U		P	P	54		P	P		0.17			Fail	Red	<	2	U		DL	P
23	CdV-R-15-3	1640	6	13-Jul-05	3		1.3			P	<	1	U		P	P	55.4		P	P		0.16			Fail	Red		4	J		P	P
24	CdV-R-15-3	1640	6	19-Oct-05	4		1.3			P	<	1	U		P	P	54.9		P	P		0.16	J		Fail	Red		4.6	J		P	P
25	CdV-R-15-3	1640	6	20-Jan-06	5	<	2	U		P		0.54	J		P	P	57.4		P	P		0.15	J		Fail	Red		3.9	J		P	P
26	CdV-R-15-3	1640	6	29-Mar-06	6	<	2	U		P		0.55	J		P	P	52.4		P	P	<	0.17	J		Fail	Red	<	4.6	J		P	P
27	CdV-R-37-2	1200	2	26-Oct-04	1		15.5			Fail		4.9	J		Fail	P	164		P	P	<	0.2			Fail	Red		4	J		P	P
28	CdV-R-37-2	1200	2	29-Mar-05	2		16.6			Fail		10.9			Fail	P	140		P	P	<	0.05			Fail	Red		2.86	J		P	P
29	CdV-R-37-2	1200	2	6-Jul-05	3		16.6			Fail		26.4			Fail	P	123		P	P	<	0.05			Fail	Red		11.5			P	P
30	CdV-R-37-2	1200	2	12-Oct-05	4		16.7			Fail		32.8			Fail	P	103		P	P	<	0.05	U		Fail	Red	<	2	U		DL	P
31	CdV-R-37-2	1200	2	9-Jan-06	5		15.8			Fail		29.2			Fail	P	97		P	P	<	0.05	U		Fail	Red	<	2	U		DL	P
32	CdV-R-37-2	1200	2	21-Mar-06	6		16.2			Fail		30.1			Fail	P	87.9		P	P	<	0.05	U		Fail	Red		2.6	J		P	P
33	CdV-R-37-2	1359	3	27-Oct-04	1	<	1.43	U		P	<	0.69	U		P	P	54.8		P	P		0.4			P	P		2.6	J		P	P
34	CdV-R-37-2	1359	3	30-Mar-05	2		1.4			P	<	1	U		P	P	55.7		P	P		0.46			P	P		3.8	J		P	P
35	CdV-R-37-2	1359	3	7-Jul-05	3	<	1.4			P	<	1	U		P	P	57.1		P	P		0.43			P	P		3.2	J		P	P
36	CdV-R-37-2	1359	3	12-Oct-05	4	<	1.2			P	<	1	U		P	P	55		P	P		0.45			P	P		10.2			P	P
37	CdV-R-37-2	1359	3	10-Jan-06	5	<	2	U		P	<	0.5	U		P	P	54.3		P	P		0.47			P	P	<	2	U		DL	P
38	CdV-R-37-2	1359	3	22-Mar-06	6		2.1	J		P	<	0.5	U		P	P	57.9		P	P		0.47			P	P		4.7	J		P	P
39	CdV-R-37-2	1551	4	27-Oct-04	1		1.7	J		P		0.89	J		P	P	39.7		Fail	P	<	0.2			Fail	Red		4	J		P	P
40	CdV-R-37-2	1551	4	31-Mar-05	2		1.8			P	<	1	U		P	P	40.4		Fail	P		0.071			Fail	Red		2.9	J		P	P
41	CdV-R-37-2	1551	4	8-Jul-05	3		1.7			P	<	1	U		P	P	42.3		Fail	P		0.096			Fail	Red		11.5			P	P
42	CdV-R-37-2	1551	4	13-Oct-05	4		1.6			P	<	1	U		P	P	41.2		Fail	P	<	0.05	U		Fail	Red		5.6	J		P	P
43	CdV-R-37-2	1551	4	11-Jan-06	5	<	2	U		P		0.78	J		P	P	43		Fail	P		0.081	J		Fail	Red	<	2	U		DL	P
44	CdV-R-37-2	1551	4	22-Mar-06	6	<	2	U		P		1	J		P	P	42.6		Fail	P		0.078	J		Fail	Red		4.1	J		P	P
45	MCOBT-4.4	485	1	28-Jan-03	1		0.96			P	<	3.11	B		Fail	P	156		P	Fail		0.11	B		P	P		2.01	B		P	P
46	MCOBT-4.4	485	1	21-May-03	2		0.81			P		2.25	B		Fail	P	157		P	Fail		0.12	B		P	P		1.06	B		P	P

Table C-6. Trace Metal Indicators

Row #	Well	Port depth (ft)	Scr #	Sample collection date (start)			Mo (F) ug/L	Lab Qual Code		Test C9		Ni (F) ug/L	Lab Qual Code		Test C8	Test F5	Sr ug/L		Test D1	Test E3		U ug/L	Lab Qual Code		Test C7, D2	Test E5		Zn ug/L	Lab Qual Code		Test D4	Test F6
										ug/L					ug/L	ug/L			ug/L	ug/L					ug/L	ug/L					ug/L	ug/L
										<UL					<UL	<UL			>LL	<UL					>LL	<UL					>LL	<UL
										4					2	50			44.88	179.8					0.2	1.52					1	40
										4					2	50			19.1	154.8					0.1	0.72					1	20
47	MCOBT-4.4	485	1	29-Mar-05	2	<	1	U	UF	P		3.4		UF	Fail	P	170	UF	P	Fail	<	0.2	U	UF	DL	P		9		UF	UF	P
48	MCOBT-4.4	485	1	8-Jun-05	3		—			ND		—			ND	ND	—		ND	ND		—			ND	ND		—			ND	ND
49	R-1	1031	1	19-May-05	1		2.4			P	<	2	J		P	P	55.4		P	P		0.78			P	P		7.6	J		P	P
50	R-1	1031	1	12-Sep-05	2		2.1	J		P		0.68	J		P	P	52.5		P	P		0.84			P	P		2.7	J		P	P
51	R-1	1031	1	28-Nov-05	3		2			P		1.1	J		P	P	50.3		P	P		0.8			P	P	<	2	U		DL	P
52	R-1	1031	1	25-Jan-06	4		2.6	J		P		0.68	J		P	P	54.5		P	P		0.93			P	P	<	2	U		DL	P
53	R-1	1031	1	19-Apr-06	5		—			ND		—			ND	ND	—		ND	ND		—			ND	ND		—			ND	ND
54	R-1	1031	1	6-Jul-06	6		2.2	J		P	<	2.5	U		DL	P	53.7		P	P		0.95			P	P		5.1	J		P	P
55	R-1	1031	1	26-Oct-06	7		3.5	J		P		1.1	J		P	P	52.6		P	P		0.65			P	P		2.3	J		P	P
56	R-2	918	1	26-Apr-05	1		5.5			Fail		4.3	J		Fail	P	41.6		Fail	P		0.71			P	P		10.1			P	P
57	R-2	918	1	9-Aug-05	2		2.7			P		2.7	J		Fail	P	46		P	P		0.45			P	P		7.4	J		P	P
58	R-2	918	1	9-Nov-05	3		2.6			P	<	1.9	J		P	P	50.2		P	P		0.57			P	P		5.6	J		P	P
59	R-2	918	1	27-Feb-06	4	<	2.5	J		P		1.4	J		P	P	51.5		P	P		0.43			P	P	<	7.3	J		P	P
60	R-2	918	1	24-Jul-06	5		3.4	J		P		1.6	J		P	P	48.3		P	P		0.44			P	P	<	8	J		P	P
61	R-3i	215	1	10-Aug-06	1	<	2	U		P		8	J		Fail	P	277		P	Fail		7.8			P	Plm	<	3	J		P	P
62	R-4	793	1	27-Apr-05	1		2.8			P	<	1	U		P	P	87.2		P	P		0.8			P	P		7.7	J		P	P
63	R-4	793	1	8-Aug-05	2		2.2			P		4.1	J		Fail	P	81.7		P	P		0.66			P	P		4.1	J		P	P
64	R-4	793	1	14-Nov-05	3		2.6			P	<	2.9	J		Fail	P	87.2		P	P		0.73			P	P	<	2	U		DL	P
65	R-4	793	1	28-Feb-06	4		3.3	J		P		1.1	J		P	P	98.6		P	P		0.87			P	P	<	4.4	J		P	P
66	R-4	793	1	25-Jul-06	5	<	2	U		P		1.6	J		P	P	75.1		P	P		0.71			P	P	<	4.1	J		P	P
67	R-5	384	2	28-Apr-04	1		2			P	<	0.69	U		P	P	329		P	Fail		2.8			P	Plm		10.9			P	P
68	R-5	384	2	27-Sep-04	2		2.1			P		1.3	J		P	P	311		P	Fail		2.6			P	Plm	<	0.883	U		Fail	P
69	R-5	384	2	2-May-05	3		2.8		UF	P	<	2	J	UF	P	P	315	UF	P	Fail		—			ND	ND		4.1	J	UF	UF	P
70	R-5	384	2	25-Jul-06	4	<	2	U		P		0.58	J		P	P	308		P	Fail		2.9			P	Plm	<	4	J		P	P
71	R-5	719	3	30-Apr-04	1		2.2			P	<	0.69	U		P	P	209		P	Fail		1.8			P	Fail		11.2			P	P
72	R-5	719	3	28-Sep-04	2		2.5			P	<	0.69	U		P	P	186		P	Fail		1.8			P	Fail	<	0.883	U		Fail	P
73	R-5	719	3	3-May-05	3		2.6		UF	P	<	1.8	J	UF	P	P	188	UF	P	Fail		—			ND	ND		3.7	J	UF	UF	P
74	R-5	719	3	26-Jul-06	4		2.5	J		P		1.4	J		P	P	308		P	Fail		1.8			P	Fail	<	3.7	J		P	P
75	R-5	861	4	3-May-04	1		4.7			Fail		18.1			Fail	P	214		P	Fail		2			P	Fail		10.8			P	P
76	R-5	861	4	30-Sep-04	2		5.0			Fail		12			Fail	P	216		P	Fail		1.7			P	Fail		11.5			P	P
77	R-5	861	4	4-May-05	3		3.9		UF	P	<	5.5		UF	Fail	P	213	UF	P	Fail		—			ND	ND		6.6	J	UF	UF	P
78	R-5	861	4	27-Jul-06	4		—			ND		—			ND	ND	—		ND	ND		—			ND	ND		—			ND	ND
79	R-6	1205	1	23-Aug-05	1		2.3			P		1.3	J		P	P	58.7		P	P		0.65			P	P		8.7	J		P	P
80	R-6	1205	1	17-Nov-05	2		2.3			P		1.2	J		P	P	59.9		P	P		0.57			P	P	<	2	U		DL	P
81	R-6	1205	1	1-Mar-06	3		2.9	J		P		0.69	J		P	P	60.8		P	P		0.52			P	P		3.7	J		P	P
82	R-6	1205	1	11-May-06	4		3	J		P		1.6	J		P	P	53.5		P	P		0.47			P	P	<	10.2			P	P
83	R-6	1205	1	26-Jul-06	5		3	J		P		0.93	J		P	P	54.5		P	P		0.54			P	P	<	6.4	J		P	P
84	R-6i	602	1	24-Aug-05	1		1.3			P		2	J		P	P	135		P	P		0.94			P	Fail		24.6			NA	Fail
85	R-6i	602	1	17-Nov-05	2		1.4			P		9.2			Fail	P	137		P	P		0.8			P	Fail		12.9			P	P
86	R-6i	602	1	1-Mar-06	3	<	2	U		P		2.2			Fail	P	134		P	P		0.73			P	Fail		16.5			NA	P
87	R-6i	602	1	11-May-06	4		2.3	J		P		1.6	J		P	P	129		P	P		0.65			P	P	<	12.4			P	P
88	R-6i	602	1	26-Jul-06	5	<	2	U		P		1.5	J		P	P	118		P	P		0.64			P	P		45.7			NA	Fail
89	R-7	915	3	18-Dec-03	1	<	1.43	U	UF	P		5.9		UF	Fail	P	40.3	UF	Fail	P		0.084	B	UF	Fail	Red		39.9		UF	UF	P
90	R-7	915	3	26-May-04	2		1.59	B	UF	P		5.17		UF	Fail	P	40.5	UF	Fail	P		0.083	B	UF	Fail	Red		16.7		UF	NA	P
91	R-7	915	3	26-Apr-05	3		2.3		UF	P	<	3.7	J	UF	Fail	P	38.1	UF	Fail	P		—			ND	ND		49.3		UF	NA	UF
92	R-7	915	3	31-Jul-06	4		2			P		2.1			Fail	P	38.4		Fail	P	<	0.2	U		Fail	Red		17.5			NA	P

Table C-6. Trace Metal Indicators

Row #	Well	Port depth (ft)	Scr #	Sample collection date (start)			Mo (F) ug/L	Lab Qual Code		Test C9		Ni (F) ug/L	Lab Qual Code		Test C8	Test F5	Sr ug/L		Test D1	Test E3		U ug/L	Lab Qual Code		Test C7, D2	Test E5		Zn ug/L	Lab Qual Code		Test D4	Test F6
										ug/L					ug/L	ug/L			ug/L	ug/L					ug/L	ug/L					ug/L	ug/L
										<UL					<UL	<UL			>LL	<UL					>LL	<UL					>LL	<UL
										4					2	50			44.88	179.8					0.2	1.52					1	40
										4					2	50			19.1	154.8					0.1	0.72					1	20
93	R-8	711	1	24-Aug-04	1		1.5			P	<	0.69	U		P	P	88		P	P		0.33			P	P	<	5.8			P	P
94	R-8	711	1	8-Dec-04	2		1.6			P	<	0.69	U		P	P	97.2		P	P		0.35			P	P		3.4	J		P	P
95	R-8	711	1	27-Apr-05	3		2.1		UF	P		1.2	J	UF	P	P	96.6	UF	P	P		—			ND	ND		8.4	J	UF	UF	P
96	R-8	711	1	1-Aug-06	4	<	2	U		P		0.69	J		P	P	88.9		P	P		0.38			P	P		2	J		P	P
97	R-8	825	2	25-Aug-04	1		2			P	<	0.69	U		P	P	204		P	Fail		0.71			P	P	<	4.8	B		P	P
98	R-8	825	2	9-Dec-04	2		1.7			P	<	0.69	U		P	P	206		P	Fail		1			P	P	<	0.883	U		Fail	P
99	R-8	825	2	28-Apr-05	3		1.3		UF	P	<	1	U	UF	P	P	162	UF	P	P		—			ND	ND	<	2.5	J	UF	UF	P
100	R-8	825	2	2-Aug-06	4		1.1			P	<	1	U		P	P	173		P	P		0.74			P	P		3.1			P	P
101	R-9	684	1	12-Dec-03	1	<	1.81	B	UF	P	<	0.8	B	UF	P	P	165	UF	P	P		1.8		UF	P	Plm	<	1.58	B	UF	UF	P
102	R-9	684	1	27-May-04	2		1.54	B	UF	P		0.67		UF	P	P	157	UF	P	P		1.75		UF	P	Plm		12.3		UF	UF	P
103	R-9	684	1	19-Mar-05	3		1.7		UF	P		1		UF	P	P	160	UF	P	P		1.6		UF	P	Plm		11		UF	UF	P
104	R-9	684	1	6-Apr-05	3		1.6		UF	P		1.7		UF	P	P	150	UF	P	P		1.6		UF	P	Plm		5		UF	UF	P
105	R-9	684	1	28-Apr-05	3		1.5		UF	P	<	1	U	UF	P	P	165	UF	P	P		—			ND	ND	<	2.9	J	UF	UF	P
106	R-9	684	1	31-Jul-06	4	<	2	U		P		0.86	J		P	P	167		P	P		1.7			P	Plm	<	2.1	J		P	P
107	R-9i	199	1	6-Feb-04	1		12.6		UF	Fail		23.3		UF	Fail	P	124	UF	P	P		0.449		UF	P	P		2.27	B	UF	UF	P
108	R-9i	199	1	2-Jun-04	2		11.6		UF	Fail		11.9		UF	Fail	P	125	UF	P	P		0.5		UF	P	P		11.4		UF	UF	P
109	R-9i	199	1	29-Apr-05	3		14.0		UF	Fail		21.3		UF	Fail	P	135	UF	P	P		—			ND	ND		6.1	J	UF	UF	P
110	R-9i	199	1	10-Aug-06	4		11.5			Fail		6.7			Fail	P	127		P	P		0.78			P	Fail		5.2			P	P
111	R-9i	279	2	6-Sep-01	1		10.7			Fail		22.3			Fail	P	86.6		P	P	<	0.003	U		Fail	Red	<	2.99	B		P	P
112	R-9i	279	2	29-Jul-02	2		9.1	B	UF	Fail		20		UF	Fail	P	85.3	UF	P	P		0.079	B	UF	Fail	Red		5.78		UF	UF	P
113	R-9i	279	2	6-Feb-04	3		4.7	B	UF	Fail		19.4		UF	Fail	P	84.9	UF	P	P		0.373		UF	P	P		1.42	B	UF	UF	P
114	R-9i	279	2	10-Aug-06	4		3.1			P	<	1	U	UF	P	P	71.3		P	P		0.93			P	Fail		660			NA	Fail
115	R-10	874	1	29-Jun-06	1	<	2.0	U	UF	P		0.97	J	UF	P	P	116	UF	P	P		1.38		UF	P	P		73.4		UF	NA	UF
116	R-10	874	1	12-Oct-06	2	<	2.0	U		P		0.94	J		P	P	108		P	P		1.3			P	P		14.8			NA	P
117	R-10	1042	2	11-Oct-05	1		1.2		UF	P	<	1	U	UF	P	P	98	UF	P	P		1.2		UF	P	P		74		UF	NA	UF
118	R-10	1042	2	29-Jun-06	2		2.2	J		P		0.58	J		P	P	123		P	P		1.4			P	P		13.1			P	P
119	R-10	1042	2	12-Oct-06	3	<	2.0	U		P		0.99	J		P	P	109		P	P		1.4			P	P		12.6			P	P
120	R-10a	690	1	7-Sep-05	1		2.1		UF	P	<	1	U	UF	P	P	200	UF	P	Fail		3.2		UF	P	Plm		160		UF	NA	UF
121	R-10a	690	1	30-Nov-05	2		3.2	J		P		2			P	P	241		P	Fail		4.6			P	Plm		111			NA	Fail
122	R-10a	690	1	1-Feb-06	3	<	2.0	U		P		1.4	J		P	P	244		P	Fail		4.6			P	Plm		42.2			NA	Fail
123	R-10a	690	1	17-Jul-06	4	<	2.0	U		P		0.89	J		P	P	229		P	Fail		4.1			P	Plm		18			NA	P
124	R-10a	690	1	12-Oct-06	5		2.4	J		P		1.4	J		P	P	222		P	Fail		3			P	Plm		14.8			NA	P
125	R-11	855	1	17-May-05	1		2			P	<	1	U		P	P	85.4		P	P		0.75			P	P	<	8.9	J		P	P
126	R-11	855	1	3-Aug-05	2		2			P		1	J		P	P	83.3		P	P		0.71			P	P	<	14.3			NA	P
127	R-11	855	1	8-Nov-05	3		2			P		1	J		P	P	83.1		P	P		0.72			P	P		16			NA	P
128	R-11	855	1	3-Feb-06	4	<	2.3	J		P		0.85	J		P	P	83.1		P	P		0.73			P	P		17.6			NA	P
129	R-11	855	1	20-Apr-06	5		—			ND		—			ND	ND	—		ND	ND		—			ND	ND		—			ND	ND
130	R-11	855	1	10-Jul-06	6	<	3.2	J		P		1.6	J		P	P	90.5		P	P		0.77			P	P		37			NA	P
131	R-11	855	1	10-Oct-06	7		2.4	J		P		1.2	J		P	P	82		P	P		0.75			P	P		17.7			NA	P
132	R-12	468	1	2-Feb-04	1		19.2		UF	Fail		4.97	B	UF	Fail	P	15.4	UF	Fail	P	<	0.157	B	UF	Plm	Red	<	3.85	B	UF	UF	P
133	R-12	468	1	2-Jun-04	2		15.7		UF	Fail	<	2.28	B	UF	Fail	P	17.4	UF	Fail	P		0.026	B	UF	Fail	Red	<	4.48	B	UF	UF	P
134	R-12	468	1	16-Jun-05	3		15.4			Fail		1.4	J		P	P	19.9		P	P	<	0.05	U		Fail	Red	<	9.2	J*		P	P
135	R-12	468	1	30-Jun-05	3		—			ND		—			ND	ND	—		ND	ND		—			ND	ND		—			ND	ND
136	R-12	468	1	2-Feb-06	4		16.6			Fail		1.5	J		P	P	14.9		Fail	P	<	0.065	J		Fail	Red	<	2	U		DL	P
137	R-12	468	1	11-Jul-06	5		16.2			Fail		1.3	J		P	P	15.2		Fail	P	<	0.05	U		Fail	Red		4.3	J		P	P
138	R-12	468	1	29-Sep-06	6		2.6	J		P		6.3			Fail	P	180		P	Fail		3.4			P	Fail		53.4			NA	Fail

Table C-6. Trace Metal Indicators

Row #	Well	Port depth (ft)	Scr #	Sample collection date (start)			Mo (F) ug/L	Lab Qual Code		Test C9		Ni (F) ug/L	Lab Qual Code		Test C8	Test F5	Sr ug/L		Test D1	Test E3		U ug/L	Lab Qual Code		Test C7, D2	Test E5		Zn ug/L	Lab Qual Code		Test D4	Test F6
										ug/L					ug/L	ug/L			ug/L	ug/L					ug/L	ug/L					ug/L	ug/L
										<UL					<UL	<UL			>LL	<UL					>LL	<UL					>LL	<UL
										4					2	50			44.88	179.8					0.2	1.52					1	40
										4					2	50			19.1	154.8					0.1	0.72					1	20
139	R-12	507	2	10-Sep-01	1		7.12			Fail	<	1.26	U		P	P	58.3		P	P		0.14	B		P	P	<	1.63	B		P	P
140	R-12	507	2	1-Aug-02	2		5.92	B	UF	Fail		7.19		UF	Fail	P	67.9	UF	P	P	<	15.6	U	UF	DL	DL	<	4.53	B		P	P
141	R-12	507	2	28-Jan-04	3		4	B	UF	P	<	0.69	U	UF	P	P	67.7	UF	P	P		0.56		UF	P	P	<	3.4	B		P	P
142	R-12	507	2	1-Feb-06	4		4.8	J		Fail		0.65	J		P	P	60		P	P		0.81			P	Fail		3.1	J		P	P
143	R-12	507	2	12-Jul-06	5		3.1	J		P	<	0.5	U		P	P	66.4		P	P		0.68			P	P	<	2.4	J		P	P
144	R-12	507	2	1-Oct-06	6	<	2	U		P		0.86	J		P	P	67.5		P	P		0.42			P	P		29.8			NA	Fail
145	R-12	811	3	27-Jan-04	1		5.9	B	UF	Fail		2.39	B	UF	Fail	P	209	UF	P	Fail		1.64	E	UF	P	Fail		7.4		UF	UF	P
146	R-12	811	3	3-Jun-04	2		5.0	B	UF	Fail	<	2.69	B	UF	Fail	P	213	UF	P	Fail		1.39		UF	P	P	<	3.11	B	UF	UF	P
147	R-12	811	3	20-Jun-05	3		6.8	J		Fail		1.3	J		P	P	208		P	Fail		1			P	P		5.9	J		P	P
148	R-12	811	3	31-Jan-06	4	<	6.7	J		Fail		1.4	J		P	P	198		P	Fail		1.2			P	P		14.8			NA	P
149	R-12	811	3	12-Jul-06	5		6.0	J		Fail		2.3			Fail	P	210		P	Fail		1.3			P	P	<	3.7	J		P	P
150	R-12	811	3	27-Sep-06	6	<	3.5	J		P		1.3	J		P	P	96.6		P	P		0.79			P	P		61.2			NA	Fail
151	R-12	811	3	18-Oct-06	7		2.4	J		P		0.76	J		P	P	126		P	P		1.4			P	P		54.5			NA	Fail
152	R-13	958	1	9-Dec-03	1	<	1.43	U	UF	P	<	1.29	B	UF	P	P	53.8	UF	P	P		0.463		UF	UF	P	<	1.46	B	UF	UF	P
153	R-13	958	1	11-Jun-04	2	<	1.43	U	UF	P	<	2.42	B	UF	Fail	P	51.1	UF	P	P		0.44		UF	UF	P		7.69		UF	UF	P
154	R-13	958	1	10-Mar-05	3		1.1		UF	P	<	1	U	UF	P	P	51	UF	P	P		0.3		UF	UF	P		4		UF	UF	P
155	R-13	958	1	26-May-05	3		—			ND		—			ND	ND	—		ND	ND		—			ND	ND		—			ND	ND
156	R-13	958	1	1-Sep-05	4		1.1		UF	P	<	1	U	UF	P	P	50	UF	P	P		0.4		UF	UF	P		38		UF	NA	P
157	R-13	958	1	2-Feb-06	5	<	2	U		P		0.56	J		P	P	50.4		P	P		0.53			P	P	<	2	U		DL	P
158	R-13	958	1	3-Jul-06	6	<	2	U		P	<	0.5	U		P	P	50.9		P	P		0.39			P	P	<	3	J		P	P
159	R-13	958	1	25-Oct-06	7	<	2	U		P		0.57	J		P	P	50.1		P	P		0.33			P	P		2.5	J		P	P
160	R-14	1205	1	12-Jul-04	1		1.4			P	<	0.69	U		P	P	61.2		P	P		0.459			P	P		3.77	B		P	P
161	R-14	1205	1	28-Oct-04	2		1.5			P	<	0.69	U		P	P	59.8		P	P		0.62			P	P		6.4			P	P
162	R-14	1205	1	11-May-05	3		1.4	*		P	<	1.5	J		P	P	60		P	P		0.63			P	P	<	2	U		DL	P
163	R-14	1205	1	24-Jan-06	4	<	2	U		P	<	0.59	J		P	P	57.2		P	P		0.65			P	P		4	J		P	P
164	R-14	1205	1	26-Jun-06	5	<	2	U		P		0.54	J		P	P	62.7		P	P		0.7			P	P	<	4.5	J		P	P
165	R-14	1205	1	23-Oct-06	6	<	2	U		P	<	0.5	U		P	P	62		P	P		0.69			P	P		2.5	J		P	P
166	R-14	1289	2	14-Jul-04	1		2.86			P	<	2.6	B		Fail	P	68.2		P	P		0.038	B		Fail	Red		6.05			P	P
167	R-14	1289	2	3-Nov-04	2		4.2			Fail	<	2.7	J		Fail	P	98.4		P	P	<	0.02	U		Fail	Red		3.7	J		P	P
168	R-14	1289	2	12-May-05	3		3.7			P		2	J		P	P	79.7		P	P		0.053	J		Fail	Red		5.3	J		P	P
169	R-14	1289	2	25-Jan-06	4	<	2	U		P	<	0.5	U		P	P	95.3		P	P	<	0.05	U		Fail	Red	<	5.4	J		P	P
170	R-14	1289	2	28-Jun-06	5	<	2	U		P	<	1	U		P	P	76.1		P	P	<	0.2	U		Fail	Red		6.04			P	P
171	R-14	1289	2	23-Oct-06	6		2.7			P		1.8			P	P	97.6		P	P	<	0.2	U		Fail	Red		6.7			P	P
172	R-15	959	1	10-Jun-04	1	<	2.66	B	UF	P	<	4.56	B	UF	Fail	P	64.5	UF	P	P		0.422		UF	UF	P	<	0.883	U	UF	Fail	P
173	R-15	959	1	25-May-05	2	<	1			P	<	1.9	J		P	P	63.1		P	P		—			ND	ND	<	2	U		DL	P
174	R-15	959	1	31-Aug-05	3	<	2	U		P		1	J		P	P	63.7		P	P		0.45			P	P		9.1	J		P	P
175	R-15	959	1	30-Jan-06	4	<	2	U		P		0.79	J		P	P	63.8		P	P		0.42			P	P	<	2	U		DL	P
176	R-15	959	1	3-Jul-06	5	<	2	U		P		0.54	J		P	P	62.7		P	P		0.39			P	P	<	3.2	J		P	P
177	R-15	959	1	24-Oct-06	6	<	2	U		P	<	0.5	U		P	P	59.1		P	P		0.33			P	P	<	3.2	J*		P	P
178	R-16	866	2	13-Oct-04	1		1.4			P	<	0.69	U		P	P	56.4		P	P		0.22			P	P	<	2.9	J		P	P
179	R-16	866	2	2-Dec-04	2		2.6	*		P		1.2	J		P	P	189		P	Fail		0.42			P	P	<	0.883	U		Fail	P
180	R-16	866	2	13-Jun-05	3		2.6	J		P	<	0.5	U		P	P	179		P	P		0.39			P	P		6.1	J		P	P
181	R-16	866	2	13-Jul-06	4		2			P	<	1	U		P	P	165.6		P	P		0.26			P	P	<	1	U		Fail	P
182	R-16	866	2	20-Jul-06	5		3.2	J		P	<	0.5	U		P	P	180		P	Fail		0.87			P	P		4.2	J		P	P
183	R-16	866	2	11-Aug-06	6	<	2	U		P		0.54	J		P	P	174		P	P		1.2			P	P		49.2			NA	Fail
184	R-16	866	2	14-Aug-06	7		1.1			P	<	1	U		P	P	164		P	P		1.04			P	P		48.2			NA	Fail

Table C-6. Trace Metal Indicators

Row #	Well	Port depth (ft)	Scr #	Sample collection date (start)			Mo (F) ug/L	Lab Qual Code		Test C9		Ni (F) ug/L	Lab Qual Code		Test C8	Test F5	Sr ug/L		Test D1	Test E3		U ug/L	Lab Qual Code		Test C7, D2	Test E5		Zn ug/L	Lab Qual Code		Test D4	Test F6
										ug/L					ug/L	ug/L			ug/L	ug/L					ug/L	ug/L					ug/L	ug/L
										<UL					<UL	<UL			>LL	<UL					>LL	<UL					>LL	<UL
										4					2	50			44.88	179.8					0.2	1.52					1	40
										4					2	50			19.1	154.8					0.1	0.72					1	20
185	R-16	866	2	10-Oct-06	8	<	4.5	J		Fail		0.98	J		P	P	186		P	Fail		1			P	P		31.1			NA	P
186	R-16	866	2	14-Nov-06	9		2.3			P		1.1			P	P	173.8		P	P		0.71			P	P		44.3			NA	Fail
187	R-16	866	2	4-Dec-06	10		2.3			P		1.1			P	P	169.2		P	P		0.61			P	P		48.7			NA	Fail
188	R-16	1018	3	14-Oct-04	1		1.6			P	<	0.69	U		P	P	316		P	Fail		3.1			P	Fail		12.5			P	P
189	R-16	1018	3	3-Dec-04	2		1.9			P	<	1.8	J		P	P	316		P	Fail		3.6			P	Fail		11			P	P
190	R-16	1018	3	13-Jun-05	3	<	2	U		P	<	1.1	J*		P	P	277		P	Fail		2.5			P	Fail		12.5			P	P
191	R-16	1018	3	12-Jul-06	4	<	2	U		P		2.7			Fail	P	291		P	Fail		2.2			P	Fail		26.6			NA	P
192	R-16	1018	3	20-Jul-06	5		—			ND		—			ND	ND	—		ND	ND		—			ND	ND		—			ND	ND
193	R-16	1018	3	10-Aug-06	6	<	2	U		P		0.83	J		P	P	227		P	Fail		1.9			P	Fail		84.5			NA	Fail
194	R-16	1018	3	11-Aug-06	7		1.3			P		—			ND	ND	212		P	Fail		1.7			P	Fail		80.45			NA	Fail
195	R-16	1018	3	12-Oct-06	8		3.3	J		P		1.6	J		P	P	235		P	Fail		1.6			P	Fail		28.7			NA	P
196	R-16	1018	3	14-Nov-06	9		1.6			P		2.4			Fail	P	229		P	Fail		1.68			P	Fail		21.6			NA	P
197	R-16	1018	3	5-Dec-06	10		1.5			P	<	1	U		P	P	238		P	Fail		1.69			P	Fail		24.9			NA	P
198	R-16	1238	4	15-Oct-04	1		15.2			Fail		7.1			Fail	P	570		P	Fail		0.17			Fail	Red		1.7	J*		P	P
199	R-16	1238	4	7-Dec-04	2		14.6			Fail		6.3			Fail	P	599		P	Fail		0.24			P	P		8.3			P	P
200	R-16	1238	4	14-Jun-05	3		14.2			Fail		7.2	*		Fail	P	475		P	Fail		0.16			Fail	Red	<	5.6	J		P	P
201	R-16	1238	4	13-Jul-06	4		17.3			Fail		7.1			Fail	P	367		P	Fail	<	0.2	U		Fail	Red		3.59			P	P
202	R-16	1238	4	20-Jul-06	5		15.7			Fail		6.1			Fail	P	385		P	Fail	<	0.05	U		Fail	Red		2.5	J		P	P
203	R-16	1238	4	9-Aug-06	6	<	2.0	U		P		2.1			Fail	P	226		P	Fail		1.7			P	Fail		199			NA	Fail
204	R-16	1238	4	11-Oct-06	7	<	8.6	J		Fail		1.1	J		P	P	260		P	Fail		0.3			P	P		47.1			NA	Fail
205	R-16	1238	4	14-Nov-06	8		8.6			Fail		2			P	P	281.5		P	Fail	<	0.2	U		Fail	Red		17.4			NA	P
206	R-16	1238	4	5-Dec-06	9		8.3			Fail		1.2			P	P	291.6		P	Fail	<	0.2	U		Fail	Red		16.7			NA	P
207	R-16r	600	1	26-Sep-05	1		51.0		UF	Fail		1.9		UF	P	P	150	UF	P	P		0.6		UF	P	P		18		UF	NA	P
208	R-16r	600	1	17-Oct-05	2		2.5		UF	P	<	1	U	UF	P	P	170	UF	P	P		1.2		UF	P	P		57		UF	NA	UF
209	R-16r	600	1	19-Dec-05	3		5.6	J		Fail	<	2.5	U		DL	P	192		P	Fail		1.5			P	P	<	5.5	J		P	P
210	R-16r	600	1	8-Mar-06	4		3.5	J		P		1.5	J		P	P	189		P	Fail		1.2			P	P	<	7.1	J		P	P
211	R-16r	600	1	24-May-06	5		2.7	J		P		1.6	J		P	P	192		P	Fail		1.2			P	P	<	9.3	J		P	P
212	R-16r	600	1	17-Aug-06	6		2.1	J		P		9.5			I-Err	I-Err	160		P	P		1.4			P	P	<	7.6	J		P	P
213	R-16r	600	1	1-Nov-06	7	<	2.0	U		P		2.1			Fail	P	196		P	Fail		1.2			P	P		12.7			P	P
214	R-17	1057	1	24-Feb-06	1		1.3		UF	P	<	1	U	UF	P	P	42	UF	Fail	P		0.4		UF	UF	P		220		UF	NA	UF
215	R-17	1057	1	19-Oct-06	2	<	2.0	U		P		1.4	J		P	P	49.8		P	P		0.46			P	P		94.7			NA	Fail
216	R-17	1124	2	17-Oct-06	1	<	2.0	U		P		5.4			Fail	P	44.2		Fail	P		0.46			P	P		96.2			NA	Fail
217	R-18	1358	1	25-Aug-05	1		0.53			P	<	1	U		P	P	47.1		P	P		0.42			P	P	<	5.4	J		P	P
218	R-18	1358	1	1-Dec-05	2	<	0.49	J		P	<	1	U		P	P	46.7		P	P		0.38			P	P	<	2	U		DL	P
219	R-18	1358	1	7-Mar-06	3	<	2	U		P	<	0.5	U		P	P	50.3		P	P		0.41			P	P		12.3			P	P
220	R-18	1358	1	16-May-06	4	<	2	U		P	<	0.5	U		P	P	46.8		P	P	<	0.47			P	P		2.5	J		P	P
221	R-18	1358	1	15-Aug-06	5	<	2	U		P		0.75	J		P	P	48		P	P		0.51			P	P	<	4	J		P	P
222	R-18	1358	1	18-Dec-06	6	<	2	U		P	<	2.5	U		DL	P	46.8		P	P		0.41			P	P		2.1	J		P	P
223	R-19	909	2	15-Dec-03	1	<	1.43	U	UF	P	<	2.92	B	UF	Fail	P	77.2	UF	P	P		0.243		UF	P	P	<	7.64		UF	UF	P
224	R-19	909	2	10-Jun-04	2	<	2.11	B	UF	P	<	1.68	B	UF	P	P	74.1	UF	P	P		0.273		UF	P	P	<	0.883	U	UF	Fail	P
225	R-19	909	2	21-Jul-05	3		2.1	J		P	<	0.5	U		P	P	64.9		P	P		0.25			P	P	<	17.2			NA	P
226	R-19	909	2	18-Aug-06	4		1.2			P	<	1	U		P	P	63.4		P	P		0.25			P	P		1.9			P	P
227	R-19	909	2	11-Dec-06	5		1.3			P		—			ND	ND	62		P	P		—			ND	ND		5.4			P	P
228	R-19	1191	3	15-Dec-03	1	<	1.43	B	UF	P		1.37	B	UF	P	P	53.6	UF	P	P		0.302		UF	UF	P		2.25	B	UF	UF	P
229	R-19	1191	3	14-Jun-04	2	<	1.62	U	UF	P	<	3.66	B	UF	Fail	P	51.5	UF	P	P		0.278		UF	UF	P	<	0.883	U	UF	Fail	P
230	R-19	1191	3	21-Jul-05	3	<	2	U		P		1.2	J		P	P	51.8		P	P		0.26			P	P	<	8.4	J		P	P

Table C-6. Trace Metal Indicators

Row #	Well	Port depth (ft)	Scr #	Sample collection date (start)			Mo (F) ug/L	Lab Qual Code		Test C9		Ni (F) ug/L	Lab Qual Code		Test C8	Test F5	Sr ug/L		Test D1	Test E3		U ug/L	Lab Qual Code		Test C7, D2	Test E5		Zn ug/L	Lab Qual Code		Test D4	Test F6
										ug/L					ug/L	ug/L			ug/L	ug/L					ug/L	ug/L					ug/L	ug/L
										<UL					<UL	<UL			>LL	<UL					>LL	<UL					>LL	<UL
										4					2	50			44.88	179.8					0.2	1.52					1	40
										4					2	50			19.1	154.8					0.1	0.72					1	20
231	R-19	1191	3	15-Aug-06	4		1.1			P	<	1	U		P	P	48.8		P	P		0.28			P	P		3.9			P	P
232	R-19	1191	3	16-Aug-06	4		1.1			P	<	1	U		P	P	48.8		P	P		0.28			P	P		3.9			P	P
233	R-19	1191	3	11-Dec-06	5	<	1	U		P		—			ND	ND	48.3		P	P		—			ND	ND		6.9			P	P
234	R-19	1413	4	16-Dec-03	1	<	1.43	B	UF	P		3.71	B	UF	Fail	P	45.6	UF	P	P		0.316		UF	UF	P		5.34		UF	UF	P
235	R-19	1413	4	15-Jun-04	2	<	1.65	U	UF	P		1.22	B	UF	P	P	45.7	UF	P	P		0.353		UF	UF	P	<	3.89	B	UF	UF	P
236	R-19	1413	4	28-Jul-05	3	<	2			P		1	J		P	P	45.3		P	P		0.36			P	P		8.8	J		P	P
237	R-19	1413	4	16-Aug-06	4	<	2	U		P		1.5	J		P	P	40.2		Fail	P		0.35			P	P	<	9.1	J		P	P
238	R-19	1413	4	17-Aug-06	4	<	1	U		P	<	1	U		P	P	41.2		Fail	P		0.29			P	P		4.6			P	P
239	R-19	1413	4	12-Dec-06	5	<	2	U		P	<	0.5	U		P	P	44.4		Fail	P		0.35			P	P		5.3			P	P
240	R-19	1586	5	20-Sep-01	1		9.6			Fail		1.54	B		P	P	717		P	Fail	<	0.003	UE		Fail	Red		3.64	B		P	P
241	R-19	1586	5	23-Aug-02	2	<	8.0	B	UF	Fail		6.77		UF	Fail	P	642	UF	P	Fail	<	15.6	U	UF	DL	DL		11.6		UF	UF	P
242	R-19	1586	5	16-Dec-03	3		4.2	B	UF	Fail		6.18		UF	Fail	P	517	UF	P	Fail		0.066	B	UF	Fail	Red		7.59		UF	UF	P
243	R-19	1586	5	17-Aug-06	4		3.2			P		4.6			Fail	P	352.2		P	Fail	<	0.2	U		Fail	Red		103			NA	Fail
244	R-19	1586	5	11-Dec-06	5		3			P		—			ND	ND	353		P	Fail		—			ND	ND		10.7			P	P
245	R-19	1730	6	21-Sep-01	1		5.2			Fail	<	1.26	U		P	P	28		Fail	P	<	0.2			Fail	Red		5.99			P	P
246	R-19	1730	6	27-Aug-02	2	<	3.81	B	UF	P	<	0.69	U	UF	P	P	25	UF	Fail	P	<	15.6	UE	UF	DL	DL		11.3		UF	UF	P
247	R-19	1730	6	16-Dec-03	3		2.1	B	UF	P		2.73	B	UF	Fail	P	23.6	UF	Fail	P		0.02	B	UF	Fail	Red		8.49		UF	UF	P
248	R-19	1730	6	17-Aug-06	4		1.9			P	<	1	U		P	P	28.7		Fail	P	<	0.2	U		Fail	Red		25.3			NA	P
249	R-19	1730	6	11-Dec-06	5		2			P		—			ND	ND	23.9		Fail	P		—			ND	ND		12.9			P	P
250	R-19	1835	7	26-Aug-02	1		35.1		UF	Fail	<	3.13	B	UF	Fail	P	32.8	UF	Fail	P	<	15.6	U	UF	DL	DL		53.2		UF	NA	UF
251	R-19	1835	7	17-Dec-03	1		20.2		UF	Fail		4.9	B	UF	Fail	P	34.7	UF	Fail	P		1.89		UF	P	Fail		26.1		UF	NA	P
252	R-19	1835	7	16-Jun-04	2		16.6		UF	Fail		3.74	B	UF	Fail	P	29.5	UF	Fail	P		1.88		UF	P	Fail		22		UF	NA	P
253	R-19	1835	7	28-Jul-05	3		13.6			Fail		1.6	J		P	P	18		Fail	P		0.8			P	P	<	7.5	J		P	P
254	R-19	1835	7	18-Aug-06	4		13.3			Fail		2.2			Fail	P	20.8		Fail	P		0.8			P	P		54.5			NA	Fail
255	R-19	1835	7	13-Dec-06	5		13.6			Fail		—			ND	ND	20.8		Fail	P		—			ND	ND		7.5			P	P
256	R-20	907	1	20-Sep-04	1		12.9			Fail	<	0.69	U		P	P	38.7		Fail	P		0.16	J		Fail	Red	<	4.6	J		P	P
257	R-20	907	1	4-Nov-04	2		8.0			Fail	<	0.69	U		P	P	38.4		Fail	P		0.095	J		Fail	Red	<	3.2	J		P	P
258	R-20	907	1	20-Jul-05	3		9.5	J		Fail		0.7	J		P	P	41.4		Fail	P		0.16	J		Fail	Red	<	5.5	J		P	P
259	R-20	907	1	6-Jun-06	4		5.4	J		Fail		0.57	J		P	P	43.2		Fail	P	<	0.21			P	P	<	7.5	J		P	P
260	R-20	907	1	6-Jul-06	5		4.3	J		Fail		2.7			Fail	P	76.2		P	P		1.4			P	P		326			NA	Fail
261	R-20	907	1	2-Oct-06	6		3			P		7.4			Fail	P	63.7		P	P		1.05			P	P		498			NA	Fail
262	R-20	907	1	17-Oct-06	7		—			ND		—			ND	ND	—		ND	ND		—			ND	ND		—			ND	ND
263	R-20	1150	2	3-Sep-04	1		2			P	<	4	J		Fail	P	1730		P	Fail		0.062	J		Fail	Red	<	0.883	U		Fail	P
264	R-20	1150	2	8-Nov-04	2		4.7	*		Fail	<	2.2	J		Fail	P	2010		P	Fail		0.058	J		Fail	Red	<	9.2			P	P
265	R-20	1150	2	19-Jul-05	3		7.4	J		Fail	<	4.1			Fail	P	2070		P	Fail		0.11	J		Fail	Red	<	5.4	J		P	P
266	R-20	1150	2	7-Jun-06	4		8.0	J		Fail		3			Fail	P	1730		P	Fail	<	0.098	J		Fail	Red	<	5.6	J		P	P
267	R-20	1150	2	8-Jul-06	5	<	2.0	J		P		0.81	J		P	P	139		P	P		1.2			P	P		313			NA	Fail
268	R-20	1330	3	7-Sep-04	1		19.0			Fail	<	4	J		Fail	P	117		P	P	<	0.02	U		Fail	Red		3	J		P	P
269	R-20	1330	3	9-Nov-04	2		15.4	*		Fail		2	J		P	P	109		P	P	<	0.02	U		Fail	Red	<	7.4			P	P
270	R-20	1330	3	18-Jul-05	3		17.0			Fail		1.8	J		P	P	105		P	P	<	0.05	U		Fail	Red		11.5			P	P
271	R-20	1330	3	8-Jun-06	4		7.9	J		Fail		1.1	J		P	P	92.6		P	P	<	0.05	U		Fail	Red	<	10.6			P	P
272	R-20	1330	3	7-Jul-06	5	<	2.0	U		P		4.5			Fail	P	98.4		P	P		0.25			P	P		576			NA	Fail
273	R-20	1330	3	21-Jul-06	6	<	2.0	U		P		1.4	J		P	P	44.1		Fail	P		0.11	J		Fail	Red		618			NA	Fail
274	R-20	1330	3	13-Oct-06	7		1.4			P		1.3			P	P	49.3		P	P	<	0.2	U		Fail	Red		706			NA	Fail
275	R-21	889	1	23-Sep-04	1		2.2			P		1.8	J		P	P	45.8		P	P		0.36			P	P	<	2.8	J		P	P
276	R-21	889	1	14-Dec-04	2		2.1			P	<	0.69	U		P	P	45.6		P	P		0.36			P	P		7.4			P	P

Table C-6. Trace Metal Indicators

Row #	Well	Port depth (ft)	Scr #	Sample collection date (start)			Mo (F) ug/L	Lab Qual Code		Test C9		Ni (F) ug/L	Lab Qual Code		Test C8	Test F5	Sr ug/L		Test D1	Test E3		U ug/L	Lab Qual Code		Test C7, D2	Test E5		Zn ug/L	Lab Qual Code		Test D4	Test F6
										ug/L					ug/L	ug/L			ug/L	ug/L					ug/L	ug/L					ug/L	ug/L
										<UL					<UL	<UL			>LL	<UL					>LL	<UL					>LL	<UL
										4					2	50			44.88	179.8					0.2	1.52					1	40
										4					2	50			19.1	154.8					0.1	0.72					1	20
277	R-21	889	1	6-Jun-05	3		3.1	J		P		0.57			P	P	45.4		P	P		0.34			P	P		2.9	J		P	P
278	R-21	889	1	7-Jul-06	4		3.5	J		P		0.59	J		P	P	44		Fail	P		0.4			P	P	<	3	J		P	P
279	R-21	889	1	6-Nov-06	5		3	J		P		0.57	J		P	P	45.6		P	P		0.36			P	P	<	2.7	J		P	P
280	R-22	907	1	18-Nov-03	1		19.5		UF	Fail		30.7		UF	Fail	P	394	UF	P	Fail		0.117	B	UF	Fail	Red	<	6.65		UF	UF	P
281	R-22	907	1	21-Jun-04	2		20.3		UF	Fail		26.1		UF	Fail	P	390	UF	P	Fail		0.197	B	UF	Fail	Red		6.55		UF	UF	P
282	R-22	907	1	27-Jun-05	3		18.2			Fail		24.8			Fail	P	366		P	Fail		0.14	J		Fail	Red	<	6.9	J		P	P
283	R-22	907	1	22-Aug-06	4		14.1			Fail		37			Fail	P	382		P	Fail	<	0.2	U		Fail	Red		14.6			NA	P
284	R-22	907	1	7-Dec-06	5		13.5			Fail		57			Fail	Fail	403		P	Fail	<	0.2	U		Fail	Red		29.4			NA	P
285	R-22	963	2	19-Nov-03	1	<	1.43	U	UF	P		0.835	B	UF	P	P	49.3	UF	P	P		0.395		UF	UF	P	<	2.48		UF	UF	P
286	R-22	963	2	22-Jun-04	2		1.81	B	UF	P	<	0.69	U	UF	P	P	49.3	UF	P	P		0.352		UF	UF	P	<	1.73	B	UF	UF	P
287	R-22	963	2	28-Jun-05	3	<	2	U		P	<	0.5	U		P	P	48.7		P	P		0.31			P	P	<	4.1	J		P	P
288	R-22	963	2	28-Aug-06	4	<	2	U		P		3.7			Fail	P	50		P	P		0.37			P	P		4.3	J		P	P
289	R-22	963	2	7-Dec-06	5	<	2	U		P	<	0.5	U		P	P	53.1		P	P		0.33			P	P	<	4.1	J		P	P
290	R-22	1274	3	9-Jul-02	1		8.3	B	UF	Fail		2.79	B*	UF	Fail	P	525	UF	P	Fail		—			ND	ND		4.94	B	UF	UF	P
291	R-22	1274	3	20-Nov-03	2		4.5	B	UF	Fail		6.94		UF	Fail	P	449	UF	P	Fail		2.03		UF	P	Fail		17.8		UF	NA	P
292	R-22	1274	3	23-Jun-04	3		3.24	B	UF	P	<	0.69	U	UF	P	P	465	UF	P	Fail		1.16		UF	P	P	<	1.98	B	UF	UF	P
293	R-22	1274	3	29-Jun-05	4		4.1	J		Fail		0.99	J		P	P	621		P	Fail		2.8			P	Fail		2.8	J		P	P
294	R-22	1274	3	22-Aug-06	5		3.4	J		P		1.3	J		P	P	606		P	Fail		3.1			P	Fail		2.8	J		P	P
295	R-22	1274	3	8-Dec-06	6	<	2	U		P		1.3	J		P	P	616		P	Fail		2.6			P	Fail	<	5.5	J		P	P
296	R-22	1378	4	11-Jul-02	1		8.9	B	UF	Fail		3.28	B*	UF	Fail	P	943	UF	P	Fail		—			ND	ND		4.47	B	UF	UF	P
297	R-22	1378	4	20-Nov-03	2		5.1	B	UF	Fail		7.01		UF	Fail	P	836	UF	P	Fail		0.18	B	UF	Fail	Red	<	3.51	B	UF	UF	P
298	R-22	1378	4	23-Jun-04	3		2.68	B	UF	P		3.69	B	UF	Fail	P	691	UF	P	Fail	<	0.103	B	UF	Fail	Red	<	3.4	B	UF	UF	P
299	R-22	1378	4	1-Jul-05	4		6.1	J		Fail		2.6			Fail	P	649		P	Fail		0.13	J		Fail	Red		12.3			P	P
300	R-22	1378	4	22-Aug-06	5		2.7			P		2.4			Fail	P	504		P	Fail	<	0.2	U		Fail	Red		14.3			NA	P
301	R-22	1378	4	8-Dec-06	6		2.7			P		—			ND	ND	665		P	Fail		—			ND	ND		11.1			P	P
302	R-22	1448	5	10-Jul-02	1		25.2		UF	Fail		2.1	B*	UF	Fail	P	280	UF	P	Fail		—			ND	ND		5.29		UF	UF	P
303	R-22	1448	5	21-Nov-03	2		18.5		UF	Fail	<	4.14	B	UF	Fail	P	281	UF	P	Fail		0.127	B	UF	Fail	Red		1.12	B	UF	UF	P
304	R-22	1448	5	5-Jul-05	3		12.1			Fail		2.5	*		Fail	P	249		P	Fail		0.16	J		Fail	Red	<	2	U		DL	P
305	R-22	1448	5	21-Aug-06	4		10.0			Fail		3.7			Fail	P	264.5		P	Fail	<	0.2	U		Fail	Red		50			NA	Fail
306	R-22	1448	5	7-Dec-06	5		8.6			Fail		9.4			Fail	P	228		P	Fail	<	0.2	U		Fail	Red		6.7			P	P
307	R-23	816	1	29-Jun-04	1		1.66			P	<	0.69	U		P	P	85.2		P	P		0.651			P	P		12			P	P
308	R-23	816	1	24-Sep-04	2		1.4			P	<	1.7	J		P	P	83.8		P	P		0.55			P	P	<	5.5			P	P
309	R-23	816	1	14-Jul-05	3	<	2	U		P		1.4	J		P	P	81.9		P	P		0.49			P	P		18.4			NA	P
310	R-23	816	1	15-Aug-06	4	<	2	U		P	<	0.5	U		P	P	79.9		P	P		0.51			P	P		2.5	J		P	P
311	R-23	816	1	18-Dec-06	5	<	2	U		P	<	2.5	U		DL	P	73.6		P	P		0.47			P	P		2.2	J		P	P
312	R-23i	470	2	20-Dec-05	1		2.1		UF	P		1.1		UF	P	P	86	UF	P	P		0.9		UF	P	Fail		130		UF	NA	UF
313	R-23i	470	2	3-Oct-06	2		3.1	J		P	<	2.5	U		DL	P	90.3		P	P		1			P	Fail		31.3			NA	Fail
314	R-23i	524	3	11-Dec-05	1		1.9		UF	P	<	1	U	UF	P	P	88	UF	P	P		0.8		UF	P	Fail		99		UF	NA	UF
315	R-23i	524	3	11-Oct-06	2		2.5	J		P		2.5			Fail	P	106		P	P		1.1			P	Fail		4.2	J		P	P
316	R-24	825	1	20-Sep-05	1		2.2		UF	P	<	1	U	UF	P	P	100	UF	P	P		1.1		UF	P	P		460		UF	NA	UF
317	R-24	825	1	15-Nov-05	2		6.5	J		Fail		0.92	J		P	P	103		P	P		2.9			P	Fail		24.3			NA	P
318	R-24	825	1	6-Mar-06	3		6.2	J		Fail		1.3	J		P	P	106		P	P		3.4	N		P	Fail	<	14.2	*		NA	P
319	R-24	825	1	10-May-06	4		7.4	J		Fail		1.1	J		P	P	116		P	P		2.1			P	Fail		13.6			P	P
320	R-24	825	1	27-Jul-06	5		5	J		Fail		1.7	J		P	P	117		P	P		2.1			P	Fail		30.7			NA	P
321	R-25	755	1	7-Aug-02	1		3.09	B	UF	P		812		UF	Fail	Fail	112	UF	P	P	<	15.6	U	UF	DL	DL	<	8.86		UF	UF	P
322	R-25	755	1	11-Dec-03	1	<	1.97	B	UF	P		1060		UF	Fail	Fail	102	UF	P	P		0.672		UF	P	P	<	9.48		UF	UF	P

Table C-6. Trace Metal Indicators

Row #	Well	Port depth (ft)	Scr #	Sample collection date (start)			Mo (F) ug/L	Lab Qual Code		Test C9		Ni (F) ug/L	Lab Qual Code		Test C8	Test F5	Sr ug/L		Test D1	Test E3		U ug/L	Lab Qual Code		Test C7, D2	Test E5		Zn ug/L	Lab Qual Code		Test D4	Test F6
										ug/L					ug/L	ug/L			ug/L	ug/L					ug/L	ug/L					ug/L	ug/L
										<UL					<UL	<UL			>LL	<UL					>LL	<UL					>LL	<UL
										4					2	50			44.88	179.8					0.2	1.52					1	40
										4					2	50			19.1	154.8					0.1	0.72					1	20
323	R-25	755	1	1-Sep-04	2	<	2.5	J	UF	P		1720		UF	Fail	Fail	90.9	UF	P	P		0.42		UF	P	P		17.6		UF	NA	P
324	R-25	755	1	2-Aug-05	3	<	2	U		P		723			Fail	Fail	109		P	P		0.74			P	Fail	<	12.6	*		P	P
325	R-25	892	2	5-Feb-02	1		—			ND		—			ND	ND	—		ND	ND		—			ND	ND		—			ND	ND
326	R-25	892	2	8-Aug-02	1		20.5		UF	Fail		10.3		UF	Fail	P	39.4	UF	P	P	<	15.6	U	UF	DL	DL		9.55		UF	UF	P
327	R-25	892	2	10-Dec-03	2		16.7		UF	Fail		126		UF	Fail	Fail	42.8	UF	P	P		0.223		UF	P	P	<	7.62		UF	UF	P
328	R-25	892	2	3-Aug-05	3		7.1	J		Fail		520			Fail	Fail	57.2		P	P	<	0.05	U		Fail	Red	<	9.5	J		P	P
329	R-25	1192	4	8-Aug-02	1	<	1.43	U	UF	P		3.59	B	UF	Fail	P	133	UF	P	P	<	15.6	U	UF	DL	DL		8.62		UF	UF	P
330	R-25	1192	4	10-Dec-03	2	<	1.43	U	UF	P	<	0.65	B	UF	P	P	108	UF	P	P		0.703		UF	P	P	<	9.27		UF	UF	P
331	R-25	1192	4	4-Aug-05	3	<	2	U		P		2.7			Fail	P	281		P	Fail		0.72			P	P	<	7.8	J		P	P
332	R-25	1303	5	9-Aug-02	1		23.8		UF	Fail		91.6		UF	Fail	Fail	157	UF	P	P	<	15.6	U	UF	DL	DL		46.3		UF	NA	UF
333	R-25	1303	5	9-Dec-03	1		9.7	B	UF	Fail		10.4		UF	Fail	P	220	UF	P	Fail		0.046	B	UF	Fail	Red	<	4.89	B	UF	UF	P
334	R-25	1303	5	31-Aug-04	2		9.7	B	UF	Fail		2.9	B	UF	Fail	P	202	UF	P	Fail		—			ND	ND		8.4		UF	UF	P
335	R-25	1303	5	9-Aug-05	3		7.0	J		Fail		4.4			Fail	P	135		P	P		0.07	J		Fail	Red	<	5.2	J		P	P
336	R-25	1406	6	8-Feb-02	1		1.64			P		5	U		DL	P	127		P	P		0.73			P	P		3.42	B		P	P
337	R-25	1406	6	12-Aug-02	2		5.2	B	UF	Fail		21.2		UF	Fail	P	123	UF	P	P	<	15.6	U	UF	DL	DL		14.8		UF	NA	P
338	R-25	1406	6	9-Dec-03	3	<	2.31	B	UF	P	<	6.71		UF	Fail	P	118	UF	P	P		0.727		UF	P	P	<	5.17		UF	UF	P
339	R-25	1606	7	11-Feb-02	1		1.68			P	<	5	U		DL	P	65.4		P	P		0.39			P	P		15.1			NA	P
340	R-25	1606	7	12-Aug-02	2		2.12	B	UF	P		4.47	B	UF	Fail	P	66.5	UF	P	P	<	15.6	U	UF	DL	DL		7.21		UF	UF	P
341	R-25	1606	7	8-Dec-03	3		1.52	B	UF	P	<	0.69	U	UF	P	P	66.6	UF	P	P		0.385		UF	UF	P	<	8.48		UF	UF	P
342	R-25	1796	8	14-Aug-02	1	<	1.43	U	UF	P	<	0.69	U	UF	P	P	101	UF	P	P	<	15.6	U	UF	DL	DL		10.5		UF	UF	P
343	R-25	1796	8	4-Dec-03	2	<	1.43	U	UF	P	<	0.69	U	UF	P	P	105	UF	P	P		0.51		UF	UF	P		17.7		UF	NA	P
344	R-25	1796	8	10-Aug-05	3	<	2	U		P		1.3	J		P	P	99.1		P	P		0.42			P	P	<	13.2			P	P
345	R-26	659	1	13-Apr-05	1		0.92			P	<	1.4	J		P	P	45.6		P	P		0.36			P	P		2.5	J		P	P
346	R-26	659	1	27-Jul-05	2		0.92			P		1	U		P	P	44.8		P	P		0.34			P	P	<	3.9	J		P	P
347	R-26	659	1	2-Nov-05	3	<	0.99			P	<	1	U		P	P	45		P	P		0.32			P	P		2.4	J		P	P
348	R-26	659	1	22-Feb-06	4	<	2	U		P	<	0.5	U		P	P	46.6		P	P		0.33			P	P	<	2	U		DL	P
349	R-27	852	1	11-Oct-05	1		1.9		UF	P	<	1	U	UF	P	P	40	UF	Fail	P		0.3		UF	UF	P		57		UF	NA	UF
350	R-27	852	1	21-Oct-05	1		2.9		UF	P		1.7		UF	P	P	48	UF	P	P		0.3		UF	UF	P		94		UF	NA	UF
351	R-27	852	1	14-Nov-05	2		1.1		UF	P	<	1	U	UF	P	P	47	UF	P	P		0.5		UF	UF	P		53		UF	NA	UF
352	R-27	852	1	1-Jul-06	3	<	2	U		P	<	0.5	U		P	P	47.9		P	P		0.47			P	P		65.5			NA	Fail
353	R-28	934	1	20-May-05	1		0.87			P	<	6.3			Fail	P	134		P	P		1.1			P	P		11			P	P
354	R-28	934	1	1-Sep-05	2	<	2	U		P		7.4			Fail	P	137		P	P		1			P	P	<	13.6			P	P
355	R-28	934	1	10-Nov-05	3	<	0.78			P	<	7.4			Fail	P	140		P	P		1.1			P	P		3.1	J		P	P
356	R-28	934	1	26-Jan-06	4	<	2	U		P		8.1			Fail	P	143		P	P		0.96			P	P	<	9.1	J		P	P
357	R-28	934	1	19-Apr-06	5		—			ND		—			ND	ND	—		ND	ND		—			ND	ND		—			ND	ND
358	R-28	934	1	5-Jul-06	6		2.2	J		P		6.1			Fail	P	156		P	P		0.99			P	P	<	6.9	J		P	P
359	R-28	934	1	26-Oct-06	7	<	2	U		P		7.2			Fail	P	147		P	P		0.86			P	P		3.6	J		P	P
360	R-31	532	2	18-Mar-04	1		52.8			Fail		6.39			Fail	P	310		P	Fail		1			P	P		2.53	J		P	P
361	R-31	532	2	17-Aug-05	2		52.4			Fail		7.2			Fail	P	279		P	Fail		1.1			P	P	<	8.2	J		P	P
362	R-31	532	2	28-Nov-06	3		54.2			Fail		7.4			Fail	P	275		P	Fail		0.95			P	P		5.8	J		P	P
363	R-31	670	3	19-Aug-05	1		5.7	J		Fail		3.6			Fail	P	103		P	P		0.11	J		Fail	Red	<	13.8			P	P
364	R-31	670	3	30-Nov-06	2	<	5.6	J		Fail		3.7			Fail	P	73.2		P	P		0.17	J		Fail	Red		6.2	J		P	P
365	R-31	831	4	23-Aug-05	1		2.2	J		P		0.67	J		P	P	61.9		P	P		0.25			P	P	<	7.2	J		P	P
366	R-31	831	4	6-Dec-06	2		4.1	J		Fail	<	0.05	UN		P	P	51.4		P	P		0.22			P	P		9.7	J		P	P
367	R-31	1011	5	24-Aug-05	1	<	2.0	U		P		0.72	J		P	P	53.2		P	P	<	0.2			Fail	Red		489			NA	Fail
368	R-31	1011	5	6-Dec-06	2		4.0	J		P		0.68	J		P	P	46.7		P	P	<	0.12	J		Fail	Red	<	4.1	J		P	P

Table C-6. Trace Metal Indicators

Row #	Well	Port depth (ft)	Scr #	Sample collection date (start)			Mo (F) ug/L	Lab Qual Code	Test C9		Ni (F) ug/L	Lab Qual Code	Test C8	Test F5	Sr ug/L	Test D1	Test E3		U ug/L	Lab Qual Code	Test C7, D2	Test E5		Zn ug/L	Lab Qual Code	Test D4	Test F6
									ug/L				ug/L	ug/L		ug/L	ug/L				ug/L	ug/L				ug/L	ug/L
									<UL				<UL	<UL		>LL	<UL				>LL	<UL				>LL	<UL
									4				2	50		44.88	179.8				0.2	1.52				1	40
									4				2	50		19.1	154.8				0.1	0.72				1	20
369	R-32	871	1	21-Sep-04	1		3.5		P	<	0.69	U	P	P	85.1	P	P		1.1		P	P	<	10.7		P	P
370	R-32	871	1	15-Nov-04	2		2.6		P		2.3	J	Fail	P	86.3	P	P		0.95		P	P		6.6		P	P
371	R-32	871	1	22-Jun-05	3	<	2	U	P		0.76	J	P	P	82.2	P	P		0.98		P	P	<	10.5		P	P
372	R-32	871	1	29-Aug-06	4		2.3	J	P	<	0.5	U	P	P	83.8	P	P		0.75		P	P		7.4	J	P	P
373	R-32	871	1	12-Dec-06	5		3	J	P	<	0.5	U	P	P	82.9	P	P		0.77		P	P		4	J	P	P
374	R-32	976	3	22-Sep-04	1		1.6		P	<	1.4	J	P	P	103	P	P		0.035	J	Fail	Red	<	6.2		P	P
375	R-32	976	3	16-Nov-04	2		1.6		P		2.1	J	Fail	P	105	P	P		0.037	J	Fail	Red		1.1	J	P	P
376	R-32	976	3	24-Jun-05	3		2.9	J	P		1.2	J*	P	P	98.3	P	P		0.065	J	Fail	Red	<	5.9	J	P	P
377	R-32	976	3	30-Aug-06	4	<	2	U	P		0.68	J	P	P	95.7	P	P	<	0.05	U	Fail	Red		6.1	J	P	P
378	R-32	976	3	13-Dec-06	5		2.7	J	P		1.2	J	P	P	94.9	P	P		0.56		P	P		7.8	J	P	P
379	R-33	996	1	27-Jun-05	1	<	1.1		P		1.2	J	P	P	52.6	P	P		—		ND	ND		38.6		NA	P
380	R-33	996	1	14-Sep-05	2	<	2	U	P		7.3		Fail	P	49.6	P	P		0.89		P	P		18.6		NA	P
381	R-33	996	1	16-Feb-06	3	<	2	U	P		5		Fail	P	52.5	P	P		0.85		P	P	<	2.7	J	P	P
382	R-33	996	1	31-Oct-06	4		1.1		P		16		Fail	P	49.4	P	P		1.11		P	P		8.38		P	P
383	R-33	1112	2	24-Jun-05	1		10.9		Fail		168		Fail	Fail	49.5	P	P		0.9		P	P		12.2		P	P
384	R-33	1112	2	15-Sep-05	2	<	2	U	P		20.6		Fail	P	49.9	P	P		0.96		P	P		9.4	J	P	P
385	R-33	1112	2	14-Feb-06	3		3.1	J	P		39.3		Fail	P	47.4	P	P		0.91		P	P		4.9	J	P	P
386	R-33	1112	2	5-Jul-06	4		2.0		P		44.6		Fail	P	47.2	P	P		0.97		P	P		2.93		P	P
387	R-33	1112	2	1-Nov-06	5		1.4		P		43		Fail	P	46.6	P	P		1.07		P	P		25.4		NA	P
388	R-34	895	1	7-Jun-05	1		1.5		P		1.5	J	P	P	65	P	P		0.48		P	P		4	J	P	P
389	R-34	895	1	7-Sep-05	2	<	2.7	J	P		0.77	J	P	P	65.4	P	P		0.46		P	P	<	2.2	J	P	P
390	R-34	895	1	29-Nov-05	3	<	1.3		P	<	1	U	P	P	64.8	P	P		0.41		P	P	<	2	U	DL	P
391	R-34	895	1	31-Jan-06	4	<	2.8	J	P		0.67	J	P	P	65.7	P	P		0.42		P	P		2.8	J	P	P
392	R-34	895	1	17-Jul-06	5	<	2	U	P		0.82	J	P	P	65.7	P	P		0.54		P	P	<	3.6	J	P	P
393	R-34	895	1	30-Oct-06	6		2.5	J	P		0.7	J	P	P	65.6	P	P		0.49		P	P		4.5	J	P	P
LL=lower limit, UL=upper limit, UF=unfiltered, F=filtered, P=pass																											
Pass/Fail outcomes																											
	Pass (or Yes)								285				238	366		345	287				246	212				213	337
	Fail (or No)								98				130	9		38	96				87	38				9	31
	Total outcomes								383				368	375		383	383				333	250				222	368
	% Pass (or Yes)								74				65	98		90	75				74	85				96	92
Indeterminate outcomes																											
ND=no data									10				17	17		10	10				30	30				10	10
Err=suspected error									0				1	1		0	0				0	0				0	0
Plm=unreliable due to contaminant plume									0				0	0		0	0				1	14				0	0
DL=inadequate detection limit									0				7	0		0	0				12	11				19	0
UF=test unreliable for UF sample									0				0	0		0	0				17	0				55	15
Red=test unreliable, reducing conditions									0				0	0		0	0				0	88				0	0
—=test not applicable									0				0	0		0	0				0	0				87	0
	Checksum								393				393	393		393	393				393	393				393	393

Data source: WQDB except where indicated otherwise

LL=lower limit, UL=upper limit, P=pass; UF=unfiltered

Notes: Pass and fail outcomes for each sample are determined by comparison against test threshold criteria. From top to bottom in the column headers above are listed the indicator name and associated test identifier, units of measurement, type of test threshold, and threshold values for the regional aquifer and perched intermediate aquifer, respectively.

Table C-7. Summary of Test Outcomes

Water Quality Sample																		
Row	Well	Port depth (ft)	Screen	Sample collection date	Event Seq.	Tests Passed	Tests Failed	No Data	Error	Plume	Inadeq Det Lmt	Not applic to UF data	Not applic if reducing	Not applic for other reason	Total Indeterminate Tests	Total P/F outcomes	% Passed	Rating
1	CdV-16-1(i)	624	1	1-Jun-05	1	26	8	0	0	2	0	0	0	2	4	34	76	Fair
2	CdV-16-1(i)	624	1	29-Aug-05	2	30	5	0	0	2	0	0	0	1	3	35	86	Good
3	CdV-16-1(i)	624	1	7-Dec-05	3	29	4	0	1	2	0	0	0	2	5	33	88	Good
4	CdV-16-1(i)	624	1	9-Mar-06	4	30	3	1	0	2	0	0	0	2	5	33	91	Very Good
5	CdV-16-2(i)r	850	1	14-Sep-05	1	17	4	11	0	1	0	2	0	3	17	21	81	Good
6	CdV-16-2(i)r	850	1	15-Dec-05	2	24	12	0	0	1	0	0	0	1	2	36	67	Fair
7	CdV-16-2(i)r	850	1	15-Mar-06	3	30	6	1	0	1	0	0	0	0	2	36	83	Good
8	CdV-16-2(i)r	850	1	17-May-06	4	28	7	1	0	1	1	0	0	0	3	35	80	Fair
9	CdV-R-15-3	1254	4	19-Oct-04	1	32	2	2	0	0	0	0	0	2	4	34	94	Very Good
10	CdV-R-15-3	1254	4	4-Apr-05	2	33	3	0	0	0	0	0	0	2	2	36	92	Very Good
11	CdV-R-15-3	1254	4	12-Jul-05	3	34	1	1	0	0	0	0	0	2	3	35	97	Very Good
12	CdV-R-15-3	1254	4	18-Oct-05	4	34	1	1	0	0	0	0	0	2	3	35	97	Very Good
13	CdV-R-15-3	1254	4	19-Jan-06	5	32	0	3	0	0	1	0	0	2	6	32	100	Very Good
14	CdV-R-15-3	1254	4	27-Mar-06	6	32	1	2	0	0	1	0	0	2	5	33	97	Very Good
15	CdV-R-15-3	1350	5	20-Oct-04	1	19	13	2	0	0	0	0	2	2	6	32	59	Fair
16	CdV-R-15-3	1350	5	5-Apr-05	2	19	16	0	0	0	0	0	1	2	3	35	54	Poor
17	CdV-R-15-3	1350	5	12-Jul-05	3	20	14	1	0	0	0	0	1	2	4	34	59	Poor
18	CdV-R-15-3	1350	5	18-Oct-05	4	22	11	1	0	0	1	0	1	2	5	33	67	Fair
19	CdV-R-15-3	1350	5	20-Jan-06	5	21	10	3	0	0	1	0	1	2	7	31	68	Fair
20	CdV-R-15-3	1350	5	28-Mar-06	6	20	12	2	0	0	1	0	1	2	6	32	63	Fair
21	CdV-R-15-3	1640	6	21-Oct-04	1	29	5	1	1	0	0	0	0	2	4	34	85	Good
22	CdV-R-15-3	1640	6	6-Apr-05	2	26	8	0	0	0	1	0	1	2	4	34	76	Fair
23	CdV-R-15-3	1640	6	13-Jul-05	3	27	6	2	0	0	0	0	1	2	5	33	82	Good
24	CdV-R-15-3	1640	6	19-Oct-05	4	25	10	1	0	0	0	0	1	1	3	35	71	Fair
25	CdV-R-15-3	1640	6	20-Jan-06	5	25	6	3	0	0	1	0	1	2	7	31	81	Good
26	CdV-R-15-3	1640	6	29-Mar-06	6	27	5	2	0	0	1	0	1	2	6	32	84	Good
27	CdV-R-37-2	1200	2	26-Oct-04	1	17	16	2	0	0	0	0	2	1	5	33	52	Poor
28	CdV-R-37-2	1200	2	29-Mar-05	2	18	17	0	0	0	0	0	2	1	3	35	51	Poor
29	CdV-R-37-2	1200	2	6-Jul-05	3	17	17	1	0	0	0	0	2	1	4	34	50	Poor
30	CdV-R-37-2	1200	2	12-Oct-05	4	18	15	1	0	0	1	0	2	1	5	33	55	Poor
31	CdV-R-37-2	1200	2	9-Jan-06	5	18	14	2	0	0	1	0	2	1	6	32	56	Poor
32	CdV-R-37-2	1200	2	21-Mar-06	6	17	16	3	0	0	0	0	2	0	5	33	52	Poor
33	CdV-R-37-2	1359	3	27-Oct-04	1	33	1	2	0	0	0	0	0	2	4	34	97	Very Good
34	CdV-R-37-2	1359	3	30-Mar-05	2	36	0	0	0	0	0	0	0	2	2	36	100	Very Good
35	CdV-R-37-2	1359	3	7-Jul-05	3	35	0	1	0	0	0	0	0	2	3	35	100	Very Good
36	CdV-R-37-2	1359	3	12-Oct-05	4	35	0	1	0	0	0	0	0	2	3	35	100	Very Good
37	CdV-R-37-2	1359	3	10-Jan-06	5	31	1	2	0	0	2	0	0	2	6	32	97	Very Good
38	CdV-R-37-2	1359	3	22-Mar-06	6	32	3	2	0	0	0	0	0	1	3	35	91	Very Good
39	CdV-R-37-2	1551	4	27-Oct-04	1	25	9	2	0	0	0	0	1	1	4	34	74	Fair
40	CdV-R-37-2	1551	4	31-Mar-05	2	25	11	0	0	0	0	0	1	1	2	36	69	Fair
41	CdV-R-37-2	1551	4	8-Jul-05	3	25	10	1	0	0	0	0	1	1	3	35	71	Fair
42	CdV-R-37-2	1551	4	13-Oct-05	4	25	10	1	0	0	0	0	1	1	3	35	71	Fair
43	CdV-R-37-2	1551	4	11-Jan-06	5	24	8	2	0	0	2	0	1	1	6	32	75	Fair
44	CdV-R-37-2	1551	4	22-Mar-06	6	25	9	2	0	0	1	0	1	0	4	34	74	Fair
45	MCOBT-4.4	485	1	28-Jan-03	1	22	5	3	0	5	1	0	0	2	11	27	81	Good
46	MCOBT-4.4	485	1	21-May-03	1.5	21	5	4	0	5	1	0	0	2	12	26	81	Good
47	MCOBT-4.4	485	1	29-Mar-05	2	16	5	8	0	5	1	2	0	1	17	21	76	Fair
48	MCOBT-4.4	485	1	8-Jun-05	3	7	1	30	0	1	0	0	0	0	31	8	88	Insuff data
49	R-1	1031	1	19-May-05	1	36	0	0	0	0	0	0	0	2	2	36	100	Very Good
50	R-1	1031	1	12-Sep-05	2	34	2	0	0	0	0	0	0	2	2	36	94	Very Good
51	R-1	1031	1	28-Nov-05	3	34	1	0	0	0	1	0	0	2	3	35	97	Very Good
52	R-1	1031	1	25-Jan-06	4	34	0	1	0	0	1	0	0	2	4	34	100	Very Good
53	R-1	1031	1	19-Apr-06	5	7	1	30	0	0	0	0	0	1	31	8	88	Insuff data
54	R-1	1031	1	6-Jul-06	6	34	0	1	2	0	1	0	0	1	5	34	100	Very Good
55	R-1	1031	1	26-Oct-06	7	35	0	1	0	0	0	0	0	2	3	35	100	Very Good
56	R-2	918	1	26-Apr-05	1	28	7	1	0	0	0	0	0	2	3	35	80	Fair
57	R-2	918	1	9-Aug-05	2	32	5	0	0	0	0	0	0	1	1	37	86	Good
58	R-2	918	1	9-Nov-05	3	33	4	0	0	0	0	0	0	1	1	37	89	Good
59	R-2	918	1	27-Feb-06	4	34	1	1	0	0	0	0	0	2	3	35	97	Very Good
60	R-2	918	1	24-Jul-06	5	33	2	1	0	0	0	0	0	2	3	35	94	Very Good
61	R-3i	215	1	10-Aug-06	1	19	12	0	0	4	1	0	0	2	7	31	61	Fair
62	R-4	793	1	27-Apr-05	1	32	1	1	0	2	0	0	0	2	5	33	97	Very Good
63	R-4	793	1	8-Aug-05	2	32	2	0	0	2	0	0	0	2	4	34	94	Very Good
64	R-4	793	1	14-Nov-05	3	30	3	0	0	2	1	0	0	2	5	33	91	Very Good
65	R-4	793	1	28-Feb-06	4	30	3	1	0	2	0	0	0	2	5	33	91	Very Good
66	R-4	793	1	25-Jul-06	5	30	2	1	0	2	1	0	0	2	6	32	94	Very Good
67	R-5	384	2	28-Apr-04	1	25	6	0	0	5	0	0	0	2	7	31	81	Fair

Table C-7. Summary of Test Outcomes

Water Quality Sample																		
Row	Well	Port depth (ft)	Screen	Sample collection date	Event Seq.	Tests Passed	Tests Failed	No Data	Error	Plume	Inadeq Det Lmt	Not applic to UF data	Not applic if reducing	Not applic for other reason	Total Indeterminate Tests	Total P/F outcomes	% Passed	Rating
68	R-5	384	2	27-Sep-04	2	24	7	0	0	5	0	0	0	2	7	31	77	Fair
69	R-5	384	2	2-May-05	3	20	6	4	0	3	0	3	0	2	12	26	77	Fair
70	R-5	384	2	25-Jul-06	4	21	7	3	0	4	1	0	0	2	10	28	75	Fair
71	R-5	719	3	30-Apr-04	1	28	5	0	0	3	0	0	0	2	5	33	85	Good
72	R-5	719	3	28-Sep-04	2	26	6	0	0	4	0	0	0	2	6	32	81	Good
73	R-5	719	3	3-May-05	3	23	3	4	0	3	0	3	0	2	12	26	88	Good
74	R-5	719	3	26-Jul-06	4	23	6	3	0	4	0	0	0	2	9	29	79	Fair
75	R-5	861	4	3-May-04	1	23	13	0	0	0	0	0	0	2	2	36	64	Fair
76	R-5	861	4	30-Sep-04	2	23	13	0	0	0	0	0	0	2	2	36	64	Fair
77	R-5	861	4	4-May-05	3	21	9	4	0	0	0	2	0	2	8	30	70	Fair
78	R-5	861	4	27-Jul-06	4	3	0	36	0	0	0	0	0	0	36	3	100	Insuff data
79	R-6	1205	1	23-Aug-05	1	33	3	0	0	0	0	0	0	2	2	36	92	Very Good
80	R-6	1205	1	17-Nov-05	2	34	1	0	0	0	1	0	0	2	3	35	97	Very Good
81	R-6	1205	1	1-Mar-06	3	34	1	1	0	0	0	0	0	2	3	35	97	Very Good
82	R-6	1205	1	11-May-06	4	33	2	1	0	0	0	0	0	2	3	35	94	Very Good
83	R-6	1205	1	26-Jul-06	5	34	1	1	0	0	0	0	0	2	3	35	97	Very Good
84	R-6i	602	1	24-Aug-05	1	23	10	0	0	3	0	0	0	2	5	33	70	Fair
85	R-6i	602	1	17-Nov-05	2	22	10	1	0	3	0	0	0	2	6	32	69	Fair
86	R-6i	602	1	1-Mar-06	3	23	9	1	0	3	1	0	0	1	6	32	72	Fair
87	R-6i	602	1	11-May-06	4	27	5	1	0	3	0	0	0	2	6	32	84	Good
88	R-6i	602	1	26-Jul-06	5	22	8	1	0	3	1	0	0	3	8	30	73	Fair
89	R-7	915	3	18-Dec-03	1	15	10	6	0	0	1	3	2	1	13	25	60	Fair
90	R-7	915	3	26-May-04	2	15	10	8	0	0	0	2	1	2	13	25	60	Fair
91	R-7	915	3	26-Apr-05	3	17	10	5	0	0	0	3	1	2	11	27	63	Fair
92	R-7	915	3	31-Jul-06	4	18	10	6	0	0	1	0	1	2	10	28	64	Fair
93	R-8	711	1	24-Aug-04	1	36	0	0	0	0	0	0	0	2	2	36	100	Very Good
94	R-8	711	1	8-Dec-04	2	34	2	1	0	0	0	0	0	1	2	36	94	Very Good
95	R-8	711	1	27-Apr-05	3	26	1	6	0	0	0	3	0	2	11	27	96	Very Good
96	R-8	711	1	1-Aug-06	4	30	2	3	0	0	1	0	0	2	6	32	94	Very Good
97	R-8	825	2	25-Aug-04	1	32	5	0	0	0	0	0	0	1	1	37	86	Good
98	R-8	825	2	9-Dec-04	2	30	5	1	0	0	0	0	0	2	3	35	86	Good
99	R-8	825	2	28-Apr-05	3	25	3	5	0	0	0	3	0	2	10	28	89	Good
100	R-8	825	2	2-Aug-06	4	25	3	7	0	0	1	0	0	2	10	28	89	Good
101	R-9	684	1	12-Dec-03	1	18	5	6	0	3	1	3	0	2	15	23	78	Fair
102	R-9	684	1	27-May-04	2	17	6	7	0	3	0	3	0	2	15	23	74	Fair
103	R-9	684	1	19-Mar-05	3	17	7	6	0	3	0	3	0	2	14	24	71	Fair
104	R-9	684	1	6-Apr-05	3	16	7	7	0	3	0	3	0	2	15	23	70	Fair
105	R-9	684	1	28-Apr-05	3	21	5	5	0	2	0	3	0	2	12	26	81	Good
106	R-9	684	1	31-Jul-06	4	23	5	4	0	3	1	0	0	2	10	28	82	Good
107	R-9i	199	1	6-Feb-04	1	10	13	9	0	2	1	3	0	0	15	23	43	Poor
108	R-9i	199	1	2-Jun-04	2	12	12	7	0	2	0	3	0	2	14	24	50	Poor
109	R-9i	199	1	29-Apr-05	3	17	10	4	0	2	0	3	0	2	11	27	63	Fair
110	R-9i	199	1	10-Aug-06	4	15	11	7	0	2	1	0	0	2	12	26	58	Poor
111	R-9i	279	2	6-Sep-01	1	18	11	5	0	2	0	0	1	1	9	29	62	Fair
112	R-9i	279	2	29-Jul-02	2	17	9	4	0	2	1	2	1	2	12	26	65	Fair
113	R-9i	279	2	6-Feb-04	3	17	7	6	0	2	1	3	0	2	14	24	71	Fair
114	R-9i	279	2	10-Aug-06	4	18	7	7	0	3	0	0	0	3	13	25	72	Fair
115	R-10	874	1	29-Jun-06	1	27	2	3	0	0	0	3	0	3	9	29	93	Very Good
116	R-10	874	1	12-Oct-06	2	30	1	3	0	0	1	0	0	3	7	31	97	Very Good
117	R-10	1042	2	11-Oct-05	1	22	0	9	0	0	1	3	0	3	16	22	100	Very Good
118	R-10	1042	2	29-Jun-06	2	31	1	4	0	0	0	0	0	2	6	32	97	Very Good
119	R-10	1042	2	12-Oct-06	3	31	1	3	0	0	1	0	0	2	6	32	97	Very Good
120	R-10a	690	1	7-Sep-05	1	14	4	11	0	3	0	3	0	3	20	18	78	Fair
121	R-10a	690	1	30-Nov-05	2	24	8	0	0	3	0	0	0	3	6	32	75	Fair
122	R-10a	690	1	1-Feb-06	3	22	8	1	0	3	1	0	0	3	8	30	73	Fair
123	R-10a	690	1	17-Jul-06	4	24	6	1	0	3	1	0	0	3	8	30	80	Fair
124	R-10a	690	1	12-Oct-06	5	26	5	1	0	3	0	0	0	3	7	31	84	Good
125	R-11	855	1	17-May-05	1	33	1	0	0	2	0	0	0	2	4	34	97	Very Good
126	R-11	855	1	3-Aug-05	2	30	3	0	0	2	0	0	0	3	5	33	91	Very Good
127	R-11	855	1	8-Nov-05	3	31	2	0	0	2	0	0	0	3	5	33	94	Very Good
128	R-11	855	1	3-Feb-06	4	29	2	1	0	3	0	0	0	3	7	31	94	Very Good
129	R-11	855	1	20-Apr-06	5	5	1	31	0	1	0	0	0	1	33	6	83	Insuff data
130	R-11	855	1	10-Jul-06	6	26	2	4	0	3	0	0	0	3	10	28	93	Very Good
131	R-11	855	1	10-Oct-06	7	29	2	1	0	3	0	0	0	3	7	31	94	Very Good
132	R-12	468	1	2-Feb-04	1	8	14	7	0	2	1	3	2	1	16	22	36	Poor
133	R-12	468	1	2-Jun-04	2	10	14	7	0	1	0	2	2	2	14	24	42	Poor
134	R-12	468	1	16-Jun-05	3	18	14	2	0	1	0	0	1	2	6	32	56	Poor

Table C-7. Summary of Test Outcomes

Water Quality Sample																		
Row	Well	Port depth (ft)	Screen	Sample collection date	Event Seq.	Tests Passed	Tests Failed	No Data	Error	Plume	Inadeq Det Lmt	Not applic to UF data	Not applic if reducing	Not applic for other reason	Total Indeterminate Tests	Total P/F outcomes	% Passed	Rating
135	R-12	468	1	30-Jun-05	3	1	1	37	0	0	0	0	0	0	37	2	50	Insuff data
136	R-12	468	1	2-Feb-06	4	17	13	3	0	1	1	0	1	2	8	30	57	Poor
137	R-12	468	1	11-Jul-06	5	16	15	3	0	1	0	0	1	2	7	31	52	Poor
138	R-12	468	1	29-Sep-06	6	21	12	0	0	3	0	0	0	2	5	33	64	Fair
139	R-12	507	2	10-Sep-01	1	19	11	4	0	2	0	0	0	2	8	30	63	Fair
140	R-12	507	2	1-Aug-02	2	14	11	5	0	2	3	2	0	1	13	25	56	Poor
141	R-12	507	2	28-Jan-04	3	19	7	6	0	2	1	1	0	2	12	26	73	Fair
142	R-12	507	2	1-Feb-06	4	20	12	3	0	1	0	0	0	2	6	32	63	Fair
143	R-12	507	2	12-Jul-06	5	24	8	3	0	1	0	0	0	2	6	32	75	Fair
144	R-12	507	2	1-Oct-06	6	26	5	0	0	3	1	0	0	3	7	31	84	Good
145	R-12	811	3	27-Jan-04	1	13	11	6	0	2	1	3	0	2	14	24	54	Poor
146	R-12	811	3	3-Jun-04	2	13	11	7	0	2	0	3	0	2	14	24	54	Poor
147	R-12	811	3	20-Jun-05	3	20	11	3	0	2	0	0	0	2	7	31	65	Fair
148	R-12	811	3	31-Jan-06	4	20	10	3	0	2	0	0	0	3	8	30	67	Fair
149	R-12	811	3	12-Jul-06	5	19	12	3	0	2	0	0	0	2	7	31	61	Fair
150	R-12	811	3	27-Sep-06	6	29	2	1	0	3	0	0	0	3	7	31	94	Very Good
151	R-12	811	3	18-Oct-06	7	28	4	0	0	3	0	0	0	3	6	32	88	Good
152	R-13	958	1	9-Dec-03	1	25	0	6	0	0	1	4	0	2	13	25	100	Very Good
153	R-13	958	1	11-Jun-04	2	24	1	7	0	0	0	4	0	2	13	25	96	Very Good
154	R-13	958	1	10-Mar-05	3	24	0	7	0	0	1	4	0	2	14	24	100	Very Good
155	R-13	958	1	26-May-05	3	13	1	25	0	0	0	0	0	0	25	14	93	Insuff data
156	R-13	958	1	1-Sep-05	4	26	0	4	2	0	0	3	0	3	12	26	100	Very Good
157	R-13	958	1	2-Feb-06	5	32	0	2	0	0	2	0	0	2	6	32	100	Very Good
158	R-13	958	1	3-Jul-06	6	34	0	1	0	0	1	0	0	2	4	34	100	Very Good
159	R-13	958	1	25-Oct-06	7	34	0	1	0	0	1	0	0	2	4	34	100	Very Good
160	R-14	1205	1	12-Jul-04	1	32	4	0	0	0	0	0	0	2	2	36	89	Good
161	R-14	1205	1	28-Oct-04	2	32	3	1	0	0	0	0	0	2	3	35	91	Very Good
162	R-14	1205	1	11-May-05	3	32	3	0	0	0	1	0	0	2	3	35	91	Very Good
163	R-14	1205	1	24-Jan-06	4	29	2	3	0	0	2	0	0	2	7	31	94	Very Good
164	R-14	1205	1	26-Jun-06	5	28	4	3	0	0	1	0	0	2	6	32	88	Good
165	R-14	1205	1	23-Oct-06	6	31	1	3	0	0	1	0	0	2	6	32	97	Very Good
166	R-14	1289	2	14-Jul-04	1	24	12	0	0	0	0	0	1	1	2	36	67	Fair
167	R-14	1289	2	3-Nov-04	2	21	13	1	0	0	0	0	2	1	4	34	62	Fair
168	R-14	1289	2	12-May-05	3	25	11	0	0	0	0	0	1	1	2	36	69	Fair
169	R-14	1289	2	25-Jan-06	4	25	7	3	0	0	1	0	1	1	6	32	78	Fair
170	R-14	1289	2	28-Jun-06	5	22	6	6	0	0	2	0	1	1	10	28	79	Fair
171	R-14	1289	2	23-Oct-06	6	20	8	7	0	0	1	0	1	1	10	28	71	Fair
172	R-15	959	1	10-Jun-04	1	20	3	7	0	3	0	3	0	2	15	23	87	Good
173	R-15	959	1	25-May-05	2	27	1	4	0	3	1	0	0	2	10	28	96	Very Good
174	R-15	959	1	31-Aug-05	3	29	1	2	0	3	1	0	0	2	8	30	97	Very Good
175	R-15	959	1	30-Jan-06	4	29	0	2	0	3	2	0	0	2	9	29	100	Very Good
176	R-15	959	1	3-Jul-06	5	31	1	1	0	2	1	0	0	2	6	32	97	Very Good
177	R-15	959	1	24-Oct-06	6	31	0	1	1	2	1	0	0	2	7	31	100	Very Good
178	R-16	866	2	13-Oct-04	1	28	7	1	0	0	0	0	0	2	3	35	80	Fair
179	R-16	866	2	2-Dec-04	2	26	9	1	0	0	0	0	0	2	3	35	74	Fair
180	R-16	866	2	13-Jun-05	3	28	6	2	0	0	0	0	0	2	4	34	82	Good
181	R-16	866	2	13-Jul-06	4	25	4	6	0	0	1	0	0	2	9	29	86	Good
182	R-16	866	2	20-Jul-06	5	28	7	1	0	0	0	0	0	2	3	35	80	Fair
183	R-16	866	2	11-Aug-06	6	30	4	0	0	0	1	0	0	3	4	34	88	Good
184	R-16	866	2	14-Aug-06	7	24	4	8	0	0	0	0	0	2	10	28	86	Good
185	R-16	866	2	10-Oct-06	8	28	5	2	0	0	0	0	0	3	5	33	85	Good
186	R-16	866	2	14-Nov-06	9	24	6	5	0	0	1	0	0	2	8	30	80	Fair
187	R-16	866	2	4-Dec-06	10	21	6	7	0	0	1	0	0	3	11	27	78	Fair
188	R-16	1018	3	14-Oct-04	1	25	10	1	0	0	0	0	0	2	3	35	71	Fair
189	R-16	1018	3	3-Dec-04	2	26	9	1	0	0	0	0	0	2	3	35	74	Fair
190	R-16	1018	3	13-Jun-05	3	26	7	2	0	0	1	0	0	2	5	33	79	Fair
191	R-16	1018	3	12-Jul-06	4	25	5	4	0	0	1	0	0	3	8	30	83	Good
192	R-16	1018	3	20-Jul-06	5	10	1	28	0	0	0	0	0	0	28	11	91	Insuff data
193	R-16	1018	3	10-Aug-06	6	28	6	0	0	0	1	0	0	3	4	34	82	Good
194	R-16	1018	3	11-Aug-06	7	21	3	10	0	0	1	0	0	3	14	24	88	Good
195	R-16	1018	3	12-Oct-06	8	28	4	3	0	0	0	0	0	3	6	32	88	Good
196	R-16	1018	3	14-Nov-06	9	23	6	5	0	0	1	0	0	3	9	29	79	Fair
197	R-16	1018	3	5-Dec-06	10	24	5	5	0	0	1	0	0	3	9	29	83	Good
198	R-16	1238	4	15-Oct-04	1	16	18	1	0	0	0	0	1	2	4	34	47	Poor
199	R-16	1238	4	7-Dec-04	2	18	17	1	0	0	0	0	0	2	3	35	51	Poor
200	R-16	1238	4	14-Jun-05	3	18	15	2	0	0	0	0	1	2	5	33	55	Poor
201	R-16	1238	4	13-Jul-06	4	17	11	6	0	0	1	0	1	2	10	28	61	Poor

Table C-7. Summary of Test Outcomes

Water Quality Sample																		
Row	Well	Port depth (ft)	Screen	Sample collection date	Event Seq.	Tests Passed	Tests Failed	No Data	Error	Plume	Inadeq Det Lmt	Not applic to UF data	Not applic if reducing	Not applic for other reason	Total Indeterminate Tests	Total P/F outcomes	% Passed	Rating
202	R-16	1238	4	20-Jul-06	5	19	15	1	0	0	0	0	1	2	4	34	56	Poor
203	R-16	1238	4	9-Aug-06	6	27	7	0	0	0	1	0	0	3	4	34	79	Fair
204	R-16	1238	4	11-Oct-06	7	22	11	2	0	0	0	0	0	3	5	33	67	Fair
205	R-16	1238	4	14-Nov-06	8	18	10	5	0	0	1	0	1	3	10	28	64	Fair
206	R-16	1238	4	5-Dec-06	9	19	9	5	0	0	1	0	1	3	10	28	68	Fair
207	R-16r	600	1	26-Sep-05	1	19	3	11	0	0	0	2	0	3	16	22	86	Good
208	R-16r	600	1	17-Oct-05	2	18	2	12	0	0	0	3	0	3	18	20	90	Good
209	R-16r	600	1	19-Dec-05	3	28	4	3	0	0	1	0	0	2	6	32	88	Good
210	R-16r	600	1	8-Mar-06	4	33	2	1	0	0	0	0	0	2	3	35	94	Very Good
211	R-16r	600	1	24-May-06	5	32	3	1	0	0	0	0	0	2	3	35	91	Very Good
212	R-16r	600	1	17-Aug-06	6	32	2	0	2	0	0	0	0	2	4	34	94	Very Good
213	R-16r	600	1	1-Nov-06	7	30	3	1	0	0	2	0	0	2	5	33	91	Very Good
214	R-17	1057	1	24-Feb-06	1	19	4	8	0	0	0	4	0	3	15	23	83	Good
215	R-17	1057	1	19-Oct-06	2	30	5	0	0	0	1	0	0	2	3	35	86	Good
216	R-17	1124	2	17-Oct-06	1	29	6	0	0	0	1	0	0	2	3	35	83	Good
217	R-18	1358	1	25-Aug-05	1	35	1	0	0	0	0	0	0	2	2	36	97	Very Good
218	R-18	1358	1	1-Dec-05	2	31	4	0	0	0	1	0	0	2	3	35	89	Very Good
219	R-18	1358	1	7-Mar-06	3	32	2	1	0	0	1	0	0	2	4	34	94	Very Good
220	R-18	1358	1	16-May-06	4	34	0	1	0	0	1	0	0	2	4	34	100	Very Good
221	R-18	1358	1	15-Aug-06	5	34	0	1	0	0	1	0	0	2	4	34	100	Very Good
222	R-18	1358	1	18-Dec-06	6	31	0	1	1	0	3	0	0	2	7	31	100	Very Good
223	R-19	909	2	15-Dec-03	1	19	7	6	0	0	1	3	0	2	12	26	73	Fair
224	R-19	909	2	10-Jun-04	2	20	6	8	0	0	0	2	0	2	12	26	77	Fair
225	R-19	909	2	21-Jul-05	3	25	6	4	0	0	0	0	0	3	7	31	81	Fair
226	R-19	909	2	18-Aug-06	4	24	4	7	0	0	1	0	0	2	10	28	86	Good
227	R-19	909	2	11-Dec-06	5	18	4	14	0	0	1	0	0	1	16	22	82	Good
228	R-19	1191	3	15-Dec-03	1	25	0	6	0	0	1	4	0	2	13	25	100	Very Good
229	R-19	1191	3	14-Jun-04	2	24	2	7	0	0	0	3	0	2	12	26	92	Very Good
230	R-19	1191	3	21-Jul-05	3	29	2	3	0	0	1	0	1	2	7	31	94	Very Good
231	R-19	1191	3	15-Aug-06	4	27	1	8	0	0	0	0	0	2	10	28	96	Very Good
232	R-19	1191	3	16-Aug-06	4	26	1	8	0	0	1	0	0	2	11	27	96	Very Good
233	R-19	1191	3	11-Dec-06	5	19	3	14	0	0	1	0	0	1	16	22	86	Good
234	R-19	1413	4	16-Dec-03	1	24	1	6	0	0	1	4	0	2	13	25	96	Very Good
235	R-19	1413	4	15-Jun-04	2	24	1	8	0	0	0	4	0	1	13	25	96	Very Good
236	R-19	1413	4	28-Jul-05	3	33	0	2	0	0	1	0	0	2	5	33	100	Very Good
237	R-19	1413	4	16-Aug-06	4	29	4	3	0	0	1	0	0	1	5	33	88	Good
238	R-19	1413	4	17-Aug-06	4	24	3	8	0	0	1	0	0	2	11	27	89	Very Good
239	R-19	1413	4	12-Dec-06	5	31	1	3	0	0	1	0	0	2	6	32	97	Very Good
240	R-19	1586	5	20-Sep-01	1	15	14	5	0	0	1	0	2	1	9	29	52	Poor
241	R-19	1586	5	23-Aug-02	2	11	15	4	0	0	3	3	1	1	12	26	42	Poor
242	R-19	1586	5	16-Dec-03	3	10	14	7	0	0	1	3	2	1	14	24	42	Poor
243	R-19	1586	5	17-Aug-06	4	13	12	7	0	0	1	0	2	3	13	25	52	Poor
244	R-19	1586	5	11-Dec-06	5	11	10	14	0	0	1	0	1	1	17	21	52	Poor
245	R-19	1730	6	21-Sep-01	1	18	11	5	0	0	1	0	2	1	9	29	62	Fair
246	R-19	1730	6	27-Aug-02	2	17	10	4	0	0	3	2	1	1	11	27	63	Fair
247	R-19	1730	6	16-Dec-03	3	14	10	7	0	0	1	3	2	1	14	24	58	Poor
248	R-19	1730	6	17-Aug-06	4	19	7	7	0	0	1	0	1	3	12	26	73	Fair
249	R-19	1730	6	11-Dec-06	5	15	7	14	0	0	1	0	0	1	16	22	68	Fair
250	R-19	1835	7	26-Aug-02	1	11	15	3	0	0	3	3	0	3	12	26	42	Poor
251	R-19	1835	7	17-Dec-03	1	11	15	7	0	0	1	2	0	2	12	26	42	Poor
252	R-19	1835	7	16-Jun-04	2	13	14	7	0	0	0	1	0	3	11	27	48	Poor
253	R-19	1835	7	28-Jul-05	3	20	16	2	0	0	0	0	0	0	2	36	56	Poor
254	R-19	1835	7	18-Aug-06	4	14	14	7	0	0	1	0	0	2	10	28	50	Poor
255	R-19	1835	7	13-Dec-06	5	9	12	15	0	0	1	0	0	1	17	21	43	Poor
256	R-20	907	1	20-Sep-04	1	18	17	0	0	0	0	0	1	2	3	35	51	Poor
257	R-20	907	1	4-Nov-04	2	18	16	1	0	0	0	0	1	2	4	34	53	Poor
258	R-20	907	1	20-Jul-05	3	17	15	2	0	0	0	0	2	2	6	32	53	Poor
259	R-20	907	1	6-Jun-06	4	25	10	1	0	0	0	0	0	2	3	35	71	Fair
260	R-20	907	1	6-Jul-06	5	26	10	0	0	0	0	0	0	2	2	36	72	Fair
261	R-20	907	1	2-Oct-06	6	21	5	10	0	0	0	0	0	2	12	26	81	Fair
262	R-20	907	1	17-Oct-06	7	1	0	38	0	0	0	0	0	0	38	1	100	Insuff data
263	R-20	1150	2	3-Sep-04	1	15	20	0	0	0	0	0	2	1	3	35	43	Poor
264	R-20	1150	2	8-Nov-04	2	13	21	1	0	0	0	0	2	1	4	34	38	Poor
265	R-20	1150	2	19-Jul-05	3	14	18	3	0	0	0	0	2	1	6	32	44	Poor
266	R-20	1150	2	7-Jun-06	4	13	22	1	0	0	0	0	2	0	3	35	37	Poor
267	R-20	1150	2	8-Jul-06	5	31	4	0	0	0	0	0	0	3	3	35	89	Good
268	R-20	1330	3	7-Sep-04	1	19	16	0	0	0	0	0	2	1	3	35	54	Poor

Table C-7. Summary of Test Outcomes

Water Quality Sample																		
Row	Well	Port depth (ft)	Screen	Sample collection date	Event Seq.	Tests Passed	Tests Failed	No Data	Error	Plume	Inadeq Det Lmt	Not applic to UF data	Not applic if reducing	Not applic for other reason	Total Indeterminate Tests	Total P/F outcomes	% Passed	Rating
269	R-20	1330	3	9-Nov-04	2	20	14	1	0	0	0	0	2	1	4	34	59	Poor
270	R-20	1330	3	18-Jul-05	3	19	12	4	0	0	0	0	2	1	7	31	61	Fair
271	R-20	1330	3	8-Jun-06	4	21	13	1	0	0	0	0	2	1	4	34	62	Fair
272	R-20	1330	3	7-Jul-06	5	22	12	0	0	0	1	0	0	3	4	34	65	Fair
273	R-20	1330	3	21-Jul-06	6	23	9	0	1	0	1	0	1	3	6	32	72	Fair
274	R-20	1330	3	13-Oct-06	7	20	9	4	0	0	1	0	1	3	9	29	69	Fair
275	R-21	889	1	23-Sep-04	1	35	0	1	0	0	0	0	0	2	3	35	100	Very Good
276	R-21	889	1	14-Dec-04	2	36	0	0	0	0	0	0	0	2	2	36	100	Very Good
277	R-21	889	1	6-Jun-05	3	33	0	2	1	0	0	0	0	2	5	33	100	Very Good
278	R-21	889	1	7-Jul-06	4	34	1	1	0	0	0	0	0	2	3	35	97	Very Good
279	R-21	889	1	6-Nov-06	5	35	0	1	0	0	0	0	0	2	3	35	100	Very Good
280	R-22	907	1	18-Nov-03	1	8	17	6	0	0	1	3	2	1	13	25	32	Poor
281	R-22	907	1	21-Jun-04	2	10	14	8	0	0	0	3	2	1	14	24	42	Poor
282	R-22	907	1	27-Jun-05	3	15	19	2	0	0	0	0	2	0	4	34	44	Poor
283	R-22	907	1	22-Aug-06	4	11	15	7	0	0	1	0	2	2	12	26	42	Poor
284	R-22	907	1	7-Dec-06	5	9	15	10	0	0	1	0	2	1	14	24	38	Poor
285	R-22	963	2	19-Nov-03	1	25	1	5	0	0	1	4	0	2	12	26	96	Very Good
286	R-22	963	2	22-Jun-04	2	25	0	7	0	0	0	4	0	2	13	25	100	Very Good
287	R-22	963	2	28-Jun-05	3	33	0	2	0	0	1	0	0	2	5	33	100	Very Good
288	R-22	963	2	28-Aug-06	4	30	2	3	0	0	1	0	0	2	6	32	94	Very Good
289	R-22	963	2	7-Dec-06	5	32	0	3	0	0	1	0	0	2	6	32	100	Very Good
290	R-22	1274	3	9-Jul-02	1	15	8	9	0	0	1	3	0	2	15	23	65	Fair
291	R-22	1274	3	20-Nov-03	1	17	10	6	0	0	1	2	0	2	11	27	63	Fair
292	R-22	1274	3	23-Jun-04	2	21	4	8	0	0	0	3	0	2	13	25	84	Good
293	R-22	1274	3	29-Jun-05	3	26	8	2	0	0	0	0	0	2	4	34	76	Fair
294	R-22	1274	3	22-Aug-06	4	25	8	3	0	0	0	0	0	2	5	33	76	Fair
295	R-22	1274	3	8-Dec-06	5	24	8	3	0	0	1	0	0	2	6	32	75	Fair
296	R-22	1378	4	11-Jul-02	1	9	14	10	0	0	1	3	0	1	15	23	39	Poor
297	R-22	1378	4	20-Nov-03	1	9	17	6	0	0	1	3	1	1	12	26	35	Poor
298	R-22	1378	4	23-Jun-04	2	10	15	9	0	0	0	2	1	1	13	25	40	Poor
299	R-22	1378	4	1-Jul-05	3	16	18	2	0	0	0	0	1	1	4	34	47	Poor
300	R-22	1378	4	22-Aug-06	4	13	14	7	0	0	1	0	1	2	11	27	48	Poor
301	R-22	1378	4	8-Dec-06	5	12	11	14	0	0	1	0	0	0	15	23	52	Poor
302	R-22	1448	5	10-Jul-02	1	12	13	7	0	0	1	3	1	1	13	25	48	Poor
303	R-22	1448	5	21-Nov-03	2	11	14	6	0	0	1	3	2	1	13	25	44	Poor
304	R-22	1448	5	5-Jul-05	3	15	17	2	0	0	1	0	2	1	6	32	47	Poor
305	R-22	1448	5	21-Aug-06	4	13	14	7	0	0	1	0	1	2	11	27	48	Poor
306	R-22	1448	5	7-Dec-06	5	14	13	8	0	0	1	0	1	1	11	27	52	Poor
307	R-23	816	1	29-Jun-04	1	33	1	1	0	1	0	0	0	2	4	34	97	Very Good
308	R-23	816	1	24-Sep-04	2	34	1	0	0	1	0	0	0	2	3	35	97	Very Good
309	R-23	816	1	14-Jul-05	3	30	1	2	0	1	1	0	0	3	7	31	97	Very Good
310	R-23	816	1	15-Aug-06	4	33	0	1	0	1	1	0	0	2	5	33	100	Very Good
311	R-23	816	1	18-Dec-06	5	30	0	1	1	1	3	0	0	2	8	30	100	Very Good
312	R-23i	470	2	20-Dec-05	1	16	7	10	0	0	0	2	0	3	15	23	70	Fair
313	R-23i	470	2	3-Oct-06	2	22	12	0	1	0	1	0	0	2	4	34	65	Fair
314	R-23i	524	3	11-Dec-05	1	15	9	9	0	0	0	2	0	3	14	24	63	Fair
315	R-23i	524	3	11-Oct-06	2	22	15	0	1	0	0	0	0	0	1	37	59	Poor
316	R-24	825	1	20-Sep-05	1	18	5	9	0	0	0	3	0	3	15	23	78	Fair
317	R-24	825	1	15-Nov-05	2	24	10	1	0	0	0	0	0	3	4	34	71	Fair
318	R-24	825	1	6-Mar-06	3	24	10	1	0	0	0	0	0	3	4	34	71	Fair
319	R-24	825	1	10-May-06	4	24	11	1	0	0	0	0	0	2	3	35	69	Fair
320	R-24	825	1	27-Jul-06	5	25	9	1	0	0	0	0	0	3	4	34	74	Fair
321	R-25	755	1	7-Aug-02	1	13	8	8	0	3	3	3	0	0	17	21	62	Fair
322	R-25	755	1	11-Dec-03	1	16	8	7	0	3	1	3	0	0	14	24	67	Fair
323	R-25	755	1	1-Sep-04	2	16	7	9	0	3	0	2	0	1	15	23	70	Fair
324	R-25	755	1	2-Aug-05	3	21	11	2	0	3	1	0	0	0	6	32	66	Fair
325	R-25	892	2	5-Feb-02	1	4	6	27	0	0	0	1	0	0	28	10	40	Insuff data
326	R-25	892	2	8-Aug-02	1	15	11	5	0	1	3	3	0	0	12	26	58	Poor
327	R-25	892	2	10-Dec-03	2	14	12	7	0	1	1	3	0	0	12	26	54	Poor
328	R-25	892	2	3-Aug-05	3	16	18	2	0	1	0	0	1	0	4	34	47	Poor
329	R-25	1192	4	8-Aug-02	1	19	8	2	0	1	3	3	0	2	11	27	70	Fair
330	R-25	1192	4	10-Dec-03	2	20	6	5	0	1	1	3	0	2	12	26	77	Fair
331	R-25	1192	4	4-Aug-05	3	23	7	2	2	1	1	0	0	2	8	30	77	Fair
332	R-25	1303	5	9-Aug-02	1	14	9	8	0	0	3	3	0	1	15	23	61	Fair
333	R-25	1303	5	9-Dec-03	1	14	11	6	1	0	1	3	1	1	13	25	56	Poor
334	R-25	1303	5	31-Aug-04	2	12	8	15	0	0	0	2	0	1	18	20	60	Fair
335	R-25	1303	5	9-Aug-05	3	17	5	13	1	0	0	0	1	1	16	22	77	Fair

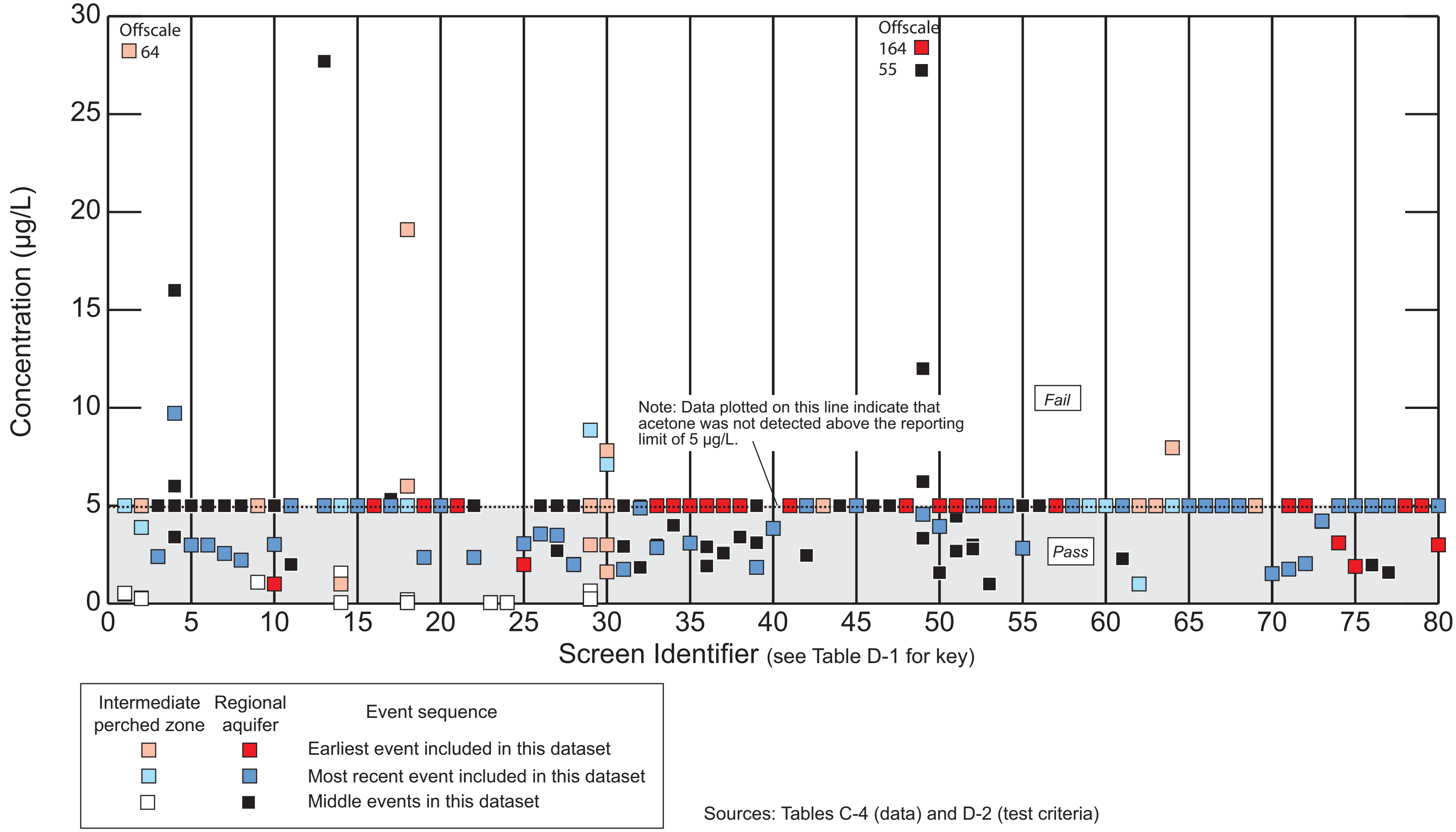
Table C-7. Summary of Test Outcomes

Row	Well	Port depth (ft)	Screen	Sample collection date	Event Seq.	Tests Passed	Tests Failed	No Data	Error	Plume	Inadeq Det Lmt	Not applic to UF data	Not applic if reducing	Not applic for other reason	Total Indeterminate Tests	Total P/F outcomes	% Passed	Rating
336	R-25	1406	6	8-Feb-02	1	29	3	2	0	0	2	0	0	2	6	32	91	Good
337	R-25	1406	6	12-Aug-02	2	23	4	4	0	0	3	2	0	2	11	27	85	Good
338	R-25	1406	6	9-Dec-03	3	24	2	6	1	0	1	3	0	1	12	26	92	Very Good
339	R-25	1606	7	11-Feb-02	1	30	1	2	0	0	2	0	0	3	7	31	97	Very Good
340	R-25	1606	7	12-Aug-02	2	25	2	3	0	0	3	3	0	2	11	27	93	Very Good
341	R-25	1606	7	8-Dec-03	3	25	1	5	0	0	1	4	0	2	12	26	96	Very Good
342	R-25	1796	8	14-Aug-02	1	26	1	3	0	0	3	3	0	2	11	27	96	Very Good
343	R-25	1796	8	4-Dec-03	2	25	1	5	0	0	1	3	0	3	12	26	96	Very Good
344	R-25	1796	8	10-Aug-05	3	30	2	3	0	0	1	0	0	2	6	32	94	Very Good
345	R-26	659	1	13-Apr-05	1	33	3	0	0	0	0	0	0	2	2	36	92	Very Good
346	R-26	659	1	27-Jul-05	2	31	3	1	0	0	0	0	1	2	4	34	91	Very Good
347	R-26	659	1	2-Nov-05	3	32	4	1	0	0	0	0	0	1	2	36	89	Very Good
348	R-26	659	1	22-Feb-06	4	31	0	3	0	0	2	0	0	2	7	31	100	Very Good
349	R-27	852	1	11-Oct-05	1	18	3	10	0	0	0	4	0	3	17	21	86	Good
350	R-27	852	1	21-Oct-05	1	17	3	9	2	0	0	4	0	3	18	20	85	Good
351	R-27	852	1	14-Nov-05	2	21	1	10	0	0	0	3	0	3	16	22	95	Very Good
352	R-27	852	1	1-Jul-06	3	33	1	0	0	0	1	0	0	3	4	34	97	Very Good
353	R-28	934	1	20-May-05	1	27	5	0	0	4	0	0	0	2	6	32	84	Good
354	R-28	934	1	1-Sep-05	2	28	3	0	0	4	1	0	0	2	7	31	90	Good
355	R-28	934	1	10-Nov-05	3	28	4	0	0	4	0	0	0	2	6	32	88	Good
356	R-28	934	1	26-Jan-06	4	27	3	1	0	4	1	0	0	2	8	30	90	Good
357	R-28	934	1	19-Apr-06	5	6	0	31	0	1	0	0	0	1	33	6	100	Insuff data
358	R-28	934	1	5-Jul-06	6	28	3	1	0	4	0	0	0	2	7	31	90	Good
359	R-28	934	1	26-Oct-06	7	27	3	1	0	4	1	0	0	2	8	30	90	Good
360	R-31	532	2	18-Mar-04	1	17	19	0	0	0	0	0	1	1	2	36	47	Poor
361	R-31	532	2	17-Aug-05	2	19	15	2	0	0	0	0	1	1	4	34	56	Poor
362	R-31	532	2	28-Nov-06	3	16	15	5	0	0	0	0	1	1	7	31	52	Poor
363	R-31	670	3	19-Aug-05	1	21	12	3	0	0	0	0	1	1	5	33	64	Fair
364	R-31	670	3	30-Nov-06	2	22	10	4	0	0	0	0	1	1	6	32	69	Fair
365	R-31	831	4	23-Aug-05	1	31	1	3	1	0	0	0	0	2	6	32	97	Very Good
366	R-31	831	4	6-Dec-06	2	31	1	4	0	0	0	0	0	2	6	32	97	Very Good
367	R-31	1011	5	24-Aug-05	1	27	3	3	0	0	1	0	1	3	8	30	90	Good
368	R-31	1011	5	6-Dec-06	2	29	1	5	0	0	0	0	1	2	8	30	97	Very Good
369	R-32	871	1	21-Sep-04	1	32	4	0	0	0	0	0	0	2	2	36	89	Good
370	R-32	871	1	15-Nov-04	2	32	4	0	0	0	0	0	0	2	2	36	89	Good
371	R-32	871	1	22-Jun-05	3	31	2	2	0	0	1	0	0	2	5	33	94	Very Good
372	R-32	871	1	29-Aug-06	4	31	1	4	0	0	0	0	0	2	6	32	97	Very Good
373	R-32	871	1	12-Dec-06	5	31	1	4	0	0	0	0	0	2	6	32	97	Very Good
374	R-32	976	3	22-Sep-04	1	23	13	0	0	0	0	0	1	1	2	36	64	Fair
375	R-32	976	3	16-Nov-04	2	22	13	1	0	0	0	0	1	1	3	35	63	Fair
376	R-32	976	3	24-Jun-05	3	25	9	2	0	0	0	0	1	1	4	34	74	Fair
377	R-32	976	3	30-Aug-06	4	22	11	3	0	0	1	0	1	0	5	33	67	Fair
378	R-32	976	3	13-Dec-06	5	25	7	4	0	0	0	0	0	2	6	32	78	Fair
379	R-33	996	1	27-Jun-05	1	26	3	5	0	0	2	0	0	2	9	29	90	Good
380	R-33	996	1	14-Sep-05	2	27	5	3	0	0	1	0	0	2	6	32	84	Good
381	R-33	996	1	16-Feb-06	3	32	2	1	0	0	1	0	0	2	4	34	94	Very Good
382	R-33	996	1	31-Oct-06	4	26	3	7	0	0	1	0	0	1	9	29	90	Good
383	R-33	1112	2	24-Jun-05	1	29	5	2	0	0	0	0	0	2	4	34	85	Good
384	R-33	1112	2	15-Sep-05	2	29	4	2	0	0	1	0	0	2	5	33	88	Good
385	R-33	1112	2	14-Feb-06	3	33	2	1	0	0	0	0	0	2	3	35	94	Very Good
386	R-33	1112	2	5-Jul-06	4	28	3	5	2	0	0	0	0	1	8	31	90	Good
387	R-33	1112	2	1-Nov-06	5	25	3	7	0	0	1	0	0	2	10	28	89	Good
388	R-34	895	1	7-Jun-05	1	32	4	0	0	0	0	0	0	2	2	36	89	Good
389	R-34	895	1	7-Sep-05	2	33	3	0	0	0	0	0	0	2	2	36	92	Very Good
390	R-34	895	1	29-Nov-05	3	32	4	0	0	0	1	0	0	1	2	36	89	Good
391	R-34	895	1	31-Jan-06	4	33	2	1	0	0	0	0	0	2	3	35	94	Very Good
392	R-34	895	1	17-Jul-06	5	32	3	1	0	0	1	0	0	1	3	35	91	Very Good
393	R-34	895	1	30-Oct-06	6	33	1	1	0	0	1	0	0	2	4	34	97	Very Good

Appendix D

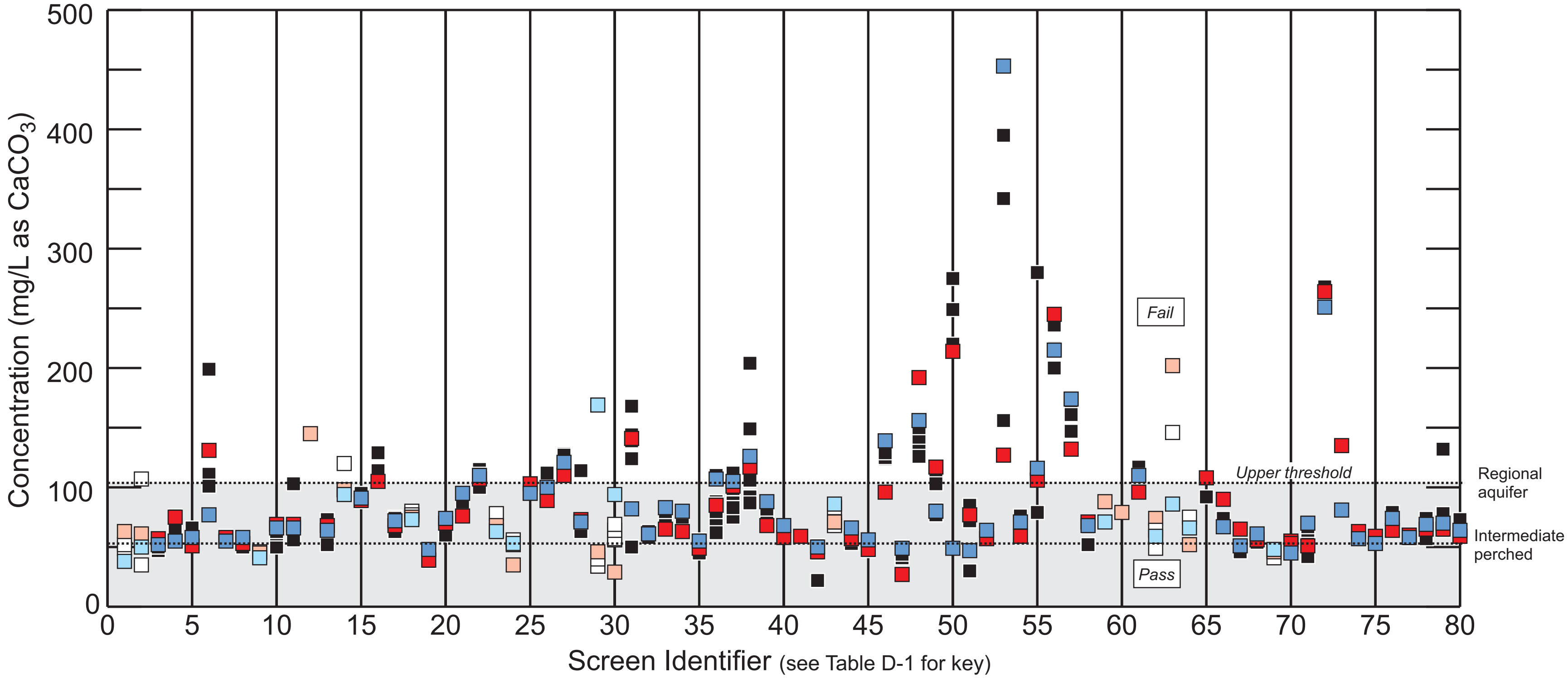
Comparison of Water-Quality Data with Test Criteria

The following figures are included in this appendix:



Sources: Tables C-4 (data) and D-2 (test criteria)

Figure D-1. Comparison of water-quality data against test criteria: acetone

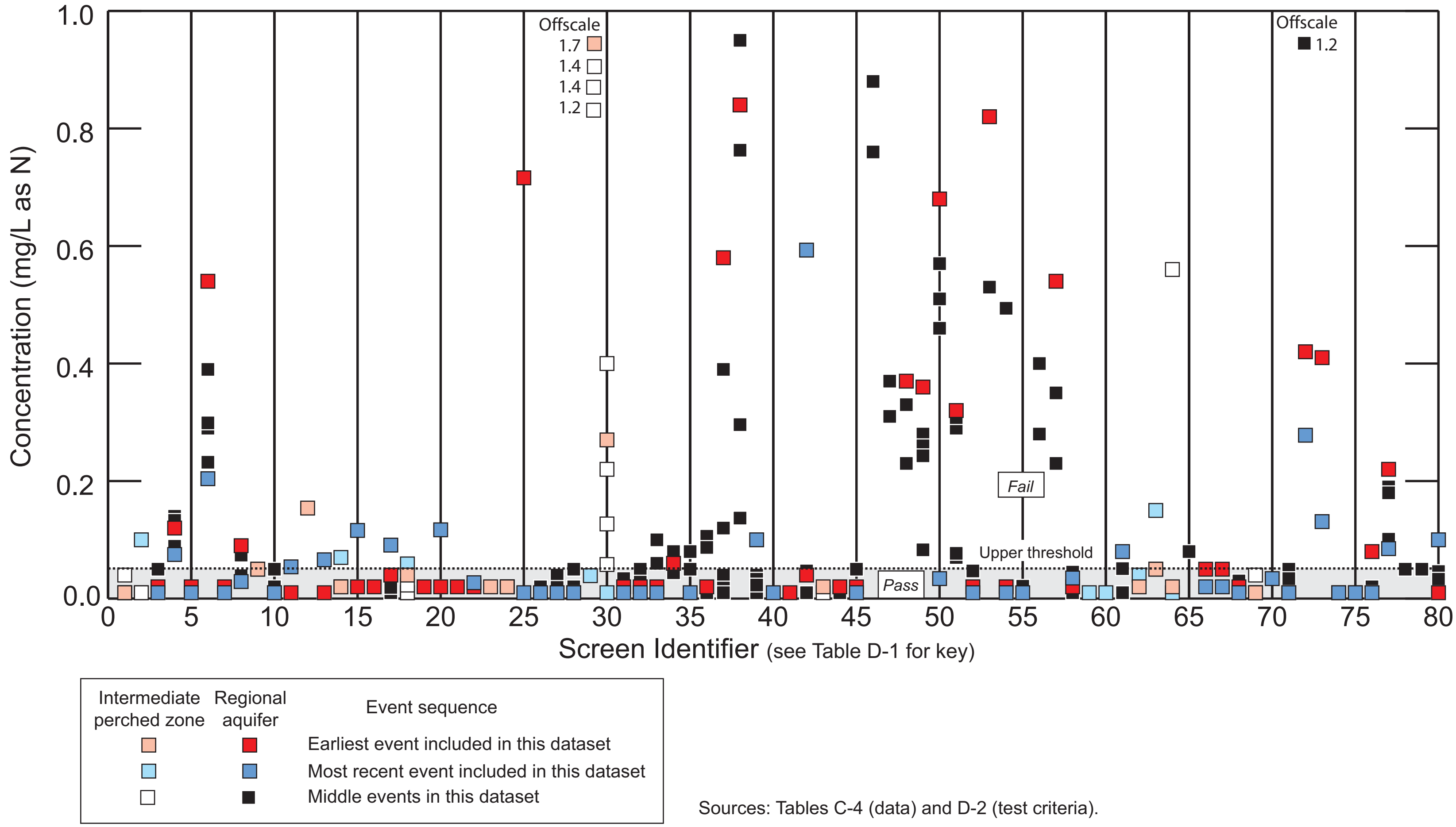


Intermediate perched zone	Regional aquifer	Event sequence
■	■	Earliest event included in this dataset
■	■	Most recent event included in this dataset
□	■	Middle events in this dataset

Note: The shaded region on this plot represents the range of values which meet the test criterion for samples from the regional aquifer. Note that a different range would apply to samples from an intermediate perched zone. When available, data shown are those measured in the field or at the EES-6 analytical laboratory (GGRL). Data obtained from an offsite analytical laboratory were used only when field or GGRL data were not available, as noted in the data table in Appendix C.

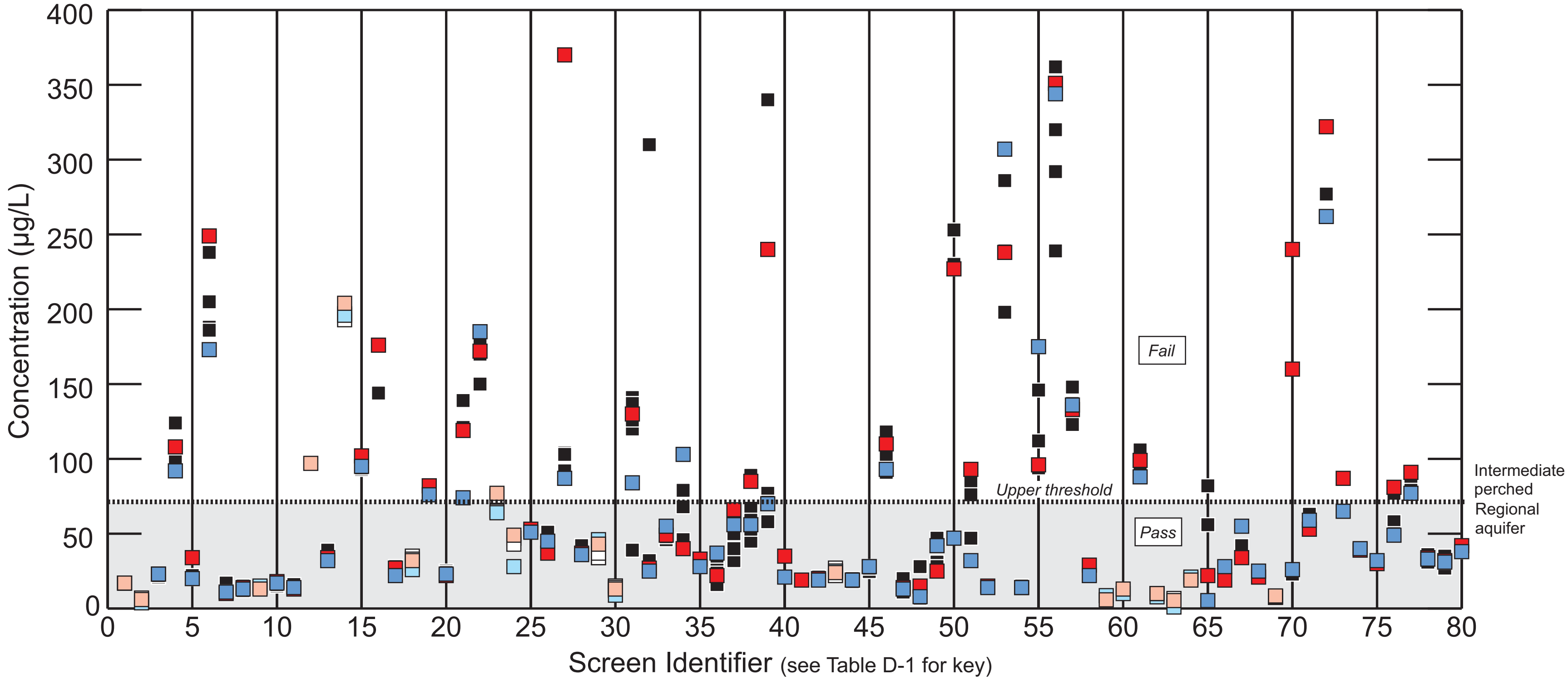
Sources: Tables C-3 (data) and D-2 (test criteria)

Figure D-2. Comparison of water-quality data against test criteria: alkalinity



Sources: Tables C-4 (data) and D-2 (test criteria).

Figure D-3. Comparison of water-quality data against test criteria: ammonia

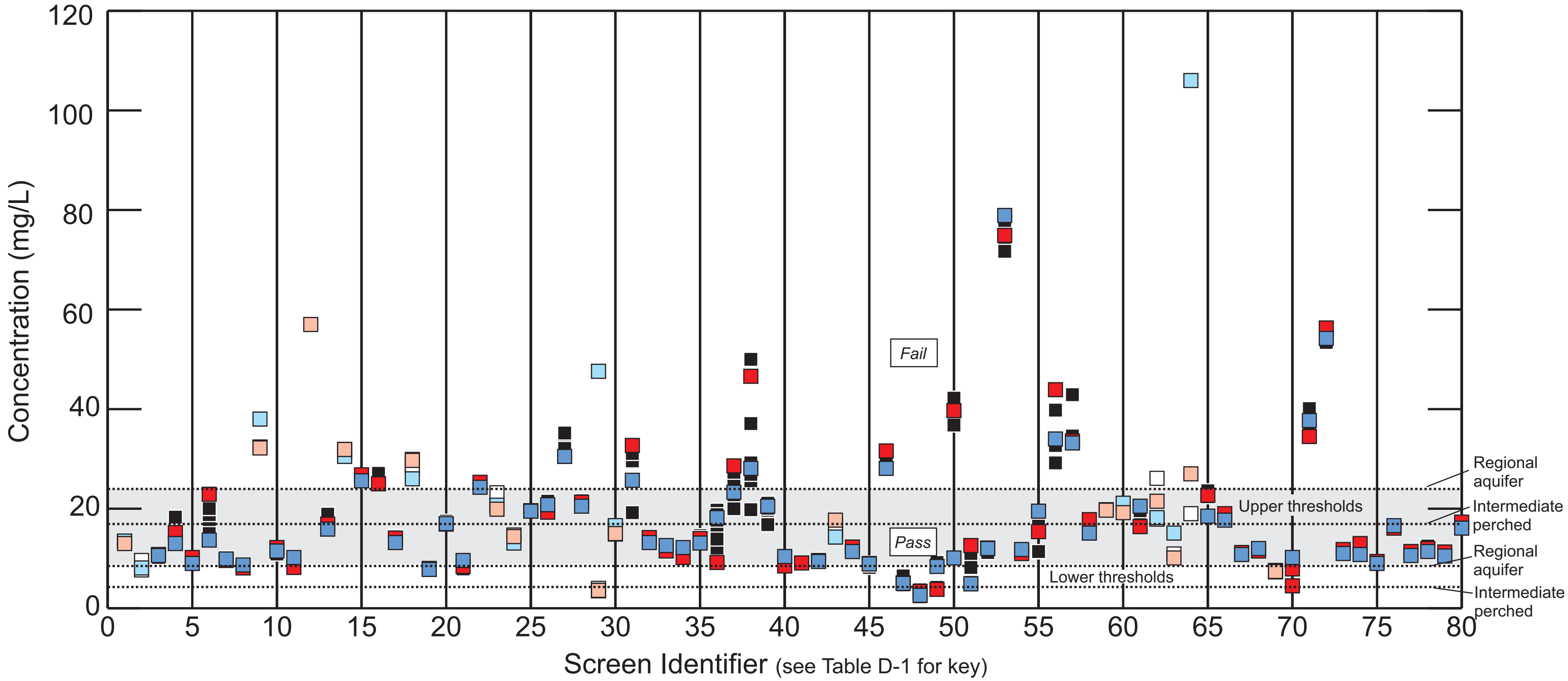


Intermediate perched zone	Regional aquifer	Event sequence
■ (light orange)	■ (red)	Earliest event included in this dataset
■ (light blue)	■ (blue)	Most recent event included in this dataset
□	■ (black)	Middle events in this dataset

Note: Some data shown on this plot were obtained on nonfiltered samples, if data for filtered samples were not available. Because the test criterion applies to dissolved concentrations, the use of nonfiltered data may not always provide an accurate indication of whether or not the sample passes the test criterion. The data table in Appendix C notes which of the samples in this plot were not filtered.

Sources: Tables C-5 (data) and D-2 (test criteria).

Figure D-4. Comparison of water-quality data against test criteria: barium



Note: The shaded region on this plot represents the range of values which meet the test criterion for samples from the regional aquifer. Note that a different range would apply to samples from an intermediate perched zone. Some data shown on this plot were obtained on nonfiltered samples, if data for filtered samples were not available. Because the test criterion applies to dissolved concentrations, the use of nonfiltered data may not always provide an accurate indication of whether or not the sample passes the test criterion. The data table in Appendix C notes which of the samples in this plot were not filtered.

Sources: Tables C-5 (data) and D-2 (test criteria).

Figure D-5. Comparison of water-quality data against test criteria: calcium

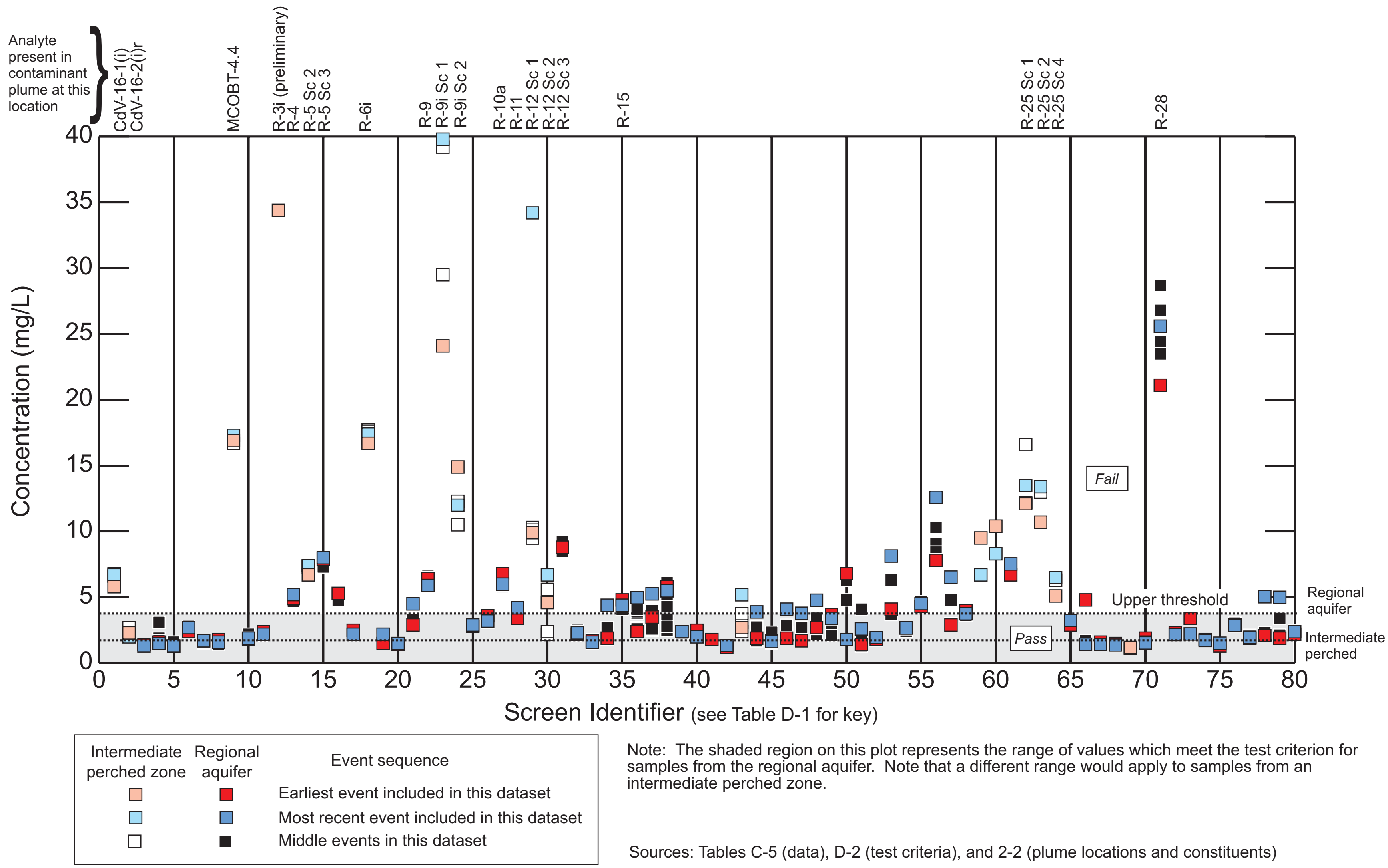
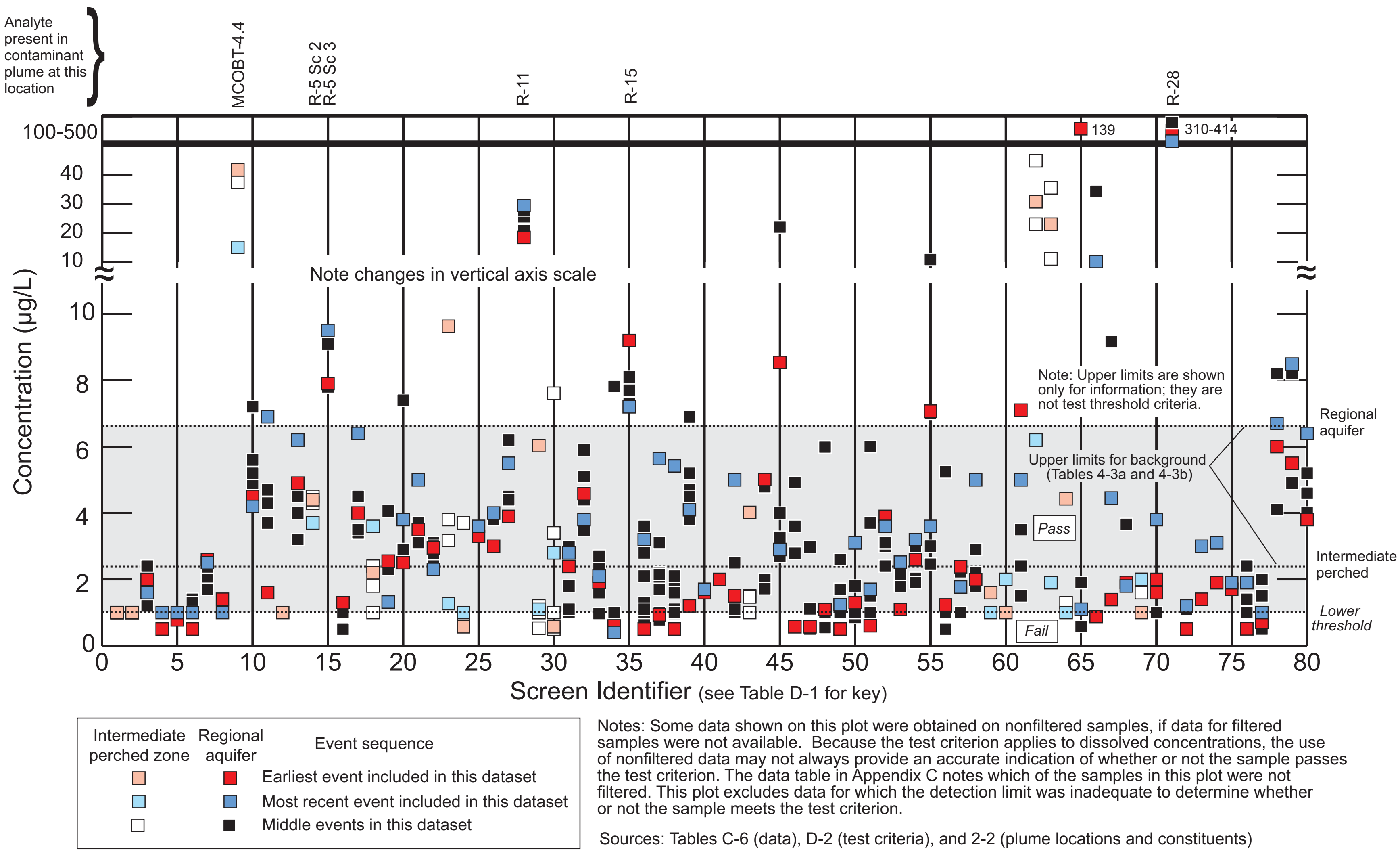


Figure D-6. Comparison of water-quality data against test criteria: chloride



Notes: Some data shown on this plot were obtained on nonfiltered samples, if data for filtered samples were not available. Because the test criterion applies to dissolved concentrations, the use of nonfiltered data may not always provide an accurate indication of whether or not the sample passes the test criterion. The data table in Appendix C notes which of the samples in this plot were not filtered. This plot excludes data for which the detection limit was inadequate to determine whether or not the sample meets the test criterion.

Sources: Tables C-6 (data), D-2 (test criteria), and 2-2 (plume locations and constituents)

Figure D-7. Comparison of water-quality data against test criteria: chromium (dissolved)

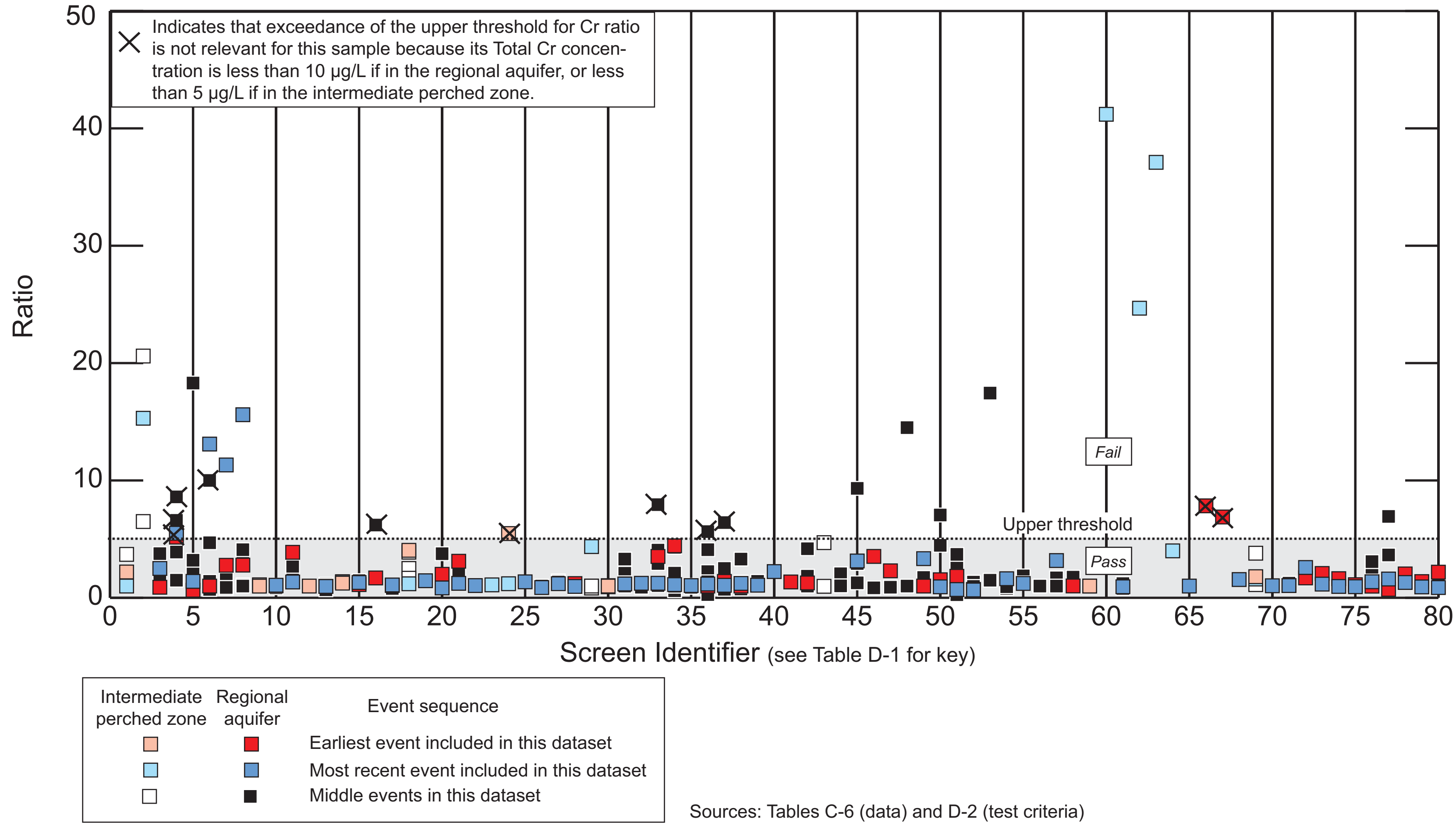
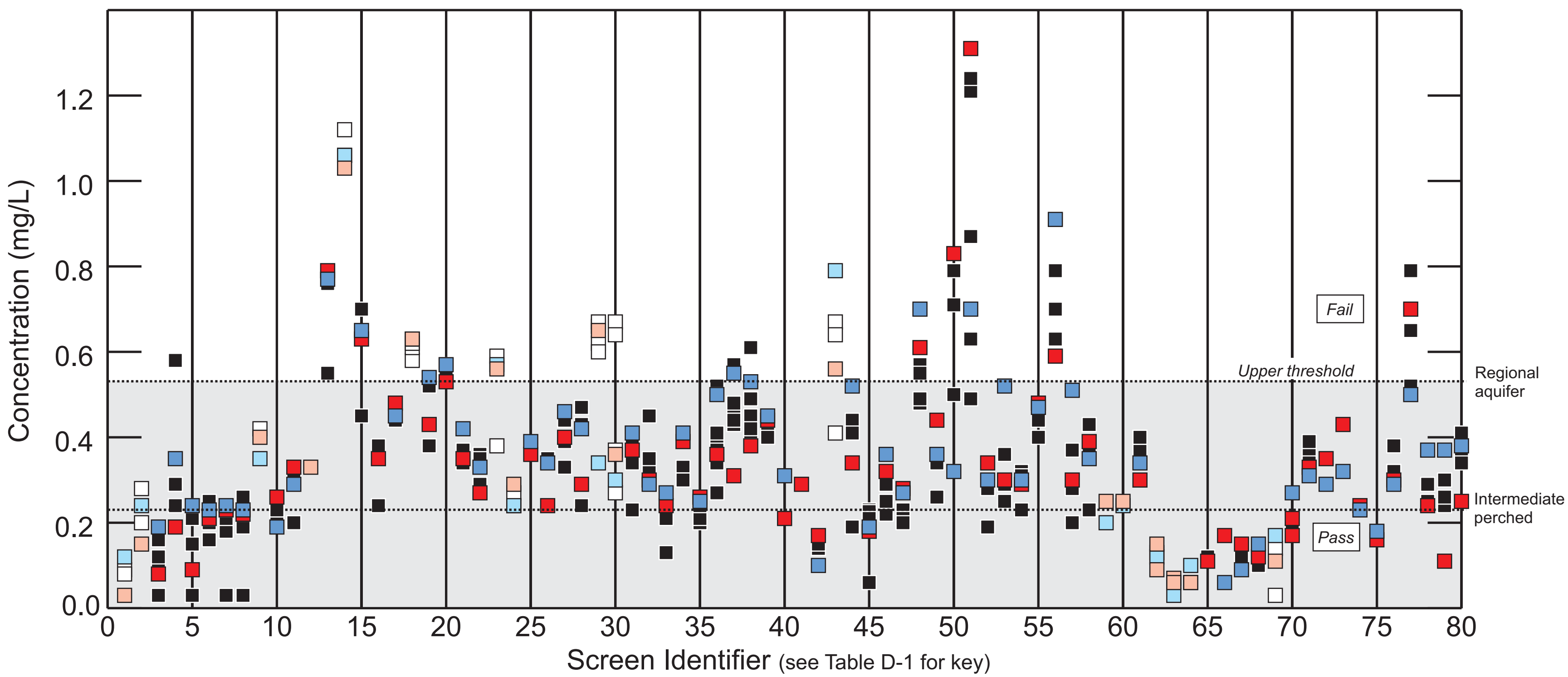


Figure D-8. Comparison of water-quality data against test criteria: chromium ratio (total/dissolved)

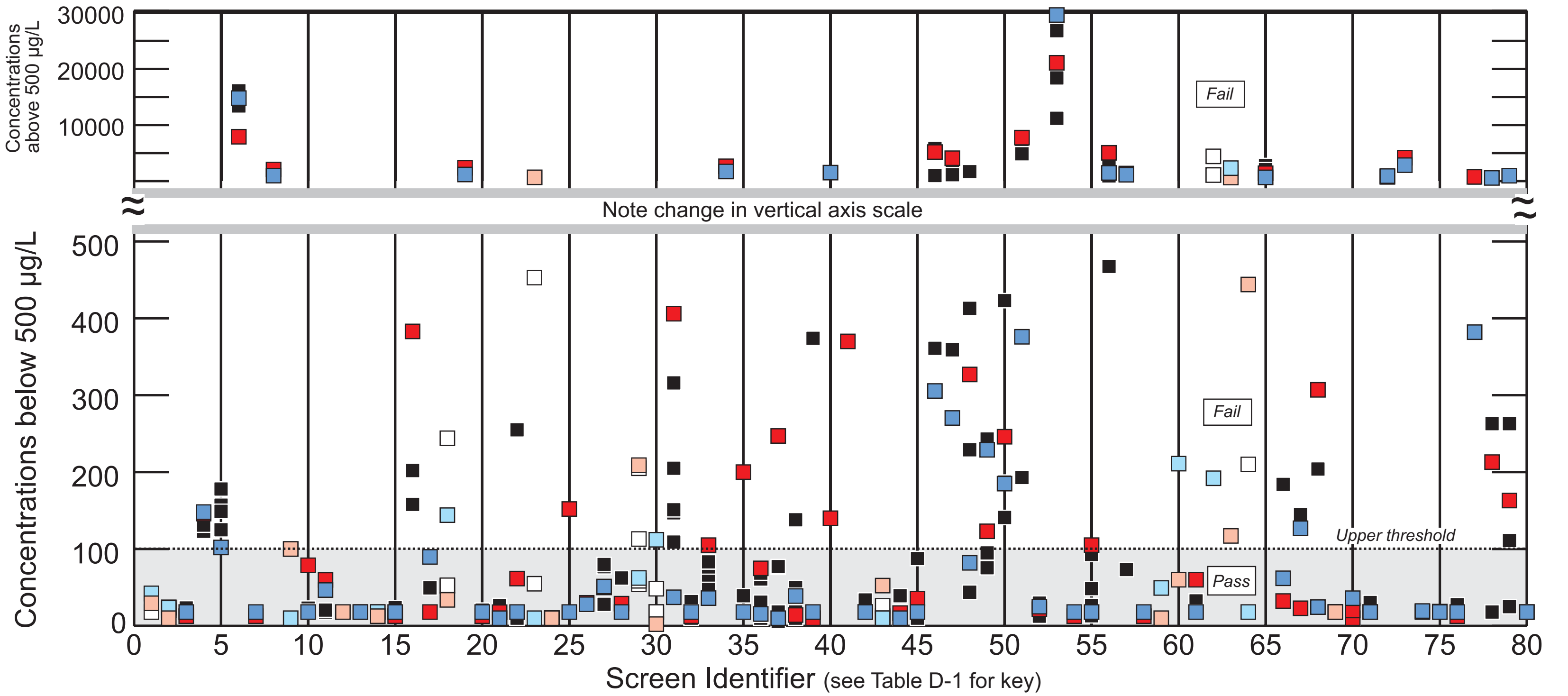


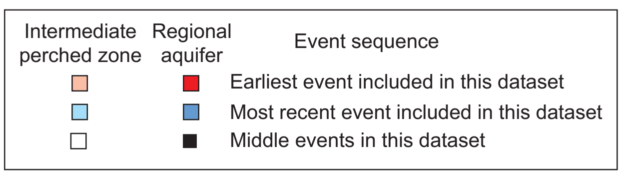
Intermediate perched zone	Regional aquifer	Event sequence
(light red)	(red)	Earliest event included in this dataset
(light blue)	(blue)	Most recent event included in this dataset
(white)	(black)	Middle events in this dataset

Note: The shaded region on this plot represents the range of values which meet the test criterion for samples from the regional aquifer. Note that a different range would apply to samples from an intermediate perched zone.

Sources: Tables C-5 (data) and D-2 (test criteria)

Figure D-9. Comparison of water-quality data against test criteria: fluoride

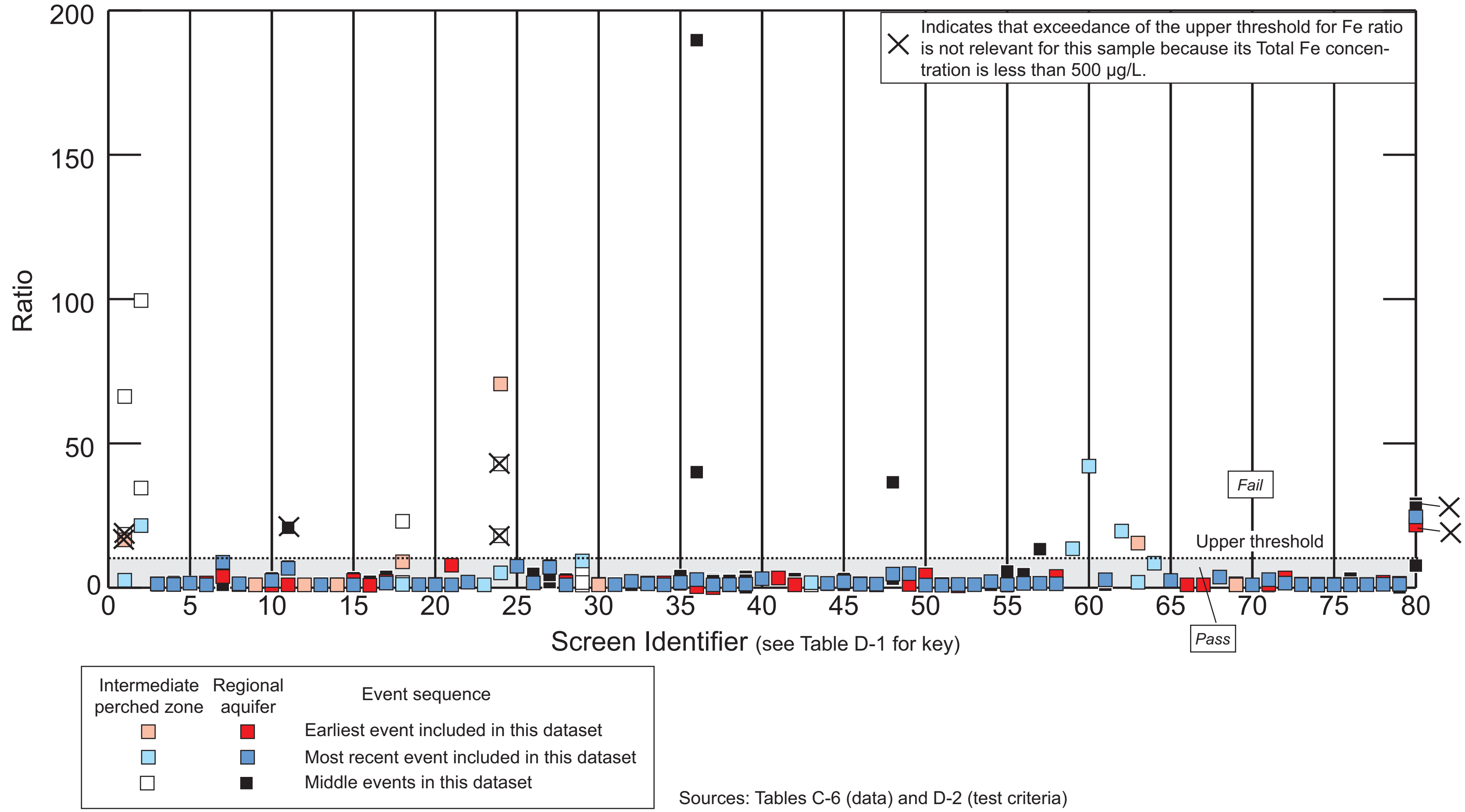




Note: Some data shown on this plot were obtained on nonfiltered samples, if data for filtered samples were not available. Because the test criterion applies to dissolved concentrations, the use of nonfiltered data may not always provide an accurate indication of whether or not the sample passes the test criterion. The data table in Appendix C notes which of the samples in this plot were not filtered.

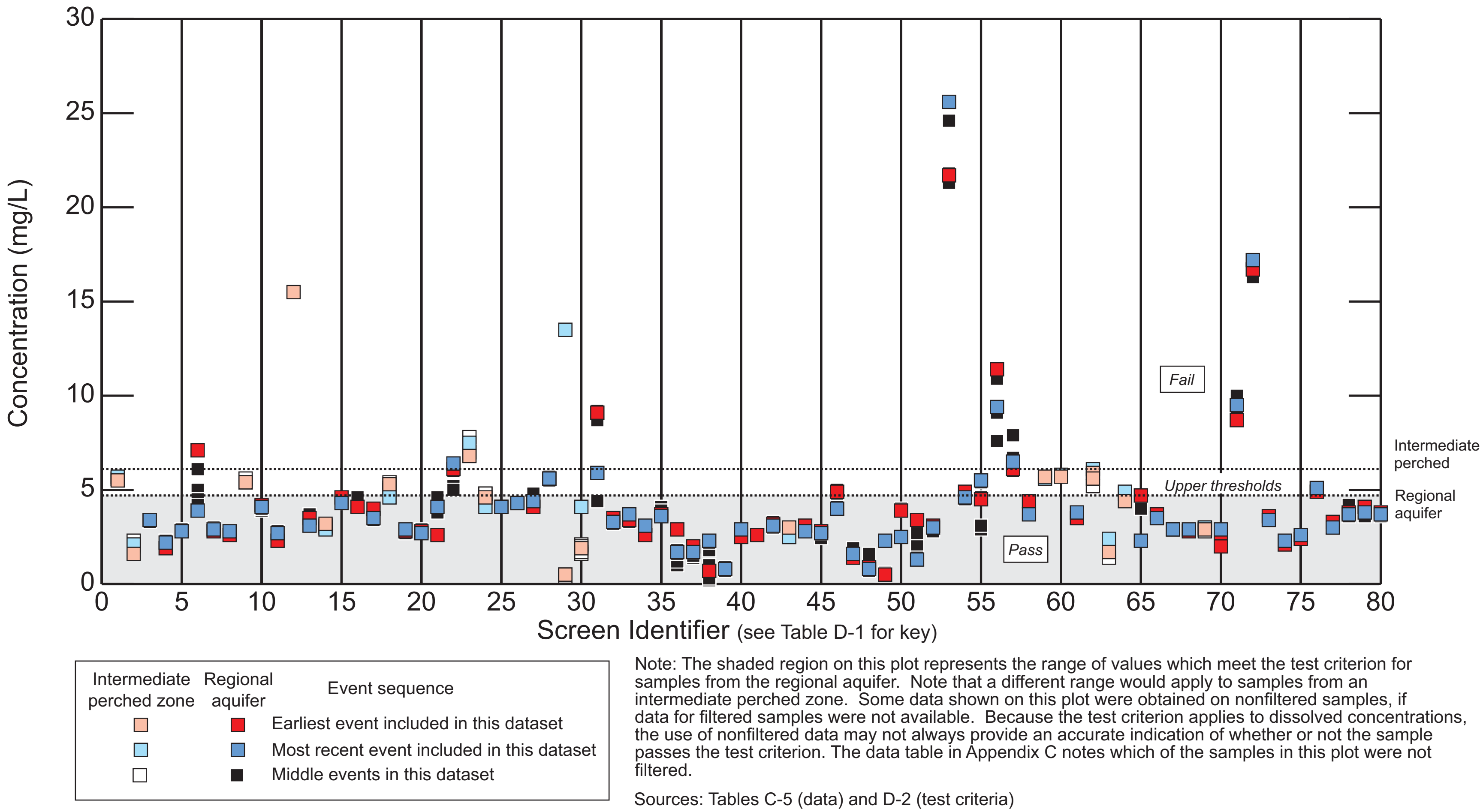
Sources: Tables C-6 (data) and D-2 (test criteria)

Figure D-10. Comparison of water-quality data against test criteria: iron (dissolved)



Sources: Tables C-6 (data) and D-2 (test criteria)

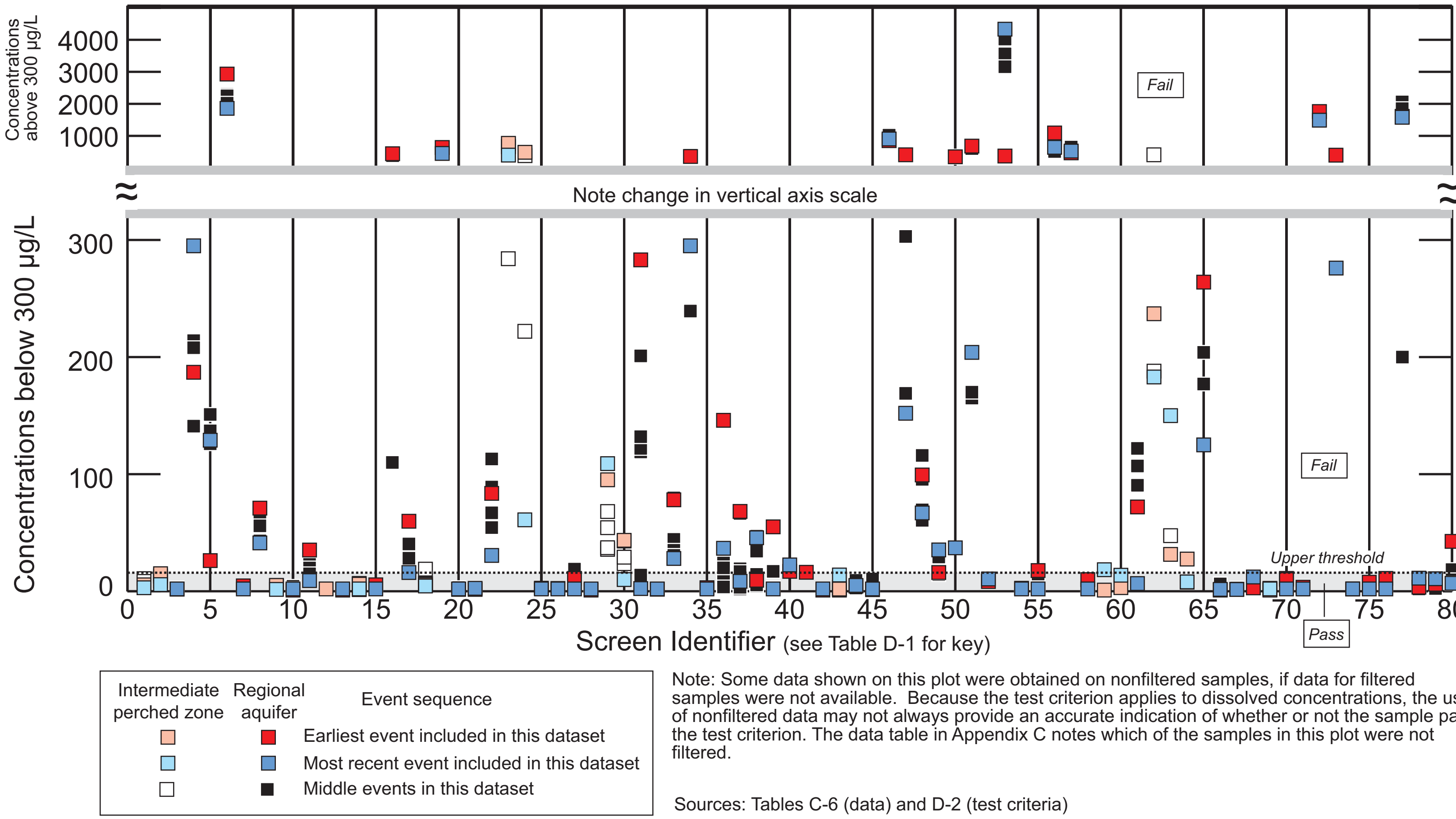
Figure D-11. Comparison of water-quality data against test criteria: iron ratio (total/dissolved)



Note: The shaded region on this plot represents the range of values which meet the test criterion for samples from the regional aquifer. Note that a different range would apply to samples from an intermediate perched zone. Some data shown on this plot were obtained on nonfiltered samples, if data for filtered samples were not available. Because the test criterion applies to dissolved concentrations, the use of nonfiltered data may not always provide an accurate indication of whether or not the sample passes the test criterion. The data table in Appendix C notes which of the samples in this plot were not filtered.

Sources: Tables C-5 (data) and D-2 (test criteria)

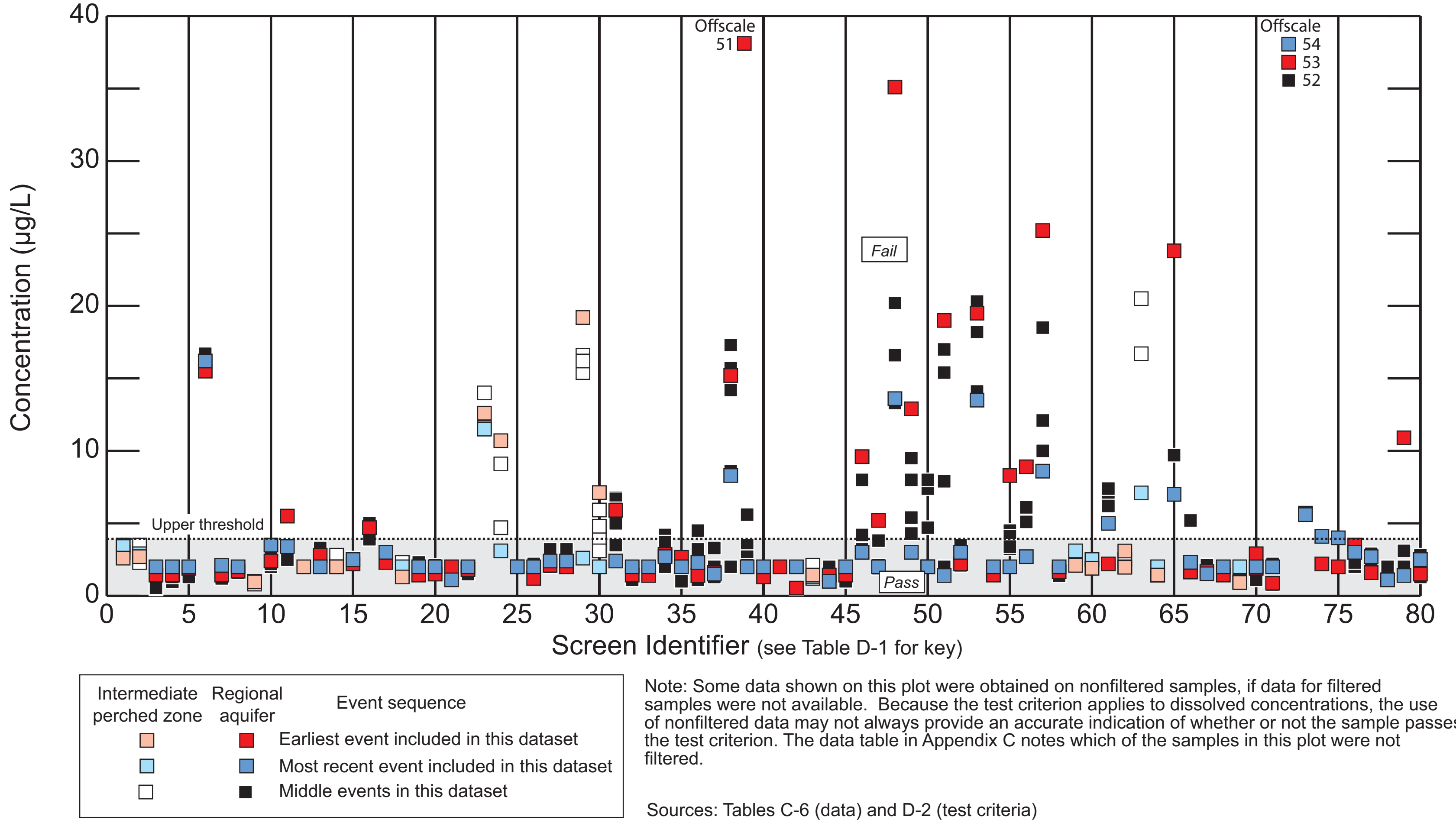
Figure D-12. Comparison of water-quality data against test criteria: magnesium



Note: Some data shown on this plot were obtained on nonfiltered samples, if data for filtered samples were not available. Because the test criterion applies to dissolved concentrations, the use of nonfiltered data may not always provide an accurate indication of whether or not the sample passes the test criterion. The data table in Appendix C notes which of the samples in this plot were not filtered.

Sources: Tables C-6 (data) and D-2 (test criteria)

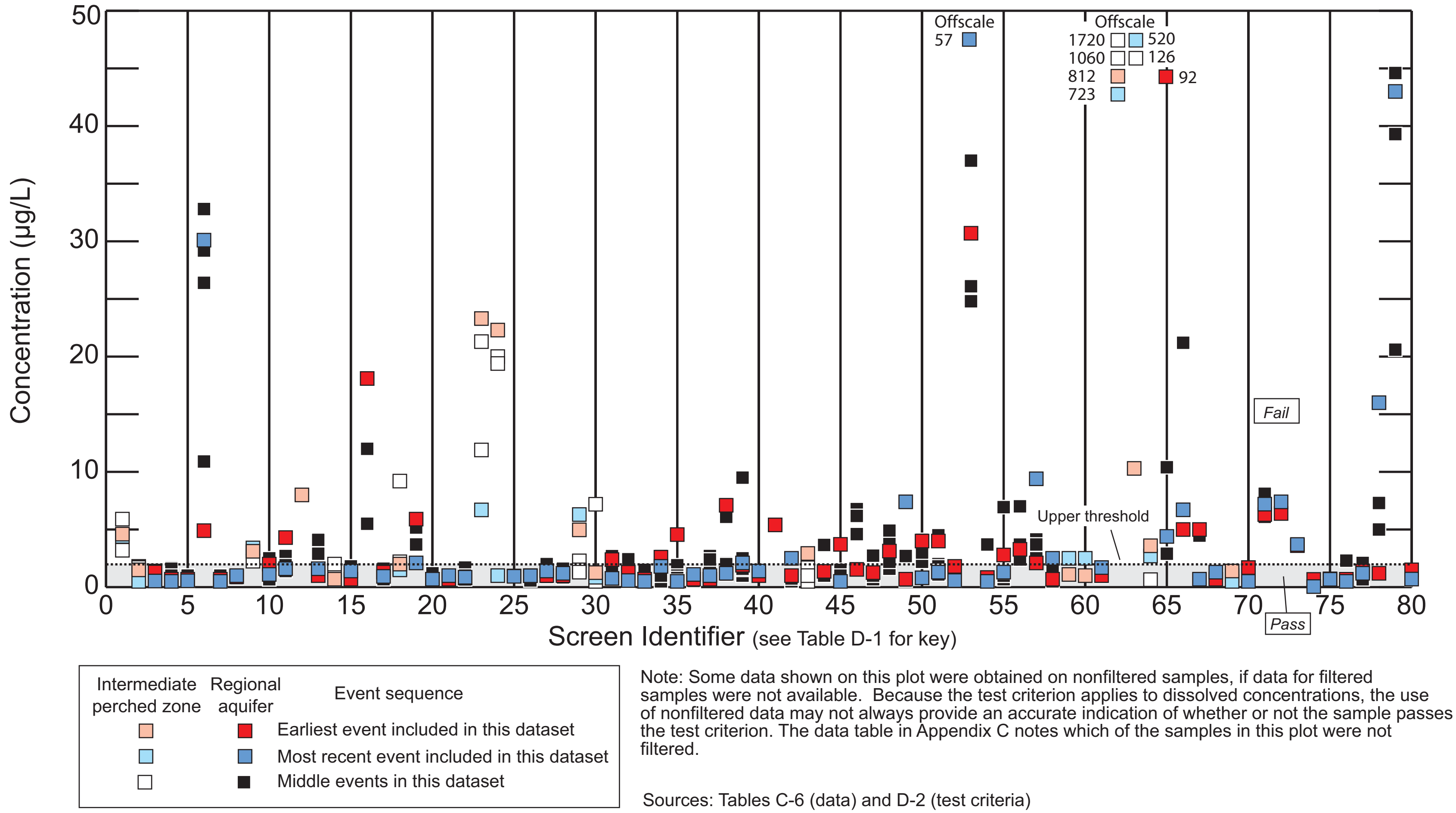
Figure D-13. Comparison of water-quality data against test criteria: manganese (dissolved)



Note: Some data shown on this plot were obtained on nonfiltered samples, if data for filtered samples were not available. Because the test criterion applies to dissolved concentrations, the use of nonfiltered data may not always provide an accurate indication of whether or not the sample passes the test criterion. The data table in Appendix C notes which of the samples in this plot were not filtered.

Sources: Tables C-6 (data) and D-2 (test criteria)

Figure D-14. Comparison of water-quality data against test criteria: molybdenum



Note: Some data shown on this plot were obtained on nonfiltered samples, if data for filtered samples were not available. Because the test criterion applies to dissolved concentrations, the use of nonfiltered data may not always provide an accurate indication of whether or not the sample passes the test criterion. The data table in Appendix C notes which of the samples in this plot were not filtered.

Sources: Tables C-6 (data) and D-2 (test criteria)

Figure D-15. Comparison of water-quality data against test criteria: nickel

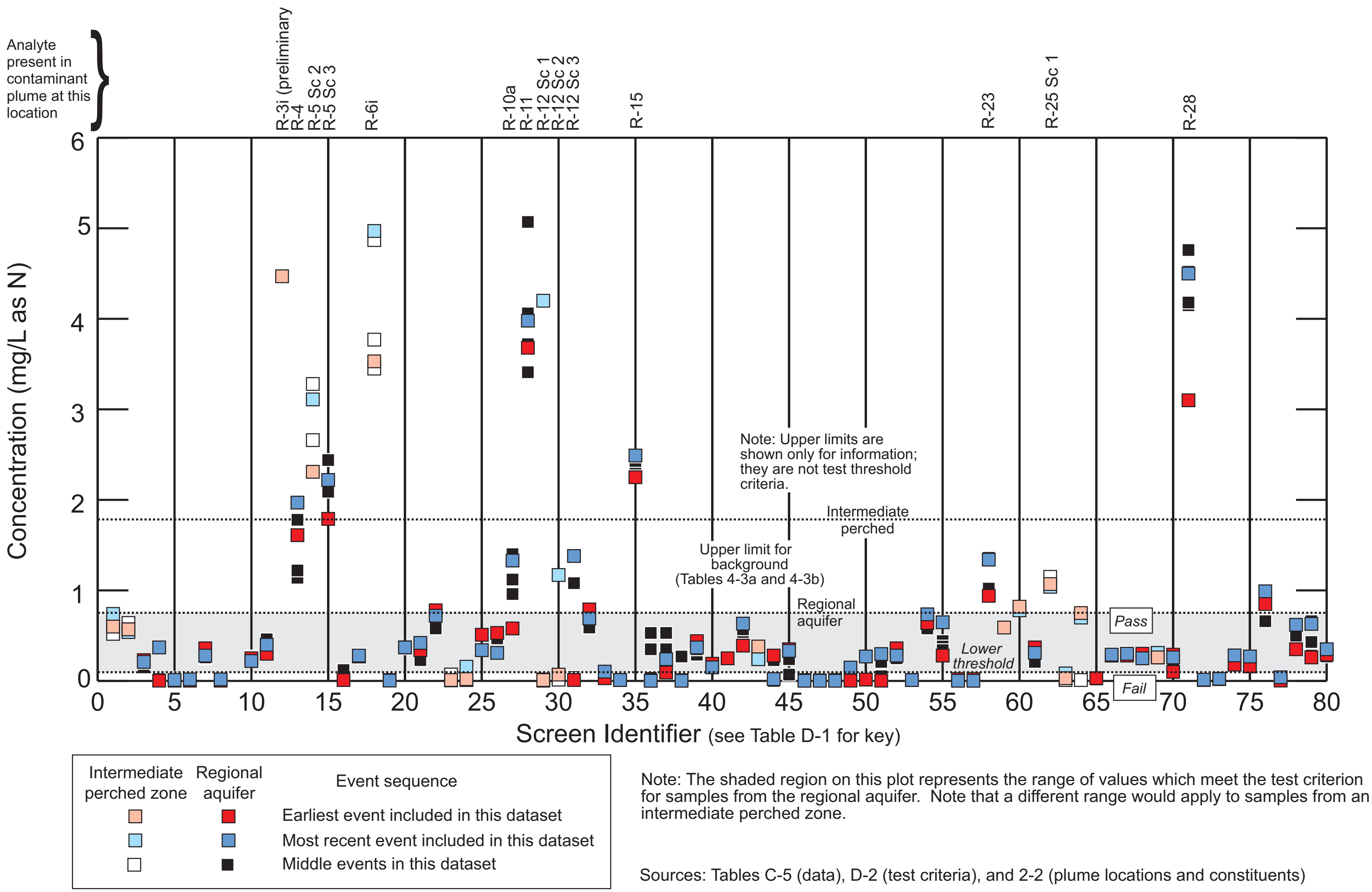
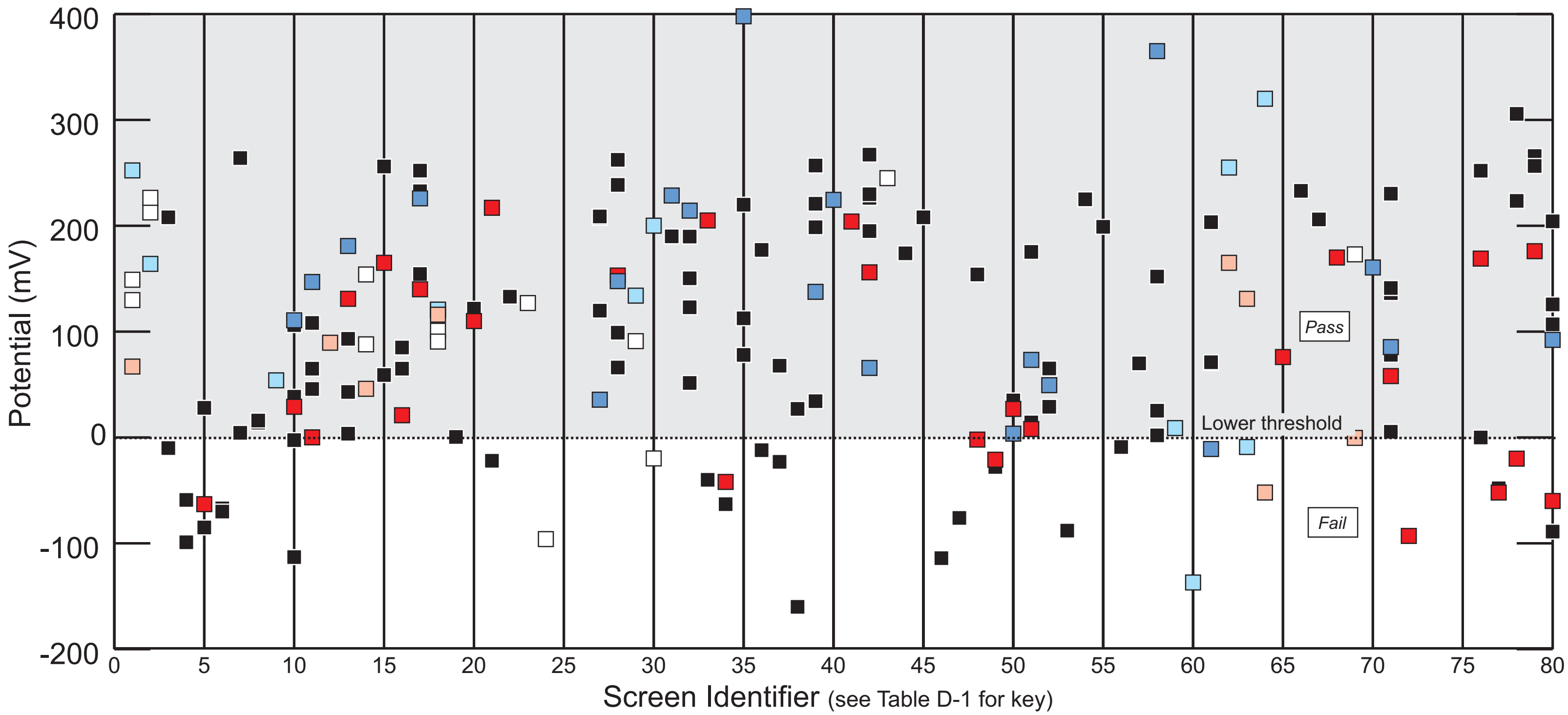


Figure D-16. Comparison of water-quality data against test criteria: nitrate

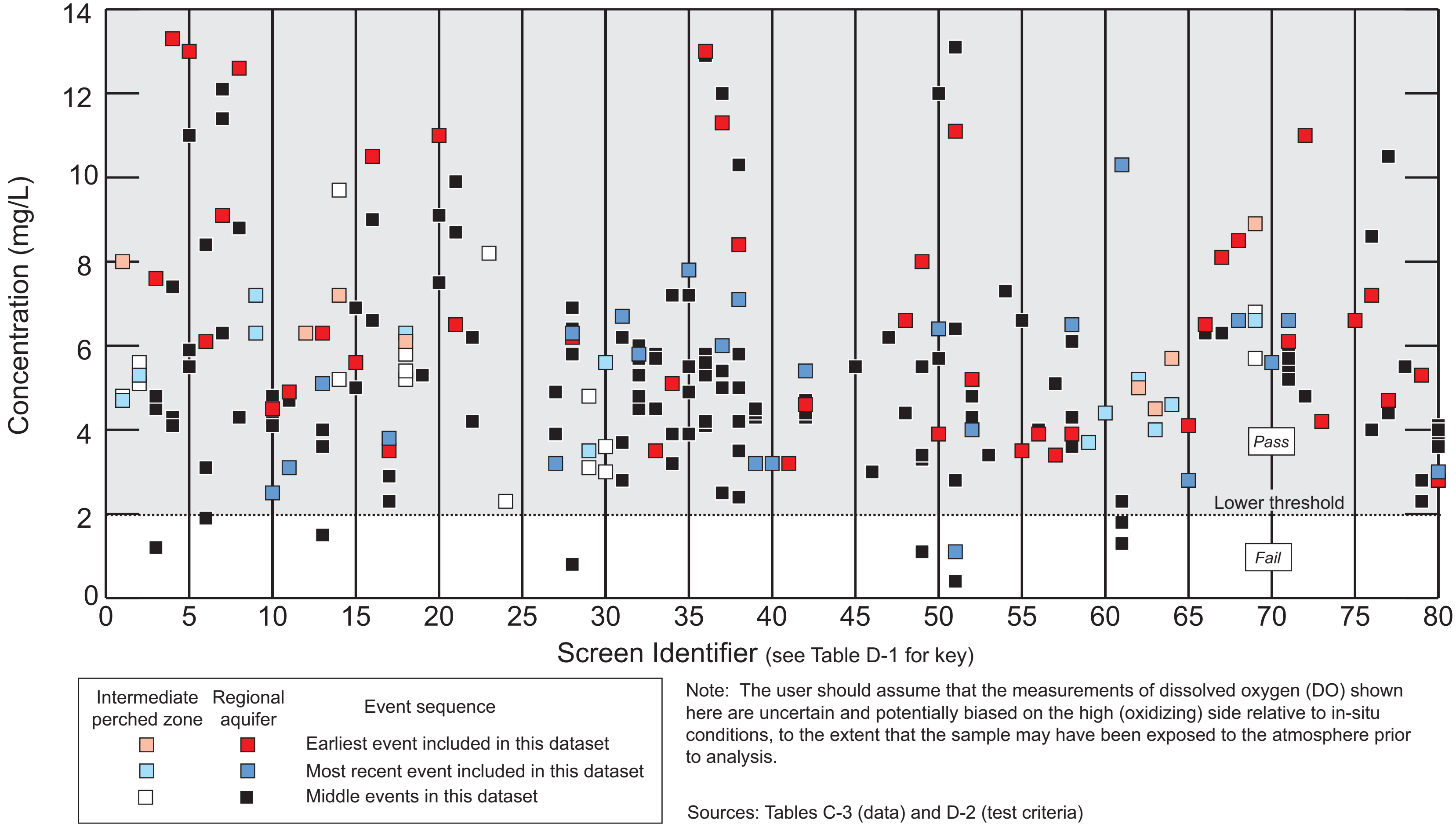


Intermediate perched zone	Regional aquifer	Event sequence
(light orange square)	(red square)	Earliest event included in this dataset
(light blue square)	(blue square)	Most recent event included in this dataset
(white square)	(black square)	Middle events in this dataset

Note: The user should assume that the measurements of oxidation reduction potential shown here are uncertain and potentially biased on the high (oxidizing) side relative to in-situ conditions, to the extent that the sample may have been exposed to the atmosphere prior to analysis.

Sources: Tables C-3 (data) and D-2 (test criteria)

Figure D-17. Comparison of water-quality data against test criteria: oxidation reduction potential



Note: The user should assume that the measurements of dissolved oxygen (DO) shown here are uncertain and potentially biased on the high (oxidizing) side relative to in-situ conditions, to the extent that the sample may have been exposed to the atmosphere prior to analysis.

Sources: Tables C-3 (data) and D-2 (test criteria)

Figure D-18. Comparison of water-quality data against test criteria: oxygen (dissolved)

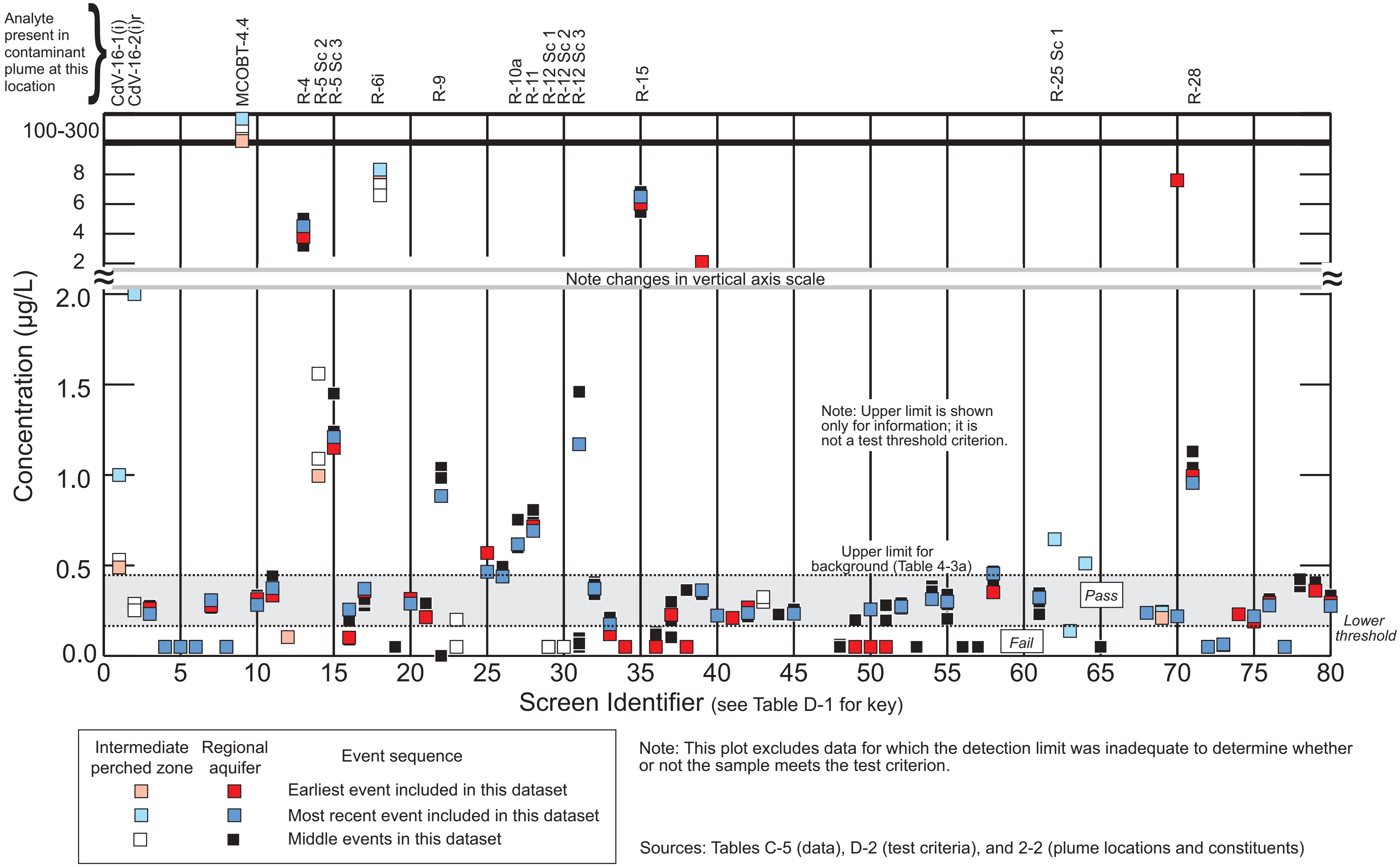
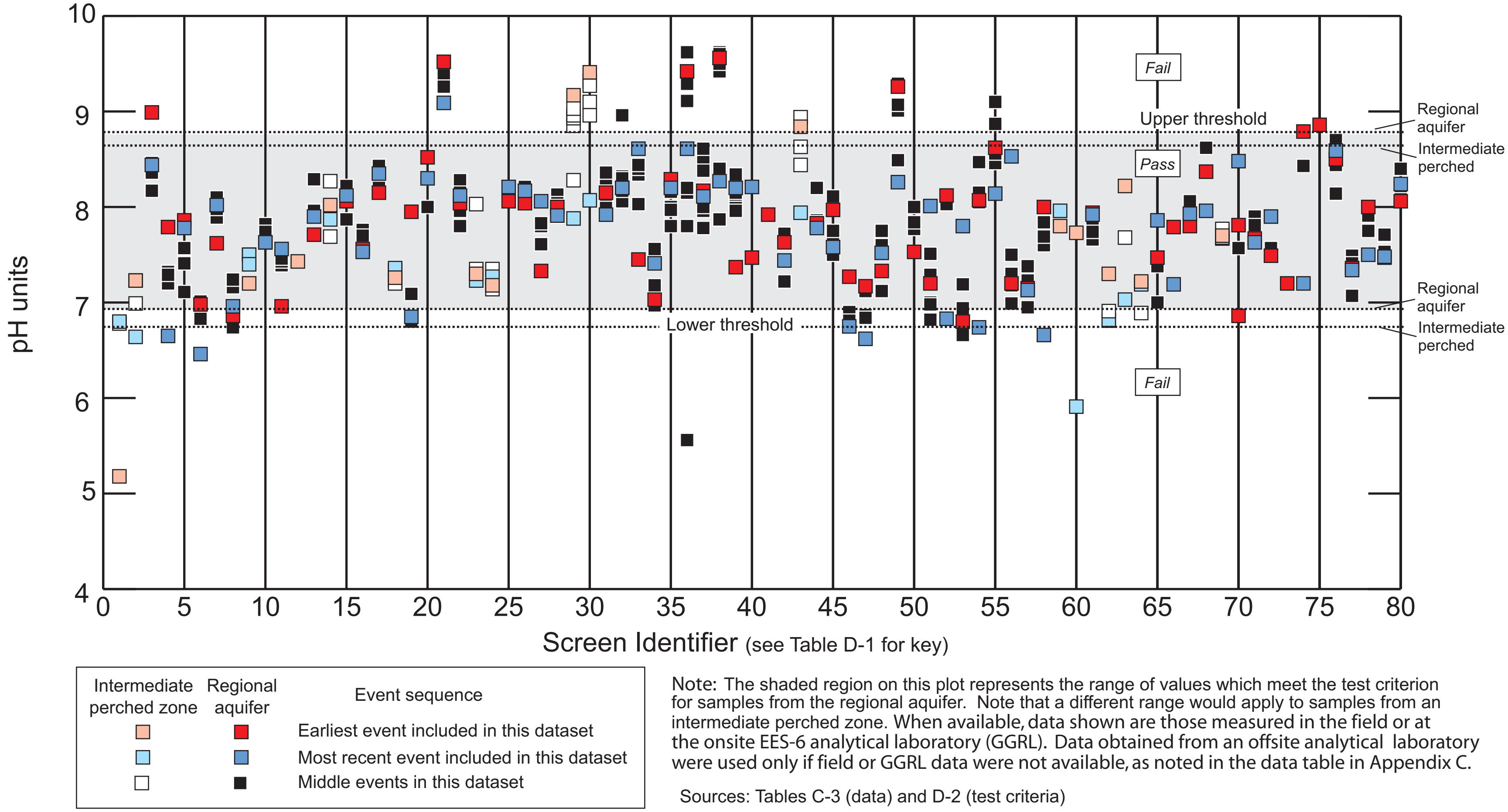


Figure D-19. Comparison of water-quality data against test criteria: perchlorate



Note: The shaded region on this plot represents the range of values which meet the test criterion for samples from the regional aquifer. Note that a different range would apply to samples from an intermediate perched zone. When available, data shown are those measured in the field or at the onsite EES-6 analytical laboratory (GGRL). Data obtained from an offsite analytical laboratory were used only if field or GGRL data were not available, as noted in the data table in Appendix C.

Sources: Tables C-3 (data) and D-2 (test criteria)

Figure D-20. Comparison of water-quality data against test criteria: pH

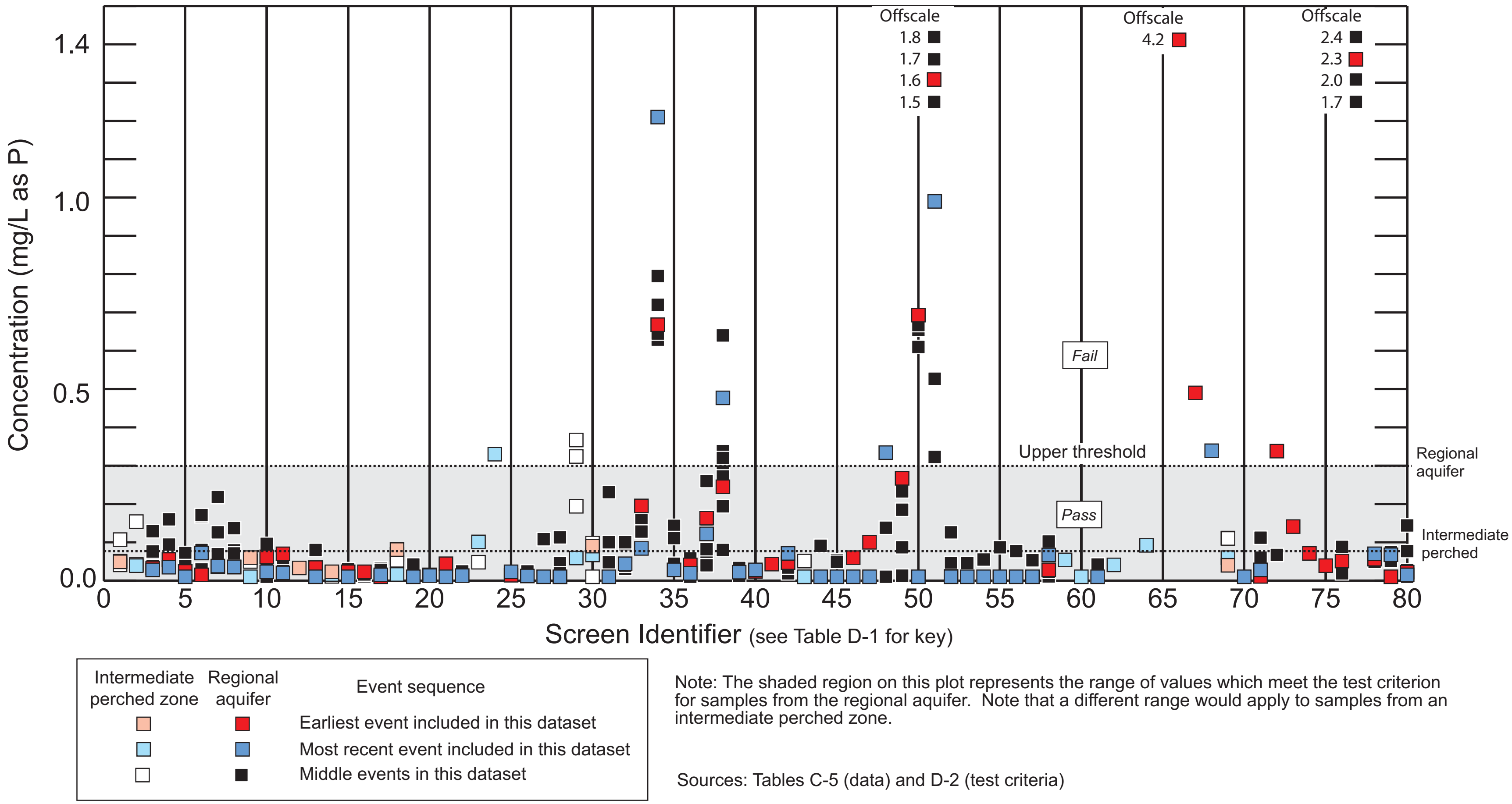
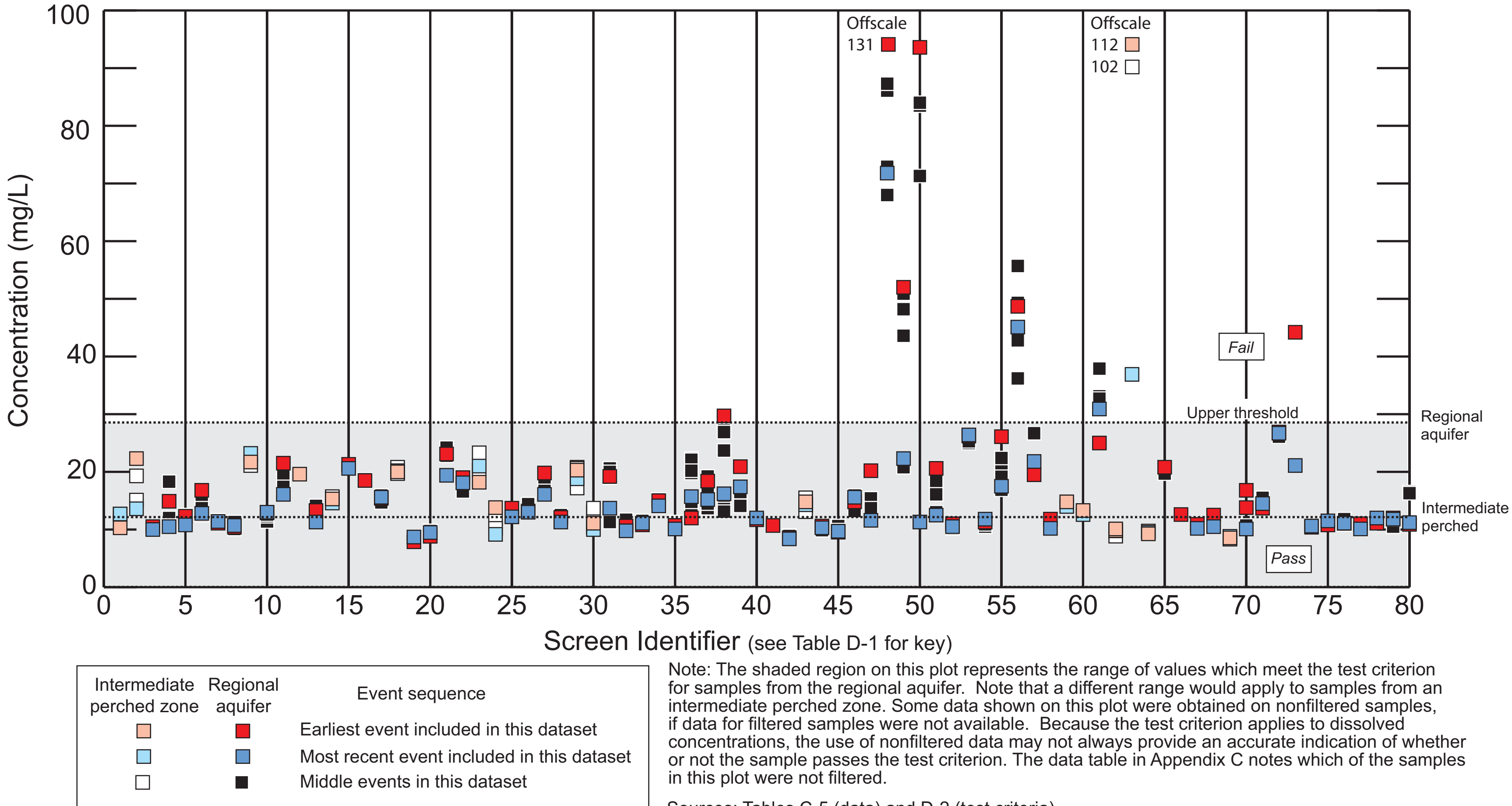


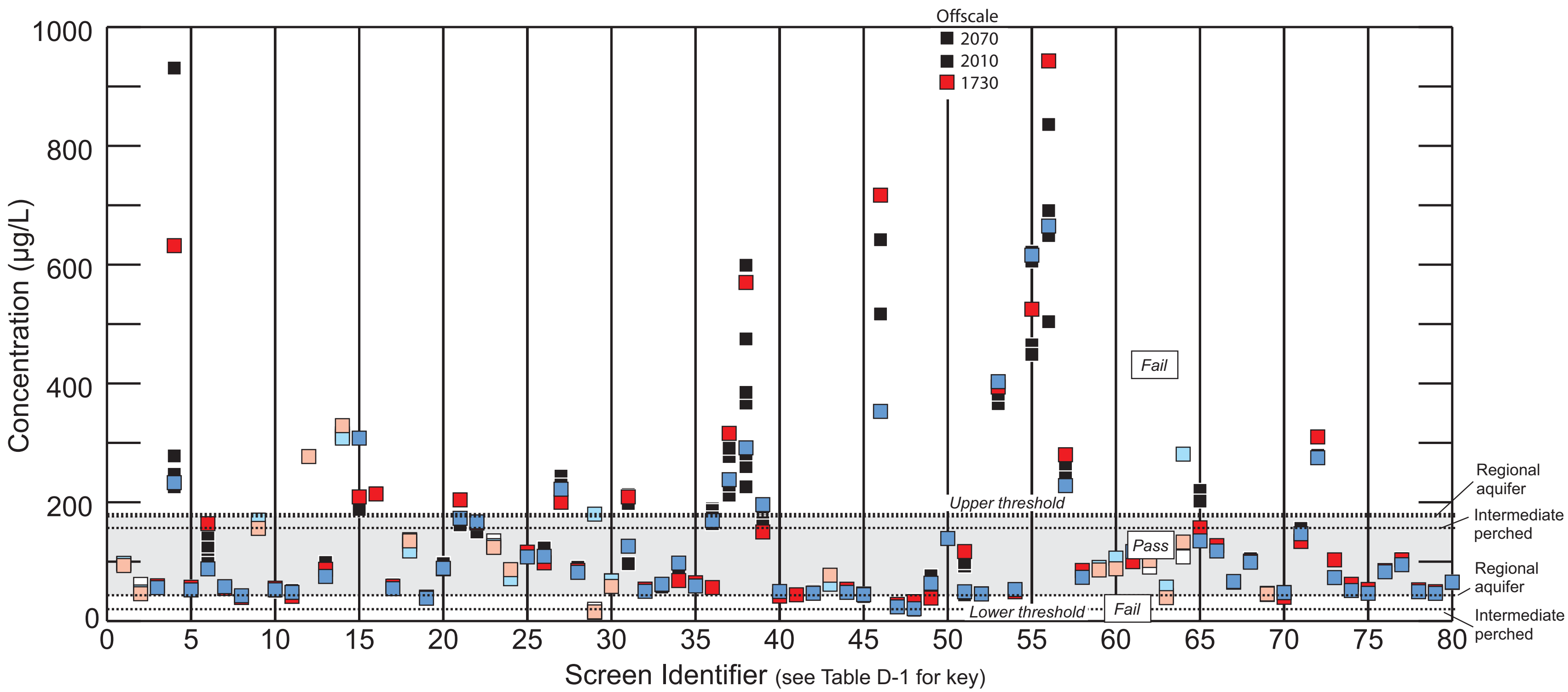
Figure D-21. Comparison of water-quality data against test criteria: phosphate



Note: The shaded region on this plot represents the range of values which meet the test criterion for samples from the regional aquifer. Note that a different range would apply to samples from an intermediate perched zone. Some data shown on this plot were obtained on nonfiltered samples, if data for filtered samples were not available. Because the test criterion applies to dissolved concentrations, the use of nonfiltered data may not always provide an accurate indication of whether or not the sample passes the test criterion. The data table in Appendix C notes which of the samples in this plot were not filtered.

Sources: Tables C-5 (data) and D-2 (test criteria)

Figure D-22. Comparison of water-quality data against test criteria: sodium

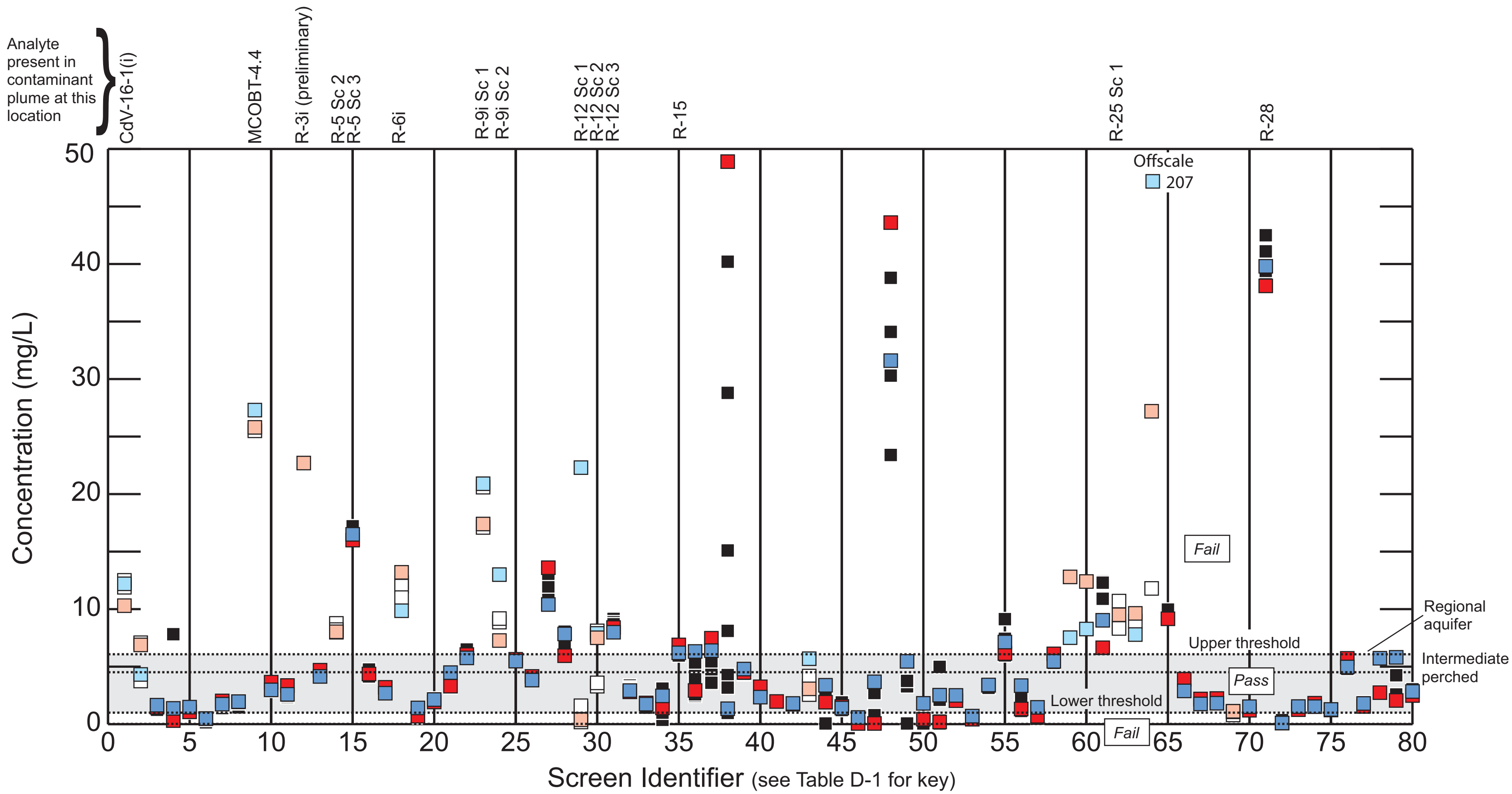


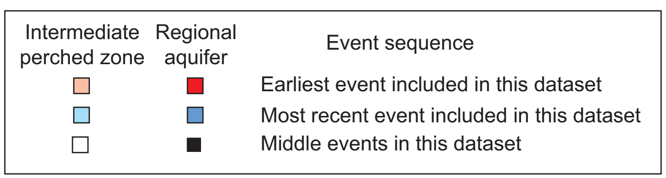
Intermediate perched zone	Regional aquifer	Event sequence
(light orange)	(red)	Earliest event included in this dataset
(light blue)	(blue)	Most recent event included in this dataset
(white)	(black)	Middle events in this dataset

Note: The shaded region on this plot represents the range of values which meet the test criterion for samples from the regional aquifer. Note that a different range would apply to samples from an intermediate perched zone. Some data shown on this plot were obtained on nonfiltered samples, if data for filtered samples were not available. Because the test criterion applies to dissolved concentrations, the use of nonfiltered data may not always provide an accurate indication of whether or not the sample passes the test criterion. The data table in Appendix C notes which of the samples in this plot were not filtered.

Sources: Tables C-6 (data) and D-2 (test criteria)

Figure D-23. Comparison of water-quality data against test criteria: strontium

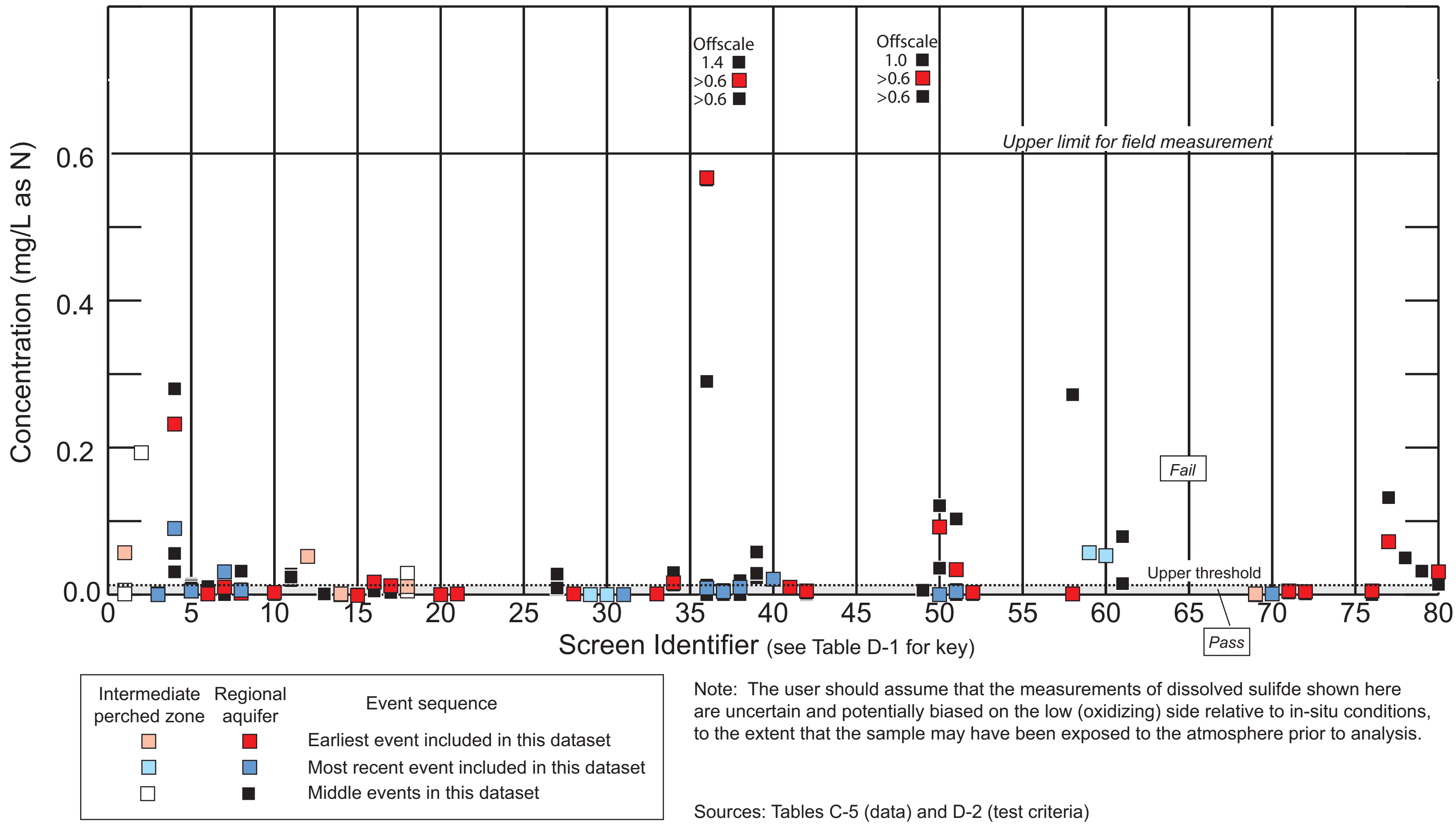




Note: The shaded region on this plot represents the range of values which meet the test criterion for samples from the regional aquifer. Note that a different range would apply to samples from an intermediate perched zone.

Sources: Tables C-5 (data), D-2 (test criteria), and 2-2 (plume locations and constituents)

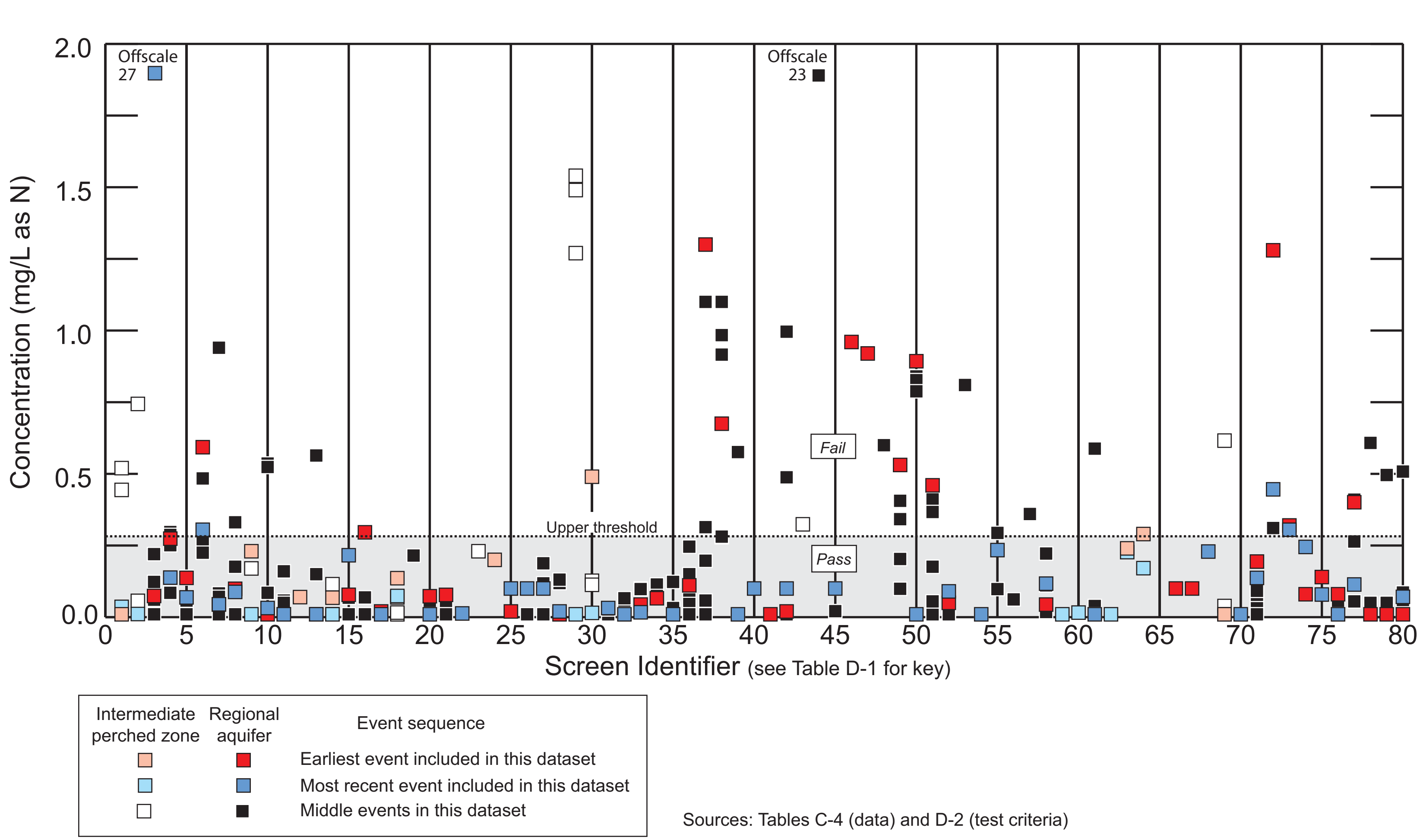
Figure D-24. Comparison of water-quality data against test criteria: sulfate



Note: The user should assume that the measurements of dissolved sulifde shown here are uncertain and potentially biased on the low (oxidizing) side relative to in-situ conditions, to the extent that the sample may have been exposed to the atmosphere prior to analysis.

Sources: Tables C-5 (data) and D-2 (test criteria)

Figure D-25. Comparison of water-quality data against test criteria: sulfide



Sources: Tables C-4 (data) and D-2 (test criteria)

Figure D-26. Comparison of water-quality data against test criteria: total Kjehldahl nitrogen

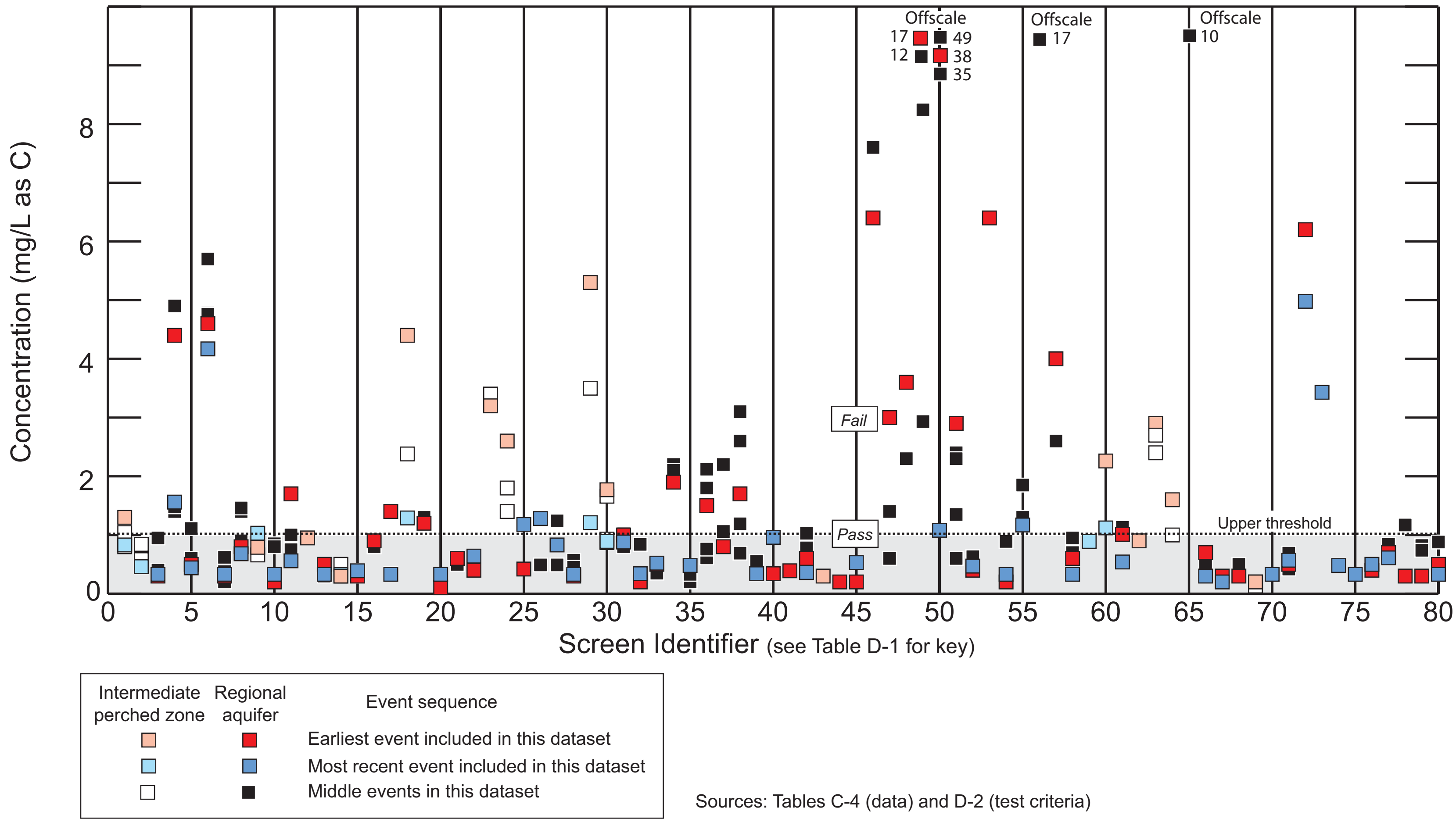
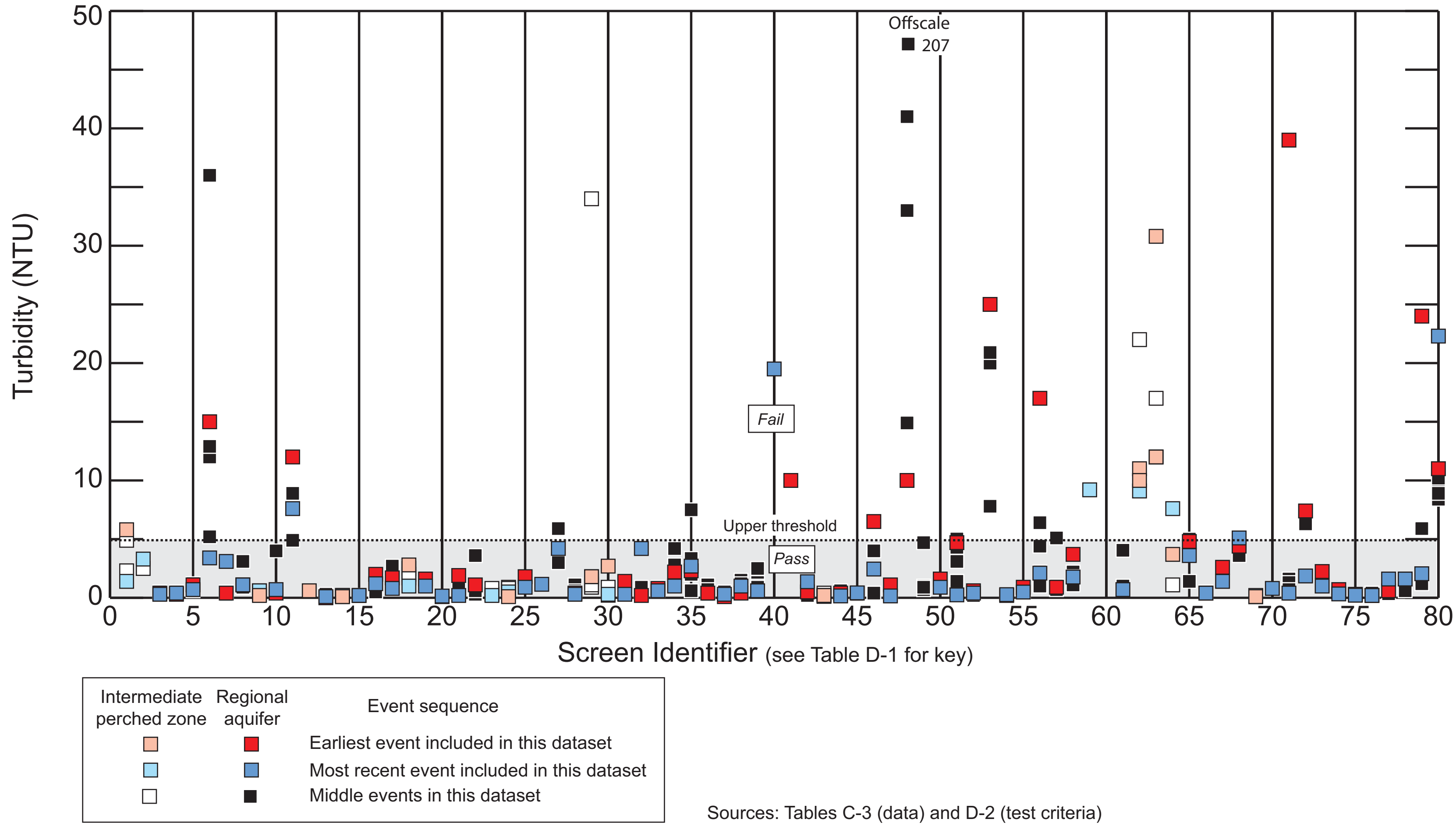
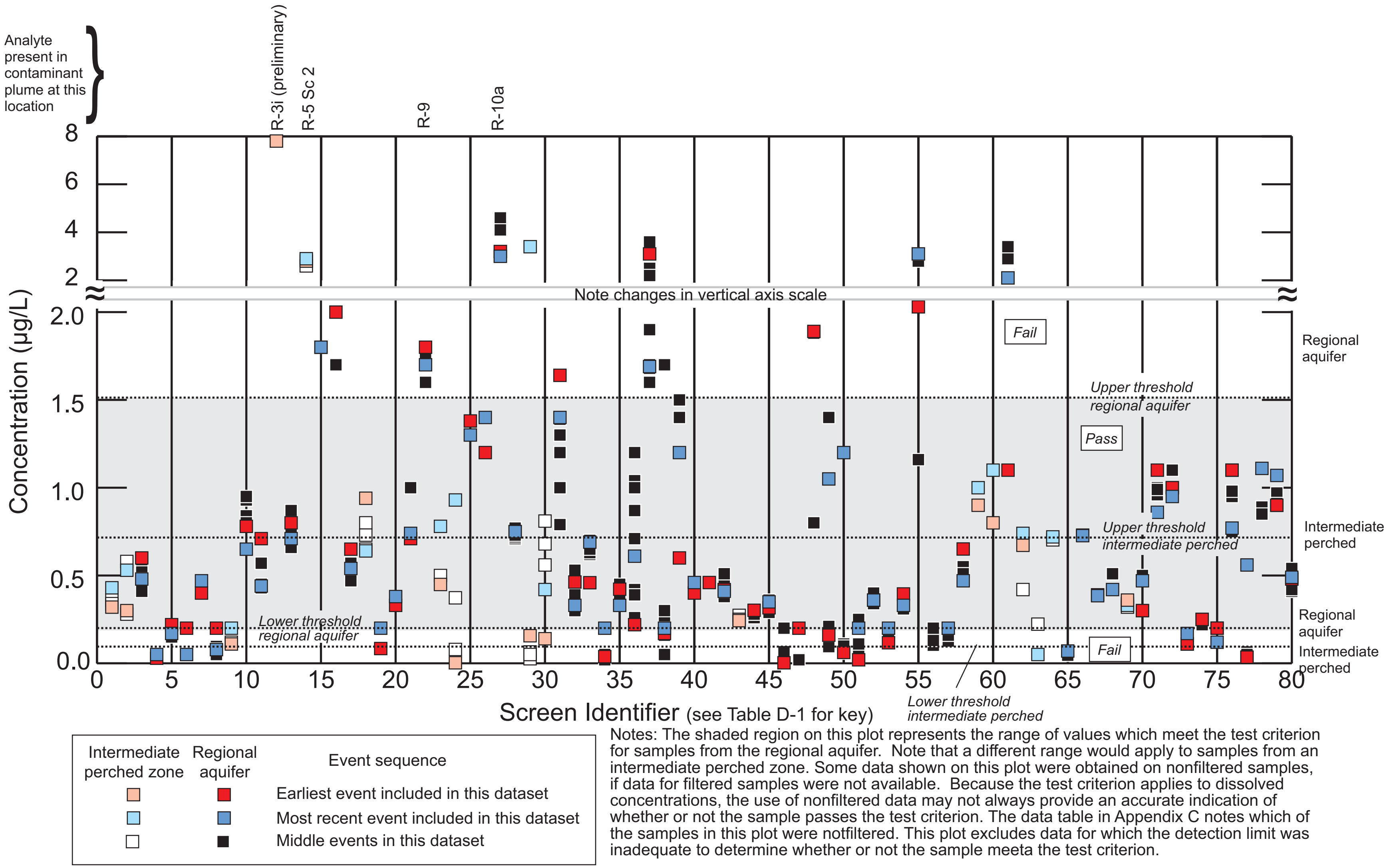


Figure D-27. Comparison of water-quality data against test criteria: total organic carbon



Sources: Tables C-3 (data) and D-2 (test criteria)

Figure D-28. Comparison of water-quality data against test criteria: turbidity



Notes: The shaded region on this plot represents the range of values which meet the test criterion for samples from the regional aquifer. Note that a different range would apply to samples from an intermediate perched zone. Some data shown on this plot were obtained on nonfiltered samples, if data for filtered samples were not available. Because the test criterion applies to dissolved concentrations, the use of nonfiltered data may not always provide an accurate indication of whether or not the sample passes the test criterion. The data table in Appendix C notes which of the samples in this plot were notfiltered. This plot excludes data for which the detection limit was inadequate to determine whether or not the sample meeta the test criterion.

Sources: Tables C-6 (data), D-2 (test criteria), and 2-2 (plume locations and constituents)

Figure D-29. Comparison of water-quality data against test criteria: uranium

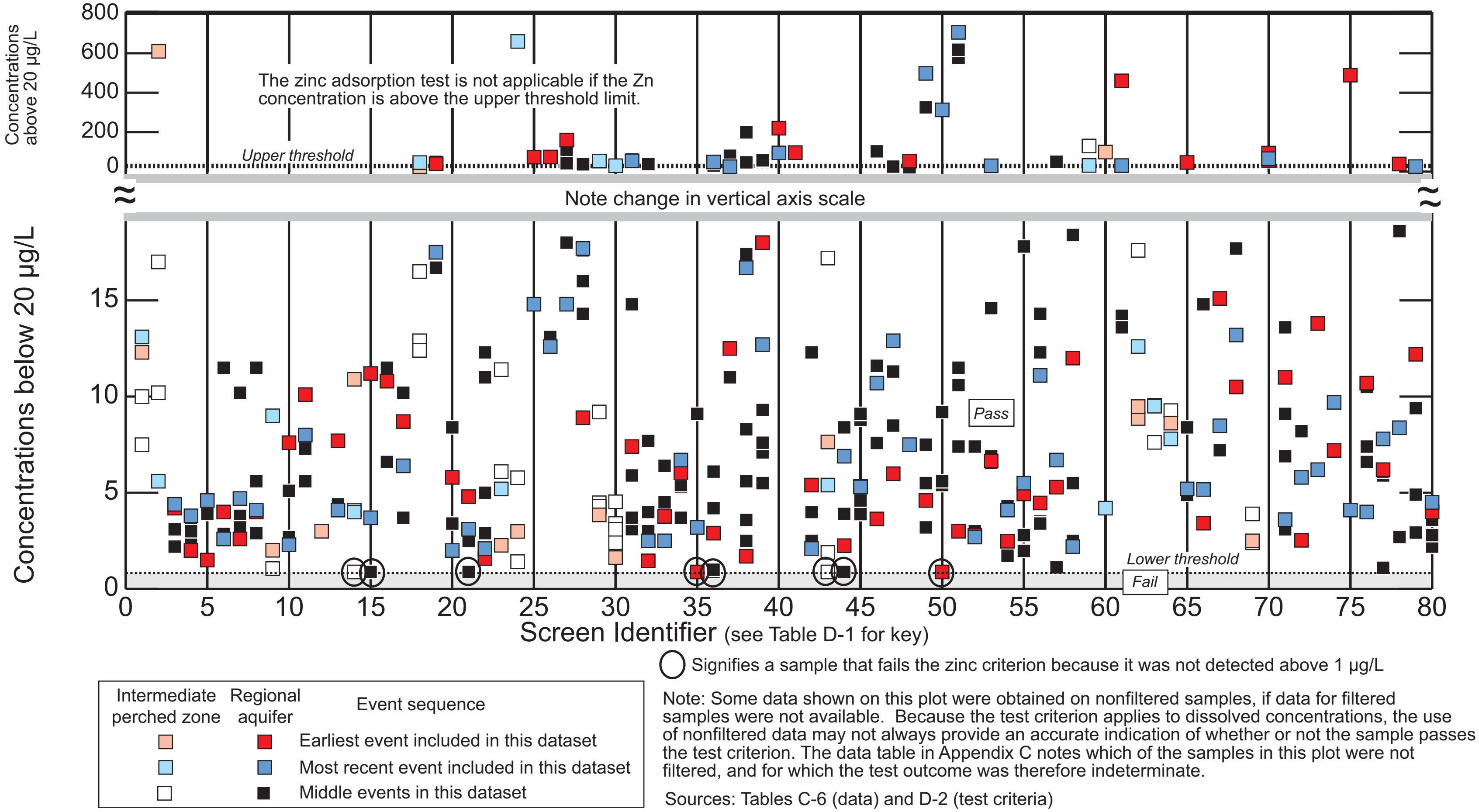


Figure D-30. Comparison of water-quality data against test criteria: zinc (dissolved)

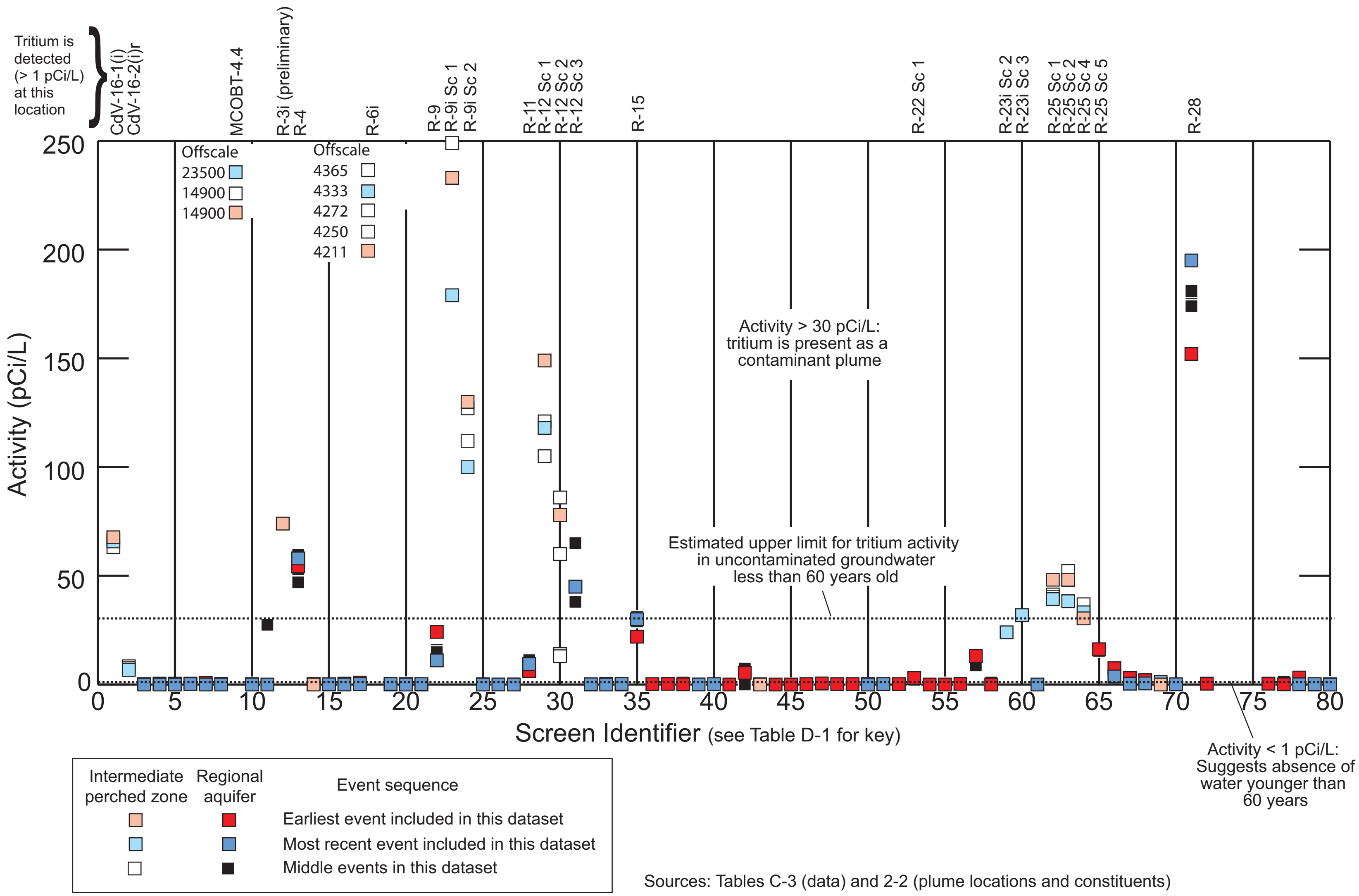


Figure D-31. Tritium activities in water-quality samples

Table D-1
Key to Plotting Order of Screens in Appendix D Figures

Screen ID[a]	Well	Screen #	Zone of Saturation[b]	Geologic Unit[b]	Primary Drilling Fluid[b]
1	CdV-16-1(i)	1	Intermediate	Otowi Member, Bandelier Tuff	QUIK-FOAM, EZ-MUD
2	CdV-16-2(i)r	2	Intermediate	Puye Formation	QUIK-FOAM, EZ-MUD
3	CdV-R-15-3	4	Regional top	Puye Formation	QUIK-FOAM, EZ-MUD
4	CdV-R-15-3	5	Regional aquifer	Puye Formation	QUIK-FOAM, EZ-MUD
5	CdV-R-15-3	6	Regional aquifer	Puye Formation	QUIK-FOAM, EZ-MUD
6	CdV-R-37-2	2	Regional top	Tschicoma Formation Dacitic Lavas	QUIK-FOAM, EZ-MUD
7	CdV-R-37-2	3	Regional aquifer	Tschicoma Formation Dacitic Lavas	QUIK-FOAM, EZ-MUD
8	CdV-R-37-2	4	Regional aquifer	Tschicoma Formation Dacitic Lavas	QUIK-FOAM, EZ-MUD
9	MCOBT-4.4	1	Intermediate	Puye fanglomerate	QUIK-FOAM, EZ-MUD
10	R-1	1	Regional top	Lower Puye Fanglomerates	QUIK-FOAM, EZ-MUD
11	R-2	1	Regional top	Unassigned fanglomerates	Bentonite
12	R-3i	1	Intermediate	Cerros del Rio Basalt	none
13	R-4	1	Regional top	Unassigned fanglomerates	Bentonite
14	R-5	2	Intermediate	Puye Formation	QUIK-FOAM, EZ-MUD
15	R-5	3	Regional top	Santa Fe Group basalt	QUIK-FOAM, EZ-MUD
16	R-5	4	Regional aquifer	Santa Fe Group basalt	QUIK-FOAM, EZ-MUD
17	R-6	1	Regional top	Unassigned fanglomerates	Bentonite, QUIK-FOAM, EZ-MUD
18	R-6i	1	Intermediate	Puye Formation	QUIK-FOAM
19	R-7	3	Regional top	Puye Formation, pumiceous	QUIK-FOAM, EZ-MUD
20	R-8	1	Regional top	Puye Formation	QUIK-FOAM, EZ-MUD
21	R-8	2	Regional aquifer	Puye Formation	QUIK-FOAM, EZ-MUD
22	R-9	1	Regional top	Santa Fe Group sediments	QUIK-FOAM, EZ-MUD
23	R-9i	1	Intermediate	Cerros del Rio basalt (fractured), upper alkalic basalt	none
24	R-9i	2	Intermediate	Cerros del Rio basalt (massive), lower alkalic basalt	none
25	R-10	1	Regional aquifer	Santa Fe Group sediments	QUIK-FOAM, Bentonite
26	R-10	2	Regional aquifer	Santa Fe Group sediments	QUIK-FOAM, Bentonite
27	R-10a	1	Regional top	Santa Fe Group sediments	QUIK-FOAM, EZ-MUD
28	R-11	1	Regional top	Lower Puye Formation	QUIK-FOAM, EZ-MUD
29	R-12	1	Intermediate	Cerros del Rio basalt	QUIK-FOAM, EZ-MUD
30	R-12	2	Intermediate	Older alluvium	QUIK-FOAM, EZ-MUD
31	R-12	3	Regional top	Santa Fe Group basalt	QUIK-FOAM, EZ-MUD
32	R-13	1	Regional top	Puye fanglomerate / pumiceous units	QUIK-FOAM[c]
33	R-14	1	Regional top	Puye Formation	Bentonite

Table D-1 (continued)

Screen ID[a]	Well	Screen #	Zone of Saturation[b]	Geologic Unit[b]	Primary Drilling Fluid[b]
34	R-14	2	Regional aquifer	Puye Formation	Bentonite
35	R-15	1	Regional top	Puye Formation	EZ-MUD, Torkease, and bentonite slurries as casing lubricants only
36	R-16	2	Regional top	Santa Fe Group sediments	Bentonite
37	R-16	3	Regional aquifer	Santa Fe Group sediments	Bentonite
38	R-16	4	Regional aquifer	Santa Fe Group sediments	Bentonite
39	R-16r	1	Regional top	Totavi Lentil	QUIK-FOAM, EZ-MUD
40	R-17	1	Regional top	Puye Formation	QUIK-FOAM, EZ-MUD
41	R-17	2	Regional aquifer	Puye Formation	QUIK-FOAM, EZ-MUD
42	R-18	1	Regional top	Puye Formation	QUIK-FOAM, EZ-MUD
43	R-19	2	Intermediate	Puye Formation	QUIK-FOAM, EZ-MUD
44	R-19	3	Regional top	Puye Formation	QUIK-FOAM, EZ-MUD
45	R-19	4	Regional aquifer	Puye Formation	QUIK-FOAM, EZ-MUD
46	R-19	5	Regional aquifer	Unassigned sedimentary deposits	QUIK-FOAM, EZ-MUD
47	R-19	6	Regional aquifer	Unassigned sedimentary deposits	QUIK-FOAM, EZ-MUD
48	R-19	7	Regional aquifer	Unassigned sedimentary deposits	QUIK-FOAM, EZ-MUD
49	R-20	1	Regional top	Puye Formation	Bentonite
50	R-20	2	Regional aquifer	Pumiceous fanglomerates	Bentonite
51	R-20	3	Regional aquifer	Santa Fe Group sediments	Bentonite
52	R-21	1	Regional top	Puye Formation	QUIK-FOAM, EZ-MUD
53	R-22	1	Regional top	Cerros del Rio basalt	QUIK-FOAM, EZ-MUD
54	R-22	2	Regional aquifer	Cerros del Rio basalt	QUIK-FOAM, EZ-MUD
55	R-22	3	Regional aquifer	Upper Puye Fanglomerates	QUIK-FOAM, EZ-MUD
56	R-22	4	Regional aquifer	Older basalt (clay-altered)	QUIK-FOAM, EZ-MUD
57	R-22	5	Regional aquifer	Lower Puye Fanglomerates	QUIK-FOAM, EZ-MUD
58	R-23	1	Regional top	Santa Fe Group sediments	QUIK-FOAM, LIQUI-TROL
59	R-23i	2	Intermediate	Cerros del Rio basalt	QUIK-FOAM, EZ-MUD
60	R-23i	3	Intermediate	Cerros del Rio basalt—interflow sediments	QUIK-FOAM, EZ-MUD
61	R-24	1	Regional aquifer	Santa Fe Group, undivided	QUIK-FOAM, EZ-MUD
62	R-25	1	Intermediate	Otowi Member, Bandelier Tuff	QUIK-FOAM, EZ-MUD
63	R-25	2	Intermediate	Puye Formation (fanglomerate facies)	QUIK-FOAM, EZ-MUD
64	R-25	4	Intermediate	Puye Formation (fanglomerate facies)	QUIK-FOAM, EZ-MUD
65	R-25	5	Regional top	Puye Formation (fanglomerate facies)	QUIK-FOAM, EZ-MUD
66	R-25	6	Regional aquifer	Puye Formation (fanglomerate facies)	QUIK-FOAM, EZ-MUD
67	R-25	7	Regional aquifer	Puye Formation (fanglomerate facies)	QUIK-FOAM, EZ-MUD
68	R-25	8	Regional aquifer	Puye Formation (fanglomerate facies)	QUIK-FOAM, EZ-MUD

Table D-1 (continued)

Screen ID[a]	Well	Screen #	Zone of Saturation[b]	Geologic Unit[b]	Primary Drilling Fluid[b]
69	R-26	1	Intermediate	Cerro Toledo interval	QUIK-FOAM, EZ-MUD
70	R-27	1	Regional top	Lower Puye Formation	QUIK-FOAM, EZ-MUD
71	R-28	1	Regional top	Puye Formation	QUIK-FOAM, EZ-MUD
72	R-31	2	Regional top	Cerros del Rio basalt	QUIK-FOAM, EZ-MUD
73	R-31	3	Regional aquifer	Cerros del Rio basalt	QUIK-FOAM, EZ-MUD
74	R-31	4	Regional aquifer	Totavi Lentil	QUIK-FOAM, EZ-MUD
75	R-31	5	Regional aquifer	Puye fanglomerates and river gravels	QUIK-FOAM, EZ-MUD
76	R-32	1	Regional top	Cerros del Rio basalt & river gravels	QUIK-FOAM, EZ-MUD
77	R-32	3	Regional aquifer	Puye Formation	Bentonite, LIQUI-TROL
78	R-33	1	Regional top	Pumiceous Unit (unassigned)	QUIK-FOAM, EZ-MUD
79	R-33	2	Regional aquifer	Pumiceous Unit (unassigned)	QUIK-FOAM, EZ-MUD
80	R-34	1	Regional top	Puye Formation	QUIK-FOAM, EZ-MUD

[a] Screen ID—unique identifier assigned to each screen addressed by this report in order to simplify management of information, including the order that data are plotted on the figures in this appendix.

[b] Data source: Tables B-2 and B-4.

Table D-2
Summary of Categories and Indicators of Residual Drilling Effects on Water Quality

Screening Question	Assessment Criteria[a, b]
Category A **Residual Water-Soluble Inorganic Constituents of Drilling Fluids**	**Issue: Have residual inorganic constituents been sufficiently removed such that they do not modify transport characteristics of contaminants in the screen interval?**
Are concentrations of the following species all below the upper threshold value representative of maximum background concentrations in groundwater?	• A1—Is Chloride less than 3.8 mg/L (1.75 mg/L)? • A2—Is Fluoride less than 0.53 mg/L (0.23 mg/L)? • A3—Is Phosphate (as P) less than 0.3 mg/L (0.08 mg/L)? • A4—Is Sodium less than 29 mg/L (12 mg/L)? • A5—Is Sulfate less than 6.2 mg/L (4.5 mg/L)? • Gen1—Is pH within the range representative of background groundwater? • Gen2—Is Alkalinity (HCO_3+CO_3) less than 106 mg/L as $CaCO_3$ (52 mg/L)?
Category B: Residual Organic Constituents of Drilling Fluids	**Issue: Have residual organic drilling fluids been sufficiently removed such that groundwater samples are reliable and representative of the groundwater?**
Are concentrations of the following organic indicators all below the threshold value representative of background concentrations in groundwater?	Are all of the following conditions met? • B1—Is acetone either below the method detection limit or less than 5 µg/L? • B2—Is ammonium (as N) less than 0.05 mg/L? • B3—Is total Kjeldahl nitrogen (TKN)[b] less than 0.28 mg/L? • B4—Is total organic carbon (TOC) below 1 mg/L?
Category C **Redox Conditions**	**Issue: Have oxidizing conditions been re-established such that groundwater samples are reliable and representative of the groundwater?**
Is sulfur present in its oxidized (SO_4) form?	Are all the following conditions met? • C1—Is sulfate present above 0.8 mg/L (1.0 mg/L)? • C2—Is sulfide less than 0.01 mg/L? • C3—Is oxidation-reduction potential (ORP) greater than 0 mV?
Have redox conditions been restored to oxidizing conditions with respect to sulfate, iron, and manganese?	Are all the following conditions met? • C4—Is dissolved iron less than 102 µg/L? • C5—Is dissolved manganese less than 14 µg/L? • C6—Is perchlorate detected above 0.17 µg/L? • C7—Is uranium detected above 0.17 µg/L (0.1 µg/L)? • C8—Is dissolved nickel less than 5 µg/L (3 µg/L)? • C9—Is dissolved molybdenum less than 4 µg/L? • C10—Is dissolved chromium greater than 1 µg/L?
Have redox conditions been restored to oxidizing conditions with respect to nitrate and dissolved oxygen?	Are the following conditions met? • C11—Is nitrate + nitrite detected above 0.1 mg/L as N? • C12—Is dissolved oxygen greater than 2 mg/L?
Category D **Changes in adsorption capacities of surface-active minerals**	**Issue: Has residual surface-active minerals (primarily bentonite clay) been sufficiently removed such that they do not interfere with transport of contaminants into the screen interval?**
Are water-quality data reliable and representative for general inorganics, metals, and radionuclides that would adsorb onto residual bentonite if present?	• D1—Is the concentration of dissolved strontium above the minimum background concentration for groundwater (45 µg/L, 19 µg/L for perched intermediate zone)?
	• D2—Is the concentration of dissolved uranium above the minimum background concentration (0.17 µg/L for regional aquifer, 0.1 µg/L for perched intermediate zone)?

Table D-2 (continued)

Screening Question	Assessment Criteria[a, b]
Category D (continued)	• D3—Is the concentration of dissolved barium above the minimum background concentration (4.7 µg/L for regional aquifer, 1.4 µg/L for perched intermediate zone)? • D4—Is the concentration of dissolved zinc above the instrument detection limit? Note: Zn is considered here to be an appropriate indicator species for the adsorption behavior of metal cations and Cs-137, Co-60, Eu isotopes, La-140, and Nd-147.
Category E: Enhanced Precipitation or Dissolution of Carbonate Minerals	**Issue: Are carbonate minerals stable in the screen interval such that groundwater samples are reliable and representative of predrilling groundwater?**
Are the following indicators of carbonate mineral stability representative of background conditions in groundwater?	• E1—Is dissolved barium within the range considered representative of background groundwater (4.7<x<69 µg/L; 1.4<x<71 µg/L)? • E2 Is dissolved calcium within the range considered representative of background groundwater (8.7<x<25 mg/L; 4.4<x<18 mg/L)? • E3—Is dissolved magnesium within the range considered representative of background groundwater (<6.1 mg/L, <4.8 mg/L)? • E4—Is dissolved strontium within the range considered representative of background groundwater (<180 µg/L; <155 µg/L)? • E5—Is dissolved uranium within the range considered representative of background groundwater (<1.8 µg/L; <0.72 µg/L)? • Gen1—Is pH within the range considered representative of background groundwater? • Gen2—Is alkalinity within the range considered representative of background groundwater (<105 mg/L, <52 mg/L)?
Category F: Metal Corrosion of Well Components	**Issue: Is the integrity of the well casing and screen intact such that groundwater samples are reliable and representative of the groundwater?**
Are concentrations of the following indicators of stainless steel corrosion all below the threshold value representative of background concentrations in groundwater?	• F1[b]—Is total iron less than 500 µg/L? • F2—If NO to the above question, then is the ratio of total to dissolved iron less than 10? • F3[b]—Is total chromium less than the upper threshold limit for background (10 µg/L, 5 µg/L)? • F4—If NO to the above question, then is the ratio of total chromium to dissolved chromium less than 5? • F5—Is dissolved nickel less than 50 µg/L? • F6[c] —Is turbidity less than 5 NTU?

[a] The assessment criteria lists the threshold value for the regional aquifer first, followed by a value for the perched intermediate aquifer shown in parentheses, if different. Values are taken from Tables 4-3a and 4-3b unless otherwise noted.

[b] Although it was measured at high concentrations in the deionized-water leachates of bentonite drilling muds, elevated NO_3 is not considered a reliable indicator species for residual inorganic drilling fluids because it is commonly present in contaminant plumes and is very sensitive even to slightly reducing condition.

[d] This test is a qualifying condition that establishes whether or not the following test criterion is applicable.

[e] This test is neither required nor sufficient to establish the presence or absence of metal corrosion. However, it can determine the level of confidence that one should have in the outcome of the other test criteria.

[f] The assessment criteria are the same for the regional aquifer and the perched intermediate aquifer because there is not expected to be a significant difference between these two populations for these species. Concentration threshold values are taken from Tables 4-3a and 4-3b, and threshold ratios are based on observed trends.

Appendix E

Screen Assessment Results

E-1.0 PURPOSE OF THIS APPENDIX

The two tables in this appendix summarize the evaluation of water-quality data for each sampling event from each screen against the applicable criteria. The results provide the basis for calculating composite water-quality scores and ratings, and for determining water-quality trends at each location.

Table E-1 is a synopsis of the detailed data assessment tables in Appendix C; in this table, the raw data and their qualifiers shown in Appendix C have been stripped out, leaving only the Pass/Fail outcomes for each test. Making the presentation of the test outcomes more compact lets trends and correlations be discerned more readily.

Table E-2 presents the scores for each sampling event and calculates a composite score based on the full data set included for the screen in this report. A comparison of the composite score with the score for the most recent sample provides the basis for characterizing each screen's evaluation in terms of four ratings:

1. an overall score that expresses the percentage of the applicable criteria met by the screen's water samples;
2. the classification of the screen with respect to its ability to provide reliable and representative water-quality samples (very good, good, fair, or poor);
3. the trend in the screen's condition with respect to the water-quality impacts of residual drilling fluids (stable, improving, worsening, variable, or indeterminate); and
4. the level of confidence in the outcome of the evaluation (high, moderate, or low).

Because each of the four ratings is based on different considerations, any combination of them can occur. For example, it is possible to have a high level of confidence concerning the poor condition of a screen while having a low level of confidence concerning the good condition of a screen. Conditions for each qualitative rating are defined in the next section.

E-2.0 DEFINITIONS OF QUALITATIVE RATINGS

For the second rating in the numbered list above, the qualities are defined in this chart:

Rating	Score (% criteria passed)
Very Good	91–00
Good	81–90
Fair	60–80
Poor	Less than 60
Not rated	Less than 15 tests with Pass/Fail outcomes

Note: The ratings in this appendix are assigned solely on the basis of the numerical score and hence are "unadjusted." However, any of several conditions could justify adjustment of the rating, such as discounting the reliability of a criterion outcome due to one of the reasons suggested in Table 4-21. In particular, several of the unadjusted ratings in Table E-2 have been adjusted upward or downward in Table 6-1, for reasons documented in table footnotes.

For the third rating in the numbered list above, the qualities are defined as follows:

- *Stable*—The impacts from residual drilling fluids neither diminish nor increase over the time period spanned by the sample events evaluated for the screen. The outcomes for each water-quality criterion do not vary significantly among the events.
- *Improving*—The impacts from residual drilling fluids have lessened over the period of time spanned by the evaluated sample events. The outcome for the most recent sample event is significantly and consistently better than those for earlier events, for one or more criteria.
- *Worsening*—The water quality is degrading as the result of residual drilling fluids; the outcome of the most recent sample event is significantly and consistently worse than those for the earlier events, for one or more criteria.
- *Variable*—Comparing the outcome of the most recent sample event against the outcomes for earlier events does not reveal a consistent trend.
- *Indeterminate*—The available data are inadequate for determining a trend.

For the fourth rating in the numbered list above, the qualities are defined as follows:

- *High level of confidence*—The outcome is based on three or more sample events that show consistent outcomes or trends and for which the majority of data are available.
- *Moderate level of confidence*—One or more of the following conditions are present: (a) only two sample events are available, (b) the most recent sample was collected more than 1 yr ago, (c) the reliability of the data for one criterion is in question, (d) field-based data provide the only indication of a worsening or improving trend, or (e) the outcomes of individual tests show minor inconsistencies.
- *Low level of confidence*—Only one sample event is available for evaluation, or several of the conditions listed above are present.

Table E-1. Summary of Test Outcomes

Water Quality Sample					General Indicators						Category A Inorganic Indicators					Category B Organic Indicators				Category C1 Redox (SO4)			Category C2 Redox (Fe/Mn)							Category C3 Redox (NO3)		Category D Adsorption				Category E Carbonate mineralogy							Category F Metal corrosion					Cat G Zn
Row	Well	Port depth (ft)	Screen	Sample date	Mod water	Low pH?	High pH?	Gen-1	Gen-2	Gen-3	A1	A2	A3	A4	A5	B1	B2	B3	B4	C1	C2	C3	C4	C5	C6	C9	C8	C7	C10	C11	C12	D1	D2	D3	D4	E1a	E1b	E1	E2	E3	E4	E5	F1	F2	F3	F4	F5	G1
				Units	3H	pH	pH	pH	Alk	Trb	Cl	F	PO4	Na	SO4	Ace	NH3	TKN	TOC	SO4	S	ORP	Fe	Mn	ClO4	Mo	Ni	U	Cr	NO3	DO	Sr	U	Ba	Zn	Ca	Ca	Ca	Ba	Sr	Mg	U	FeT	FeR	CrT	CrR	Ni	Zn
				Test	>UL	>LL	<UL	In range	<UL	<UL	<UL	<UL	<UL	<UL	<UL	<UL	<UL	<UL	<UL	>LL	<UL	>LL	<UL	<UL	>LL	<UL	<UL	>LL	>LL	>LL	>LL	>LL	>LL	>LL	>LL	>LL	<UL	In range	<UL	<UL	<UL	<UL	<UL	<UL	<UL	<UL	<UL	<UL
				Regional	1	6.94	8.65		105	5	3.75	0.53	0.3	28.6	6.22	5	0.05	0.28	1	0.8	0.01	0	102	16	0.17	4	2	0.2	1	0.1	2	44.88	0.2	4.6	1	8.66	24.1		70	180	4.81	1.52	500	10	10	5	50	40
				Perched	1	6.73	8.80		52	5	1.75	0.23	0.08	12.2	4.48	5	0.05	0.28	1	1.07	0.01	0	102	16	0.17	4	2	0.1	1	0.1	2	19.1	0.1	1.4	1	4.39	17.3		72	155	6.12	0.72	500	10	5	5	50	20
1	CdV-16-1(i)	624	1	06/01/05	Yes	No	Yes	Fail	Fail	Fail	Plm	P	P	P	Plm	Fail	P	P	Fail	P	Fail	P	P	P	P	P	Fail	P	Fail	P	P	P	P	P	P	Yes	Yes	P	P	P	P	P	Yes	—	P	—	P	P
2	CdV-16-1(i)	624	1	08/29/05	Yes	Yes	Yes	P	P	P	Plm	P	Fail	P	Plm	P	P	Fail	P	P	P	P	P	P	P	P	Fail	P	Fail	P	P	P	P	P	P	Yes	Yes	P	P	P	P	P	No	Fail	P	—	P	P
3	CdV-16-1(i)	624	1	12/07/05	Yes	Yes	Yes	P	P	P	Plm	P	P	Fail	Plm	P	P	Fail	P	P	P	P	P	P	P	P	Fail	P	Fail	P	-Err-	P	P	P	P	Yes	Yes	P	P	P	P	P	Yes	—	P	—	P	P
4	CdV-16-1(i)	624	1	03/09/06	Yes	Yes	Yes	P	P	P	Plm	P	P	Fail	Plm	P	P	P	P	P	-ND-	P	P	P	P	P	Fail	P	Fail	P	P	P	P	P	P	Yes	Yes	P	P	P	P	P	Yes	—	P	—	P	P
5	CdV-16-2(i)r	850	1	09/14/05	-ND-	Yes	Yes	P	Fail	-ND-	Plm	P	-ND-	Fail	Fail	-ND-	-ND-	-ND-	-ND-	P	-ND-	-ND-	P	P	-ND-	P	P	P	Fail	P	-ND-	P	P	P	—	—	—	-ND-	P	P	P	P	Yes	—	P	—	P	-UF-
6	CdV-16-2(i)r	850	1	12/15/05	Yes	Yes	Yes	P	Fail	P	Plm	Fail	Fail	Fail	Fail	Fail	P	Fail	P	P	Fail	P	P	P	P	P	P	P	Fail	P	P	P	P	P	—	Yes	Yes	P	P	P	P	P	No	Fail	Fail	Fail	P	P
7	CdV-16-2(i)r	850	1	03/15/06	Yes	Yes	Yes	P	P	Fail	Plm	P	P	Fail	P	P	P	P	P	P	-ND-	P	P	P	P	P	P	P	Fail	P	P	P	P	P	P	Yes	Yes	P	P	P	P	P	No	Fail	Fail	Fail	P	P
8	CdV-16-2(i)r	850	1	05/17/06	Yes	No	Yes	Fail	P	P	Plm	Fail	P	Fail	P	P	-DL-	P	P	P	-ND-	P	P	P	P	P	P	P	Fail	P	P	P	P	P	P	Yes	Yes	P	P	P	P	P	No	Fail	Fail	Fail	P	P
9	CdV-R-15-3	1254	4	10/19/04	No	Yes	No	Fail	P	P	P	P	P	P	P	-ND-	P	P	P	P	P	-ND-	P	P	P	P	P	P	P	P	P	P	P	P	P	Yes	Yes	P	P	P	P	P	Yes	—	P	—	P	P
10	CdV-R-15-3	1254	4	04/04/05	No	Yes	Yes	P	P	P	P	P	P	P	P	P	P	P	P	P	P	Fail	P	P	P	P	P	P	P	P	Fail	P	P	P	P	Yes	Yes	P	P	P	P	P	Yes	—	P	—	P	P
11	CdV-R-15-3	1254	4	07/12/05	No	Yes	Yes	P	P	P	P	P	P	P	P	P	P	P	P	P	-ND-	P	P	P	P	P	P	P	P	P	P	P	P	P	P	Yes	Yes	P	P	P	P	P	Yes	—	P	—	P	P
12	CdV-R-15-3	1254	4	10/18/05	No	Yes	Yes	P	P	P	P	P	P	P	P	P	P	P	P	P	P	-ND-	P	P	P	P	P	P	P	P	P	P	P	P	P	Yes	Yes	P	P	P	P	P	Yes	—	P	—	P	P
13	CdV-R-15-3	1254	4	01/19/06	No	Yes	Yes	P	P	P	P	P	P	P	P	P	P	P	-ND-	P	P	-ND-	P	P	P	P	P	P	P	P	-ND-	P	P	P	P	Yes	Yes	P	P	P	P	P	Yes	—	P	—	P	P
14	CdV-R-15-3	1254	4	03/27/06	No	Yes	Yes	P	P	P	P	P	P	P	P	P	P	Fail	P	P	P	-ND-	P	P	P	P	P	P	P	P	-ND-	P	P	P	P	Yes	Yes	P	P	P	P	P	Yes	—	P	—	P	P
15	CdV-R-15-3	1350	5	10/20/04	No	Yes	Yes	P	P	P	P	P	P	P	-Red-	-ND-	Fail	P	Fail	Fail	Fail	-ND-	Fail	Fail	Fail	P	P	Fail	Fail	Fail	P	P	Fail	P	P	Yes	Yes	P	Fail	Fail	P	-Red-	Yes	—	P	—	P	P
16	CdV-R-15-3	1350	5	04/05/05	No	Yes	Yes	P	P	P	P	Fail	P	P	P	Fail	Fail	Fail	Fail	P	Fail	Fail	Fail	Fail	Fail	P	P	Fail	Fail	Fail	P	P	Fail	P	P	Yes	Yes	P	Fail	Fail	P	-Red-	Yes	—	P	—	P	P
17	CdV-R-15-3	1350	5	07/12/05	No	Yes	Yes	P	P	P	P	P	P	P	Fail	Fail	Fail	Fail	Fail	P	-ND-	Fail	Fail	Fail	Fail	P	P	Fail	Fail	Fail	P	P	Fail	P	P	Yes	Yes	P	Fail	Fail	P	-Red-	Yes	—	P	—	P	P
18	CdV-R-15-3	1350	5	10/18/05	No	Yes	Yes	P	P	P	P	P	P	P	P	P	Fail	P	Fail	P	Fail	-ND-	Fail	Fail	Fail	P	P	Fail	Fail	Fail	P	P	Fail	P	-DL-	Yes	Yes	P	Fail	Fail	P	-Red-	Yes	—	P	—	P	P
19	CdV-R-15-3	1350	5	01/20/06	No	Yes	Yes	P	P	P	P	P	P	P	P	P	Fail	P	-ND-	P	Fail	-ND-	Fail	Fail	Fail	P	P	Fail	Fail	Fail	-ND-	P	Fail	P	P	Yes	Yes	P	Fail	Fail	P	-Red-	Yes	—	P	—	P	P
20	CdV-R-15-3	1350	5	03/28/06	No	No	Yes	Fail	P	P	P	P	P	P	P	Fail	Fail	P	Fail	P	Fail	-ND-	Fail	Fail	Fail	P	P	Fail	Fail	P	-ND-	P	Fail	P	P	Yes	Yes	P	Fail	Fail	P	-Red-	Yes	—	P	—	P	P
21	CdV-R-15-3	1640	6	10/21/04	No	Yes	Yes	P	P	P	P	P	P	P	P	-ND-	P	P	P	P	P	Fail	-Err-	Fail	Fail	P	P	P	Fail	Fail	P	P	P	P	P	Yes	Yes	P	P	P	P	P	Yes	—	P	—	P	P
22	CdV-R-15-3	1640	6	04/06/05	No	Yes	Yes	P	P	P	P	P	P	P	P	P	P	P	P	P	Fail	Fail	Fail	Fail	Fail	P	P	Fail	Fail	Fail	P	P	Fail	P	-DL-	Yes	Yes	P	P	P	P	-Red-	Yes	—	P	—	P	P
23	CdV-R-15-3	1640	6	07/13/05	No	Yes	Yes	P	P	P	P	P	P	P	P	P	P	P	-ND-	P	-ND-	P	Fail	Fail	Fail	P	P	Fail	Fail	Fail	P	P	Fail	P	P	Yes	Yes	P	P	P	P	-Red-	Yes	—	P	—	P	P
24	CdV-R-15-3	1640	6	10/19/05	No	Yes	Yes	P	P	P	P	P	P	P	P	P	P	P	Fail	P	Fail	-ND-	Fail	Fail	Fail	P	P	Fail	Fail	Fail	P	P	Fail	P	P	Yes	Yes	P	P	P	P	-Red-	Yes	—	Fail	Fail	P	P
25	CdV-R-15-3	1640	6	01/20/06	No	Yes	Yes	P	P	P	P	P	P	P	P	P	P	P	-ND-	P	P	-ND-	Fail	Fail	Fail	P	P	Fail	Fail	Fail	-ND-	P	Fail	P	P	Yes	Yes	P	P	P	P	-Red-	Yes	—	P	—	P	P
26	CdV-R-15-3	1640	6	03/29/06	No	Yes	Yes	P	P	P	P	P	P	P	P	P	P	P	P	P	P	-ND-	P	Fail	Fail	P	P	Fail	Fail	Fail	-ND-	P	Fail	P	P	Yes	Yes	P	P	P	P	-Red-	Yes	—	P	—	P	P
27	CdV-R-37-2	1200	2	10/26/04	No	Yes	Yes	P	Fail	Fail	P	P	P	P	-Red-	-ND-	Fail	Fail	Fail	Fail	P	-ND-	Fail	Fail	Fail	Fail	Fail	Fail	Fail	Fail	P	P	Fail	P	P	Yes	Yes	P	Fail	P	Fail	-Red-	No	P	P	—	P	P
28	CdV-R-37-2	1200	2	03/29/05	No	No	Yes	Fail	Fail	Fail	P	P	P	P	-Red-	P	Fail	Fail	Fail	Fail	P	Fail	Fail	Fail	Fail	Fail	Fail	Fail	P	Fail	P	P	Fail	P	P	Yes	Yes	P	Fail	P	Fail	-Red-	No	P	P	—	P	P
29	CdV-R-37-2	1200	2	07/06/05	No	No	Yes	Fail	Fail	Fail	P	P	P	P	-Red-	P	Fail	Fail	Fail	Fail	-ND-	Fail	Fail	Fail	Fail	Fail	Fail	Fail	P	Fail	P	P	Fail	P	P	Yes	Yes	P	Fail	P	Fail	-Red-	No	P	P	—	P	P
30	CdV-R-37-2	1200	2	10/12/05	No	Yes	Yes	P	Fail	Fail	P	P	P	P	-Red-	P	Fail	P	Fail	Fail	P	-ND-	Fail	Fail	Fail	Fail	Fail	Fail	Fail	Fail	Fail	P	Fail	P	-DL-	Yes	Yes	P	Fail	P	P	-Red-	No	P	P	—	P	P
31	CdV-R-37-2	1200	2	01/09/06	No	Yes	Yes	P	P	Fail	P	P	P	P	-Red-	P	Fail	P	Fail	Fail	Fail	-ND-	Fail	Fail	Fail	Fail	Fail	Fail	Fail	Fail	-ND-	P	Fail	P	-DL-	Yes	Yes	P	Fail	P	P	-Red-	No	P	P	—	P	P
32	CdV-R-37-2	1200	2	03/21/06	No	No	Yes	Fail	P	P	P	P	P	P	-Red-	P	Fail	Fail	Fail	Fail	-ND-	-ND-	Fail	Fail	Fail	Fail	Fail	Fail	Fail	Fail	-ND-	P	Fail	P	P	Yes	Yes	P	Fail	P	P	-Red-	No	P	Fail	Fail	P	P
33	CdV-R-37-2	1359	3	10/27/04	No	Yes	Yes	P	P	P	P	P	P	P	P	-ND-	P	P	P	P	P	-ND-	P	P	P	P	P	P	P	P	P	P	P	P	P	Yes	Yes	P	P	P	P	P	Yes	—	P	—	P	P
34	CdV-R-37-2	1359	3	03/30/05	No	Yes	Yes	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	Yes	Yes	P	P	P	P	P	Yes	—	P	—	P	P
35	CdV-R-37-2	1359	3	07/07/05	No	Yes	Yes	P	P	P	P	P	P	P	P	P	P	P	P	P	-ND-	P	P	P	P	P	P	P	P	P	P	P	P	P	P	Yes	Yes	P	P	P	P	P	Yes	—	P	—	P	P
36	CdV-R-37-2	1359	3	10/12/05	No	Yes	Yes	P	P	P	P	P	P	P	P	P	P	P	P	P	P	-ND-	P	P	P	P	P	P	P	P	P	P	P	P	P	Yes	Yes	P	P	P	P	P	Yes	—	P	—	P	P
37	CdV-R-37-2	1359	3	01/10/06	No	Yes	Yes	P	P	P	P	P	P	P	P	P	P	Fail	P	P	P	-ND-	P	P	P	P	P	P	P	P	-ND-	P	P	P	-DL-	Yes	Yes	P	P	P	P	P	Yes	—	P	—	P	P
38	CdV-R-37-2	1359	3	03/22/06	No	Yes	Yes	P	P	P	P	P	P	P	P	P	P	P	P	P	Fail	-ND-	P	P	P	P	P	P	P	P	-ND-	P	P	P	P	Yes	Yes	P	P	P	P	P	Yes	—	Fail	Fail	P	P
39	CdV-R-37-2	1551	4	10/27/04	No	No	Yes	Fail	P	P	P	P	P	P	P	-ND-	Fail	P	P	P	P	-ND-	Fail	Fail	Fail	P	P	Fail	P	Fail	P	Fail	Fail	P	P	No	Yes	Fail	P	P	P	-Red-	No	P	P	—	P	P
40	CdV-R-37-2	1551	4	03/31/05	No	Yes	Yes	P	P	P	P	P	P	P	P	P	Fail	Fail	Fail	P	P	P	Fail	Fail	Fail	P	P	Fail	Fail	Fail	P	Fail	Fail	P	P	No	Yes	Fail	P	P	P	-Red-	No	P	P	—	P	P
41	CdV-R-37-2	1551	4	07/08/05	No	No	Yes	Fail	P	P	P	P	P	P	P	P	Fail	P	P	P	-ND-	P	Fail	Fail	Fail	P	P	Fail	Fail	Fail	P	Fail	Fail	P	P	No	Yes	Fail	P	P	P	-Red-	No	P	P	—	P	P
42	CdV-R-37-2	1551	4	10/13/05	No	No	Yes	Fail	P	P	P	P	P	P	P	P	Fail	P	Fail	P	P	-ND-	Fail	Fail	Fail	P	P	Fail	Fail	Fail	P	Fail	Fail	P	P	Yes	Yes	P	P	P	P	-Red-	No	P	P	—	P	P
43	CdV-R-37-2	1551	4	01/11/06	No	Yes	Yes	P	P	P	P	P	P	P	P	P	P	P	P	P	Fail	-ND-	Fail	Fail	Fail	P	P	Fail	Fail	Fail	-ND-	Fail	Fail	P	-DL-	Yes	Yes	P	P	P	P	-Red-	No	P	P	—	P	P
44	CdV-R-37-2	1551	4	03/22/06	No	Yes	Yes	P	P	P	P	P	P	P	P	P	P	P	P	P	P	-ND-	Fail	Fail	Fail	P	P	Fail	Fail	Fail	-ND-	Fail	Fail	P	P	Yes	Yes	P	P	P	P	-Red-	No	P	Fail	Fail	P	P
45	MCOBT-4.4	485	1	01/28/03	Yes	Yes	Yes	P	P	P	Plm	Plm	P	Fail	Plm	P	P	P	P	P	-ND-	-ND-	-DL-	P	P	P	Fail	P	Plm	Plm	-ND-	P	P	P	P	—	—	Fail	P	Fail	P	P	Yes	—	Plm	—	P	P
46	MCOBT-4.4	485	1	05/21/03	Yes	Yes	Yes	P	P	P	Plm	Plm	P	Fail	Plm	-ND-	P	P	P	P	-ND-	-ND-	-DL-	P	P	P	Fail	P	Plm	Plm	-ND-	P	P	P	P	—	—	Fail	P	Fail	P	P	Yes	—	Plm	—	P	P
47	MCOBT-4.4	485	1	03/29/05	-ND-	Yes	Yes	P	P	P	Plm	Plm	-ND-	Fail	Plm	-ND-	-ND-	-ND-	-ND-	P	-ND-	-ND-	P	P	P	P	Fail	-DL-	-UF-	Plm	P	P	-DL-	P	-UF-	—	—	Fail	P	Fail	P	P	Yes	—	Plm	-ND-	P	P
48	MCOBT-4.4	485	1	06/08/05	Yes	Yes	Yes	P	-ND-	P	-ND-	-ND-	P	-ND-	-ND-	-ND-	-ND-	P	Fail	-ND-	-ND-	P	-ND-	-ND-	P	-ND-	-ND-	-ND-	-ND-	Plm	P	-ND-	-ND-	-ND-	-ND-	—	—	-ND-	-ND-	-ND-	-ND-	-ND-	-ND-	-ND-	-ND-	-ND-	-ND-	-ND-

Table E-1. Summary of Test Outcomes

Water Quality Sample					General Indicators						Category A Inorganic Indicators					Category B Organic Indicators				Category C1 Redox (SO4)			Category C2 Redox (Fe/Mn)							Category C3 Redox (NO3)		Category D Adsorption				Category E Carbonate mineralogy							Category F Metal corrosion					Cat G Zn
Row	Well	Port depth (ft)	Screen	Sample date	Mod water	Low pH?	High pH?	Gen-1	Gen-2	Gen-3	A1	A2	A3	A4	A5	B1	B2	B3	B4	C1	C2	C3	C4	C5	C6	C9	C8	C7	C10	C11	C12	D1	D2	D3	D4	E1a	E1b	E1	E2	E3	E4	E5	F1	F2	F3	F4	F5	G1
				Units	3H	pH	pH	pH	Alk	Trb	Cl	F	PO4	Na	SO4	Ace	NH3	TKN	TOC	SO4	S	ORP	Fe	Mn	ClO4	Mo	Ni	U	Cr	NO3	DO	Sr	U	Ba	Zn	Ca	Ca	Ca	Ba	Sr	Mg	U	FeT	FeR	CrT	CrR	Ni	Zn
				Test	>UL	>LL	<UL	In	<UL	<UL	<UL	<UL	<UL	<UL	<UL	<UL	<UL	<UL	<UL	>LL	<UL	>LL	<UL	<UL	>LL	<UL	<UL	>LL	>LL	>LL	>LL	>LL	>LL	>LL	>LL	>LL	<UL	In	<UL	<UL	<UL	<UL	<UL	<UL	<UL	<UL	<UL	<UL
				Regional	1	6.94	8.65	range	105	5	3.75	0.53	0.3	28.6	6.22	5	0.05	0.28	1	0.8	0.01	0	102	16	0.17	4	2	0.2	1	0.1	2	44.88	0.2	4.6	1	8.66	24.1	range	70	180	4.81	1.52	500	10	10	5	50	40
				Perched	1	6.73	8.80		52	5	1.75	0.23	0.08	12.2	4.48	5	0.05	0.28	1	1.07	0.01	0	102	16	0.17	4	2	0.1	1	0.1	2	19.1	0.1	1.4	1	4.39	17.3		72	155	6.12	0.72	500	10	5	5	50	20
49	R-1	1031	1	05/19/05	No	Yes	Yes	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	Yes	Yes	P	P	P	P	P	Yes	—	P	—	P	P
50	R-1	1031	1	09/12/05	No	Yes	Yes	P	P	P	P	P	P	P	P	P	P	Fail	P	P	P	Fail	P	P	P	P	P	P	P	P	P	P	P	P	P	Yes	Yes	P	P	P	P	P	Yes	—	P	—	P	P
51	R-1	1031	1	11/28/05	No	Yes	Yes	P	P	P	P	P	P	P	P	P	P	Fail	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	-DL-	Yes	Yes	P	P	P	P	P	Yes	—	P	—	P	P
52	R-1	1031	1	01/25/06	No	Yes	Yes	P	P	P	P	P	P	P	P	P	P	P	-ND-	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	-DL-	Yes	Yes	P	P	P	P	P	Yes	—	P	—	P	P
53	R-1	1031	1	04/19/06	-ND-	Yes	Yes	P	P	P	-ND-	-ND-	-ND-	-ND-	-ND-	P	-ND-	-ND-	-ND-	-ND-	-ND-	Fail	-ND-	-ND-	-ND-	-ND-	-ND-	-ND-	P	-ND-	P	-ND-	-ND-	-ND-	-ND-	—	—	-ND-	-ND-	-ND-	-ND-	-ND-	-ND-	-ND-	P	—	-ND-	-ND-
54	R-1	1031	1	07/06/06	No	Yes	Yes	P	P	P	P	P	P	P	P	P	P	P	P	P	-ND-	P	P	P	P	P	-DL-	P	P	P	P	P	P	P	P	Yes	Yes	P	P	P	P	P	-Err-	-Err-	P	—	P	P
55	R-1	1031	1	10/26/06	No	Yes	Yes	P	P	P	P	P	P	P	P	P	P	P	P	P	-ND-	P	P	P	P	P	P	P	P	P	P	P	P	P	P	Yes	Yes	P	P	P	P	P	Yes	—	P	—	P	P
56	R-2	918	1	04/26/05	-ND-	Yes	Yes	P	P	Fail	P	P	P	P	P	P	P	P	Fail	P	-ND-	P	P	Fail	P	Fail	Fail	P	P	P	P	Fail	P	P	P	No	Yes	Fail	P	P	P	P	Yes	—	P	—	P	P
57	R-2	918	1	08/09/05	Yes	Yes	Yes	P	P	Fail	P	P	P	P	P	P	P	P	P	P	Fail	P	P	Fail	P	P	Fail	P	P	P	P	P	P	P	P	Yes	Yes	P	P	P	P	P	Yes	—	Fail	P	P	P
58	R-2	918	1	11/09/05	No	Yes	Yes	P	P	Fail	P	P	P	P	P	P	P	P	P	P	Fail	P	P	Fail	P	P	P	P	P	P	P	P	P	P	P	Yes	Yes	P	P	P	P	P	Yes	—	Fail	P	P	P
59	R-2	918	1	02/27/06	No	Yes	Yes	P	P	P	P	P	P	P	P	P	P	P	-ND-	P	Fail	P	P	P	P	P	P	P	P	P	P	P	P	P	P	Yes	Yes	P	P	P	P	P	Yes	—	P	—	P	P
60	R-2	918	1	07/24/06	No	Yes	Yes	P	P	Fail	P	P	P	P	P	P	Fail	P	P	P	-ND-	P	P	P	P	P	P	P	P	P	P	P	P	P	P	Yes	Yes	P	P	P	P	P	Yes	—	P	—	P	P
61	R-3i	215	1	08/10/06	Yes	Yes	Yes	P	Fail	P	Plm	Fail	P	Fail	Plm	P	Fail	P	P	P	Fail	P	P	P	Fail	P	Fail	P	Fail	Plm	P	P	P	P	P	Yes	No	Fail	Fail	Fail	Fail	Plm	Yes	—	P	—	P	P
62	R-4	793	1	04/27/05	Yes	Yes	Yes	P	P	P	Plm	Fail	P	P	P	P	P	P	P	P	-ND-	P	P	P	P	P	P	P	P	Plm	P	P	P	P	P	Yes	Yes	P	P	P	P	P	Yes	—	P	—	P	P
63	R-4	793	1	08/08/05	Yes	Yes	Yes	P	P	P	Plm	Fail	P	P	P	P	P	P	P	P	P	P	P	P	P	P	Fail	P	P	Plm	P	P	P	P	P	Yes	Yes	P	P	P	P	P	Yes	—	P	—	P	P
64	R-4	793	1	11/14/05	Yes	Yes	Yes	P	P	P	Plm	Fail	P	P	P	P	P	Fail	P	P	P	P	P	P	P	P	Fail	P	P	Plm	P	P	P	P	-DL-	Yes	Yes	P	P	P	P	P	Yes	—	P	—	P	P
65	R-4	793	1	02/28/06	Yes	Yes	Yes	P	P	P	Plm	Fail	P	P	P	Fail	P	P	-ND-	P	P	P	P	P	P	P	P	P	P	Plm	Fail	P	P	P	P	Yes	Yes	P	P	P	P	P	Yes	—	P	—	P	P
66	R-4	793	1	07/25/06	Yes	Yes	Yes	P	P	P	Plm	Fail	P	P	P	P	Fail	P	P	P	-ND-	P	P	P	P	P	P	P	P	Plm	P	P	P	P	P	Yes	Yes	P	P	P	P	P	Yes	—	P	—	P	P
67	R-5	384	2	04/28/04	No	Yes	Yes	P	Fail	P	Plm	Fail	P	Fail	Plm	P	P	P	P	P	P	P	P	P	P	P	P	P	P	Plm	P	P	P	P	P	Yes	No	Fail	Fail	Fail	P	Plm	Yes	—	Plm	—	P	P
68	R-5	384	2	09/27/04	No	Yes	Yes	P	Fail	P	Plm	Fail	P	Fail	Plm	P	P	P	P	P	P	P	P	P	P	P	P	P	P	Plm	P	P	P	P	Fail	Yes	No	Fail	Fail	Fail	P	Plm	Yes	—	Plm	—	P	P
69	R-5	384	2	05/02/05	No	Yes	Yes	P	Fail	P	Plm	Fail	P	Fail	Plm	P	-ND-	P	P	P	-ND-	P	P	P	P	P	P	-ND-	-UF-	Plm	P	P	-ND-	P	-UF-	Yes	No	Fail	Fail	Fail	P	-ND-	Yes	—	P	—	P	P
70	R-5	384	2	07/25/06	No	Yes	Yes	P	Fail	P	Plm	Fail	P	Fail	Plm	P	Fail	P	P	P	-ND-	-ND-	P	P	P	P	P	P	P	Plm	-ND-	P	P	P	P	Yes	No	Fail	Fail	Fail	P	Plm	Yes	—	P	—	P	P
71	R-5	719	3	04/30/04	No	Yes	Yes	P	P	P	Plm	Fail	P	P	Plm	P	P	P	P	P	P	P	P	P	P	P	P	P	P	Plm	P	P	P	P	P	Yes	No	Fail	Fail	Fail	P	Fail	Yes	—	P	—	P	P
72	R-5	719	3	09/28/04	No	Yes	Yes	P	P	P	Plm	Fail	P	P	Plm	P	P	P	P	P	P	P	P	P	P	P	P	P	P	Plm	P	P	P	P	Fail	Yes	No	Fail	Fail	Fail	P	Fail	Yes	—	Plm	—	P	P
73	R-5	719	3	05/03/05	No	Yes	Yes	P	P	P	Plm	P	P	P	Plm	P	-ND-	P	P	P	-ND-	P	P	P	P	P	P	-ND-	-UF-	Plm	P	P	-ND-	P	-UF-	Yes	No	Fail	Fail	Fail	P	-ND-	Yes	—	P	—	P	P
74	R-5	719	3	07/26/06	No	Yes	Yes	P	P	P	Plm	Fail	P	P	Plm	P	Fail	P	P	P	-ND-	-ND-	P	P	P	P	P	P	P	Plm	-ND-	P	P	P	P	Yes	No	Fail	Fail	Fail	P	Fail	Yes	—	Plm	—	P	P
75	R-5	861	4	05/03/04	No	Yes	Yes	P	P	P	Fail	P	P	P	P	P	P	Fail	P	P	Fail	P	Fail	Fail	Fail	Fail	Fail	P	P	Fail	P	P	P	P	P	Yes	No	Fail	Fail	Fail	P	Fail	Yes	—	P	—	P	P
76	R-5	861	4	09/30/04	No	Yes	Yes	P	Fail	P	Fail	P	P	P	P	P	P	P	P	P	P	P	Fail	Fail	Fail	Fail	Fail	P	Fail	Fail	P	P	P	P	P	Yes	No	Fail	Fail	Fail	P	Fail	Yes	—	P	—	P	P
77	R-5	861	4	05/04/05	No	Yes	Yes	P	Fail	P	Fail	P	P	P	P	P	-ND-	P	P	P	-ND-	P	Fail	Fail	P	P	Fail	-ND-	Fail	P	P	P	-ND-	P	-UF-	Yes	No	Fail	Fail	Fail	P	-ND-	Yes	—	P	—	P	P
78	R-5	861	4	07/27/06	No	Yes	Yes	P	-ND-	P	-ND-	-ND-	-ND-	-ND-	-ND-	-ND-	-ND-	-ND-	-ND-	-ND-	-ND-	-ND-	-ND-	-ND-	P	-ND-	-ND-	-ND-	-ND-	-ND-	-ND-	-ND-	-ND-	-ND-	-ND-	—	—	-ND-	-ND-	-ND-	-ND-	-ND-	-ND-	-ND-	-ND-	-ND-	-ND-	-ND-
79	R-6	1205	1	08/23/05	No	Yes	Yes	P	P	P	P	P	P	P	P	P	P	P	Fail	P	Fail	P	P	Fail	P	P	P	P	P	P	P	P	P	P	P	Yes	Yes	P	P	P	P	P	Yes	—	P	—	P	P
80	R-6	1205	1	11/17/05	No	Yes	Yes	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	Fail	P	P	P	P	P	P	P	P	P	P	-DL-	Yes	Yes	P	P	P	P	P	Yes	—	P	—	P	P
81	R-6	1205	1	03/01/06	No	Yes	Yes	P	P	P	P	P	P	P	P	P	P	P	-ND-	P	P	P	P	Fail	P	P	P	P	P	P	P	P	P	P	P	Yes	Yes	P	P	P	P	P	Yes	—	P	—	P	P
82	R-6	1205	1	05/11/06	No	Yes	Yes	P	P	P	P	P	P	P	P	Fail	P	P	-ND-	P	P	P	P	Fail	P	P	P	P	P	P	P	P	P	P	P	Yes	Yes	P	P	P	P	P	Yes	—	P	—	P	P
83	R-6	1205	1	07/26/06	No	Yes	Yes	P	P	P	P	P	P	P	P	P	Fail	P	P	P	-ND-	P	P	P	P	P	P	P	P	P	P	P	P	P	P	Yes	Yes	P	P	P	P	P	Yes	—	P	—	P	P
84	R-6i	602	1	08/24/05	Yes	Yes	Yes	P	Fail	P	Plm	Fail	Fail	Fail	Plm	P	P	P	Fail	P	Fail	P	P	P	P	P	P	P	P	Plm	P	P	P	P	—	Yes	No	Fail	P	P	P	Fail	Yes	—	Fail	P	P	Fail
85	R-6i	602	1	11/17/05	Yes	Yes	Yes	P	Fail	P	Plm	Fail	P	Fail	Plm	P	P	P	Fail	P	-ND-	P	Fail	Fail	P	P	Fail	P	Fail	Plm	P	P	P	P	P	Yes	No	Fail	P	P	P	Fail	Yes	—	P	—	P	P
86	R-6i	602	1	03/01/06	Yes	Yes	Yes	P	Fail	P	Plm	Fail	P	Fail	Plm	P	P	P	-ND-	P	Fail	P	P	P	P	P	Fail	P	P	Plm	P	P	P	P	—	Yes	No	Fail	P	P	P	Fail	No	Fail	Fail	P	P	P
87	R-6i	602	1	05/11/06	Yes	Yes	Yes	P	Fail	P	Plm	Fail	P	Fail	Plm	Fail	P	P	-ND-	P	P	P	P	P	P	P	P	P	P	Plm	P	P	P	P	P	Yes	No	Fail	P	P	P	P	Yes	—	P	—	P	P
88	R-6i	602	1	07/26/06	Yes	Yes	Yes	P	Fail	P	Plm	Fail	P	Fail	Plm	P	Fail	P	Fail	P	-ND-	P	Fail	P	P	P	P	P	P	Plm	P	P	P	P	—	Yes	No	Fail	P	P	P	P	Yes	—	P	—	P	Fail
89	R-7	915	3	12/18/03	No	Yes	Yes	P	P	P	P	P	-ND-	P	-Red-	P	P	-ND-	Fail	Fail	-ND-	-ND-	Fail	Fail	-DL-	P	Fail	Fail	-UF-	Fail	-ND-	Fail	Fail	P	-UF-	No	Yes	Fail	Fail	P	P	-Red-	No	-ND-	P	—	P	P
90	R-7	915	3	05/26/04	No	No	Yes	Fail	P	P	P	P	-ND-	P	P	P	-ND-	-ND-	-ND-	P	-ND-	-ND-	Fail	Fail	Fail	P	Fail	Fail	-UF-	Fail	-ND-	Fail	Fail	P	—	No	Yes	Fail	Fail	P	P	-Red-	No	-ND-	P	—	P	P
91	R-7	915	3	04/26/05	No	Yes	Yes	P	P	P	P	P	P	P	-Red-	P	-ND-	P	Fail	Fail	-ND-	P	Fail	Fail	Fail	P	Fail	-ND-	-UF-	Fail	P	Fail	-ND-	P	—	No	Yes	Fail	Fail	P	P	-ND-	No	-ND-	P	—	P	-UF-
92	R-7	915	3	07/31/06	No	No	Yes	Fail	P	P	P	Fail	P	P	P	P	-ND-	-ND-	-ND-	P	-ND-	-ND-	Fail	Fail	-DL-	P	Fail	Fail	P	Fail	-ND-	Fail	Fail	P	—	No	Yes	Fail	Fail	P	P	-Red-	No	P	P	—	P	P
93	R-8	711	1	08/24/04	No	Yes	Yes	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	Yes	Yes	P	P	P	P	P	Yes	—	P	—	P	P
94	R-8	711	1	12/08/04	No	Yes	Yes	P	P	P	P	Fail	P	P	P	P	P	P	P	P	P	-ND-	P	P	P	P	P	P	P	P	P	P	P	P	P	Yes	Yes	P	P	P	P	P	Yes	—	Fail	P	P	P
95	R-8	711	1	04/27/05	No	Yes	Yes	P	P	P	P	Fail	-ND-	P	P	P	-ND-	P	P	P	-ND-	P	P	P	P	P	P	-ND-	-UF-	-ND-	P	P	-ND-	P	-UF-	Yes	Yes	P	P	P	P	-ND-	Yes	—	P	—	P	P
96	R-8	711	1	08/01/06	No	Yes	Yes	P	P	P	P	Fail	P	P	P	P	Fail	P	P	P	-ND-	-ND-	P	P	P	P	P	P	P	P	-ND-	P	P	P	P	Yes	Yes	P	P	P	P	P	Yes	—	P	—	P	P

Table E-1. Summary of Test Outcomes

Water Quality Sample					General Indicators						Category A Inorganic Indicators					Category B Organic Indicators				Category C1 Redox (SO4)			Category C2 Redox (Fe/Mn)							Category C3 Redox (NO3)		Category D Adsorption				Category E Carbonate mineralogy							Category F Metal corrosion					Cat G Zn
Row	Well	Port depth (ft)	Screen	Sample date	Mod water	Low pH?	High pH?	Gen-1	Gen-2	Gen-3	A1	A2	A3	A4	A5	B1	B2	B3	B4	C1	C2	C3	C4	C5	C6	C9	C8	C7	C10	C11	C12	D1	D2	D3	D4	E1a	E1b	E1	E2	E3	E4	E5	F1	F2	F3	F4	F5	G1
				Units	3H	pH	pH	pH	Alk	Trb	Cl	F	PO4	Na	SO4	Ace	NH3	TKN	TOC	SO4	S	ORP	Fe	Mn	ClO4	Mo	Ni	U	Cr	NO3	DO	Sr	U	Ba	Zn	Ca	Ca	Ca	Ba	Sr	Mg	U	FeT	FeR	CrT	CrR	Ni	Zn
				Test	>UL	>LL	<UL	In range	<UL	<UL	<UL	<UL	<UL	<UL	<UL	<UL	<UL	<UL	<UL	>LL	<UL	>LL	<UL	<UL	>LL	<UL	<UL	>LL	>LL	>LL	>LL	>LL	>LL	>LL	>LL	>LL	<UL	In range	<UL	<UL	<UL	<UL	<UL	<UL	<UL	<UL	<UL	<UL
				Regional	1	6.94	8.65		105	5	3.75	0.53	0.3	28.6	6.22	5	0.05	0.28	1	0.8	0.01	0	102	16	0.17	4	2	0.2	1	0.1	2	44.88	0.2	4.6	1	8.66	24.1		70	180	4.81	1.52	500	10	10	5	50	40
				Perched	1	6.73	8.80		52	5	1.75	0.23	0.08	12.2	4.48	5	0.05	0.28	1	1.07	0.01	0	102	16	0.17	4	2	0.1	1	0.1	2	19.1	0.1	1.4	1	4.39	17.3		72	155	6.12	0.72	500	10	5	5	50	20
97	R-8	825	2	08/25/04	No	Yes	No	Fail	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	No	Yes	Fail	Fail	Fail	P	P	Yes	–	Fail	P	P	P
98	R-8	825	2	12/09/04	No	Yes	No	Fail	P	P	P	P	P	P	P	P	P	P	P	P	P	-ND-	P	P	P	P	P	P	P	P	P	P	P	P	Fail	No	Yes	Fail	Fail	Fail	P	P	Yes	–	P	–	P	P
99	R-8	825	2	04/28/05	No	Yes	No	Fail	P	P	P	P	P	P	P	-ND-	-ND-	P	P	P	-ND-	Fail	P	P	P	P	P	-ND-	-UF-	P	P	P	-ND-	P	-UF-	Yes	Yes	P	Fail	P	P	-ND-	Yes	–	P	–	P	P
100	R-8	825	2	08/02/06	No	Yes	No	Fail	P	P	Fail	P	P	P	P	-ND-	-ND-	-ND-	-ND-	P	-ND-	-ND-	P	P	-DL-	P	P	P	P	P	-ND-	P	P	P	P	Yes	Yes	P	Fail	P	P	P	Yes	–	P	–	P	P
101	R-9	684	1	12/12/03	Yes	Yes	Yes	P	Fail	P	Plm	P	-ND-	P	P	-ND-	P	-ND-	P	P	-ND-	-ND-	P	Fail	-DL-	P	P	P	-UF-	Plm	-ND-	P	P	P	-UF-	Yes	No	Fail	Fail	P	Fail	Plm	Yes	–	P	–	P	P
102	R-9	684	1	05/27/04	Yes	Yes	Yes	P	P	P	Plm	P	-ND-	P	Fail	P	-ND-	-ND-	-ND-	P	-ND-	-ND-	Fail	Fail	P	P	P	P	-UF-	Plm	-ND-	P	P	P	-UF-	Yes	No	Fail	Fail	P	Fail	Plm	Yes	–	P	–	P	P
103	R-9	684	1	03/19/05	-ND-	Yes	Yes	P	Fail	P	Plm	P	-ND-	P	Fail	-ND-	-ND-	-ND-	-ND-	P	-ND-	P	P	Fail	Fail	P	P	P	-UF-	Plm	P	P	P	P	-UF-	Yes	No	Fail	Fail	P	Fail	Plm	Yes	–	P	–	P	P
104	R-9	684	1	04/06/05	-ND-	Yes	Yes	P	Fail	P	Plm	P	-ND-	P	Fail	-ND-	-ND-	-ND-	-ND-	P	-ND-	-ND-	P	Fail	Fail	P	P	P	-UF-	Plm	P	P	P	P	-UF-	Yes	No	Fail	Fail	P	Fail	Plm	Yes	–	P	–	P	P
105	R-9	684	1	04/28/05	Yes	Yes	Yes	P	Fail	P	Plm	P	P	P	P	P	-ND-	P	P	P	-ND-	-ND-	P	Fail	P	P	P	-ND-	-UF-	Plm	P	P	-ND-	P	-UF-	Yes	No	Fail	Fail	P	Fail	-ND-	Yes	–	P	–	P	P
106	R-9	684	1	07/31/06	Yes	Yes	Yes	P	Fail	-ND-	Plm	P	P	P	P	P	P	P	P	P	-ND-	-ND-	P	Fail	P	P	P	P	P	Plm	-ND-	P	P	P	P	Yes	No	Fail	Fail	P	Fail	Plm	Yes	–	P	–	P	P
107	R-9i	199	1	02/06/04	Yes	Yes	Yes	P	Fail	-ND-	Plm	Fail	-ND-	Fail	Plm	-ND-	P	-ND-	Fail	P	-ND-	-ND-	Fail	Fail	-DL-	Fail	Fail	P	-UF-	Fail	-ND-	P	P	P	-UF-	Yes	No	Fail	Fail	P	Fail	P	No	-ND-	Fail	-ND-	P	P
108	R-9i	199	1	06/02/04	Yes	Yes	Yes	P	Fail	P	Plm	Fail	-ND-	Fail	Plm	P	-ND-	-ND-	-ND-	P	-ND-	-ND-	Fail	Fail	Fail	Fail	Fail	P	-UF-	Fail	-ND-	P	P	P	-UF-	Yes	No	Fail	Fail	P	Fail	P	Yes	–	P	–	P	P
109	R-9i	199	1	04/29/05	Yes	Yes	Yes	P	Fail	P	Plm	Fail	P	Fail	Plm	P	-ND-	P	Fail	P	-ND-	P	P	Fail	P	Fail	Fail	-ND-	-UF-	Fail	P	P	-ND-	P	-UF-	Yes	No	Fail	P	P	Fail	-ND-	Yes	–	P	–	P	P
110	R-9i	199	1	08/10/06	Yes	Yes	Yes	P	Fail	P	Plm	Fail	Fail	Fail	Plm	-ND-	-ND-	-ND-	-ND-	P	-ND-	-ND-	P	Fail	-DL-	Fail	Fail	P	P	Fail	-ND-	P	P	P	P	Yes	No	Fail	P	P	Fail	Fail	Yes	–	P	–	P	P
111	R-9i	279	2	09/06/01	Yes	Yes	Yes	P	P	P	Plm	Fail	-ND-	Fail	Plm	Fail	P	P	Fail	P	-ND-	-ND-	P	Fail	-ND-	Fail	Fail	Fail	Fail	Fail	-ND-	P	Fail	P	P	Yes	Yes	P	P	P	P	-Red-	No	Fail	P	–	P	P
112	R-9i	279	2	07/29/02	Yes	Yes	Yes	P	P	P	Plm	Fail	-ND-	P	Plm	-ND-	P	-ND-	Fail	P	-ND-	Fail	P	Fail	-DL-	Fail	Fail	Fail	Fail	Fail	P	P	Fail	P	-UF-	Yes	Yes	P	P	P	P	-Red-	Yes	–	P	–	P	P
113	R-9i	279	2	02/06/04	Yes	Yes	Yes	P	Fail	P	Plm	Fail	-ND-	P	Plm	-ND-	P	-ND-	Fail	P	-ND-	-ND-	P	Fail	-DL-	Fail	Fail	P	-UF-	Fail	-ND-	P	P	P	-UF-	Yes	Yes	P	P	P	P	P	Yes	–	P	–	P	P
114	R-9i	279	2	08/10/06	Yes	Yes	Yes	P	Fail	P	Plm	Fail	Fail	P	Plm	-ND-	-ND-	-ND-	-ND-	P	-ND-	-ND-	P	Fail	P	P	P	P	Fail	Plm	-ND-	P	P	P	–	Yes	Yes	P	P	P	P	Fail	Yes	–	P	–	P	Fail
115	R-10	874	1	06/29/06	No	Yes	Yes	P	P	P	P	P	P	P	P	P	Fail	P	P	P	-ND-	-ND-	Fail	P	P	P	P	P	-UF-	P	-ND-	P	P	P	–	Yes	Yes	P	P	P	P	P	Yes	–	P	–	P	-UF-
116	R-10	874	1	10/12/06	No	Yes	Yes	P	P	P	P	P	P	P	P	P	P	P	Fail	P	-ND-	-ND-	P	P	P	P	P	P	P	P	-ND-	P	P	P	–	Yes	Yes	P	P	P	P	P	Yes	–	P	–	P	P
117	R-10	1042	2	10/11/05	-ND-	Yes	Yes	P	P	-ND-	P	P	-ND-	P	P	-ND-	-ND-	-ND-	-ND-	P	-ND-	-ND-	P	P	-DL-	P	P	P	-UF-	P	-ND-	P	P	P	–	Yes	Yes	P	P	P	P	P	Yes	–	P	–	P	-UF-
118	R-10	1042	2	06/29/06	No	Yes	Yes	P	Fail	-ND-	P	P	P	P	P	P	P	P	P	P	-ND-	-ND-	P	P	P	P	P	P	P	P	-ND-	P	P	P	P	Yes	Yes	P	P	P	P	P	Yes	–	P	–	P	P
119	R-10	1042	2	10/12/06	No	Yes	Yes	P	P	P	P	P	P	P	P	P	P	P	Fail	P	-ND-	-ND-	P	P	P	P	P	P	P	P	-ND-	P	P	P	P	Yes	Yes	P	P	P	P	P	Yes	–	P	–	P	P
120	R-10a	690	1	09/07/05	-ND-	Yes	Yes	P	Fail	-ND-	Plm	P	-ND-	P	Fail	-ND-	-ND-	-ND-	-ND-	P	-ND-	-ND-	P	P	-ND-	P	P	P	-UF-	Plm	-ND-	P	P	P	–	–	–	-ND-	Fail	Fail	P	Plm	Yes	–	P	–	P	-UF-
121	R-10a	690	1	11/30/05	No	Yes	Yes	P	Fail	P	Plm	P	P	P	Fail	P	P	P	Fail	P	P	P	P	Fail	P	P	P	P	P	Plm	P	P	P	P	–	Yes	No	Fail	Fail	Fail	P	Plm	Yes	–	P	–	P	Fail
122	R-10a	690	1	02/01/06	No	Yes	Yes	P	Fail	P	Plm	P	P	P	Fail	P	P	P	-ND-	P	Fail	P	P	P	P	P	P	P	P	Plm	P	P	P	P	–	Yes	No	Fail	Fail	Fail	Fail	Plm	Yes	–	P	–	P	Fail
123	R-10a	690	1	07/17/06	No	Yes	Yes	P	Fail	Fail	Plm	P	P	P	Fail	P	P	P	P	P	-ND-	P	P	P	P	P	P	P	P	Plm	P	P	P	P	–	Yes	No	Fail	Fail	Fail	P	Plm	Yes	–	P	–	P	P
124	R-10a	690	1	10/12/06	No	Yes	Yes	P	Fail	P	Plm	P	P	P	Fail	P	P	P	P	P	-ND-	P	P	P	P	P	P	P	P	Plm	P	P	P	P	–	Yes	No	Fail	Fail	Fail	P	Plm	Yes	–	P	–	P	P
125	R-11	855	1	05/17/05	Yes	Yes	Yes	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	Plm	Plm	P	P	P	P	P	Yes	Yes	P	P	P	Fail	P	Yes	–	Plm	–	P	P
126	R-11	855	1	08/03/05	Yes	Yes	Yes	P	P	P	P	P	P	P	Fail	P	P	P	P	P	P	P	P	P	P	P	P	P	Plm	Plm	Fail	P	P	P	–	Yes	Yes	P	P	P	Fail	P	Yes	–	Plm	–	P	P
127	R-11	855	1	11/08/05	Yes	Yes	Yes	P	P	P	P	P	P	P	Fail	P	P	P	P	P	P	P	P	P	P	P	P	P	Plm	Plm	P	P	P	P	–	Yes	Yes	P	P	P	Fail	P	Yes	–	Plm	–	P	P
128	R-11	855	1	02/03/06	Yes	Yes	Yes	P	P	P	Plm	P	P	P	Fail	P	P	P	-ND-	P	P	P	P	P	P	P	P	P	Plm	Plm	P	P	P	P	–	Yes	Yes	P	P	P	Fail	P	Yes	–	Plm	–	P	P
129	R-11	855	1	04/20/06	-ND-	Yes	Yes	P	Fail	P	-ND-	-ND-	-ND-	-ND-	-ND-	-ND-	-ND-	-ND-	-ND-	-ND-	-ND-	P	-ND-	-ND-	-ND-	-ND-	-ND-	-ND-	Plm	-ND-	P	-ND-	-ND-	-ND-	-ND-	–	–	-ND-	-ND-	-ND-	-ND-	-ND-	-ND-	-ND-	Plm	–	-ND-	-ND-
130	R-11	855	1	07/10/06	Yes	Yes	Yes	P	P	-ND-	Plm	P	P	P	Fail	P	P	P	P	P	-ND-	-ND-	P	P	P	P	P	P	Plm	Plm	-ND-	P	P	P	–	Yes	Yes	P	P	P	Fail	P	Yes	–	Plm	–	P	P
131	R-11	855	1	10/10/06	Yes	Yes	Yes	P	P	P	Plm	P	P	P	Fail	P	P	P	P	P	-ND-	P	P	P	P	P	P	P	Plm	Plm	P	P	P	P	–	Yes	Yes	P	P	P	Fail	P	Yes	–	Plm	–	P	P
132	R-12	468	1	02/02/04	Yes	Yes	No	Fail	P	P	Plm	Fail	-ND-	Fail	-Red-	-ND-	Fail	-ND-	Fail	Fail	-ND-	-ND-	Fail	Fail	-DL-	Fail	Fail	Plm	-UF-	Fail	-ND-	Fail	Plm	P	-UF-	No	Yes	Fail	P	P	P	-Red-	Yes	–	Fail	-ND-	P	P
133	R-12	468	1	06/02/04	-ND-	Yes	No	Fail	P	P	Plm	Fail	-ND-	Fail	-Red-	P	-ND-	-ND-	-ND-	Fail	-ND-	-ND-	Fail	Fail	Fail	Fail	Fail	Fail	Fail	Fail	-ND-	Fail	Fail	P	-UF-	No	Yes	Fail	P	P	P	-Red-	Yes	–	P	–	P	P
134	R-12	468	1	06/16/05	-ND-	Yes	No	Fail	P	P	Plm	Fail	Fail	Fail	P	P	Fail	Fail	-ND-	P	-ND-	P	Fail	Fail	Fail	Fail	P	Fail	Fail	Fail	P	P	Fail	P	P	No	Yes	Fail	P	P	P	-Red-	Yes	–	P	–	P	P
135	R-12	468	1	06/30/05	-ND-	Yes	Yes	P	-ND-	Fail	-ND-	-ND-	-ND-	-ND-	-ND-	-ND-	-ND-	-ND-	-ND-	-ND-	-ND-	-ND-	-ND-	-ND-	-ND-	-ND-	-ND-	-ND-	-ND-	-ND-	-ND-	-ND-	-ND-	-ND-	-ND-	–	–	-ND-	-ND-	-ND-	-ND-	-ND-	-ND-	-ND-	-ND-	-ND-	-ND-	-ND-
136	R-12	468	1	02/02/06	Yes	Yes	No	Fail	P	P	Plm	Fail	Fail	Fail	P	P	Fail	Fail	-ND-	P	-ND-	-ND-	P	Fail	Fail	Fail	P	Fail	P	Fail	P	Fail	Fail	P	-DL-	No	Yes	Fail	P	P	P	-Red-	Yes	–	P	–	P	P
137	R-12	468	1	07/11/06	Yes	Yes	No	Fail	P	P	Plm	Fail	Fail	Fail	P	P	Fail	Fail	Fail	P	-ND-	-ND-	P	Fail	Fail	Fail	P	Fail	Fail	Fail	-ND-	Fail	Fail	P	P	No	Yes	Fail	P	P	P	-Red-	Yes	–	P	–	P	P
138	R-12	468	1	09/29/06	Yes	Yes	Yes	P	Fail	P	Plm	Fail	P	Fail	Plm	Fail	P	P	Fail	P	P	P	P	Fail	P	P	Fail	P	P	Plm	P	P	P	P	–	Yes	No	Fail	P	Fail	Fail	Fail	No	P	P	–	P	Fail
139	R-12	507	2	09/10/01	Yes	Yes	No	Fail	P	P	Plm	Fail	Fail	P	Plm	Fail	Fail	Fail	Fail	P	-ND-	-ND-	P	Fail	-ND-	Fail	P	P	Fail	Fail	-ND-	P	P	P	P	Yes	Yes	P	P	P	P	P	Yes	–	P	–	P	P
140	R-12	507	2	08/01/02	Yes	Yes	No	Fail	Fail	P	Plm	Fail	-ND-	P	Plm	-ND-	Fail	-ND-	Fail	P	-ND-	Fail	P	Fail	-DL-	Fail	Fail	-DL-	-UF-	Fail	P	P	-DL-	P	P	Yes	Yes	P	P	P	P	-DL-	Yes	–	Fail	-ND-	P	P
141	R-12	507	2	01/28/04	Yes	Yes	No	Fail	Fail	P	Plm	Fail	-ND-	P	Plm	-ND-	Fail	-ND-	P	P	-ND-	-ND-	P	Fail	-DL-	P	P	P	Fail	Fail	-ND-	P	P	P	P	Yes	Yes	P	P	P	P	P	Yes	–	P	–	P	P
142	R-12	507	2	02/01/06	Yes	Yes	No	Fail	Fail	P	Plm	Fail	Fail	Fail	P	P	Fail	P	-ND-	P	-ND-	-ND-	P	Fail	Fail	Fail	P	P	Fail	Fail	P	P	P	P	P	Yes	Yes	P	P	P	P	Fail	Yes	–	P	–	P	P
143	R-12	507	2	07/12/06	Yes	Yes	No	Fail	Fail	P	Plm	Fail	P	Fail	P	P	Fail	P	P	P	-ND-	-ND-	P	Fail	Fail	P	P	P	P	Fail	-ND-	P	P	P	P	Yes	Yes	P	P	P	P	P	Yes	–	P	–	P	P
144	R-12	507	2	10/01/06	Yes	Yes	Yes	P	Fail	P	Plm	Fail	P	P	Plm	Fail	P	P	P	P	P	P	Fail	P	P	P	P	P	P	Plm	P	P	P	P	–	Yes	Yes	P	P	P	P	P	Yes	–	P	–	P	Fail

Table E-1. Summary of Test Outcomes

Water Quality Sample					General Indicators						Category A Inorganic Indicators					Category B Organic Indicators				Category C1 Redox (SO4)			Category C2 Redox (Fe/Mn)							Category C3 Redox (NO3)		Category D Adsorption				Category E Carbonate mineralogy							Category F Metal corrosion					Cat G Zn
Row	Well	Port depth (ft)	Screen	Sample date	Mod water	Low pH?	High pH?	Gen-1	Gen-2	Gen-3	A1	A2	A3	A4	A5	B1	B2	B3	B4	C1	C2	C3	C4	C5	C6	C9	C8	C7	C10	C11	C12	D1	D2	D3	D4	E1a	E1b	E1	E2	E3	E4	E5	F1	F2	F3	F4	F5	G1
				Units	3H	pH	pH	pH	Alk	Trb	Cl	F	PO4	Na	SO4	Ace	NH3	TKN	TOC	SO4	S	ORP	Fe	Mn	ClO4	Mo	Ni	U	Cr	NO3	DO	Sr	U	Ba	Zn	Ca	Ca	Ca	Ba	Sr	Mg	U	FeT	FeR	CrT	CrR	Ni	Zn
				Test	>UL	>LL	<UL	In range	<UL	<UL	<UL	<UL	<UL	<UL	<UL	<UL	<UL	<UL	<UL	>LL	<UL	>LL	<UL	<UL	>LL	<UL	<UL	>LL	>LL	>LL	>LL	>LL	>LL	>LL	>LL	>LL	<UL	In range	<UL	<UL	<UL	<UL	<UL	<UL	<UL	<UL	<UL	<UL
				Regional	1	6.94	8.65		105	5	3.75	0.53	0.3	28.6	6.22	5	0.05	0.28	1	0.8	0.01	0	102	16	0.17	4	2	0.2	1	0.1	2	44.88	0.2	4.6	1	8.66	24.1		70	180	4.81	1.52	500	10	10	5	50	40
				Perched	1	6.73	8.80		52	5	1.75	0.23	0.08	12.2	4.48	5	0.05	0.28	1	1.07	0.01	0	102	16	0.17	4	2	0.1	1	0.1	2	19.1	0.1	1.4	1	4.39	17.3		72	155	6.12	0.72	500	10	5	5	50	20
145	R-12	811	3	01/27/04	Yes	Yes	Yes	P	Fail	P	Plm	P	-ND-	P	Plm	-ND-	P	-ND-	P	P	-ND-	-ND-	Fail	Fail	-DL-	Fail	Fail	P	-UF-	Fail	-ND-	P	P	P	-UF-	Yes	No	Fail	Fail	Fail	Fail	Fail	Yes	—	P	—	P	P
146	R-12	811	3	06/03/04	-ND-	Yes	Yes	P	Fail	P	Plm	P	-ND-	P	Plm	P	-ND-	-ND-	-ND-	P	-ND-	-ND-	Fail	Fail	Fail	Fail	Fail	P	-UF-	Fail	-ND-	P	P	P	-UF-	Yes	No	Fail	Fail	Fail	Fail	P	Yes	—	P	—	P	P
147	R-12	811	3	06/20/05	-ND-	Yes	Yes	P	Fail	P	Plm	P	P	P	Plm	-ND-	P	P	-ND-	P	-ND-	P	Fail	Fail	Fail	Fail	P	P	Fail	Fail	P	P	P	P	P	Yes	No	Fail	Fail	Fail	Fail	P	Yes	—	P	—	P	P
148	R-12	811	3	01/31/06	Yes	Yes	Yes	P	Fail	P	Plm	P	P	P	Plm	P	P	P	-ND-	P	-ND-	-ND-	Fail	Fail	Fail	Fail	P	P	P	Fail	P	P	P	P	—	Yes	No	Fail	Fail	Fail	Fail	P	Yes	—	P	—	P	P
149	R-12	811	3	07/12/06	Yes	Yes	Yes	P	Fail	P	Plm	P	P	P	Plm	P	P	P	Fail	P	-ND-	-ND-	Fail	Fail	Fail	Fail	Fail	P	P	Fail	-ND-	P	P	P	P	Yes	No	Fail	Fail	Fail	Fail	P	Yes	—	P	—	P	P
150	R-12	811	3	09/27/06	Yes	Yes	Yes	P	P	P	Plm	P	P	P	Plm	P	P	P	P	P	P	-ND-	Fail	P	P	P	P	P	P	Plm	P	P	P	P	—	Yes	Yes	P	P	P	P	P	Yes	—	P	—	P	Fail
151	R-12	811	3	10/18/06	Yes	Yes	Yes	P	P	P	Plm	P	P	P	Plm	P	P	P	P	P	P	P	P	P	P	P	P	P	P	Plm	P	P	P	P	—	Yes	No	Fail	Fail	P	Fail	P	Yes	—	P	—	P	Fail
152	R-13	958	1	12/09/03	No	Yes	Yes	P	P	P	P	P	-ND-	P	P	-ND-	P	-ND-	P	P	-ND-	-ND-	P	P	-DL-	P	P	-UF-	-UF-	P	-ND-	P	-UF-	P	-UF-	Yes	Yes	P	P	P	P	P	Yes	—	P	—	P	P
153	R-13	958	1	06/11/04	No	Yes	Yes	P	P	P	P	P	-ND-	P	P	P	-ND-	-ND-	-ND-	P	-ND-	-ND-	P	P	P	P	Fail	-UF-	-UF-	P	-ND-	P	-UF-	P	-UF-	Yes	Yes	P	P	P	P	P	Yes	—	P	—	P	P
154	R-13	958	1	03/10/05	-ND-	Yes	Yes	P	P	P	P	P	-ND-	P	P	-ND-	-ND-	-ND-	-ND-	P	-ND-	-ND-	P	P	-DL-	P	P	-UF-	-UF-	P	P	P	-UF-	P	-UF-	Yes	Yes	P	P	P	P	P	Yes	—	P	—	P	P
155	R-13	958	1	05/26/05	No	Yes	No	Fail	P	P	P	P	P	-ND-	P	-ND-	-ND-	P	P	P	-ND-	P	-ND-	-ND-	P	-ND-	-ND-	-ND-	-ND-	P	P	-ND-	-ND-	-ND-	-ND-	—	—	-ND-	-ND-	-ND-	-ND-	-ND-	-ND-	-ND-	-ND-	-ND-	-ND-	-ND-
156	R-13	958	1	09/01/05	No	Yes	Yes	P	P	P	P	P	P	P	P	-ND-	-ND-	P	P	P	-ND-	P	P	P	P	P	P	-UF-	-UF-	P	P	P	-UF-	-Err-	—	—	—	-ND-	-Err-	P	P	P	Yes	—	P	—	P	P
157	R-13	958	1	02/02/06	No	Yes	Yes	P	P	P	P	P	P	P	P	P	P	P	-ND-	P	-ND-	P	P	P	P	P	P	P	P	P	P	P	P	P	-DL-	Yes	Yes	P	P	P	P	P	Yes	—	P	—	P	P
158	R-13	958	1	07/03/06	No	Yes	Yes	P	P	P	P	P	P	P	P	P	P	P	P	P	-ND-	P	P	P	P	P	P	P	P	P	P	P	P	P	P	Yes	Yes	P	P	P	P	P	Yes	—	P	—	P	P
159	R-13	958	1	10/25/06	No	Yes	Yes	P	P	P	P	P	P	P	P	P	P	P	P	P	-ND-	P	P	P	P	P	P	P	P	P	P	P	P	P	P	Yes	Yes	P	P	P	P	P	Yes	—	P	—	P	P
160	R-14	1205	1	07/12/04	No	Yes	Yes	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	Fail	Fail	Fail	P	P	P	P	Fail	P	P	P	P	P	Yes	Yes	P	P	P	P	P	Yes	—	P	—	P	P
161	R-14	1205	1	10/28/04	No	Yes	Yes	P	P	P	P	P	P	P	P	P	P	P	P	P	P	-ND-	P	Fail	P	P	P	P	Fail	Fail	P	P	P	P	P	Yes	Yes	P	P	P	P	P	Yes	—	P	—	P	P
162	R-14	1205	1	05/11/05	No	Yes	Yes	P	P	P	P	P	P	P	P	P	P	P	P	P	P	Fail	P	Fail	P	P	P	P	P	Fail	P	P	P	P	-DL-	Yes	Yes	P	P	P	P	P	Yes	—	P	—	P	P
163	R-14	1205	1	01/24/06	No	Yes	Yes	P	P	P	P	P	P	P	P	P	-DL-	P	-ND-	P	-ND-	-ND-	P	Fail	P	P	P	P	P	Fail	P	P	P	P	P	Yes	Yes	P	P	P	P	P	Yes	—	P	—	P	P
164	R-14	1205	1	06/26/06	No	Yes	Yes	P	P	P	P	P	P	P	P	P	Fail	P	P	P	-ND-	-ND-	P	Fail	Fail	P	P	P	P	Fail	-ND-	P	P	P	P	Yes	Yes	P	P	P	P	P	Yes	—	P	—	P	P
165	R-14	1205	1	10/23/06	No	Yes	Yes	P	P	P	P	P	P	P	P	P	P	P	P	P	-ND-	-ND-	P	Fail	P	P	P	P	P	P	-ND-	P	P	P	P	Yes	Yes	P	P	P	P	P	Yes	—	P	—	P	P
166	R-14	1289	2	07/14/04	No	Yes	Yes	P	P	P	P	P	Fail	P	P	P	Fail	P	Fail	P	Fail	Fail	Fail	Fail	Fail	P	Fail	Fail	Fail	Fail	P	P	Fail	P	P	Yes	Yes	P	P	P	P	-Red-	No	P	P	—	P	P
167	R-14	1289	2	11/03/04	No	Yes	Yes	P	P	P	P	P	Fail	P	-Red-	P	Fail	P	Fail	Fail	Fail	-ND-	Fail	Fail	Fail	Fail	Fail	Fail	Fail	Fail	P	P	Fail	P	P	Yes	Yes	P	P	P	P	-Red-	No	P	P	—	P	P
168	R-14	1289	2	05/12/05	No	Yes	Yes	P	P	P	P	P	Fail	P	P	P	Fail	P	Fail	P	Fail	Fail	Fail	Fail	Fail	P	P	Fail	Fail	Fail	P	P	Fail	P	P	Yes	Yes	P	P	P	P	-Red-	No	P	P	—	P	P
169	R-14	1289	2	01/25/06	No	Yes	Yes	P	P	P	P	P	Fail	P	P	P	P	P	-ND-	P	-ND-	-ND-	Fail	Fail	Fail	P	P	Fail	Fail	Fail	P	P	Fail	P	P	Yes	Yes	P	P	P	P	-Red-	No	P	P	—	P	P
170	R-14	1289	2	06/28/06	No	Yes	Yes	P	P	P	P	P	Fail	P	P	P	-ND-	-ND-	-ND-	P	-ND-	-ND-	Fail	Fail	-DL-	P	P	Fail	P	Fail	-ND-	P	Fail	P	P	Yes	Yes	P	Fail	P	P	-Red-	No	P	P	—	P	P
171	R-14	1289	2	10/23/06	No	Yes	Yes	P	P	P	Fail	P	Fail	P	P	-ND-	-ND-	-ND-	-ND-	P	-ND-	-ND-	Fail	Fail	-DL-	P	P	Fail	Fail	Fail	-ND-	P	Fail	P	P	Yes	Yes	P	Fail	P	P	-Red-	No	P	P	—	P	P
172	R-15	959	1	06/10/04	Yes	Yes	Yes	P	P	P	Plm	P	-ND-	P	Plm	P	-ND-	-ND-	-ND-	P	-ND-	-ND-	Fail	P	P	P	Fail	-UF-	-UF-	Plm	-ND-	P	-UF-	P	Fail	Yes	Yes	P	P	P	P	P	Yes	—	P	—	P	P
173	R-15	959	1	05/25/05	Yes	Yes	Yes	P	P	P	Plm	P	P	P	Plm	P	-ND-	P	P	P	-ND-	P	P	P	P	P	P	-ND-	Plm	Plm	P	P	-ND-	P	-DL-	Yes	Yes	P	P	P	P	-ND-	Yes	—	P	—	P	P
174	R-15	959	1	08/31/05	Yes	Yes	Yes	P	P	Fail	Plm	P	P	P	Plm	P	-ND-	P	P	P	-ND-	P	P	P	P	P	P	P	Plm	Plm	P	P	P	P	P	Yes	Yes	P	P	P	P	P	Yes	—	P	—	P	P
175	R-15	959	1	01/30/06	Yes	Yes	Yes	P	P	P	Plm	P	P	P	Plm	P	P	P	-ND-	P	-ND-	P	P	P	P	P	P	P	Plm	Plm	P	P	P	P	-DL-	Yes	Yes	P	P	P	P	P	Yes	—	P	—	P	P
176	R-15	959	1	07/03/06	Yes	Yes	Yes	P	P	P	Plm	P	P	P	P	P	Fail	P	P	P	-ND-	P	P	P	P	P	P	P	Plm	Plm	P	P	P	P	P	Yes	Yes	P	P	P	P	P	Yes	—	P	—	P	P
177	R-15	959	1	10/24/06	Yes	Yes	Yes	P	P	P	Plm	P	P	P	P	P	P	P	P	P	-ND-	-Err-	P	P	P	P	P	P	Plm	Plm	P	P	P	P	P	Yes	Yes	P	P	P	P	P	Yes	—	P	—	P	P
178	R-16	866	2	10/13/04	No	Yes	No	Fail	P	P	P	P	P	P	P	P	P	P	Fail	P	Fail	-ND-	P	Fail	Fail	P	P	P	Fail	Fail	P	P	P	P	P	Yes	Yes	P	P	P	P	P	Yes	—	P	—	P	P
179	R-16	866	2	12/02/04	No	Yes	No	Fail	P	P	P	P	P	P	P	P	P	P	Fail	P	Fail	-ND-	P	Fail	Fail	P	P	P	Fail	Fail	P	P	P	P	Fail	Yes	Yes	P	P	Fail	P	P	Yes	—	P	—	P	P
180	R-16	866	2	06/13/05	-ND-	Yes	No	Fail	P	P	P	P	P	P	P	P	P	P	-ND-	P	-ND-	Fail	P	Fail	Fail	P	P	P	Fail	Fail	P	P	P	P	P	Yes	Yes	P	P	P	P	P	Yes	—	P	—	P	P
181	R-16	866	2	07/13/06	No	Yes	No	Fail	P	P	Fail	P	P	P	P	P	-ND-	-ND-	-ND-	P	-ND-	-ND-	P	P	-DL-	P	P	P	P	Fail	-ND-	P	P	P	Fail	Yes	Yes	P	P	P	P	P	Yes	—	P	—	P	P
182	R-16	866	2	07/20/06	No	Yes	No	Fail	P	P	P	P	P	P	P	P	Fail	P	Fail	P	Fail	-ND-	P	P	Fail	P	P	P	P	Fail	P	P	P	P	P	Yes	Yes	P	P	Fail	P	P	Yes	—	P	—	P	P
183	R-16	866	2	08/11/06	No	Yes	Yes	P	Fail	P	P	P	P	P	P	P	Fail	P	P	P	P	P	P	P	Fail	P	P	P	P	P	P	P	P	P	—	Yes	Yes	P	P	P	P	P	Yes	—	P	—	P	Fail
184	R-16	866	2	08/14/06	-ND-	Yes	Yes	P	P	-ND-	Fail	P	P	P	P	-ND-	-ND-	-ND-	-ND-	P	-ND-	-ND-	P	P	Fail	P	P	P	P	P	-ND-	P	P	P	—	Yes	Yes	P	P	P	P	P	No	Fail	P	—	P	Fail
185	R-16	866	2	10/10/06	No	Yes	Yes	P	P	P	P	P	P	P	P	P	P	P	P	P	-ND-	-ND-	P	Fail	Fail	Fail	P	P	P	Fail	P	P	P	P	—	Yes	Yes	P	P	Fail	P	P	Yes	—	P	—	P	P
186	R-16	866	2	11/14/06	-ND-	Yes	Yes	P	P	P	Fail	P	P	P	P	-ND-	-ND-	-ND-	-ND-	P	Fail	-ND-	P	Fail	-DL-	P	P	P	P	Fail	P	P	P	P	—	Yes	Yes	P	P	P	P	P	No	Fail	P	—	P	Fail
187	R-16	866	2	12/04/06	-ND-	Yes	Yes	P	Fail	-ND-	Fail	P	P	P	Fail	-ND-	-ND-	-ND-	-ND-	P	P	-ND-	P	Fail	-DL-	P	P	P	P	Fail	-ND-	P	P	P	—	Yes	Yes	P	P	P	P	P	Yes	—	P	—	P	Fail
188	R-16	1018	3	10/14/04	No	Yes	Yes	P	P	P	P	P	P	P	Fail	P	Fail	Fail	P	P	P	-ND-	Fail	Fail	P	P	P	P	Fail	Fail	P	P	P	P	P	Yes	No	Fail	P	Fail	P	Fail	Yes	—	P	—	P	P
189	R-16	1018	3	12/03/04	No	Yes	Yes	P	Fail	P	P	P	P	P	Fail	P	Fail	Fail	P	P	P	-ND-	P	Fail	P	P	P	P	Fail	P	P	P	P	P	P	Yes	No	Fail	P	Fail	P	Fail	Yes	—	P	—	P	P
190	R-16	1018	3	06/13/05	-ND-	Yes	Yes	P	P	P	P	P	P	P	P	P	P	Fail	-ND-	P	-ND-	Fail	P	Fail	P	P	P	P	Fail	P	P	P	P	P	P	Yes	No	Fail	P	Fail	P	Fail	Yes	—	P	—	P	P
191	R-16	1018	3	07/12/06	No	Yes	Yes	P	P	-ND-	P	P	P	P	P	P	P	P	Fail	P	-ND-	-ND-	P	P	P	P	Fail	P	P	P	-ND-	P	P	P	—	Yes	No	Fail	P	Fail	P	Fail	Yes	—	P	—	P	P
192	R-16	1018	3	07/20/06	No	Yes	Yes	P	P	P	P	-ND-	-ND-	-ND-	P	-ND-	-ND-	-ND-	-ND-	P	P	-ND-	-ND-	-ND-	-ND-	-ND-	-ND-	-ND-	-ND-	-ND-	P	-ND-	-ND-	P	-ND-	Yes	No	Fail	P	-ND-	-ND-	-ND-	-ND-	-ND-	-ND-	-ND-	-ND-	-ND-

Table E-1. Summary of Test Outcomes

Water Quality Sample					General Indicators						Category A Inorganic Indicators					Category B Organic Indicators				Category C1 Redox (SO4)			Category C2 Redox (Fe/Mn)							Category C3 Redox (NO3)		Category D Adsorption				Category E Carbonate mineralogy							Category F Metal corrosion					Cat G Zn
Row	Well	Port depth (ft)	Scr een	Sample date	Mod water	Low pH?	High pH?	Gen-1	Gen-2	Gen-3	A1	A2	A3	A4	A5	B1	B2	B3	B4	C1	C2	C3	C4	C5	C6	C9	C8	C7	C10	C11	C12	D1	D2	D3	D4	E1a	E1b	E1	E2	E3	E4	E5	F1	F2	F3	F4	F5	G1
				Units	3H	pH	pH	pH	Alk	Trb	Cl	F	PO4	Na	SO4	Ace	NH3	TKN	TOC	SO4	S	ORP	Fe	Mn	ClO4	Mo	Ni	U	Cr	NO3	DO	Sr	U	Ba	Zn	Ca	Ca	Ca	Ba	Sr	Mg	U	FeT	FeR	CrT	CrR	Ni	Zn
				Test	>UL	>LL	<UL	In	<UL	<UL	<UL	<UL	<UL	<UL	<UL	<UL	<UL	<UL	<UL	>LL	<UL	>LL	<UL	<UL	>LL	<UL	<UL	>LL	>LL	>LL	>LL	>LL	>LL	>LL	>LL	>LL	<UL	In	<UL	<UL	<UL	<UL	<UL	<UL	<UL	<UL	<UL	<UL
				Regional	1	6.94	8.65	range	105	5	3.75	0.53	0.3	28.6	6.22	5	0.05	0.28	1	0.8	0.01	0	102	16	0.17	4	2	0.2	1	0.1	2	44.88	0.2	4.6	1	8.66	24.1	range	70	180	4.81	1.52	500	10	10	5	50	40
				Perched	1	6.73	8.80		52	5	1.75	0.23	0.08	12.2	4.48	5	0.05	0.28	1	1.07	0.01	0	102	16	0.17	4	2	0.1	1	0.1	2	19.1	0.1	1.4	1	4.39	17.3		72	155	6.12	0.72	500	10	5	5	50	20
193	R-16	1018	3	08/10/06	No	Yes	Yes	P	P	P	P	P	P	P	P	P	Fail	P	Fail	P	P	P	P	P	Fail	P	P	P	P	P	P	P	P	P	—	Yes	Yes	P	P	Fail	P	Fail	Yes	—	P	—	P	Fail
194	R-16	1018	3	08/11/06	-ND-	Yes	Yes	P	P	-ND-	P	P	P	P	P	-ND-	-ND-	-ND-	-ND-	P	-ND-	-ND-	P	P	-DL-	P	-ND-	P	P	P	-ND-	P	P	P	—	Yes	Yes	P	P	Fail	P	Fail	Yes	—	P	—	-ND-	Fail
195	R-16	1018	3	10/12/06	No	Yes	Yes	P	Fail	P	P	P	P	P	P	P	P	P	P	P	-ND-	-ND-	P	P	P	P	P	P	P	P	-ND-	P	P	P	—	Yes	No	Fail	P	Fail	P	Fail	Yes	—	P	—	P	P
196	R-16	1018	3	11/14/06	-ND-	Yes	Yes	P	P	P	Fail	Fail	P	P	P	-ND-	-ND-	-ND-	-ND-	P	P	-ND-	P	Fail	-DL-	P	Fail	P	P	P	P	P	P	P	—	Yes	Yes	P	P	Fail	P	Fail	Yes	—	P	—	P	P
197	R-16	1018	3	12/05/06	-ND-	Yes	Yes	P	P	P	Fail	Fail	P	P	Fail	-ND-	-ND-	-ND-	-ND-	P	P	-ND-	P	P	-DL-	P	P	P	P	P	P	P	P	P	—	Yes	Yes	P	P	Fail	P	Fail	Yes	—	P	—	P	P
198	R-16	1238	4	10/15/04	No	Yes	No	Fail	Fail	P	Fail	P	P	Fail	Fail	P	Fail	Fail	Fail	P	Fail	-ND-	P	P	Fail	Fail	Fail	Fail	Fail	Fail	P	P	Fail	P	P	Yes	No	Fail	Fail	Fail	P	-Red-	Yes	—	P	—	P	P
199	R-16	1238	4	12/07/04	No	Yes	No	Fail	Fail	P	Fail	P	Fail	P	Fail	P	Fail	Fail	Fail	P	Fail	-ND-	P	P	Fail	Fail	Fail	P	Fail	Fail	P	P	P	P	P	Yes	No	Fail	Fail	Fail	P	P	Yes	—	P	—	P	P
200	R-16	1238	4	06/14/05	-ND-	Yes	No	Fail	Fail	P	Fail	P	P	P	Fail	P	Fail	Fail	-ND-	P	-ND-	Fail	P	P	Fail	Fail	Fail	Fail	Fail	Fail	P	P	Fail	P	P	Yes	No	Fail	P	Fail	P	-Red-	Yes	—	P	—	P	P
201	R-16	1238	4	07/13/06	No	Yes	No	Fail	P	P	Fail	Fail	Fail	P	Fail	P	-ND-	-ND-	-ND-	P	-ND-	-ND-	P	P	-DL-	Fail	Fail	Fail	P	Fail	-ND-	P	Fail	P	P	Yes	No	Fail	P	Fail	P	-Red-	Yes	—	P	—	P	P
202	R-16	1238	4	07/20/06	No	Yes	No	Fail	Fail	P	P	P	Fail	P	Fail	P	Fail	Fail	Fail	P	Fail	-ND-	P	P	Fail	Fail	Fail	Fail	P	Fail	P	P	Fail	P	P	Yes	No	Fail	P	Fail	P	-Red-	Yes	—	P	—	P	P
203	R-16	1238	4	08/09/06	No	Yes	Yes	P	Fail	P	P	P	P	P	P	P	Fail	P	P	P	P	P	Fail	P	P	P	Fail	P	P	P	P	P	P	P	—	Yes	Yes	P	P	Fail	P	Fail	Yes	—	P	—	P	Fail
204	R-16	1238	4	10/11/06	No	Yes	Yes	P	Fail	P	P	P	P	P	P	P	Fail	Fail	Fail	P	-ND-	-ND-	P	Fail	Fail	Fail	P	P	P	Fail	P	P	P	P	—	Yes	No	Fail	P	Fail	P	P	Yes	—	P	—	P	Fail
205	R-16	1238	4	11/14/06	-ND-	Yes	Yes	P	P	P	Fail	P	Fail	P	P	-ND-	-ND-	-ND-	-ND-	P	Fail	-ND-	P	Fail	-DL-	Fail	P	Fail	Fail	Fail	P	P	Fail	P	—	Yes	No	Fail	P	Fail	P	-Red-	Yes	—	P	—	P	P
206	R-16	1238	4	12/05/06	-ND-	Yes	Yes	P	Fail	P	Fail	P	Fail	P	P	-ND-	-ND-	-ND-	-ND-	P	P	-ND-	P	Fail	-DL-	Fail	P	Fail	P	Fail	P	P	Fail	P	—	Yes	No	Fail	P	Fail	P	-Red-	Yes	—	P	—	P	P
207	R-16r	600	1	09/26/05	-ND-	Yes	Yes	P	P	-ND-	P	P	-ND-	P	P	-ND-	-ND-	-ND-	-ND-	P	-ND-	-ND-	P	Fail	P	Fail	P	P	-UF-	P	-ND-	P	P	P	—	—	—	-ND-	Fail	P	-ND-	P	Yes	—	P	—	P	P
208	R-16r	600	1	10/17/05	-ND-	Yes	Yes	P	P	-ND-	P	P	-ND-	P	P	-ND-	-ND-	-ND-	-ND-	P	-ND-	-ND-	P	Fail	-ND-	P	P	P	-UF-	P	-ND-	P	P	P	—	—	—	-ND-	Fail	P	-ND-	P	Yes	—	P	—	P	-UF-
209	R-16r	600	1	12/19/05	No	Yes	Yes	P	P	P	P	P	-ND-	P	P	P	P	Fail	-ND-	P	-ND-	P	P	P	P	Fail	-DL-	P	P	P	P	P	P	P	P	Yes	Yes	P	Fail	Fail	P	P	Yes	—	P	—	P	P
210	R-16r	600	1	03/08/06	No	Yes	Yes	P	P	P	P	P	P	P	P	P	P	P	-ND-	P	Fail	P	P	P	P	P	P	P	P	P	P	P	P	P	P	Yes	Yes	P	P	Fail	P	P	Yes	—	P	—	P	P
211	R-16r	600	1	05/24/06	No	Yes	Yes	P	P	P	P	P	P	P	P	P	P	P	-ND-	P	Fail	P	P	P	P	P	P	P	P	P	P	P	P	P	P	Yes	Yes	P	Fail	Fail	P	P	Yes	—	P	—	P	P
212	R-16r	600	1	08/17/06	No	Yes	Yes	P	P	P	P	P	P	P	P	P	P	P	P	P	Fail	P	Fail	P	P	P	-Err-	P	P	P	P	P	P	P	P	Yes	Yes	P	P	P	P	P	Yes	—	P	—	-Err-	P
213	R-16r	600	1	11/01/06	No	Yes	Yes	P	P	P	P	P	P	P	P	P	-DL-	P	P	P	-ND-	P	P	P	P	P	Fail	P	P	P	P	P	P	P	P	Yes	Yes	P	Fail	Fail	P	P	Yes	—	P	—	P	P
214	R-17	1057	1	02/24/06	-ND-	Yes	Yes	P	P	-ND-	P	P	P	P	P	-ND-	-ND-	-ND-	P	P	-ND-	-ND-	Fail	Fail	-ND-	P	P	-UF-	-UF-	P	-ND-	Fail	-UF-	P	—	No	Yes	Fail	P	P	P	P	Yes	—	P	—	P	-UF-
215	R-17	1057	1	10/19/06	No	Yes	Yes	P	P	Fail	P	P	P	P	P	P	P	P	P	P	Fail	P	Fail	Fail	P	P	P	P	P	P	P	P	P	P	—	Yes	Yes	P	P	P	P	P	No	P	P	—	P	Fail
216	R-17	1124	2	10/17/06	No	Yes	Yes	P	P	Fail	P	P	P	P	P	P	P	P	P	P	P	P	Fail	Fail	P	P	Fail	P	P	P	P	Fail	P	P	—	Yes	Yes	P	P	P	P	P	No	P	P	—	P	Fail
217	R-18	1358	1	08/25/05	Yes	Yes	Yes	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	Yes	Yes	P	P	P	P	P	Yes	—	P	—	P	P
218	R-18	1358	1	12/01/05	No	Yes	Yes	P	P	P	P	P	P	P	P	P	P	Fail	Fail	P	P	P	P	P	P	P	P	P	Fail	P	P	P	P	P	-DL-	Yes	Yes	P	P	P	P	P	Yes	—	P	—	P	P
219	R-18	1358	1	03/07/06	Yes	Yes	Yes	P	P	P	P	P	P	P	P	P	P	Fail	-ND-	P	P	P	P	P	P	P	P	P	Fail	P	P	P	P	P	P	Yes	Yes	P	P	P	P	P	Yes	—	P	—	P	P
220	R-18	1358	1	05/16/06	No	Yes	Yes	P	P	P	P	P	P	P	P	P	P	P	-ND-	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	Yes	Yes	P	P	P	P	P	Yes	—	P	—	P	P
221	R-18	1358	1	08/15/06	No	Yes	Yes	P	P	P	P	P	P	P	P	P	P	P	P	P	-ND-	P	P	P	P	P	P	P	P	P	P	P	P	P	P	Yes	Yes	P	P	P	P	P	Yes	—	P	—	P	P
222	R-18	1358	1	12/18/06	-ND-	Yes	Yes	P	P	P	P	P	P	P	P	P	-Err-	P	P	P	-ND-	P	P	P	P	P	-DL-	P	-DL-	P	P	P	P	P	P	Yes	Yes	P	P	P	P	P	Yes	—	P	—	P	P
223	R-19	909	2	12/15/03	No	Yes	No	Fail	Fail	P	Fail	Fail	-ND-	Fail	P	-ND-	P	-ND-	P	P	-ND-	-ND-	P	P	-DL-	P	Fail	P	-UF-	P	-ND-	P	P	P	-UF-	Yes	No	Fail	P	P	P	P	Yes	—	P	—	P	P
224	R-19	909	2	06/10/04	-ND-	Yes	No	Fail	Fail	P	Fail	Fail	-ND-	Fail	P	-ND-	-ND-	-ND-	-ND-	P	-ND-	-ND-	P	P	P	P	P	P	-UF-	P	-ND-	P	P	P	Fail	Yes	No	P	P	P	P	P	Yes	—	P	—	P	P
225	R-19	909	2	07/21/05	-ND-	Yes	Yes	P	Fail	P	Fail	Fail	P	Fail	P	-ND-	P	Fail	-ND-	P	-ND-	P	P	P	P	P	P	P	Fail	P	-ND-	P	P	P	—	Yes	Yes	P	P	P	P	P	Yes	—	P	—	P	P
226	R-19	909	2	08/18/06	No	Yes	Yes	P	Fail	P	Fail	Fail	P	Fail	P	-ND-	-ND-	-ND-	-ND-	P	-ND-	-ND-	P	P	-DL-	P	P	P	P	P	-ND-	P	P	P	P	Yes	No	P	P	P	P	P	Yes	—	P	—	P	P
227	R-19	909	2	12/11/06	-ND-	Yes	Yes	P	P	P	Fail	Fail	P	Fail	Fail	-ND-	-ND-	-ND-	-ND-	P	-ND-	-ND-	P	P	-DL-	P	-ND-	-ND-	-ND-	P	-ND-	P	-ND-	P	P	Yes	Yes	P	P	P	P	-ND-	Yes	—	-ND-	-ND-	-ND-	P
228	R-19	1191	3	12/15/03	No	Yes	Yes	P	P	P	P	P	-ND-	P	P	-ND-	P	-ND-	P	P	-ND-	-ND-	P	P	-DL-	P	P	-UF-	-UF-	P	-ND-	P	-UF-	P	-UF-	Yes	Yes	P	P	P	P	P	Yes	—	P	—	P	P
229	R-19	1191	3	06/14/04	-ND-	Yes	Yes	P	P	P	P	P	-ND-	P	P	P	-ND-	-ND-	-ND-	P	-ND-	-ND-	P	P	P	P	Fail	-UF-	-UF-	P	-ND-	P	-UF-	P	Fail	Yes	Yes	P	P	P	P	P	Yes	—	P	—	P	P
230	R-19	1191	3	07/21/05	-ND-	Yes	Yes	P	P	P	P	P	P	P	-Red-	P	P	Fail	-ND-	Fail	-ND-	P	P	P	P	P	P	P	P	P	-ND-	P	P	P	P	Yes	Yes	P	P	P	P	P	Yes	—	P	—	P	P
231	R-19	1191	3	08/15/06	No	Yes	Yes	P	P	P	P	P	P	P	P	-ND-	-ND-	-ND-	-ND-	P	-ND-	-ND-	P	P	-ND-	P	P	P	P	Fail	-ND-	P	P	P	P	Yes	Yes	P	P	P	P	P	Yes	—	P	—	P	P
232	R-19	1191	3	08/16/06	-ND-	Yes	Yes	P	P	-ND-	P	P	P	P	P	-ND-	-ND-	-ND-	-ND-	P	-ND-	-ND-	P	P	-DL-	P	P	P	P	Fail	-ND-	P	P	P	P	Yes	Yes	P	P	P	P	P	Yes	—	P	—	P	P
233	R-19	1191	3	12/11/06	-ND-	Yes	Yes	P	P	P	Fail	P	P	P	P	-ND-	-ND-	-ND-	-ND-	P	-ND-	-ND-	P	P	-DL-	P	-ND-	-ND-	-ND-	Fail	-ND-	P	-ND-	P	P	Yes	Yes	P	P	P	P	-ND-	Yes	—	-ND-	-ND-	-ND-	P
234	R-19	1413	4	12/16/03	No	Yes	Yes	P	P	P	P	P	-ND-	P	P	-ND-	P	-ND-	P	P	-ND-	-ND-	P	P	-DL-	P	Fail	-UF-	-UF-	P	-ND-	P	-UF-	P	-UF-	Yes	Yes	P	P	P	P	P	Yes	—	P	—	P	P
235	R-19	1413	4	06/15/04	-ND-	Yes	Yes	P	P	P	P	P	-ND-	P	P	P	-ND-	-ND-	-ND-	P	-ND-	-ND-	P	P	P	P	P	-UF-	-UF-	P	-ND-	P	-UF-	P	-UF-	Yes	Yes	P	P	P	P	P	Yes	—	Fail	-ND-	P	P
236	R-19	1413	4	07/28/05	-ND-	Yes	Yes	P	P	P	P	P	P	P	P	P	P	P	-ND-	P	-ND-	P	P	P	P	P	P	P	P	P	P	P	P	P	P	Yes	Yes	P	P	P	P	P	Yes	—	P	—	P	P
237	R-19	1413	4	08/16/06	No	Yes	Yes	P	P	P	P	P	P	P	P	P	P	P	P	P	-ND-	-ND-	P	P	P	P	P	P	P	P	-ND-	Fail	P	P	P	No	Yes	Fail	P	P	P	P	Yes	—	Fail	Fail	P	P
238	R-19	1413	4	08/17/06	-ND-	Yes	Yes	P	P	-ND-	P	P	P	P	P	-ND-	-ND-	-ND-	-ND-	P	-ND-	-ND-	P	P	-DL-	P	P	P	P	Fail	-ND-	Fail	P	P	P	Yes	Yes	P	P	P	P	P	Yes	—	P	—	P	P
239	R-19	1413	4	12/12/06	-ND-	Yes	Yes	P	P	P	P	P	P	P	P	P	P	P	P	P	-ND-	-ND-	P	P	P	P	P	P	P	P	-ND-	Fail	P	P	P	Yes	Yes	P	P	P	P	P	Yes	—	P	—	P	P
240	R-19	1586	5	09/20/01	No	Yes	Yes	P	P	Fail	P	P	P	P	-Red-	-ND-	-ND-	Fail	Fail	Fail	-ND-	-ND-	Fail	Fail	-DL-	Fail	P	Fail	Fail	Fail	-ND-	P	Fail	P	P	Yes	No	Fail	Fail	Fail	Fail	-Red-	No	P	P	—	P	P

Table E-1. Summary of Test Outcomes

Water Quality Sample					General Indicators						Category A Inorganic Indicators					Category B Organic Indicators				Category C1 Redox (SO4)			Category C2 Redox (Fe/Mn)							Category C3 Redox (NO3)		Category D Adsorption				Category E Carbonate mineralogy							Category F Metal corrosion					Cat G Zn
Row	Well	Port depth (ft)	Screen	Sample date	Mod water	Low pH?	High pH?	Gen-1	Gen-2	Gen-3	A1	A2	A3	A4	A5	B1	B2	B3	B4	C1	C2	C3	C4	C5	C6	C9	C8	C7	C10	C11	C12	D1	D2	D3	D4	E1a	E1b	E1	E2	E3	E4	E5	F1	F2	F3	F4	F5	G1
				Units	3H	pH	pH	pH	Alk	Trb	Cl	F	PO4	Na	SO4	Ace	NH3	TKN	TOC	SO4	S	ORP	Fe	Mn	ClO4	Mo	Ni	U	Cr	NO3	DO	Sr	U	Ba	Zn	Ca	Ca	Ca	Ba	Sr	Mg	U	FeT	FeR	CrT	CrR	Ni	Zn
				Test	>UL	>LL	<UL	In range	<UL	<UL	<UL	<UL	<UL	<UL	<UL	<UL	<UL	<UL	<UL	>LL	<UL	>LL	<UL	<UL	>LL	<UL	<UL	>LL	>LL	>LL	>LL	>LL	>LL	>LL	>LL	>LL	<UL	In range	<UL	<UL	<UL	<UL	<UL	<UL	<UL	<UL	<UL	<UL
				Regional	1	6.94	8.65	range	105	5	3.75	0.53	0.3	28.6	6.22	5	0.05	0.28	1	0.8	0.01	0	102	16	0.17	4	2	0.2	1	0.1	2	44.88	0.2	4.6	1	8.66	24.1	range	70	180	4.81	1.52	500	10	10	5	50	40
				Perched	1	6.73	8.80		52	5	1.75	0.23	0.08	12.2	4.48	5	0.05	0.28	1	1.07	0.01	0	102	16	0.17	4	2	0.1	1	0.1	2	19.1	0.1	1.4	1	4.39	17.3		72	155	6.12	0.72	500	10	5	5	50	20
241	R-19	1586	5	08/23/02	No	No	Yes	Fail	Fail	P	P	P	-ND-	P	-Red-	P	Fail	-ND-	Fail	Fail	-ND-	Fail	Fail	Fail	-DL-	Fail	Fail	-DL-	-UF-	Fail	P	P	-DL-	P	-UF-	Yes	No	Fail	Fail	Fail	Fail	-DL-	No	-ND-	P	–	P	P
242	R-19	1586	5	12/16/03	No	No	Yes	Fail	Fail	P	P	P	-ND-	P	-Red-	-ND-	Fail	-ND-	Fail	Fail	-ND-	-ND-	Fail	Fail	-DL-	Fail	Fail	Fail	-UF-	Fail	-ND-	P	Fail	P	-UF-	Yes	No	Fail	Fail	Fail	P	-Red-	No	-ND-	P	–	P	P
243	R-19	1586	5	08/17/06	No	No	Yes	Fail	Fail	P	P	P	P	P	-Red-	-ND-	-ND-	-ND-	-ND-	Fail	-ND-	-ND-	Fail	Fail	-DL-	P	Fail	Fail	P	Fail	-ND-	P	Fail	P	–	Yes	No	Fail	Fail	Fail	P	-Red-	Yes	–	P	–	P	Fail
244	R-19	1586	5	12/11/06	-ND-	No	Yes	Fail	Fail	P	Fail	P	P	P	-Red-	-ND-	-ND-	-ND-	-ND-	Fail	-ND-	-ND-	Fail	Fail	-DL-	P	-ND-	-ND-	-ND-	Fail	-ND-	P	-ND-	P	P	Yes	No	Fail	Fail	Fail	P	-ND-	Yes	–	-ND-	-ND-	-ND-	P
245	R-19	1730	6	09/21/01	No	Yes	Yes	P	P	P	P	P	P	P	-Red-	-ND-	-ND-	Fail	Fail	Fail	-ND-	-ND-	Fail	Fail	-DL-	Fail	P	Fail	Fail	Fail	-ND-	Fail	Fail	P	P	No	Yes	Fail	P	P	P	-Red-	No	P	P	–	P	P
246	R-19	1730	6	08/27/02	No	Yes	Yes	P	P	P	P	P	-ND-	P	-Red-	P	Fail	-ND-	Fail	Fail	-ND-	Fail	Fail	Fail	-DL-	P	P	-DL-	Fail	Fail	P	Fail	-DL-	P	-UF-	No	Yes	Fail	P	P	P	-DL-	No	-ND-	P	–	P	P
247	R-19	1730	6	12/16/03	No	No	Yes	Fail	P	P	P	P	-ND-	P	-Red-	-ND-	Fail	-ND-	P	Fail	-ND-	-ND-	Fail	Fail	-DL-	P	Fail	Fail	-UF-	Fail	-ND-	Fail	Fail	P	-UF-	No	Yes	Fail	P	P	P	-Red-	No	-ND-	P	–	P	P
248	R-19	1730	6	08/17/06	No	No	Yes	Fail	P	P	P	P	P	P	P	-ND-	-ND-	-ND-	-ND-	P	-ND-	-ND-	Fail	Fail	-DL-	P	P	Fail	P	Fail	-ND-	Fail	Fail	P	–	No	Yes	Fail	P	P	P	-Red-	Yes	–	P	–	P	P
249	R-19	1730	6	12/11/06	-ND-	No	Yes	Fail	P	P	Fail	P	P	P	P	-ND-	-ND-	-ND-	-ND-	P	-ND-	-ND-	Fail	Fail	-DL-	P	-ND-	-ND-	-ND-	Fail	-ND-	Fail	-ND-	P	P	No	Yes	Fail	P	P	P	-ND-	Yes	–	-ND-	-ND-	-ND-	P
250	R-19	1835	7	08/26/02	No	Yes	Yes	P	Fail	Fail	P	Fail	-ND-	Fail	Fail	P	Fail	-ND-	Fail	P	-ND-	Fail	Fail	Fail	-DL-	Fail	Fail	-DL-	-UF-	Fail	P	Fail	-DL-	P	–	No	Yes	Fail	P	P	P	-DL-	Yes	–	P	–	P	-UF-
251	R-19	1835	7	12/17/03	No	Yes	Yes	P	Fail	Fail	P	Fail	-ND-	Fail	Fail	-ND-	Fail	-ND-	Fail	P	-ND-	-ND-	Fail	Fail	-DL-	Fail	Fail	P	-UF-	Fail	-ND-	Fail	P	P	–	No	Yes	Fail	P	P	P	Fail	No	-ND-	P	–	P	P
252	R-19	1835	7	06/16/04	-ND-	Yes	Yes	P	Fail	Fail	P	P	-ND-	Fail	Fail	P	-ND-	-ND-	-ND-	P	-ND-	-ND-	Fail	Fail	Fail	Fail	Fail	P	Fail	Fail	-ND-	Fail	P	P	–	No	Yes	Fail	P	P	P	Fail	Yes	–	P	–	P	P
253	R-19	1835	7	07/28/05	-ND-	Yes	Yes	P	Fail	Fail	P	P	P	Fail	Fail	P	Fail	Fail	-ND-	P	-ND-	P	P	Fail	Fail	Fail	P	P	Fail	Fail	P	Fail	P	P	P	No	Yes	Fail	P	P	P	P	No	Fail	Fail	Fail	P	P
254	R-19	1835	7	08/18/06	No	Yes	Yes	P	Fail	Fail	P	Fail	P	Fail	Fail	-ND-	-ND-	-ND-	-ND-	P	-ND-	-ND-	Fail	Fail	-DL-	Fail	Fail	P	Fail	Fail	-ND-	Fail	P	P	–	No	Yes	Fail	P	P	P	P	No	P	P	–	P	Fail
255	R-19	1835	7	12/13/06	-ND-	Yes	Yes	P	Fail	-ND-	Fail	Fail	Fail	Fail	Fail	-ND-	-ND-	-ND-	-ND-	P	-ND-	-ND-	Fail	Fail	-DL-	Fail	-ND-	-ND-	-ND-	Fail	-ND-	Fail	-ND-	P	P	No	Yes	Fail	P	P	P	-ND-	Yes	–	-ND-	-ND-	-ND-	P
256	R-20	907	1	09/20/04	No	Yes	No	Fail	Fail	P	P	P	P	Fail	P	Fail	Fail	Fail	Fail	P	Fail	Fail	Fail	P	Fail	Fail	P	Fail	Fail	Fail	P	Fail	Fail	P	P	No	Yes	Fail	P	P	P	-Red-	Yes	–	P	–	P	P
257	R-20	907	1	11/04/04	No	Yes	No	Fail	Fail	P	P	P	P	Fail	P	Fail	Fail	Fail	Fail	P	Fail	-ND-	P	Fail	Fail	Fail	P	Fail	Fail	Fail	P	Fail	Fail	P	P	No	Yes	Fail	P	P	P	-Red-	Yes	–	P	–	P	P
258	R-20	907	1	07/20/05	No	Yes	No	Fail	P	P	P	P	P	Fail	-Red-	Fail	Fail	Fail	-ND-	Fail	-ND-	Fail	Fail	P	Fail	Fail	P	Fail	Fail	Fail	P	Fail	Fail	P	P	No	Yes	Fail	P	P	P	-Red-	Yes	–	P	–	P	P
259	R-20	907	1	06/06/06	No	Yes	No	Fail	P	P	P	P	P	Fail	P	P	Fail	P	Fail	P	Fail	-ND-	P	P	Fail	Fail	P	P	P	Fail	P	Fail	P	P	P	No	Yes	Fail	P	P	P	P	Yes	–	P	–	P	P
260	R-20	907	1	07/06/06	No	Yes	Yes	P	P	P	P	P	P	P	P	Fail	Fail	P	Fail	P	P	Fail	Fail	Fail	P	Fail	Fail	P	P	P	Fail	P	P	P	–	Yes	Yes	P	P	P	P	P	No	P	P	–	P	Fail
261	R-20	907	1	10/02/06	-ND-	Yes	Yes	P	P	-ND-	P	P	-ND-	P	P	-ND-	-ND-	-ND-	-ND-	P	-ND-	-ND-	Fail	Fail	-ND-	P	Fail	P	P	P	-ND-	P	P	P	–	No	Yes	Fail	P	P	P	P	No	P	P	–	P	Fail
262	R-20	907	1	10/17/06	-ND-	—	—	-ND-	-ND-	-ND-	-ND-	-ND-	-ND-	-ND-	-ND-	P	-ND-	-ND-	-ND-	-ND-	-ND-	-ND-	-ND-	-ND-	-ND-	-ND-	-ND-	-ND-	-ND-	-ND-	-ND-	-ND-	-ND-	-ND-	-ND-	—	—	-ND-	-ND-	-ND-	-ND-	-ND-	-ND-	-ND-	-ND-	-ND-	-ND-	-ND-
263	R-20	1150	2	09/03/04	No	Yes	Yes	P	Fail	P	Fail	Fail	Fail	Fail	-Red-	P	Fail	Fail	Fail	Fail	Fail	P	Fail	Fail	Fail	P	Fail	Fail	P	Fail	P	P	Fail	P	Fail	Yes	No	Fail	Fail	Fail	P	-Red-	No	P	P	–	P	P
264	R-20	1150	2	11/08/04	No	Yes	Yes	P	Fail	P	Fail	Fail	Fail	Fail	-Red-	P	Fail	Fail	Fail	Fail	Fail	-ND-	Fail	Fail	Fail	Fail	Fail	Fail	Fail	Fail	P	P	Fail	P	P	Yes	No	Fail	Fail	Fail	P	-Red-	No	P	P	–	P	P
265	R-20	1150	2	07/19/05	-ND-	Yes	Yes	P	Fail	P	Fail	P	Fail	Fail	-Red-	P	Fail	Fail	-ND-	Fail	-ND-	P	Fail	Fail	Fail	Fail	Fail	Fail	Fail	Fail	-ND-	P	Fail	P	P	Yes	No	Fail	Fail	Fail	P	-Red-	No	P	P	–	P	P
266	R-20	1150	2	06/07/06	No	Yes	Yes	P	Fail	P	Fail	Fail	Fail	Fail	-Red-	P	Fail	Fail	Fail	Fail	Fail	-ND-	Fail	Fail	Fail	Fail	Fail	Fail	P	Fail	P	P	Fail	P	P	Yes	No	Fail	Fail	Fail	P	-Red-	No	P	Fail	Fail	P	P
267	R-20	1150	2	07/08/06	No	Yes	Yes	P	P	P	P	P	P	P	P	P	P	P	Fail	P	P	P	Fail	Fail	P	P	P	P	P	P	P	P	P	P	–	Yes	Yes	P	P	P	P	P	Yes	–	P	–	P	Fail
268	R-20	1330	3	09/07/04	No	Yes	Yes	P	P	P	P	Fail	Fail	P	-Red-	P	Fail	Fail	Fail	Fail	Fail	P	Fail	Fail	Fail	Fail	Fail	Fail	Fail	Fail	P	P	Fail	P	P	Yes	Yes	P	Fail	P	P	-Red-	No	P	P	–	P	P
269	R-20	1330	3	11/09/04	No	Yes	Yes	P	P	P	P	Fail	Fail	P	-Red-	P	Fail	Fail	Fail	Fail	P	-ND-	Fail	Fail	Fail	Fail	P	Fail	Fail	Fail	P	P	Fail	P	P	Yes	Yes	P	Fail	P	P	-Red-	No	P	P	–	P	P
270	R-20	1330	3	07/18/05	-ND-	Yes	Yes	P	P	P	P	Fail	Fail	P	-Red-	P	Fail	Fail	-ND-	Fail	-ND-	-ND-	Fail	Fail	Fail	Fail	P	Fail	P	Fail	-ND-	P	Fail	P	P	Yes	Yes	P	Fail	P	P	-Red-	No	P	P	–	P	P
271	R-20	1330	3	06/08/06	No	Yes	Yes	P	P	P	P	Fail	Fail	P	-Red-	P	Fail	P	Fail	Fail	Fail	-ND-	Fail	Fail	Fail	Fail	P	Fail	P	Fail	P	P	Fail	P	P	Yes	Yes	P	Fail	P	P	-Red-	No	P	P	–	P	P
272	R-20	1330	3	07/07/06	No	Yes	Yes	P	P	P	Fail	Fail	Fail	P	P	P	Fail	P	Fail	P	P	P	Fail	Fail	P	P	Fail	P	P	Fail	Fail	P	P	P	–	No	Yes	Fail	P	P	P	P	Yes	–	P	–	P	Fail
273	R-20	1330	3	07/21/06	No	No	Yes	Fail	P	P	P	P	Fail	P	P	P	Fail	P	P	P	P	P	Fail	Fail	P	P	P	Fail	-Err-	P	P	Fail	Fail	P	–	No	Yes	Fail	P	P	P	-Red-	Yes	–	P	–	P	Fail
274	R-20	1330	3	10/13/06	No	No	Yes	Fail	P	P	P	Fail	Fail	P	P	-ND-	-ND-	-ND-	-ND-	P	P	P	Fail	Fail	-DL-	P	P	Fail	P	P	Fail	P	Fail	P	–	No	Yes	Fail	P	P	P	-Red-	Yes	–	P	–	P	Fail
275	R-21	889	1	09/23/04	No	Yes	Yes	P	P	P	P	P	P	P	P	P	P	P	P	P	P	-ND-	P	P	P	P	P	P	P	P	P	P	P	P	P	Yes	Yes	P	P	P	P	P	Yes	–	P	–	P	P
276	R-21	889	1	12/14/04	No	Yes	Yes	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	Yes	Yes	P	P	P	P	P	Yes	–	P	–	P	P
277	R-21	889	1	06/06/05	-ND-	Yes	Yes	P	P	P	P	P	P	P	P	P	P	P	-ND-	P	-ND-	-Err-	P	P	P	P	P	P	P	P	P	P	P	P	P	Yes	Yes	P	P	P	P	P	Yes	–	P	–	P	P
278	R-21	889	1	07/07/06	No	Yes	Yes	P	P	P	P	P	P	P	P	P	P	P	P	P	-ND-	P	P	P	P	P	P	P	P	P	P	Fail	P	P	P	Yes	Yes	P	P	P	P	P	Yes	–	P	–	P	P
279	R-21	889	1	11/06/06	-ND-	Yes	Yes	P	P	P	P	P	P	P	P	P	P	P	P	P	-ND-	P	P	P	P	P	P	P	P	P	P	P	P	P	P	Yes	Yes	P	P	P	P	P	Yes	–	P	–	P	P
280	R-22	907	1	11/18/03	Yes	No	Yes	Fail	Fail	Fail	Fail	P	-ND-	P	-Red-	P	Fail	-ND-	Fail	Fail	-ND-	-ND-	Fail	Fail	-DL-	Fail	Fail	Fail	-UF-	Fail	-ND-	P	Fail	P	-UF-	Yes	No	Fail	Fail	Fail	Fail	-Red-	No	-ND-	P	–	P	P
281	R-22	907	1	06/21/04	Yes	Yes	Yes	P	Fail	Fail	P	P	-ND-	P	-Red-	P	-ND-	-ND-	-ND-	Fail	-ND-	-ND-	Fail	Fail	Fail	Fail	Fail	Fail	-UF-	Fail	-ND-	P	Fail	P	-UF-	Yes	No	Fail	Fail	Fail	Fail	-Red-	No	-ND-	P	–	P	P
282	R-22	907	1	06/27/05	Yes	Yes	Yes	P	Fail	Fail	P	P	P	P	-Red-	P	Fail	Fail	-ND-	Fail	-ND-	Fail	Fail	Fail	Fail	Fail	Fail	Fail	P	Fail	P	P	Fail	P	P	Yes	No	Fail	Fail	Fail	Fail	-Red-	No	P	Fail	Fail	P	P
283	R-22	907	1	08/22/06	Yes	No	Yes	Fail	Fail	Fail	Fail	P	P	P	-Red-	-ND-	-ND-	-ND-	-ND-	Fail	-ND-	-ND-	Fail	Fail	-DL-	Fail	Fail	Fail	P	Fail	-ND-	P	Fail	P	–	Yes	No	Fail	Fail	Fail	Fail	-Red-	No	P	P	–	P	P
284	R-22	907	1	12/07/06	-ND-	No	Yes	Fail	Fail	-ND-	Fail	P	P	P	-Red-	-ND-	-ND-	-ND-	-ND-	Fail	-ND-	-ND-	Fail	Fail	-DL-	Fail	Fail	Fail	P	Fail	-ND-	P	Fail	P	–	Yes	No	Fail	Fail	Fail	Fail	-Red-	No	P	-ND-	-ND-	Fail	P
285	R-22	963	2	11/19/03	No	Yes	Yes	P	P	P	P	P	-ND-	P	P	P	P	-ND-	P	P	-ND-	-ND-	P	P	-DL-	P	P	-UF-	-UF-	P	-ND-	P	-UF-	P	-UF-	Yes	Yes	P	P	P	Fail	P	Yes	–	P	–	P	P
286	R-22	963	2	06/22/04	No	Yes	Yes	P	P	P	P	P	-ND-	P	P	P	-ND-	-ND-	-ND-	P	-ND-	-ND-	P	P	P	P	P	-UF-	-UF-	P	-ND-	P	-UF-	P	-UF-	Yes	Yes	P	P	P	P	P	Yes	–	P	–	P	P
287	R-22	963	2	06/28/05	No	Yes	Yes	P	P	P	P	P	P	P	P	P	P	P	-ND-	P	-ND-	P	P	P	P	P	P	P	P	P	P	P	P	P	P	Yes	Yes	P	P	P	P	P	Yes	–	P	–	P	P
288	R-22	963	2	08/28/06	No	Yes	Yes	P	P	P	P	P	P	P	P	P	Fail	P	P	P	-ND-	-ND-	P	P	P	P	Fail	P	P	P	-ND-	P	P	P	P	Yes	Yes	P	P	P	P	P	Yes	–	P	–	P	P
289	R-22	963	2	12/07/06	-ND-	Yes	Yes	P	P	P	P	P	P	P	P	P	P	P	P	P	-ND-	-ND-	P	P	P	P	P	P	P	P	-ND-	P	P	P	P	Yes	Yes	P	P	P	P	P	Yes	–	P	–	P	P

Table E-1. Summary of Test Outcomes

Water Quality Sample					General Indicators						Category A Inorganic Indicators					Category B Organic Indicators				Category C1 Redox (SO4)			Category C2 Redox (Fe/Mn)							Category C3 Redox (NO3)		Category D Adsorption				Category E Carbonate mineralogy							Category F Metal corrosion					Cat G Zn
Row	Well	Port depth (ft)	Screen	Sample date	Mod water	Low pH?	High pH?	Gen-1	Gen-2	Gen-3	A1	A2	A3	A4	A5	B1	B2	B3	B4	C1	C2	C3	C4	C5	C6	C9	C8	C7	C10	C11	C12	D1	D2	D3	D4	E1a	E1b	E1	E2	E3	E4	E5	F1	F2	F3	F4	F5	G1
				Units	3H	pH	pH	pH	Alk	Trb	Cl	F	PO4	Na	SO4	Ace	NH3	TKN	TOC	SO4	S	ORP	Fe	Mn	ClO4	Mo	Ni	U	Cr	NO3	DO	Sr	U	Ba	Zn	Ca	Ca	Ca	Ba	Sr	Mg	U	FeT	FeR	CrT	CrR	Ni	Zn
				Test	>UL	>LL	<UL	In	<UL	<UL	<UL	<UL	<UL	<UL	<UL	<UL	<UL	<UL	<UL	>LL	<UL	>LL	<UL	<UL	>LL	<UL	<UL	>LL	>LL	>LL	>LL	>LL	>LL	>LL	>LL	>LL	<UL	In	<UL	<UL	<UL	<UL	<UL	<UL	<UL	<UL	<UL	<UL
				Regional	1	6.94	8.65	range	105	5	3.75	0.53	0.3	28.6	6.22	5	0.05	0.28	1	0.8	0.01	0	102	16	0.17	4	2	0.2	1	0.1	2	44.88	0.2	4.6	1	8.66	24.1	range	70	180	4.81	1.52	500	10	10	5	50	40
				Perched	1	6.73	8.80		52	5	1.75	0.23	0.08	12.2	4.48	5	0.05	0.28	1	1.07	0.01	0	102	16	0.17	4	2	0.1	1	0.1	2	19.1	0.1	1.4	1	4.39	17.3		72	155	6.12	0.72	500	10	5	5	50	20
290	R-22	1274	3	07/09/02	No	Yes	Yes	P	Fail	P	Fail	P	-ND-	P	P	-ND-	-ND-	-ND-	-ND-	P	-ND-	-ND-	Fail	Fail	-DL-	Fail	Fail	-ND-	-UF-	P	P	P	-ND-	P	-UF-	Yes	Yes	P	Fail	Fail	P	-ND-	Yes	—	P	—	P	P
291	R-22	1274	3	11/20/03	No	Yes	No	Fail	Fail	P	Fail	P	-ND-	P	P	P	P	-ND-	Fail	P	-ND-	-ND-	P	P	-DL-	Fail	Fail	P	-UF-	P	-ND-	P	P	P	—	Yes	Yes	P	Fail	Fail	P	Fail	Yes	—	Fail	-ND-	P	P
292	R-22	1274	3	06/23/04	No	Yes	No	Fail	P	P	Fail	P	-ND-	P	P	-ND-	-ND-	-ND-	-ND-	P	-ND-	-ND-	P	P	P	P	P	P	-UF-	P	-ND-	P	P	P	-UF-	Yes	Yes	P	Fail	Fail	P	P	Yes	—	P	—	P	P
293	R-22	1274	3	06/29/05	No	Yes	Yes	P	Fail	P	Fail	P	P	P	Fail	P	P	Fail	-ND-	P	-ND-	P	P	P	P	Fail	P	P	P	P	P	P	P	P	P	Yes	Yes	P	Fail	Fail	P	Fail	Yes	—	P	—	P	P
294	R-22	1274	3	08/22/06	No	Yes	Yes	P	Fail	P	Fail	P	P	P	Fail	P	P	P	Fail	P	-ND-	-ND-	P	P	P	P	P	P	P	P	-ND-	P	P	P	P	Yes	Yes	P	Fail	Fail	Fail	Fail	Yes	—	P	—	P	P
295	R-22	1274	3	12/08/06	-ND-	Yes	Yes	P	Fail	P	Fail	P	P	P	Fail	P	P	P	Fail	P	-ND-	-ND-	P	P	P	P	P	P	P	P	-ND-	P	P	P	P	Yes	Yes	P	Fail	Fail	Fail	Fail	Yes	—	P	—	P	P
296	R-22	1378	4	07/11/02	No	Yes	Yes	P	Fail	Fail	Fail	Fail	-ND-	Fail	P	-ND-	-ND-	-ND-	-ND-	P	-ND-	-ND-	Fail	Fail	-DL-	Fail	Fail	-ND-	-UF-	Fail	P	P	-ND-	P	-UF-	Yes	No	Fail	Fail	Fail	Fail	-ND-	No	-ND-	P	—	P	P
297	R-22	1378	4	11/20/03	No	Yes	Yes	P	Fail	Fail	Fail	Fail	-ND-	Fail	P	P	Fail	-ND-	Fail	P	-ND-	-ND-	Fail	Fail	-DL-	Fail	Fail	Fail	-UF-	Fail	-ND-	P	Fail	P	-UF-	Yes	No	Fail	Fail	Fail	Fail	-Red-	No	-ND-	P	—	P	P
298	R-22	1378	4	06/23/04	No	Yes	Yes	P	Fail	P	Fail	Fail	-ND-	Fail	P	-ND-	-ND-	-ND-	-ND-	P	-ND-	-ND-	Fail	Fail	Fail	P	Fail	Fail	Fail	Fail	-ND-	P	Fail	P	-UF-	Yes	No	Fail	Fail	Fail	Fail	-Red-	No	-ND-	P	—	P	P
299	R-22	1378	4	07/01/05	No	Yes	Yes	P	Fail	P	Fail	Fail	P	Fail	P	P	Fail	P	-ND-	P	-ND-	Fail	Fail	Fail	Fail	Fail	Fail	Fail	Fail	Fail	P	P	Fail	P	P	Yes	No	Fail	Fail	Fail	Fail	-Red-	No	P	P	—	P	P
300	R-22	1378	4	08/22/06	No	Yes	Yes	P	Fail	P	Fail	Fail	P	Fail	P	-ND-	-ND-	-ND-	-ND-	P	-ND-	-ND-	Fail	Fail	-DL-	P	Fail	Fail	Fail	Fail	-ND-	P	Fail	P	—	Yes	No	Fail	Fail	Fail	Fail	-Red-	No	P	P	—	P	P
301	R-22	1378	4	12/08/06	-ND-	Yes	Yes	P	Fail	P	Fail	Fail	P	Fail	P	-ND-	-ND-	-ND-	-ND-	P	-ND-	-ND-	Fail	Fail	-DL-	P	-ND-	-ND-	-ND-	Fail	-ND-	P	-ND-	P	P	Yes	No	Fail	Fail	Fail	Fail	-ND-	No	P	-ND-	-ND-	-ND-	P
302	R-22	1448	5	07/10/02	Yes	Yes	Yes	P	Fail	P	P	P	-ND-	P	-Red-	P	Fail	-ND-	Fail	Fail	-ND-	-ND-	Fail	Fail	-DL-	Fail	Fail	-ND-	-UF-	Fail	P	P	-ND-	P	-UF-	Yes	No	Fail	Fail	Fail	Fail	-ND-	No	-ND-	P	—	P	P
303	R-22	1448	5	11/21/03	Yes	Yes	Yes	P	Fail	P	P	P	-ND-	P	-Red-	P	Fail	-ND-	Fail	Fail	-ND-	-ND-	Fail	Fail	-DL-	Fail	Fail	Fail	-UF-	Fail	-ND-	P	Fail	P	-UF-	Yes	No	Fail	Fail	Fail	Fail	-Red-	No	-ND-	P	—	P	P
304	R-22	1448	5	07/05/05	Yes	Yes	Yes	P	Fail	Fail	P	P	P	P	-Red-	P	Fail	Fail	-ND-	Fail	-ND-	P	P	Fail	Fail	Fail	Fail	Fail	Fail	Fail	P	P	Fail	P	-DL-	Yes	No	Fail	Fail	Fail	Fail	-Red-	No	Fail	P	—	P	P
305	R-22	1448	5	08/21/06	Yes	Yes	Yes	P	Fail	P	Fail	P	P	P	P	-ND-	-ND-	-ND-	-ND-	P	-ND-	-ND-	Fail	Fail	-DL-	Fail	Fail	Fail	Fail	Fail	-ND-	P	Fail	P	—	Yes	No	Fail	Fail	Fail	Fail	-Red-	No	P	P	—	P	Fail
306	R-22	1448	5	12/07/06	-ND-	No	Yes	Fail	Fail	-ND-	Fail	P	P	P	P	-ND-	-ND-	-ND-	-ND-	P	-ND-	-ND-	Fail	Fail	-DL-	Fail	Fail	Fail	P	Fail	-ND-	P	Fail	P	P	Yes	No	Fail	Fail	Fail	Fail	-Red-	No	P	P	—	P	P
307	R-23	816	1	06/29/04	No	Yes	Yes	P	P	P	Fail	P	P	P	P	P	P	P	P	P	P	-ND-	P	P	P	P	P	P	P	Plm	P	P	P	P	P	Yes	Yes	P	P	P	P	P	Yes	—	P	—	P	P
308	R-23	816	1	09/24/04	No	Yes	Yes	P	P	P	P	P	P	P	P	P	P	P	P	P	Fail	P	P	P	P	P	P	P	P	Plm	P	P	P	P	P	Yes	Yes	P	P	P	P	P	Yes	—	P	—	P	P
309	R-23	816	1	07/14/05	No	Yes	Yes	P	P	P	Fail	P	P	P	P	P	P	P	-ND-	P	-ND-	P	P	P	P	P	P	P	P	Plm	P	P	P	P	—	Yes	Yes	P	P	P	P	P	Yes	—	P	—	P	P
310	R-23	816	1	08/15/06	No	Yes	Yes	P	P	P	P	P	P	P	P	P	P	P	P	P	-ND-	P	P	P	P	P	P	P	P	Plm	P	P	P	P	P	Yes	Yes	P	P	P	P	P	Yes	—	P	—	P	P
311	R-23	816	1	12/18/06	-ND-	Yes	Yes	P	P	P	P	P	P	P	P	P	P	P	P	P	-ND-	-Err-	P	P	P	P	-DL-	P	**-DL-**	Plm	P	P	P	P	P	Yes	Yes	P	P	P	P	P	Yes	—	P	—	P	P
312	R-23i	470	2	12/20/05	-ND-	Yes	Yes	P	Fail	-ND-	Fail	Fail	-ND-	Fail	Fail	-ND-	-ND-	-ND-	-ND-	P	-ND-	-ND-	P	P	-ND-	P	P	P	P	P	-ND-	P	P	P	—	Yes	No	Fail	P	P	P	Fail	Yes	—	P	—	P	-UF-
313	R-23i	470	2	10/03/06	Yes	Yes	Yes	P	Fail	Fail	Fail	P	P	Fail	Fail	P	P	P	P	P	Fail	P	P	Fail	P	P	-DL-	P	Fail	-Err-	P	P	P	P	—	Yes	No	Fail	P	P	P	Fail	No	Fail	P	—	P	Fail
314	R-23i	524	3	12/11/05	-ND-	Yes	Yes	P	Fail	-ND-	Fail	Fail	-ND-	Fail	Fail	-ND-	-ND-	-ND-	Fail	P	-ND-	-ND-	P	P	-ND-	P	P	P	Fail	P	-ND-	P	P	P	—	Yes	No	Fail	P	P	P	Fail	Yes	—	P	—	P	-UF-
315	R-23i	524	3	10/11/06	Yes	Yes	Yes	P	Fail	-Err-	Fail	Fail	P	Fail	Fail	P	P	P	Fail	P	Fail	Fail	Fail	P	P	P	Fail	P	P	P	P	P	P	P	P	Yes	No	Fail	P	P	P	Fail	No	Fail	Fail	Fail	P	P
316	R-24	825	1	09/20/05	-ND-	Yes	Yes	P	P	-ND-	Fail	P	-ND-	P	Fail	-ND-	-ND-	-ND-	Fail	P	-ND-	-ND-	P	Fail	-ND-	P	P	P	-UF-	P	-ND-	P	P	P	—	Yes	Yes	P	Fail	P	P	P	Yes	—	P	—	P	-UF-
317	R-24	825	1	11/15/05	No	Yes	Yes	P	Fail	P	Fail	P	P	Fail	Fail	P	P	Fail	Fail	P	-ND-	P	P	Fail	P	Fail	P	P	P	P	P	P	P	P	—	Yes	Yes	P	Fail	P	P	Fail	Yes	—	P	—	P	P
318	R-24	825	1	03/06/06	No	Yes	Yes	P	Fail	P	Fail	P	P	Fail	Fail	P	P	P	-ND-	P	Fail	P	P	Fail	P	Fail	P	P	P	P	Fail	P	P	P	—	Yes	Yes	P	Fail	P	P	Fail	Yes	—	P	—	P	P
319	R-24	825	1	05/10/06	No	Yes	Yes	P	Fail	P	Fail	P	P	Fail	Fail	P	Fail	P	-ND-	P	Fail	P	P	Fail	P	Fail	P	P	P	P	Fail	P	P	P	P	Yes	Yes	P	Fail	P	P	Fail	Yes	—	P	—	P	P
320	R-24	825	1	07/27/06	No	Yes	Yes	P	Fail	P	Fail	P	P	Fail	Fail	P	Fail	P	P	P	-ND-	Fail	P	P	P	Fail	P	P	P	P	P	P	P	P	—	Yes	Yes	P	Fail	P	P	Fail	Yes	—	P	—	P	P
321	R-25	755	1	08/07/02	Yes	Yes	Yes	P	Fail	Fail	Plm	P	-ND-	P	Plm	-ND-	-ND-	-ND-	-ND-	P	-ND-	P	Fail	Fail	-DL-	P	Fail	-DL-	-UF-	Plm	P	P	-DL-	P	-UF-	Yes	No	Fail	P	P	P	-DL-	No	-ND-	Fail	-ND-	Fail	P
322	R-25	755	1	12/11/03	Yes	Yes	Yes	P	Fail	Fail	Plm	P	-ND-	P	Plm	P	P	-ND-	P	P	-ND-	-ND-	Fail	Fail	-DL-	P	Fail	P	-UF-	Plm	-ND-	P	P	P	-UF-	Yes	No	Fail	P	P	P	P	No	-ND-	Fail	-ND-	Fail	P
323	R-25	755	1	09/01/04	Yes	Yes	Yes	P	P	Fail	Plm	P	-ND-	P	Plm	P	-ND-	-ND-	-ND-	P	-ND-	-ND-	Fail	Fail	P	P	Fail	P	-UF-	Plm	-ND-	P	P	P	—	Yes	No	Fail	P	P	P	P	No	-ND-	Fail	-ND-	Fail	P
324	R-25	755	1	08/02/05	Yes	Yes	Yes	P	Fail	Fail	Plm	P	P	P	Plm	P	P	P	-ND-	P	-ND-	P	Fail	Fail	P	P	Fail	P	P	Plm	P	P	P	P	P	Yes	No	Fail	P	P	P	Fail	No	Fail	Fail	Fail	Fail	P
325	R-25	892	2	02/05/02	Yes	—	—	-ND-	-ND-	Fail	-ND-	P	Fail	-ND-	-ND-	P	P	P	Fail	-ND-	-ND-	-ND-	Fail	-ND-	-ND-	-ND-	-ND-	-ND-	-UF-	-ND-	-ND-	-ND-	-ND-	-ND-	-ND-	—	—	-ND-	-ND-	-ND-	-ND-	-ND-	No	Fail	Fail	-ND-	-ND-	-ND-
326	R-25	892	2	08/08/02	Yes	Yes	Yes	P	Fail	Fail	Plm	P	-ND-	Fail	Fail	P	P	-ND-	Fail	P	-ND-	P	Fail	Fail	-DL-	Fail	Fail	-DL-	-UF-	Fail	P	P	-DL-	P	-UF-	Yes	Yes	P	P	P	P	-DL-	No	-ND-	Fail	-ND-	P	P
327	R-25	892	2	12/10/03	Yes	Yes	Yes	P	Fail	Fail	Plm	P	-ND-	Fail	Fail	P	P	-ND-	Fail	P	-ND-	-ND-	Fail	Fail	-DL-	Fail	Fail	P	-UF-	Fail	-ND-	P	P	P	-UF-	Yes	Yes	P	P	P	P	P	No	-ND-	Fail	-ND-	Fail	P
328	R-25	892	2	08/03/05	Yes	Yes	Yes	P	Fail	Fail	Plm	P	Fail	Fail	Fail	P	Fail	P	-ND-	P	-ND-	Fail	Fail	Fail	Fail	Fail	Fail	Fail	P	Fail	P	P	Fail	Fail	P	Yes	Yes	P	P	P	P	-Red-	No	P	Fail	Fail	Fail	P
329	R-25	1192	4	08/08/02	Yes	Yes	Yes	P	P	P	Plm	P	-ND-	P	Fail	P	P	Fail	Fail	P	-ND-	Fail	Fail	Fail	-DL-	P	Fail	-DL-	-UF-	P	P	P	-DL-	P	-UF-	Yes	No	Fail	P	P	P	-DL-	Yes	—	P	—	P	P
330	R-25	1192	4	12/10/03	Yes	Yes	Yes	P	Fail	P	Plm	P	-ND-	P	Fail	P	Fail	-ND-	P	P	-ND-	-ND-	Fail	P	-DL-	P	P	P	-UF-	Fail	-ND-	P	P	P	-UF-	Yes	No	Fail	P	P	P	P	Yes	—	P	—	P	P
331	R-25	1192	4	08/04/05	Yes	Yes	Yes	P	Fail	Fail	Plm	P	Fail	P	-Err-	P	P	P	-ND-	-Err-	-ND-	P	P	P	P	P	Fail	P	Fail	P	P	P	P	P	P	Yes	No	Fail	P	Fail	P	P	Yes	—	P	—	P	P
332	R-25	1303	5	08/09/02	Yes	Yes	Yes	P	Fail	P	P	P	-ND-	P	Fail	-ND-	-ND-	-ND-	-ND-	P	-ND-	P	Fail	Fail	-DL-	Fail	Fail	-DL-	-UF-	Fail	P	P	-DL-	P	—	Yes	Yes	P	P	P	P	-DL-	No	-ND-	Fail	-ND-	Fail	-UF-
333	R-25	1303	5	12/09/03	Yes	Yes	Yes	P	P	P	P	P	-ND-	-Err-	Fail	P	Fail	-ND-	Fail	P	-ND-	-ND-	Fail	Fail	-DL-	Fail	Fail	Fail	-UF-	Fail	-ND-	P	Fail	P	-UF-	Yes	Yes	P	Fail	Fail	P	-Red-	No	-ND-	P	—	P	P
334	R-25	1303	5	08/31/04	Yes	Yes	Yes	P	-ND-	P	-ND-	-ND-	-ND-	P	-ND-	P	-ND-	-ND-	-ND-	-ND-	-ND-	-ND-	Fail	Fail	Fail	Fail	Fail	-ND-	Fail	Fail	-ND-	P	-ND-	P	-UF-	Yes	Yes	P	P	Fail	P	-ND-	No	-ND-	P	—	P	P
335	R-25	1303	5	08/09/05	-ND-	Yes	Yes	P	-ND-	P	-ND-	-ND-	-ND-	-Err-	-ND-	P	-ND-	-ND-	-ND-	-ND-	-ND-	-ND-	Fail	Fail	-ND-	Fail	Fail	Fail	P	-ND-	P	P	Fail	P	P	Yes	Yes	P	P	P	P	-Red-	No	P	P	—	P	P
336	R-25	1406	6	02/08/02	Yes	Yes	Yes	P	P	P	Fail	P	Fail	P	P	P	P	P	P	P	-ND-	-ND-	P	P	-DL-	P	-DL-	P	Fail	P	P	P	P	P	P	Yes	Yes	P	P	P	P	P	Yes	—	P	—	P	P
337	R-25	1406	6	08/12/02	Yes	Yes	Yes	P	P	P	P	P	-ND-	P	P	P	P	-ND-	P	P	-ND-	P	Fail	P	-DL-	Fail	Fail	-DL-	-UF-	P	P	P	-DL-	P	—	Yes	Yes	P	P	P	P	-DL-	Yes	—	Fail	-ND-	P	P

Table E-1. Summary of Test Outcomes

Water Quality Sample					General Indicators						Category A Inorganic Indicators					Category B Organic Indicators				Category C1 Redox (SO4)			Category C2 Redox (Fe/Mn)							Category C3 Redox (NO3)		Category D Adsorption				Category E Carbonate mineralogy							Category F Metal corrosion					Cat G Zn
Row	Well	Port depth (ft)	Screen	Sample date	Mod water	Low pH?	High pH?	Gen-1	Gen-2	Gen-3	A1	A2	A3	A4	A5	B1	B2	B3	B4	C1	C2	C3	C4	C5	C6	C9	C8	C7	C10	C11	C12	D1	D2	D3	D4	E1a	E1b	E1	E2	E3	E4	E5	F1	F2	F3	F4	F5	G1
				Units	3H	pH	pH	pH	Alk	Trb	Cl	F	PO4	Na	SO4	Ace	NH3	TKN	TOC	SO4	S	ORP	Fe	Mn	ClO4	Mo	Ni	U	Cr	NO3	DO	Sr	U	Ba	Zn	Ca	Ca	Ca	Ba	Sr	Mg	U	FeT	FeR	CrT	CrR	Ni	Zn
				Test	>UL	>LL	<UL	In	<UL	<UL	<UL	<UL	<UL	<UL	<UL	<UL	<UL	<UL	<UL	>LL	<UL	>LL	<UL	<UL	>LL	<UL	<UL	>LL	>LL	>LL	>LL	>LL	>LL	>LL	>LL	>LL	<UL	In	<UL	<UL	<UL	<UL	<UL	<UL	<UL	<UL	<UL	<UL
				Regional	1	6.94	8.65	range	105	5	3.75	0.53	0.3	28.6	6.22	5	0.05	0.28	1	0.8	0.01	0	102	16	0.17	4	2	0.2	1	0.1	2	44.88	0.2	4.6	1	8.66	24.1	range	70	180	4.81	1.52	500	10	10	5	50	40
				Perched	1	6.73	8.80		52	5	1.75	0.23	0.08	12.2	4.48	5	0.05	0.28	1	1.07	0.01	0	102	16	0.17	4	2	0.1	1	0.1	2	19.1	0.1	1.4	1	4.39	17.3		72	155	6.12	0.72	500	10	5	5	50	20
338	R-25	1406	6	12/09/03	Yes	Yes	Yes	P	P	P	P	P	-ND-	-Err-	P	P	P	-ND-	P	P	-ND-	-ND-	P	P	-DL-	P	Fail	P	-UF-	P	-ND-	P	P	P	-UF-	Yes	Yes	P	P	P	P	P	Yes	–	Fail	-ND-	P	P
339	R-25	1606	7	02/11/02	Yes	Yes	Yes	P	P	P	P	P	Fail	P	P	P	P	P	P	P	-ND-	-ND-	P	P	-DL-	P	-DL-	P	P	P	P	P	P	P	–	Yes	Yes	P	P	P	P	P	Yes	–	P	–	P	P
340	R-25	1606	7	08/12/02	Yes	Yes	Yes	P	P	P	P	P	-ND-	P	P	P	P	-ND-	P	P	-ND-	P	Fail	P	-DL-	P	Fail	-DL-	-UF-	P	P	P	-DL-	P	-UF-	Yes	Yes	P	P	P	P	-DL-	Yes	–	P	–	P	P
341	R-25	1606	7	12/08/03	No	Yes	Yes	P	P	P	P	P	-ND-	P	P	P	P	-ND-	P	P	-ND-	-ND-	Fail	P	-DL-	P	P	-UF-	-UF-	P	-ND-	P	-UF-	P	-UF-	Yes	Yes	P	P	P	P	P	Yes	–	P	–	P	P
342	R-25	1796	8	08/14/02	Yes	Yes	Yes	P	P	P	P	P	-ND-	P	P	P	P	-ND-	P	P	-ND-	P	Fail	P	-DL-	P	P	-DL-	-UF-	P	P	P	-DL-	P	-UF-	Yes	Yes	P	P	P	P	-DL-	Yes	–	P	–	P	P
343	R-25	1796	8	12/04/03	No	Yes	Yes	P	P	P	P	P	-ND-	P	P	P	P	-ND-	P	P	-ND-	-ND-	Fail	P	-DL-	P	P	-UF-	-UF-	P	-ND-	P	-UF-	P	–	Yes	Yes	P	P	P	P	P	Yes	–	P	–	P	P
344	R-25	1796	8	08/10/05	No	Yes	Yes	P	P	Fail	P	P	Fail	P	P	P	P	P	-ND-	P	-ND-	-ND-	P	P	P	P	P	P	P	P	P	P	P	P	P	Yes	Yes	P	P	P	P	P	Yes	–	P	–	P	P
345	R-26	659	1	04/13/05	No	Yes	Yes	P	P	P	P	P	P	P	P	P	P	P	P	P	P	Fail	P	P	P	P	P	P	Fail	P	P	P	P	P	P	Yes	Yes	P	P	P	P	P	Yes	–	P	–	P	P
346	R-26	659	1	07/27/05	No	Yes	Yes	P	P	P	P	P	Fail	P	-Red-	P	P	P	P	Fail	-ND-	P	P	P	P	P	P	P	P	P	P	P	P	P	P	Yes	Yes	P	P	P	P	P	Yes	–	P	–	P	P
347	R-26	659	1	11/02/05	No	Yes	Yes	P	P	P	P	P	Fail	P	P	P	P	Fail	P	P	P	-ND-	P	P	P	P	P	P	P	P	P	P	P	P	P	Yes	Yes	P	P	P	P	P	Yes	–	Fail	P	P	P
348	R-26	659	1	02/22/06	No	Yes	Yes	P	P	P	P	P	P	P	P	P	P	P	-ND-	P	-ND-	-ND-	P	P	P	P	P	P	P	P	P	P	P	P	-DL-	Yes	Yes	P	P	P	P	P	Yes	–	P	–	P	P
349	R-27	852	1	10/11/05	-ND-	Yes	Yes	P	P	-ND-	P	P	-ND-	P	P	-ND-	-ND-	-ND-	-ND-	P	-ND-	-ND-	P	P	-ND-	P	P	-UF-	-UF-	P	-ND-	Fail	-UF-	P	–	No	Yes	Fail	Fail	P	P	P	Yes	–	P	–	P	-UF-
350	R-27	852	1	10/21/05	-ND-	No	Yes	Fail	P	-ND-	P	P	-ND-	P	-Err-	-ND-	-ND-	-ND-	-ND-	-Err-	-ND-	-ND-	P	P	P	P	P	-UF-	-UF-	P	-ND-	P	-UF-	P	–	No	Yes	Fail	Fail	P	P	P	Yes	–	P	–	P	-UF-
351	R-27	852	1	11/14/05	-ND-	Yes	Yes	P	P	-ND-	P	P	-ND-	P	P	-ND-	-ND-	-ND-	-ND-	P	-ND-	-ND-	P	P	-ND-	P	P	-UF-	Fail	P	-ND-	P	-UF-	P	–	Yes	Yes	P	P	P	P	P	Yes	–	P	–	P	-UF-
352	R-27	852	1	07/01/06	No	Yes	Yes	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	–	Yes	Yes	P	P	P	P	P	Yes	–	P	–	P	Fail
353	R-28	934	1	05/20/05	Yes	Yes	Yes	P	P	Fail	Plm	P	P	P	Plm	P	P	P	P	P	P	P	P	P	P	P	Fail	P	Plm	Plm	P	P	P	P	P	Yes	No	Fail	P	P	Fail	P	Yes	–	Plm	–	P	P
354	R-28	934	1	09/01/05	Yes	Yes	Yes	P	P	P	Plm	P	P	P	Plm	P	P	P	P	P	P	P	P	P	P	P	Fail	P	Plm	Plm	P	P	P	P	P	Yes	No	Fail	P	P	Fail	P	Yes	–	Plm	–	P	P
355	R-28	934	1	11/10/05	Yes	Yes	Yes	P	P	P	Plm	P	P	P	Plm	P	P	P	P	P	P	P	P	P	P	P	Fail	P	Plm	Plm	P	P	P	P	P	Yes	No	Fail	P	P	Fail	P	Yes	–	Plm	–	P	P
356	R-28	934	1	01/26/06	Yes	Yes	Yes	P	P	P	Plm	P	P	P	Plm	P	P	P	-ND-	P	P	P	P	P	P	P	Fail	P	Plm	Plm	P	P	P	P	P	Yes	No	Fail	P	P	Fail	P	Yes	–	Plm	–	P	P
357	R-28	934	1	04/19/06	-ND-	Yes	Yes	P	P	P	-ND-	-ND-	-ND-	-ND-	-ND-	-ND-	-ND-	-ND-	-ND-	-ND-	-ND-	P	-ND-	-ND-	-ND-	-ND-	-ND-	-ND-	Plm	-ND-	P	-ND-	-ND-	-ND-	-ND-	—	—	-ND-	-ND-	-ND-	-ND-	-ND-	-ND-	-ND-	Plm	–	-ND-	-ND-
358	R-28	934	1	07/05/06	Yes	Yes	Yes	P	P	P	Plm	P	P	P	Plm	P	P	P	P	P	-ND-	P	P	P	P	P	Fail	P	Plm	Plm	P	P	P	P	P	Yes	No	Fail	P	P	Fail	P	Yes	–	Plm	–	P	P
359	R-28	934	1	10/26/06	Yes	Yes	Yes	P	P	P	Plm	P	P	P	Plm	P	P	P	P	P	-ND-	P	P	P	P	P	Fail	P	Plm	Plm	P	P	P	P	P	Yes	No	Fail	P	P	Fail	P	Yes	–	Plm	–	P	P
360	R-31	532	2	03/18/04	No	Yes	Yes	P	Fail	Fail	P	P	Fail	P	-Red-	P	Fail	Fail	Fail	Fail	P	Fail	Fail	Fail	Fail	Fail	Fail	P	Fail	Fail	P	P	P	P	P	Yes	No	Fail	Fail	Fail	Fail	P	No	P	P	–	P	P
361	R-31	532	2	08/17/05	-ND-	Yes	Yes	P	Fail	Fail	P	P	P	P	-Red-	P	Fail	Fail	-ND-	Fail	P	-ND-	Fail	Fail	Fail	Fail	Fail	P	P	Fail	P	P	P	P	P	Yes	No	Fail	Fail	Fail	Fail	P	No	P	P	–	P	P
362	R-31	532	2	11/28/06	-ND-	–	–	-ND-	Fail	P	P	P	-ND-	P	-Red-	P	Fail	Fail	Fail	Fail	-ND-	-ND-	Fail	Fail	Fail	Fail	Fail	P	P	Fail	-ND-	P	P	P	P	Yes	No	Fail	Fail	Fail	Fail	P	No	P	P	–	P	P
363	R-31	670	3	08/19/05	-ND-	Yes	Yes	P	Fail	P	P	P	P	Fail	P	P	Fail	Fail	-ND-	P	-ND-	-ND-	Fail	Fail	Fail	Fail	Fail	Fail	P	Fail	P	P	Fail	P	P	Yes	Yes	P	Fail	P	P	-Red-	No	P	P	–	P	P
364	R-31	670	3	11/30/06	-ND-	Yes	Yes	P	P	P	P	P	-ND-	P	P	P	Fail	Fail	Fail	P	-ND-	-ND-	Fail	Fail	Fail	Fail	Fail	Fail	P	Fail	-ND-	P	Fail	P	P	Yes	Yes	P	P	P	P	-Red-	No	P	P	–	P	P
365	R-31	831	4	08/23/05	-ND-	Yes	No	Fail	P	P	P	P	P	P	P	P	P	P	-ND-	P	-ND-	-ND-	P	P	P	P	P	P	P	P	-Err-	P	P	P	P	Yes	Yes	P	P	P	P	P	Yes	–	P	–	P	P
366	R-31	831	4	12/06/06	-ND-	Yes	Yes	P	P	P	P	P	-ND-	P	P	P	P	P	P	P	-ND-	-ND-	P	P	P	Fail	P	P	P	P	-ND-	P	P	P	P	Yes	Yes	P	P	P	P	P	Yes	–	P	–	P	P
367	R-31	1011	5	08/24/05	-ND-	Yes	No	Fail	P	P	P	P	P	P	P	P	P	P	-ND-	P	-ND-	-ND-	P	P	P	P	P	Fail	P	P	P	P	Fail	P	–	Yes	Yes	P	P	P	P	-Red-	Yes	–	P	–	P	Fail
368	R-31	1011	5	12/06/06	-ND-	–	–	-ND-	P	P	P	P	-ND-	P	P	P	P	P	P	P	-ND-	-ND-	P	P	P	P	P	Fail	P	P	-ND-	P	Fail	P	P	Yes	Yes	P	P	P	P	-Red-	Yes	–	P	–	P	P
369	R-32	871	1	09/21/04	No	Yes	Yes	P	P	P	P	P	P	P	P	P	Fail	P	P	P	P	P	P	P	P	P	P	P	Fail	P	P	P	P	P	P	Yes	Yes	P	Fail	P	Fail	P	Yes	–	P	–	P	P
370	R-32	871	1	11/15/04	No	Yes	No	Fail	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	Fail	P	P	P	P	P	P	P	P	Yes	Yes	P	Fail	P	Fail	P	Yes	–	P	–	P	P
371	R-32	871	1	06/22/05	-ND-	Yes	Yes	P	P	P	P	P	P	P	P	P	P	P	-ND-	P	-ND-	P	P	P	P	P	P	P	Fail	P	P	P	P	P	P	Yes	Yes	P	P	P	Fail	P	Yes	–	P	–	P	P
372	R-32	871	1	08/29/06	No	Yes	Yes	P	P	P	P	P	P	P	P	P	P	P	-ND-	P	-ND-	-ND-	P	P	P	P	P	P	P	P	-ND-	P	P	P	P	Yes	Yes	P	P	P	Fail	P	Yes	–	P	–	P	P
373	R-32	871	1	12/12/06	-ND-	Yes	Yes	P	P	P	P	P	-ND-	P	P	P	P	P	P	P	-ND-	-ND-	P	P	P	P	P	P	P	P	-ND-	P	P	P	P	Yes	Yes	P	P	P	Fail	P	Yes	–	P	–	P	P
374	R-32	976	3	09/22/04	No	Yes	Yes	P	P	P	P	Fail	Fail	P	P	P	Fail	Fail	P	P	Fail	Fail	Fail	Fail	Fail	P	P	Fail	Fail	Fail	P	P	Fail	P	P	Yes	Yes	P	Fail	P	P	-Red-	No	P	P	–	P	P
375	R-32	976	3	11/16/04	No	Yes	Yes	P	P	P	P	Fail	Fail	P	P	P	Fail	Fail	P	P	Fail	-ND-	Fail	Fail	Fail	P	Fail	Fail	Fail	Fail	P	P	Fail	P	P	Yes	Yes	P	Fail	P	P	-Red-	No	P	P	–	P	P
376	R-32	976	3	06/24/05	-ND-	Yes	Yes	P	P	P	P	P	Fail	P	P	P	Fail	P	-ND-	P	-ND-	Fail	Fail	Fail	Fail	P	P	Fail	P	Fail	P	P	Fail	P	P	Yes	Yes	P	Fail	P	P	-Red-	No	P	P	–	P	P
377	R-32	976	3	08/30/06	Yes	Yes	Yes	P	P	P	P	Fail	Fail	P	P	P	Fail	P	P	P	-ND-	-ND-	Fail	Fail	Fail	P	P	Fail	P	Fail	-ND-	P	Fail	P	P	Yes	Yes	P	Fail	P	P	-Red-	No	P	Fail	Fail	P	P
378	R-32	976	3	12/13/06	-ND-	Yes	Yes	P	P	P	P	P	-ND-	P	P	P	Fail	P	P	P	-ND-	-ND-	Fail	Fail	Fail	P	P	P	Fail	Fail	-ND-	P	P	P	P	Yes	Yes	P	Fail	P	P	P	Yes	–	P	–	P	P
379	R-33	996	1	06/27/05	Yes	Yes	Yes	P	P	P	P	P	P	P	P	P	-ND-	P	P	P	-ND-	Fail	Fail	P	-DL-	P	P	-ND-	P	P	-ND-	P	-ND-	P	–	Yes	Yes	P	P	P	P	-ND-	Yes	–	Fail	P	P	P
380	R-33	996	1	09/14/05	No	Yes	Yes	P	P	P	P	P	P	P	P	P	-ND-	Fail	Fail	P	-ND-	P	Fail	P	P	P	Fail	P	P	P	-ND-	P	P	P	–	Yes	Yes	P	P	P	P	P	Yes	–	Fail	P	P	P
381	R-33	996	1	02/16/06	No	Yes	Yes	P	P	P	P	P	P	P	P	P	P	P	-ND-	P	Fail	P	P	P	P	P	Fail	P	P	P	P	P	P	P	P	Yes	Yes	P	P	P	P	P	Yes	–	P	–	P	P
382	R-33	996	1	10/31/06	No	Yes	Yes	P	P	P	Fail	P	P	P	P	-ND-	-ND-	-ND-	-ND-	P	-ND-	-ND-	Fail	P	-DL-	P	Fail	P	P	P	-ND-	P	P	P	P	Yes	Yes	P	P	P	P	P	No	P	P	–	P	P
383	R-33	1112	2	06/24/05	No	Yes	Yes	P	P	Fail	P	P	P	P	P	P	-ND-	P	P	P	-ND-	P	Fail	P	P	Fail	Fail	P	P	P	P	P	P	P	P	Yes	Yes	P	P	P	P	P	Yes	–	P	–	Fail	P
384	R-33	1112	2	09/15/05	No	Yes	Yes	P	Fail	P	P	P	P	P	P	P	-ND-	Fail	P	P	-ND-	P	Fail	P	P	P	Fail	P	P	P	P	P	P	P	P	Yes	Yes	P	P	P	P	P	Yes	–	P	–	P	P
385	R-33	1112	2	02/14/06	No	Yes	Yes	P	P	P	P	P	P	P	P	P	P	P	-ND-	P	Fail	P	P	P	P	P	Fail	P	P	P	P	P	P	P	P	Yes	Yes	P	P	P	P	P	Yes	–	P	–	P	P

Table E-1. Summary of Test Outcomes

Water Quality Sample					General Indicators						Category A Inorganic Indicators					Category B Organic Indicators			
Row	Well	Port depth (ft)	Screen	Sample date	Mod water	Low pH?	High pH?	Gen-1	Gen-2	Gen-3	A1	A2	A3	A4	A5	B1	B2	B3	B4
				Units	3H	pH	pH	pH	Alk	Trb	Cl	F	PO4	Na	SO4	Ace	NH3	TKN	TOC
				Test	>UL	>LL	<UL	In	<UL	<UL	<UL	<UL	<UL	<UL	<UL	<UL	<UL	<UL	<UL
				Regional	1	6.94	8.65	range	105	5	3.75	0.53	0.3	28.6	6.22	5	0.05	0.28	1
				Perched	1	6.73	8.80		52	5	1.75	0.23	0.08	12.2	4.48	5	0.05	0.28	1
386	R-33	1112	2	07/05/06	No	Yes	Yes	P	P	Fail	P	P	P	P	P	P	-ND-	-ND-	P
387	R-33	1112	2	11/01/06	No	Yes	Yes	P	P	P	Fail	P	P	P	P	-ND-	-ND-	-ND-	-ND-
388	R-34	895	1	06/07/05	No	Yes	Yes	P	P	Fail	P	P	P	P	P	P	P	P	P
389	R-34	895	1	09/07/05	No	Yes	Yes	P	P	Fail	P	P	P	P	P	P	P	P	P
390	R-34	895	1	11/29/05	No	Yes	Yes	P	P	Fail	P	P	P	P	P	P	P	Fail	P
391	R-34	895	1	01/31/06	No	Yes	Yes	P	P	Fail	P	P	P	P	P	P	P	P	-ND-
392	R-34	895	1	07/17/06	No	Yes	Yes	P	P	Fail	P	P	P	P	P	P	P	P	P
393	R-34	895	1	10/30/06	No	Yes	Yes	P	P	Fail	P	P	P	P	P	P	-DL-	P	P
Tallies of Pass/Fail outcomes																			
	Pass (or Yes)				214	364	352	327	264	314	228	302	256	310	233	285	189	211	162
	Fail (or No)				101	25	37	62	122	51	62	78	46	70	51	16	96	62	89
	Total outcomes				315	389	389	389	386	365	290	380	302	380	284	301	285	273	251
	% Pass (or Yes)				68	94	90	84	68	86	79	79	85	82	82	95	66	77	65
Reasons for indeterminate outcomes																			
ND=no data					78	0	0	4	7	27	10	10	91	10	10	92	103	120	142
Err=suspected error					0	0	0	0	0	1	0	0	0	3	2	0	1	0	0
Plm=unreliable due to contaminant plume					0	0	0	0	0	0	93	3	0	0	55	0	0	0	0
DL=inadequate detection limit					0	0	0	0	0	0	0	0	0	0	0	0	4	0	0
UF=test unreliable for UF sample					0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Red=test unreliable, reducing conditions					0	0	0	0	0	0	0	0	0	0	42	0	0	0	0
—=test not applicable					0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

	Category C1 Redox (SO4)			Category C2 Redox (Fe/Mn)							Category C3 Redox (NO3)	
Row	C1	C2	C3	C4	C5	C6	C9	C8	C7	C10	C11	C12
Units	SO4	S	ORP	Fe	Mn	ClO4	Mo	Ni	U	Cr	NO3	DO
Test	>LL	<UL	>LL	<UL	<UL	>LL	<UL	<UL	>LL	>LL	>LL	>LL
Regional	0.8	0.01	0	102	16	0.17	4	2	0.2	1	0.1	2
Perched	1.07	0.01	0	102	16	0.17	4	2	0.1	1	0.1	2
386	P	-ND-	-ND-	Fail	P	P	P	Fail	P	P	P	-ND-
387	P	-ND-	-ND-	Fail	P	-DL-	P	Fail	P	P	P	-ND-
388	P	Fail	Fail	P	Fail	P	P	P	P	P	P	P
389	P	Fail	P	P	Fail	P	P	P	P	P	P	P
390	P	Fail	P	P	P	P	P	P	P	P	P	P
391	P	Fail	P	P	P	P	P	P	P	P	P	P
392	P	-ND-	Fail	P	P	P	P	P	P	P	P	P
393	P	-ND-	P	P	P	P	P	P	P	P	P	P
Tallies of Pass/Fail outcomes												
Pass (or Yes)	339	88	149	238	206	198	285	238	246	191	171	236
Fail (or No)	42	57	37	143	177	92	98	130	87	93	145	9
Total outcomes	381	145	186	381	383	290	383	368	333	284	316	245
% Pass (or Yes)	89	61	80	62	54	68	74	65	74	67	54	96
Reasons for indeterminate outcomes												
ND=no data	10	248	204	9	10	21	10	17	30	12	10	146
Err=suspected error	2	0	3	1	0	0	0	1	0	1	1	2
Plm=unreliable due to contaminant plume	0	0	0	0	0	0	0	0	1	21	66	0
DL=inadequate detection limit	0	0	0	2	0	82	0	7	12	2	0	0
UF=test unreliable for UF sample	0	0	0	0	0	0	0	0	17	73	0	0
Red=test unreliable, reducing conditions	0	0	0	0	0	0	0	0	0	0	0	0
—=test not applicable	0	0	0	0	0	0	0	0	0	0	0	0

	Category D Adsorption				Category E Carbonate mineralogy							Category F Metal corrosion					Cat G Zn
Row	D1	D2	D3	D4	E1a	E1b	E1	E2	E3	E4	E5	F1	F2	F3	F4	F5	G1
Units	Sr	U	Ba	Zn	Ca	Ca	Ca	Ba	Sr	Mg	U	FeT	FeR	CrT	CrR	Ni	Zn
Test	>LL	>LL	>LL	>LL	>LL	<UL	In	<UL	<UL	<UL	<UL	<UL	<UL	<UL	<UL	<UL	<UL
Regional	44.88	0.2	4.6	1	8.66	24.1	range	70	180	4.81	1.52	500	10	10	5	50	40
Perched	19.1	0.1	1.4	1	4.39	17.3		72	155	6.12	0.72	500	10	5	5	50	20
386	P	P	P	P	Yes	Yes	P	P	P	P	P	-Err-	-Err-	P	—	P	P
387	P	P	P	—	Yes	Yes	P	P	P	P	P	No	P	P	—	P	P
388	P	P	P	P	Yes	Yes	P	P	P	P	P	Yes	—	P	—	P	P
389	P	P	P	P	Yes	Yes	P	P	P	P	P	Yes	—	P	—	P	P
390	P	P	P	-DL-	Yes	Yes	P	P	P	P	P	No	Fail	P	—	P	P
391	P	P	P	P	Yes	Yes	P	P	P	P	P	Yes	—	P	—	P	P
392	P	P	P	P	Yes	Yes	P	P	P	P	P	No	Fail	P	—	P	P
393	P	P	P	P	Yes	Yes	P	P	P	P	P	Yes	—	P	—	P	P
Tallies of Pass/Fail outcomes																	
Pass (or Yes)	345	246	382	213	338	276	240	269	287	318	212	286	56	321	9	366	337
Fail (or No)	38	87	1	9	38	100	139	114	96	63	38	96	16	38	15	9	31
Total outcomes	383	333	383	222	376	376	379	383	383	381	250	382	72	359	24	375	368
% Pass (or Yes)	90	74	100	96	90	73	63	70	75	83	85	75	78	89	38	98	92
Reasons for indeterminate outcomes																	
ND=no data	10	30	9	10	0	0	14	9	10	12	30	9	33	13	28	17	10
Err=suspected error	0	0	1	0	0	0	0	1	0	0	0	2	2	0	0	1	0
Plm=unreliable due to contaminant plume	0	1	0	0	0	0	0	0	0	0	14	0	0	21	0	0	0
DL=inadequate detection limit	0	12	0	19	0	0	0	0	0	0	11	0	0	0	0	0	0
UF=test unreliable for UF sample	0	17	0	55	0	0	0	0	0	0	0	0	0	0	0	0	15
Red=test unreliable, reducing conditions	0	0	0	0	0	0	0	0	0	0	88	0	0	0	0	0	0
—=test not applicable	0	0	0	87	0	0	0	0	0	0	0	0	286	0	341	0	0

Source: Tables C-3 to C-6

Abbreviations for test indicators: Mod=Modern; Alk=alkalinity; Trb=turbidity; Ace=acetone; FeT=Fe (Total); FeR=Fe ratio (total/dissolved); CrT=Cr (Total); CrR=Cr ratio (total/dissolved)

Abbreviations for type of test threshold and outcome: LL=lower limit; UL=upper limit; P=pass

Notes: From top to bottom in the column headers above are listed the test identifier, indicator name, type of test threshold, and threshold values for the regional aquifer and perched intermediate aquifer, respectively.

Table E-2. Composite Ratings and Trends

Row ID	Well	Port depth (ft)	Scr #	Sample collection date	Tests Pass	Tests Fail	% Pass	Sample Rating	Composite Outcome[a]			Most recent event			Overall Trend	Level of confidence
									Nr of events	Score	Rating	Sample Date	Score	Rating		
1	CdV-16-1(i)	624	1	1-Jun-05	26	8	76	Fair								
2	CdV-16-1(i)	624	1	29-Aug-05	30	5	86	Good								
3	CdV-16-1(i)	624	1	7-Dec-05	29	4	88	Good								
4	CdV-16-1(i)	624	1	9-Mar-06	30	3	91	V Good	4	85	Good	9-Mar-06	91	V Good	Improving	High
5	CdV-16-2(i)r	850	1	14-Sep-05	17	4	81	Good								
6	CdV-16-2(i)r	850	1	15-Dec-05	24	12	67	Fair								
7	CdV-16-2(i)r	850	1	15-Mar-06	30	6	83	Good								
8	CdV-16-2(i)r	850	1	17-May-06	28	7	80	Fair	4	77	Fair	17-May-06	80	Fair	Variable	Moderate
9	CdV-R-15-3	1254	4	19-Oct-04	32	2	94	V Good								
10	CdV-R-15-3	1254	4	4-Apr-05	33	3	92	V Good								
11	CdV-R-15-3	1254	4	12-Jul-05	34	1	97	V Good								
12	CdV-R-15-3	1254	4	18-Oct-05	34	1	97	V Good								
13	CdV-R-15-3	1254	4	19-Jan-06	32	0	100	V Good								
14	CdV-R-15-3	1254	4	27-Mar-06	32	1	97	V Good	6	96	V Good	27-Mar-06	97	V Good	Stable	High
15	CdV-R-15-3	1350	5	20-Oct-04	19	13	59	Fair								
16	CdV-R-15-3	1350	5	5-Apr-05	19	16	54	Poor								
17	CdV-R-15-3	1350	5	12-Jul-05	20	14	59	Poor								
18	CdV-R-15-3	1350	5	18-Oct-05	22	11	67	Fair								
19	CdV-R-15-3	1350	5	20-Jan-06	21	10	68	Fair								
20	CdV-R-15-3	1350	5	28-Mar-06	20	12	63	Fair	6	61	Fair	28-Mar-06	63	Fair	Stable	High
21	CdV-R-15-3	1640	6	21-Oct-04	29	5	85	Good								
22	CdV-R-15-3	1640	6	6-Apr-05	26	8	76	Fair								
23	CdV-R-15-3	1640	6	13-Jul-05	27	6	82	Good								
24	CdV-R-15-3	1640	6	19-Oct-05	25	10	71	Fair								
25	CdV-R-15-3	1640	6	20-Jan-06	25	6	81	Good								
26	CdV-R-15-3	1640	6	29-Mar-06	27	5	84	Good	6	80	Fair	29-Mar-06	84	Good	Improving	High
27	CdV-R-37-2	1200	2	26-Oct-04	17	16	52	Poor								
28	CdV-R-37-2	1200	2	29-Mar-05	18	17	51	Poor								
29	CdV-R-37-2	1200	2	6-Jul-05	17	17	50	Poor								
30	CdV-R-37-2	1200	2	12-Oct-05	18	15	55	Poor								
31	CdV-R-37-2	1200	2	9-Jan-06	18	14	56	Poor								
32	CdV-R-37-2	1200	2	21-Mar-06	17	16	52	Poor	6	53	Poor	21-Mar-06	52	Poor	Stable	High
33	CdV-R-37-2	1359	3	27-Oct-04	33	1	97	V Good								
34	CdV-R-37-2	1359	3	30-Mar-05	36	0	100	V Good								
35	CdV-R-37-2	1359	3	7-Jul-05	35	0	100	V Good								
36	CdV-R-37-2	1359	3	12-Oct-05	35	0	100	V Good								
37	CdV-R-37-2	1359	3	10-Jan-06	31	1	97	V Good								
38	CdV-R-37-2	1359	3	22-Mar-06	32	3	91	V Good	6	98	V Good	22-Mar-06	91	V Good	Stable	High
39	CdV-R-37-2	1551	4	27-Oct-04	25	9	74	Fair								
40	CdV-R-37-2	1551	4	31-Mar-05	25	11	69	Fair								
41	CdV-R-37-2	1551	4	8-Jul-05	25	10	71	Fair								
42	CdV-R-37-2	1551	4	13-Oct-05	25	10	71	Fair								
43	CdV-R-37-2	1551	4	11-Jan-06	24	8	75	Fair								
44	CdV-R-37-2	1551	4	22-Mar-06	25	9	74	Fair	6	72	Fair	22-Mar-06	74	Fair	Stable	High
45	MCOBT-4.4	485	1	28-Jan-03	22	5	81	Good								
46	MCOBT-4.4	485	1	21-May-03	21	5	81	Good								
47	MCOBT-4.4	485	1	29-Mar-05	16	5	76	Fair								
48	MCOBT-4.4	485	1	8-Jun-05	7	1	88	Insuff data	4	80	Good	29-Mar-05	76	Fair	Variable	Moderate
49	R-1	1031	1	19-May-05	36	0	100	V Good								
50	R-1	1031	1	12-Sep-05	34	2	94	V Good								
51	R-1	1031	1	28-Nov-05	34	1	97	V Good								
52	R-1	1031	1	25-Jan-06	34	0	100	V Good								
53	R-1	1031	1	19-Apr-06	7	1	88	Insuff data								
54	R-1	1031	1	6-Jul-06	34	0	100	V Good								
55	R-1	1031	1	26-Oct-06	35	0	100	V Good	7	99	V Good	26-Oct-06	100	V Good	Stable	High
56	R-2	918	1	26-Apr-05	28	7	80	Fair								
57	R-2	918	1	9-Aug-05	32	5	86	Good								
58	R-2	918	1	9-Nov-05	33	4	89	Good								
59	R-2	918	1	27-Feb-06	34	1	97	V Good								
60	R-2	918	1	24-Jul-06	33	2	94	V Good	5	89	Good	24-Jul-06	94	V Good	Improving	High
61	R-3i	215	1	10-Aug-06	19	12	61	Fair	1	61	Not rated	10-Aug-06	61	Fair	Indeter	Low
62	R-4	793	1	27-Apr-05	32	1	97	V Good								
63	R-4	793	1	8-Aug-05	32	2	94	V Good								
64	R-4	793	1	14-Nov-05	30	3	91	V Good								
65	R-4	793	1	28-Feb-06	30	3	91	V Good								
66	R-4	793	1	25-Jul-06	30	2	94	V Good	5	93	V Good	25-Jul-06	94	V Good	Stable	High
67	R-5	384	2	28-Apr-04	25	6	81	Fair								
68	R-5	384	2	27-Sep-04	24	7	77	Fair								

Table E-2. Composite Ratings and Trends																
Row ID	Well	Port depth (ft)	Scr #	Sample collection date	Tests Pass	Tests Fail	% Pass	Sample Rating	Composite Outcome[a]			Most recent event			Overall Trend	Level of confidence
									Nr of events	Score	Rating	Sample Date	Score	Rating		
69	R-5	384	2	2-May-05	20	6	77	Fair								
70	R-5	384	2	25-Jul-06	21	7	75	Fair	4	78	Fair	25-Jul-06	75	Fair	Stable	High
71	R-5	719	3	30-Apr-04	28	5	85	Good								
72	R-5	719	3	28-Sep-04	26	6	81	Good								
73	R-5	719	3	3-May-05	23	3	88	Good								
74	R-5	719	3	26-Jul-06	23	6	79	Fair	4	83	Good	26-Jul-06	79	Fair	Stable	Moderate
75	R-5	861	4	3-May-04	23	13	64	Fair								
76	R-5	861	4	30-Sep-04	23	13	64	Fair								
77	R-5	861	4	4-May-05	21	9	70	Fair								
78	R-5	861	4	27-Jul-06	3	0	100	Insuff data	3	67	Fair	4-May-05	70	Fair	Stable	Moderate
79	R-6	1205	1	23-Aug-05	33	3	92	V Good								
80	R-6	1205	1	17-Nov-05	34	1	97	V Good								
81	R-6	1205	1	1-Mar-06	34	1	97	V Good								
82	R-6	1205	1	11-May-06	33	2	94	V Good								
83	R-6	1205	1	26-Jul-06	34	1	97	V Good	5	95	V Good	26-Jul-06	94	V Good	Stable	High
84	R-6i	602	1	24-Aug-05	23	10	70	Fair								
85	R-6i	602	1	17-Nov-05	22	10	69	Fair								
86	R-6i	602	1	1-Mar-06	23	9	72	Fair								
87	R-6i	602	1	11-May-06	27	5	84	Good								
88	R-6i	602	1	26-Jul-06	22	8	73	Fair	5	74	Fair	26-Jul-06	73	Fair[b]	Stable	Moderate
89	R-7	915	3	18-Dec-03	15	10	60	Fair								
90	R-7	915	3	26-May-04	15	10	60	Fair								
91	R-7	915	3	26-Apr-05	17	10	63	Fair								
92	R-7	915	3	31-Jul-06	18	10	64	Fair	4	62	Fair	31-Jul-06	64	Fair	Stable	High
93	R-8	711	1	24-Aug-04	36	0	100	V Good								
94	R-8	711	1	8-Dec-04	34	2	94	V Good								
95	R-8	711	1	27-Apr-05	26	1	96	V Good								
96	R-8	711	1	1-Aug-06	30	2	94	V Good	4	96	V Good	1-Aug-06	94	V Good	Stable	High
97	R-8	825	2	25-Aug-04	32	5	86	Good								
98	R-8	825	2	9-Dec-04	30	5	86	Good								
99	R-8	825	2	28-Apr-05	25	3	89	Good								
100	R-8	825	2	2-Aug-06	25	3	89	Good	4	88	Good	2-Aug-06	89	Good	Stable	Moderate
101	R-9	684	1	12-Dec-03	18	5	78	Fair								
102	R-9	684	1	27-May-04	17	6	74	Fair								
103	R-9	684	1	19-Mar-05	17	7	71	Fair								
104	R-9	684	1	6-Apr-05	16	7	70	Fair								
105	R-9	684	1	28-Apr-05	21	5	81	Good								
106	R-9	684	1	31-Jul-06	23	5	82	Good	6	76	Fair	31-Jul-06	82	Good	Improving	Moderate
107	R-9i	199	1	6-Feb-04	10	13	43	Poor								
108	R-9i	199	1	2-Jun-04	12	12	50	Poor								
109	R-9i	199	1	29-Apr-05	17	10	63	Fair								
110	R-9i	199	1	10-Aug-06	15	11	58	Poor	4	54	Poor	10-Aug-06	62	Poor	Improving	Moderate
111	R-9i	279	2	6-Sep-01	18	11	62	Fair								
112	R-9i	279	2	29-Jul-02	17	9	65	Fair								
113	R-9i	279	2	6-Feb-04	17	7	71	Fair								
114	R-9i	279	2	10-Aug-06	18	7	72	Fair	4	67	Fair	10-Aug-06	72	Fair	Improving	Moderate
115	R-10	874	1	29-Jun-06	27	2	93	V Good								
116	R-10	874	1	12-Oct-06	30	1	97	V Good	2	95	V Good	12-Oct-06	97	V Good	Indeter	Low
117	R-10	1042	2	11-Oct-05	22	0	100	V Good								
118	R-10	1042	2	29-Jun-06	31	1	97	V Good								
119	R-10	1042	2	12-Oct-06	31	1	97	V Good	3	98	V Good	12-Oct-06	97	V Good	Indeter	Low
120	R-10a	690	1	7-Sep-05	14	4	78	Fair								
121	R-10a	690	1	30-Nov-05	24	8	75	Fair								
122	R-10a	690	1	1-Feb-06	22	8	73	Fair								
123	R-10a	690	1	17-Jul-06	24	6	80	Fair								
124	R-10a	690	1	12-Oct-06	26	5	84	Good	5	78	Fair	12-Oct-06	84	Good	Improving	Moderate
125	R-11	855	1	17-May-05	33	1	97	V Good								
126	R-11	855	1	3-Aug-05	30	3	91	V Good								
127	R-11	855	1	8-Nov-05	31	2	94	V Good								
128	R-11	855	1	3-Feb-06	29	2	94	V Good								
129	R-11	855	1	20-Apr-06	5	1	83	Insuff data								
130	R-11	855	1	10-Jul-06	26	2	93	V Good								
131	R-11	855	1	10-Oct-06	29	2	94	V Good	7	93	V Good	10-Oct-06	94	V Good	Stable	Moderate
132	R-12	468	1	2-Feb-04	8	14	36	Poor								
133	R-12	468	1	2-Jun-04	10	14	42	Poor								
134	R-12	468	1	16-Jun-05	18	14	56	Poor								
135	R-12	468	1	30-Jun-05	1	1	50	Insuff data								
136	R-12	468	1	2-Feb-06	17	13	57	Poor								

Table E-2. Composite Ratings and Trends

Row ID	Well	Port depth (ft)	Scr #	Sample collection date	Tests Pass	Tests Fail	% Pass	Sample Rating	Composite Outcome[a]			Most recent event			Overall Trend	Level of confidence
									Nr of events	Score	Rating	Sample Date	Score	Rating		
137	R-12	468	1	11-Jul-06	16	15	52	Poor								
138	R-12	468	1	29-Sep-06	21	12	64	Fair	6	50[c]	Poor	29-Sep-06	64	Fair	Improving	Moderate
139	R-12	507	2	10-Sep-01	19	11	63	Fair								
140	R-12	507	2	1-Aug-02	14	11	56	Poor								
141	R-12	507	2	28-Jan-04	19	7	73	Fair								
142	R-12	507	2	1-Feb-06	20	12	63	Fair								
143	R-12	507	2	12-Jul-06	24	8	75	Fair								
144	R-12	507	2	1-Oct-06	26	5	84	Good	6	66[c]	Fair	1-Oct-06	84	Good	Improving	Moderate
145	R-12	811	3	27-Jan-04	13	11	54	Poor								
146	R-12	811	3	3-Jun-04	13	11	54	Poor								
147	R-12	811	3	20-Jun-05	20	11	65	Fair								
148	R-12	811	3	31-Jan-06	20	10	67	Fair								
149	R-12	811	3	12-Jul-06	19	12	61	Fair								
150	R-12	811	3	27-Sep-06	29	2	94	V Good								
151	R-12	811	3	18-Oct-06	28	4	88	Good	7	61[c]	Fair	18-Oct-06	88	Good	Improving	Moderate
152	R-13	958	1	9-Dec-03	25	0	100	V Good								
153	R-13	958	1	11-Jun-04	24	1	96	V Good								
154	R-13	958	1	10-Mar-05	24	0	100	V Good								
155	R-13	958	1	26-May-05	13	1	93	Insuff data								
156	R-13	958	1	1-Sep-05	26	0	100	V Good								
157	R-13	958	1	2-Feb-06	32	0	100	V Good								
158	R-13	958	1	3-Jul-06	34	0	100	V Good								
159	R-13	958	1	25-Oct-06	34	0	100	V Good	7	99	V Good	25-Oct-06	100	V Good	Stable	High
160	R-14	1205	1	12-Jul-04	32	4	89	Good								
161	R-14	1205	1	28-Oct-04	32	3	91	V Good								
162	R-14	1205	1	11-May-05	32	3	91	V Good								
163	R-14	1205	1	24-Jan-06	29	2	94	V Good								
164	R-14	1205	1	26-Jun-06	28	4	88	Good								
165	R-14	1205	1	23-Oct-06	31	1	97	V Good	6	92	Good[c]	23-Oct-06	97	Good[c]	Improving	High
166	R-14	1289	2	14-Jul-04	24	12	67	Fair								
167	R-14	1289	2	3-Nov-04	21	13	62	Fair								
168	R-14	1289	2	12-May-05	25	11	69	Fair								
169	R-14	1289	2	25-Jan-06	25	7	78	Fair								
170	R-14	1289	2	28-Jun-06	22	6	79	Fair								
171	R-14	1289	2	23-Oct-06	20	8	71	Fair	6	71	Fair	23-Oct-06	71	Fair	Stable	High
172	R-15	959	1	10-Jun-04	20	3	87	Good								
173	R-15	959	1	25-May-05	27	1	96	V Good								
174	R-15	959	1	31-Aug-05	29	1	97	V Good								
175	R-15	959	1	30-Jan-06	29	0	100	V Good								
176	R-15	959	1	3-Jul-06	31	1	97	V Good								
177	R-15	959	1	24-Oct-06	31	0	100	V Good	6	97	V Good	24-Oct-06	100	V Good	Stable	High
178	R-16	866	2	13-Oct-04	28	7	80	Fair								
179	R-16	866	2	2-Dec-04	26	9	74	Fair								
180	R-16	866	2	13-Jun-05	28	6	82	Good								
181	R-16	866	2	13-Jul-06	25	4	86	Good								
182	R-16	866	2	20-Jul-06	28	7	80	Fair								
183	R-16	866	2	11-Aug-06	30	4	88	Good								
184	R-16	866	2	14-Aug-06	24	4	86	Good								
185	R-16	866	2	10-Oct-06	28	5	85	Good								
186	R-16	866	2	14-Nov-06	24	6	80	Fair								
187	R-16	866	2	4-Dec-06	21	6	78	Fair	10	80[c]	Good	4-Dec-06	78	Fair	Degrading	Moderate
188	R-16	1018	3	14-Oct-04	25	10	71	Fair								
189	R-16	1018	3	3-Dec-04	26	9	74	Fair								
190	R-16	1018	3	13-Jun-05	26	7	79	Fair								
191	R-16	1018	3	12-Jul-06	25	5	83	Good								
192	R-16	1018	3	20-Jul-06	10	1	91	Insuff data								
193	R-16	1018	3	10-Aug-06	28	6	82	Good								
194	R-16	1018	3	11-Aug-06	21	3	88	Good								
195	R-16	1018	3	12-Oct-06	28	4	88	Good								
196	R-16	1018	3	14-Nov-06	23	6	79	Fair								
197	R-16	1018	3	5-Dec-06	24	5	83	Good	10	78[c]	Fair	5-Dec-06	83	Good	Improving	Moderate
198	R-16	1238	4	15-Oct-04	16	18	47	Poor								
199	R-16	1238	4	7-Dec-04	18	17	51	Poor								
200	R-16	1238	4	14-Jun-05	18	15	55	Poor								
201	R-16	1238	4	13-Jul-06	17	11	61	Poor								
202	R-16	1238	4	20-Jul-06	19	15	56	Poor								
203	R-16	1238	4	9-Aug-06	27	7	79	Fair								
204	R-16	1238	4	11-Oct-06	22	11	67	Fair								

Table E-2. Composite Ratings and Trends

Row ID	Well	Port depth (ft)	Scr #	Sample collection date	Tests Pass	Tests Fail	% Pass	Sample Rating	Composite Outcome[a]			Most recent event			Overall Trend	Level of confidence
									Nr of events	Score	Rating	Sample Date	Score	Rating		
205	R-16	1238	4	14-Nov-06	18	10	64	Fair								
206	R-16	1238	4	5-Dec-06	19	9	68	Fair	9	54[c]	Poor	5-Dec-06	68	Fair	Improving	Moderate
207	R-16r	600	1	26-Sep-05	19	3	86	Good								
208	R-16r	600	1	17-Oct-05	18	2	90	Good								
209	R-16r	600	1	19-Dec-05	28	4	88	Good								
210	R-16r	600	1	8-Mar-06	33	2	94	V Good								
211	R-16r	600	1	24-May-06	32	3	91	V Good								
212	R-16r	600	1	17-Aug-06	32	2	94	V Good								
213	R-16r	600	1	1-Nov-06	30	3	91	V Good	7	91	V Good	1-Nov-06	91	V Good	Improving	High
214	R-17	1057	1	24-Feb-06	19	4	83	Good								
215	R-17	1057	1	19-Oct-06	30	5	86	Good	2	84	Good	19-Oct-06	86	Fair[b]	Indeter	Low
216	R-17	1124	2	17-Oct-06	29	6	83	Good	1	83	Not rated	17-Oct-06	83	Good	Indeter	Low
217	R-18	1358	1	25-Aug-05	35	1	97	V Good								
218	R-18	1358	1	1-Dec-05	31	4	89	V Good								
219	R-18	1358	1	7-Mar-06	32	2	94	V Good								
220	R-18	1358	1	16-May-06	34	0	100	V Good								
221	R-18	1358	1	15-Aug-06	34	0	100	V Good								
222	R-18	1358	1	18-Dec-06	31	0	100	V Good	6	97	V Good	18-Dec-06	100	V Good	Stable	Moderate
223	R-19	909	2	15-Dec-03	19	7	73	Fair								
224	R-19	909	2	10-Jun-04	20	6	77	Fair								
225	R-19	909	2	21-Jul-05	25	6	81	Fair								
226	R-19	909	2	18-Aug-06	24	4	86	Good								
227	R-19	909	2	11-Dec-06	18	4	82	Good	5	80	Fair	11-Dec-06	82	Good	Stable	Moderate
228	R-19	1191	3	15-Dec-03	25	0	100	V Good								
229	R-19	1191	3	14-Jun-04	24	2	92	V Good								
230	R-19	1191	3	21-Jul-05	29	2	94	V Good								
231	R-19	1191	3	15-Aug-06	27	1	96	V Good								
232	R-19	1191	3	16-Aug-06	26	1	96	V Good								
233	R-19	1191	3	11-Dec-06	19	3	86	Good	6	94	V Good	11-Dec-06	94	V Good	Stable	Moderate
234	R-19	1413	4	16-Dec-03	24	1	96	V Good								
235	R-19	1413	4	15-Jun-04	24	1	96	V Good								
236	R-19	1413	4	28-Jul-05	33	0	100	V Good								
237	R-19	1413	4	16-Aug-06	29	4	88	Good								
238	R-19	1413	4	17-Aug-06	24	3	89	V Good								
239	R-19	1413	4	12-Dec-06	31	1	97	V Good	6	94	V Good	12-Dec-06	97	V Good	Stable	Moderate
240	R-19	1586	5	20-Sep-01	15	14	52	Poor								
241	R-19	1586	5	23-Aug-02	11	15	42	Poor								
242	R-19	1586	5	16-Dec-03	10	14	42	Poor								
243	R-19	1586	5	17-Aug-06	13	12	52	Poor								
244	R-19	1586	5	11-Dec-06	11	10	52	Poor	5	48	Poor	11-Dec-06	52	Poor	Stable	Moderate
245	R-19	1730	6	21-Sep-01	18	11	62	Fair								
246	R-19	1730	6	27-Aug-02	17	10	63	Fair								
247	R-19	1730	6	16-Dec-03	14	10	58	Poor								
248	R-19	1730	6	17-Aug-06	19	7	73	Fair								
249	R-19	1730	6	11-Dec-06	15	7	68	Fair	5	65	Fair	11-Dec-06	68	Fair	Stable	Moderate
250	R-19	1835	7	26-Aug-02	11	15	42	Poor								
251	R-19	1835	7	17-Dec-03	11	15	42	Poor								
252	R-19	1835	7	16-Jun-04	13	14	48	Poor								
253	R-19	1835	7	28-Jul-05	20	16	56	Poor								
254	R-19	1835	7	18-Aug-06	14	14	50	Poor								
255	R-19	1835	7	13-Dec-06	9	12	43	Poor	6	48	Poor	13-Dec-06	43	Poor	Stable	Moderate
256	R-20	907	1	20-Sep-04	18	17	51	Poor								
257	R-20	907	1	4-Nov-04	18	16	53	Poor								
258	R-20	907	1	20-Jul-05	17	15	53	Poor								
259	R-20	907	1	6-Jun-06	25	10	71	Fair								
260	R-20	907	1	6-Jul-06	26	10	72	Fair								
261	R-20	907	1	2-Oct-06	21	5	81	Fair								
262	R-20	907	1	17-Oct-06	1	0	100	Insuff data	7	60[c]	Poor	2-Oct-06	81	Good	Improving	Moderate
263	R-20	1150	2	3-Sep-04	15	20	43	Poor								
264	R-20	1150	2	8-Nov-04	13	21	38	Poor								
265	R-20	1150	2	19-Jul-05	14	18	44	Poor								
266	R-20	1150	2	7-Jun-06	13	22	37	Poor								
267	R-20	1150	2	8-Jul-06	31	4	89	Good	5	40[c]	Poor		89	Fair[b]	Improving	High
268	R-20	1330	3	7-Sep-04	19	16	54	Poor								
269	R-20	1330	3	9-Nov-04	20	14	59	Poor								
270	R-20	1330	3	18-Jul-05	19	12	61	Fair								
271	R-20	1330	3	8-Jun-06	21	13	62	Fair								
272	R-20	1330	3	7-Jul-06	22	12	65	Fair								

Table E-2. Composite Ratings and Trends

Row ID	Well	Port depth (ft)	Scr #	Sample collection date	Tests Pass	Tests Fail	% Pass	Sample Rating	Composite Outcome[a]			Most recent event			Overall Trend	Level of confidence
									Nr of events	Score	Rating	Sample Date	Score	Rating		
273	R-20	1330	3	21-Jul-06	23	9	72	Fair								
274	R-20	1330	3	13-Oct-06	20	9	69	Fair	6	59[c]	Poor	13-Oct-06	69	Fair	Improving	High
275	R-21	889	1	23-Sep-04	35	0	100	V Good								
276	R-21	889	1	14-Dec-04	36	0	100	V Good								
277	R-21	889	1	6-Jun-05	33	0	100	V Good								
278	R-21	889	1	7-Jul-06	34	1	97	V Good								
279	R-21	889	1	6-Nov-06	35	0	100	V Good	5	99	V Good	6-Nov-06	100	V Good	Stable	High
280	R-22	907	1	18-Nov-03	8	17	32	Poor								
281	R-22	907	1	21-Jun-04	10	14	42	Poor								
282	R-22	907	1	27-Jun-05	15	19	44	Poor								
283	R-22	907	1	22-Aug-06	11	15	42	Poor								
284	R-22	907	1	7-Dec-06	9	15	38	Poor	5	40	Poor	7-Dec-06	38	Poor	Stable	High
285	R-22	963	2	19-Nov-03	25	1	96	V Good								
286	R-22	963	2	22-Jun-04	25	0	100	V Good								
287	R-22	963	2	28-Jun-05	33	0	100	V Good								
288	R-22	963	2	28-Aug-06	30	2	94	V Good								
289	R-22	963	2	7-Dec-06	32	0	100	V Good	5	98	V Good	7-Dec-06	100	V Good	Stable	High
290	R-22	1274	3	9-Jul-02	15	8	65	Fair								
291	R-22	1274	3	20-Nov-03	17	10	63	Fair								
292	R-22	1274	3	23-Jun-04	21	4	84	Good								
293	R-22	1274	3	29-Jun-05	26	8	76	Fair								
294	R-22	1274	3	22-Aug-06	25	8	76	Fair								
295	R-22	1274	3	8-Dec-06	24	8	75	Fair	6	74	Fair	8-Dec-06	75	Fair	Stable	High
296	R-22	1378	4	11-Jul-02	9	14	39	Poor								
297	R-22	1378	4	20-Nov-03	9	17	35	Poor								
298	R-22	1378	4	23-Jun-04	10	15	40	Poor								
299	R-22	1378	4	1-Jul-05	16	18	47	Poor								
300	R-22	1378	4	22-Aug-06	13	14	48	Poor								
301	R-22	1378	4	8-Dec-06	12	11	52	Poor	6	44	Poor	8-Dec-06	52	Poor	Stable	High
302	R-22	1448	5	10-Jul-02	12	13	48	Poor								
303	R-22	1448	5	21-Nov-03	11	14	44	Poor								
304	R-22	1448	5	5-Jul-05	15	17	47	Poor								
305	R-22	1448	5	21-Aug-06	13	14	48	Poor								
306	R-22	1448	5	7-Dec-06	14	13	52	Poor	5	48	Poor	7-Dec-06	52	Poor	Stable	High
307	R-23	816	1	29-Jun-04	33	1	97	V Good								
308	R-23	816	1	24-Sep-04	34	1	97	V Good								
309	R-23	816	1	14-Jul-05	30	1	97	V Good								
310	R-23	816	1	15-Aug-06	33	0	100	V Good								
311	R-23	816	1	18-Dec-06	30	0	100	V Good	5	98	V Good	18-Dec-06	100	V Good	Stable	High
312	R-23i	470	2	20-Dec-05	16	7	70	Fair								
313	R-23i	470	2	3-Oct-06	22	12	65	Fair	2	67	Fair	3-Oct-06	65	Fair	Indeter	Low
314	R-23i	524	3	11-Dec-05	15	9	63	Fair								
315	R-23i	524	3	11-Oct-06	22	15	59	Poor	2	61	Poor	11-Oct-06	59	Poor	Indeter	Low
316	R-24	825	1	20-Sep-05	18	5	78	Fair								
317	R-24	825	1	15-Nov-05	24	10	71	Fair								
318	R-24	825	1	6-Mar-06	24	10	71	Fair								
319	R-24	825	1	10-May-06	24	11	69	Fair								
320	R-24	825	1	27-Jul-06	25	9	74	Fair	5	72	Fair	27-Jul-06	74	Fair	Stable	High
321	R-25	755	1	7-Aug-02	13	8	62	Fair								
322	R-25	755	1	11-Dec-03	16	8	67	Fair								
323	R-25	755	1	1-Sep-04	16	7	70	Fair								
324	R-25	755	1	2-Aug-05	21	11	66	Fair	4	66	Fair	2-Aug-05	66	Fair	Degrading	Low
325	R-25	892	2	5-Feb-02	4	6	40	Insuff data								
326	R-25	892	2	8-Aug-02	15	11	58	Poor								
327	R-25	892	2	10-Dec-03	14	12	54	Poor								
328	R-25	892	2	3-Aug-05	16	18	47	Poor	4	51	Poor	3-Aug-05	47	Poor	Degrading	Low
329	R-25	1192	4	8-Aug-02	19	8	70	Fair								
330	R-25	1192	4	10-Dec-03	20	6	77	Fair								
331	R-25	1192	4	4-Aug-05	23	7	77	Fair	3	75	Fair	4-Aug-05	77	Fair	Indeter	Low
332	R-25	1303	5	9-Aug-02	14	9	61	Fair								
333	R-25	1303	5	9-Dec-03	14	11	56	Poor								
334	R-25	1303	5	31-Aug-04	12	8	60	Fair								
335	R-25	1303	5	9-Aug-05	17	5	77	Fair	4	63	Fair	9-Aug-05	77	Good	Improving	Low
336	R-25	1406	6	8-Feb-02	29	3	91	Good								
337	R-25	1406	6	12-Aug-02	23	4	85	Good								
338	R-25	1406	6	9-Dec-03	24	2	92	V Good	3	89	Good	9-Dec-03	92	0	Indeter	Low
339	R-25	1606	7	11-Feb-02	30	1	97	V Good								
340	R-25	1606	7	12-Aug-02	25	2	93	V Good								

Table E-2. Composite Ratings and Trends

Row ID	Well	Port depth (ft)	Scr #	Sample collection date	Tests Pass	Tests Fail	% Pass	Sample Rating	Composite Outcome[a]			Most recent event			Overall Trend	Level of confidence
									Nr of events	Score	Rating	Sample Date	Score	Rating		
341	R-25	1606	7	8-Dec-03	25	1	96	V Good	3	95	Good[b]	8-Dec-03	96	Good[b]	Indeter	Low
342	R-25	1796	8	14-Aug-02	26	1	96	V Good								
343	R-25	1796	8	4-Dec-03	25	1	96	V Good								
344	R-25	1796	8	10-Aug-05	30	2	94	V Good	3	95	Good[b]	10-Aug-05	94	Good[b]	Stable	Low
345	R-26	659	1	13-Apr-05	33	3	92	V Good								
346	R-26	659	1	27-Jul-05	31	3	91	V Good								
347	R-26	659	1	2-Nov-05	32	4	89	V Good								
348	R-26	659	1	22-Feb-06	31	0	100	V Good	4	93	V Good	22-Feb-06	100	V Good	Stable	High
349	R-27	852	1	11-Oct-05	18	3	86	Good								
350	R-27	852	1	21-Oct-05	17	3	85	Good								
351	R-27	852	1	14-Nov-05	21	1	95	V Good								
352	R-27	852	1	1-Jul-06	33	1	97	V Good	4	92	V Good	1-Jul-06	97	V Good	Improving	High
353	R-28	934	1	20-May-05	27	5	84	Good								
354	R-28	934	1	1-Sep-05	28	3	90	Good								
355	R-28	934	1	10-Nov-05	28	4	88	Good								
356	R-28	934	1	26-Jan-06	27	3	90	Good								
357	R-28	934	1	19-Apr-06	6	0	100	Insuff data								
358	R-28	934	1	5-Jul-06	28	3	90	Good								
359	R-28	934	1	26-Oct-06	27	3	90	Good	7	89	Good	26-Oct-06	90	Good	Stable	High
360	R-31	532	2	18-Mar-04	17	19	47	Poor								
361	R-31	532	2	17-Aug-05	19	15	56	Poor								
362	R-31	532	2	28-Nov-06	16	15	52	Poor	3	51	Poor	28-Nov-06	52	Poor	Stable	High
363	R-31	670	3	19-Aug-05	21	12	64	Fair								
364	R-31	670	3	30-Nov-06	22	10	69	Fair	2	66	Fair	30-Nov-06	69	Fair	Stable	Moderate
365	R-31	831	4	23-Aug-05	31	1	97	V Good								
366	R-31	831	4	6-Dec-06	31	1	97	V Good	2	97	V Good	6-Dec-06	97	V Good	Stable	Moderate
367	R-31	1011	5	24-Aug-05	27	3	90	Good								
368	R-31	1011	5	6-Dec-06	29	1	97	V Good	2	93	V Good	6-Dec-06	97	V Good	Stable	Moderate
369	R-32	871	1	21-Sep-04	32	4	89	Good								
370	R-32	871	1	15-Nov-04	32	4	89	Good								
371	R-32	871	1	22-Jun-05	31	2	94	V Good								
372	R-32	871	1	29-Aug-06	31	1	97	V Good								
373	R-32	871	1	12-Dec-06	31	1	97	V Good	5	93	V Good	12-Dec-06	97	V Good	Stable	High
374	R-32	976	3	22-Sep-04	23	13	64	Fair								
375	R-32	976	3	16-Nov-04	22	13	63	Fair								
376	R-32	976	3	24-Jun-05	25	9	74	Fair								
377	R-32	976	3	30-Aug-06	22	11	67	Fair								
378	R-32	976	3	13-Dec-06	25	7	78	Fair	5	69	Fair	13-Dec-06	78	Fair	Improving	High
379	R-33	996	1	27-Jun-05	26	3	90	Good								
380	R-33	996	1	14-Sep-05	27	5	84	Good								
381	R-33	996	1	16-Feb-06	32	2	94	V Good								
382	R-33	996	1	31-Oct-06	26	3	90	Good	4	90	Good	31-Oct-06	90	Good	Stable	High
383	R-33	1112	2	24-Jun-05	29	5	85	Good								
384	R-33	1112	2	15-Sep-05	29	4	88	Good								
385	R-33	1112	2	14-Feb-06	33	2	94	V Good								
386	R-33	1112	2	5-Jul-06	28	3	90	Good								
387	R-33	1112	2	1-Nov-06	25	3	89	Good	5	89	Good	1-Nov-06	89	Good	Stable	High
388	R-34	895	1	7-Jun-05	32	4	89	Good								
389	R-34	895	1	7-Sep-05	33	3	92	V Good								
390	R-34	895	1	29-Nov-05	32	4	89	Good								
391	R-34	895	1	31-Jan-06	33	2	94	V Good								
392	R-34	895	1	17-Jul-06	32	3	91	V Good								
393	R-34	895	1	30-Oct-06	33	1	97	V Good	6	92	V Good	30-Oct-06	97	V Good	Improving	High

Notes: The number of pass and fail outcomes for each sample are calculated from Table E-1. See the introductory text for this appendix for a description of the protocol for assigning qualitative ratings to conditions, trends, and level of confidence in these conditions; V Good = Very Good; "Indeter" means that the presence or absence of a plume at this location cannot be determined with confidence, although the water quality is definitely not representative of uncontaminated groundwater. The screens to which this designation applies are R-16 and R-24, which are each located next to one of the county's two sewage treatment facilities (in White Rock and Bayo Canyon, respectively).

a. Composite score and rating—average score calculated as the percent of all tests with passing outcomes (i.e., score has not been weighted for any variability in the number of outcomes per event). However, see footnote c below for exceptions.

b. The composite scores and ratings for screens in R-12, R-16, and R-20 are based on average scores calculated only for sampling events prior to the rehabilitation pilot studies. The rehabilitation activities occurred at R-12 from 23-Sep-2006 to 19-Oct-2006 (isolation packers were installed until a dedicated sampling system can be re-installed); at R-16 from 2 Aug-2006 to 12-Aug-2006 (Westbay was reinstalled and completed on 28-Aug-2006); and at R-20 from 29-Jun-2006 to 17-Oct-2006. The scores and ratings for the most recent samples from these well screens all apply to post-rehabilitation samples.

c. Qualitative ratings for some screens have been adjusted for the following reasons:

Table E-2. Composite Ratings and Trends

Row ID	Well	Port depth (ft)	Scr #	Sample collection date	Tests Pass	Tests Fail	% Pass	Sample Rating	Composite Outcome[a]			Most recent event			Overall Trend	Level of confidence
									Nr of events	Score	Rating	Sample Date	Score	Rating		
• R-6i—F, Na and Ca in samples from this single-screen well consistently exceed the upper threshold limits for these analytes but these exceedances are probably not due to residual drilling fluids. Because the concentrations are fairly stable and not decreasing with time, the more likely explanations are either (a) the sampling locations used to establish background levels for these analytes did not capture the full range of their variability in intermediate perched zones, or (b) these analytes may be part of, or affected by, the contaminant plume intersected by this well, which contains Cl, ClO4, NO3, and tritium. Consequently, ratings for the composite and most recent sample from R-6i have been upgraded to “Good.”																
• R-14 Screen 1-Although all test outcomes are defensible and result in a score above 90%, it is inappropriate to assign a rating of Very Good" to a sample which is still reducing (although improving with time) with respect to NO3 and Mn.																
• R-17 Screen 1-Downgraded to Fair" because the variability observed in some of the indicators (e.g., decreasing Cl, NO3 and SO4 concentrations) and very high turbidity suggests that conditions may not have stabilized in this screen interval.																
• R-20 Screen 2-The test outcomes result in a score of 88, implying a dramatic improvement in the screen's condition immediately following completion of pilot rehabilitation activities. However, additional sampling events are needed to establish the extent to which the improved conditions continue to exist.																
• R-25 Screens 6, 7 and 8-downgraded to Good" because geochemical trends indicate that, as of the last time these screens were sampled, they had not yet attained stable levels but rather still showed diminishing presence of water from upper screens																
• R-28-Although the score of 90% for the most recent sample would result in a rating of Good," the failed test outcomes for Ca, Mg, and Ni are probably not attributable to residual drilling effects. In the case of Ca and Mg, the stability of their concentrations in R-28 suggests that the sampling locations used to establish background levels for Ca and Mg did not capture the full range of their variability in the top of the regional aquifer. Secondly, the lack of Fe-reducing conditions in R-28 suggests that the failed test for elevated Ni is not due to desorption from dissolution of iron-bearing minerals but rather from its possible presence in the contaminant plume at this screen. Hence, its rating is upgraded to "Very Good" on the assumption that the negative test outcomes for these three analytes are not valid at this site.																

Appendix F

Principal Component Analysis:
Correlation Matrices, Factor Loadings, and Stations Used for Comparison with Regional Characterization Wells

Table F-1
Correlation Matrix for Principal Component Analysis (PCA) Analysis of Nonfiltered Metal Concentrations

	B	Ba	Cr	Fe	Mn	Mo	Sr	V	Zn
B	1.00	*0.49*	0.05	0.09	0.08	*0.27*	*0.52*	*-0.15*	0.01
Ba	*0.49*	1.00	0.00	*0.54*	*0.62*	*0.42*	*0.61*	*-0.29*	-0.06
Cr	0.05	0.00	1.00	0.11	0.02	*0.16*	-0.03	-0.04	0.10
Fe	0.09	*0.54*	0.11	1.00	*0.85*	*0.52*	0.08	*-0.26*	0.08
Mn	0.08	*0.62*	0.02	*0.85*	1.00	*0.47*	0.13	*-0.29*	0.03
Mo	*0.27*	*0.42*	*0.16*	*0.52*	*0.47*	1.00	0.13	*-0.27*	0.13
Sr	*0.52*	*0.61*	-0.03	0.08	0.13	0.13	1.00	*-0.23*	-0.09
V	*-0.15*	*-0.29*	-0.04	*-0.26*	*-0.29*	*-0.27*	*-0.23*	1.00	-0.08
Zn	0.01	-0.06	0.10	0.08	0.03	0.13	-0.09	-0.08	1.00

Notes: *Marked* correlations are significant at $p < 0.05$; Pearson product moment correlation matrix for raw metal concentrations; $N = 201$ samples.

Table F-2
Correlation Matrix for PCA Analysis of Filtered Metal Concentrations

	B	Ba	Cr	Fe	Mn	Mo	Sr	V	Zn
B	1.00	*0.47*	0.00	0.03	0.05	*0.21*	*0.63*	-0.13	0.12
Ba	*0.47*	1.00	-0.03	*0.46*	*0.62*	*0.49*	*0.60*	*-0.35*	0.05
Cr	0.00	-0.03	1.00	-0.04	-0.05	-0.06	-0.03	0.03	0.07
Fe	0.03	*0.46*	-0.04	1.00	*0.75*	*0.51*	-0.03	*-0.27*	0.01
Mn	0.05	*0.62*	-0.05	*0.75*	1.00	*0.47*	0.06	*-0.31*	-0.02
Mo	*0.21*	*0.49*	-0.06	*0.51*	*0.47*	1.00	0.12	*-0.30*	-0.02
Sr	*0.63*	*0.60*	-0.03	-0.03	0.06	0.12	1.00	*-0.22*	0.12
V	-0.13	*-0.35*	0.03	*-0.27*	*-0.31*	*-0.30*	*-0.22*	1.00	0.01
Zn	0.12	0.05	0.07	0.01	-0.02	-0.02	0.12	0.01	1.00

Notes: *Marked* correlations are significant at $p < 0.05$; Pearson product moment correlation matrix for raw metal concentrations; $N = 172$ samples.

Table F-3
Correlation Matrix for PCA Analysis of Nonfiltered Major Ion Concentrations

	Ca	Mg	Cl	Alkalinity	F	Na	NO_3	SO_4	K
Ca	1.00	*0.76*	*0.25*	*0.27*	-0.01	*-0.59*	0.13	*-0.41*	0.17
Mg	*0.76*	1.00	0.22	0.24	0.09	*-0.53*	0.14	*-0.32*	*0.28*
Cl	*0.25*	0.22	1.00	0.17	*0.26*	*-0.38*	*0.52*	0.16	*0.46*
Alkalinity	*0.27*	0.24	0.17	1.00	0.19	*-0.90*	-0.09	-0.16	*0.41*
F	-0.01	0.09	*0.26*	0.19	1.00	-0.19	0.04	-0.02	*0.25*
Na	*-0.59*	*-0.53*	*-0.38*	*-0.90*	-0.19	1.00	-0.14	0.08	*-0.44*
NO_3	0.13	0.14	*0.52*	-0.09	0.04	-0.14	1.00	*0.35*	0.15
SO_4	*-0.41*	*-0.32*	0.16	-0.16	-0.02	0.08	0.35	1.00	-0.13
K	0.17	*0.28*	*0.46*	*0.41*	*0.25*	*-0.44*	*0.15*	-0.13	1.00

Notes: Marked correlations are significant at $p < 0.05$; Pearson product moment correlation matrix for concentrations of major ions normalized to total dissolved solids (TDS); $N = 69$ samples.

Table F-4
Correlation Matrix for Filtered Major Ion PCA Analysis

	Ca	Mg	Cl	Alkalinity	F	Na	NO_3	SO_4	K
Ca	1.00	*0.28*	*0.38*	*-0.56*	0.03	*-0.36*	*0.27*	*0.40*	*0.18*
Mg	*0.28*	1.00	*0.16*	0.01	0.08	*-0.36*	*0.24*	*-0.23*	0.12
Cl	*0.38*	*0.16*	1.00	*-0.60*	0.05	-0.06	*0.51*	*0.48*	0.15
Alkalinity	*-0.56*	0.01	*-0.60*	1.00	-0.10	*-0.40*	*-0.25*	*-0.64*	*-0.32*
F	0.03	0.08	0.05	-0.10	1.00	0.14	-0.01	-0.13	0.14
Na	*-0.36*	*-0.36*	-0.06	*-0.40*	0.14	1.00	*-0.26*	-0.14	*0.25*
NO_3	*0.27*	*0.24*	*0.51*	*-0.25*	-0.01	*-0.26*	1.00	0.24	-0.10
SO_4	*0.40*	*-0.23*	*0.48*	*-0.64*	-0.13	-0.14	*0.24*	1.00	0.01
K	*0.18*	0.12	0.15	*-0.32*	0.14	*0.25*	-0.10	0.01	1.00

Notes: Marked correlations are significant at $p < 0.05$; Pearson product moment correlation matrix for concentrations of major ions normalized to TDS; $N = 156$ samples.

Table F-5
Factor Loadings for PCA Analysis of Nonfiltered Metal Concentrations

	PC 1	PC 2	PC 3
B	0.063641	*-0.845542*	0.075553
Ba	0.656593	-0.615378	0.022989
Cr	-0.023393	0.096733	*0.771014*
Fe	*0.878721*	0.118140	0.044241
Mn	*0.893730*	0.006644	0.006898
Mo	*0.716934*	-0.153567	-0.059048
Sr	0.051223	*-0.910554*	0.018693
V	-0.469510	0.245670	0.099244
Zn	-0.029322	-0.169085	0.675259
Eigenvalue	2.744534	2.058624	1.072364
Percentage of total variance explained by principal component (PC)	30.5%	22.9%	11.9%

Notes: Marked loadings are > 0.70; factor loadings are obtained using Varimax normalized rotation.

Table F-6
Factor Loadings for Filtered Metals PCA Analysis

	PC 1	PC 2	PC 3
B	0.063641	*-0.845542*	0.075553
Ba	0.656593	-0.615378	0.022989
Cr	-0.023393	0.096733	*0.771014*
Fe	*0.878721*	0.118140	0.044241
Mn	*0.893730*	0.006644	0.006898
Mo	*0.716934*	-0.153567	-0.059048
Sr	0.051223	*-0.910554*	0.018693
V	-0.469510	0.245670	0.099244
Zn	-0.029322	-0.169085	0.675259
Eigenvalue	2.744534	2.058624	1.072364
Percentage of total variance explained by PC	30.5%	22.9%	11.9%

Notes: Marked loadings are > 0.70; factor loadings are obtained using Varimax normalized rotation.

Table F-7
Factor Loadings for PCA Analysis of Nonfiltered Major Ion Concentrations

	PC 1	PC 2	PC 3
Ca	*0.929692*	0.081098	0.101810
Mg	*0.864032*	0.123665	0.145470
Cl	0.159319	*0.739187*	0.389905
Alkalinity	0.228968	-0.184704	*0.852464*
F	-0.156837	0.097452	0.556595
Na	-0.512927	-0.096715	*-0.759118*
NO_3	0.105197	*0.885686*	-0.037289
SO_4	-0.545717	0.556883	-0.038026
K	0.160931	0.216603	0.668974
Eigenvalue	2.311152	1.762710	2.246667
Percentage of total variance explained by PC	25.7%	19.6%	25.0%

Notes: Marked loadings are > 0.70; factor loadings are obtained using Varimax normalized rotation.

Table F-8
Factor Loadings for PCA Analysis of Filtered Major Ion Concentrations

	PC 1	PC 2	PC 3
Ca	0.650073	0.418542	0.000016
Mg	0.006189	*0.775421*	-0.340205
Cl	*0.790816*	0.183635	-0.094271
Alkalinity	*-0.901874*	0.259550	0.204507
F	0.030725	-0.002589	*-0.841186*
Na	0.041384	*-0.812236*	-0.414006
NO_3	0.494093	0.472425	0.011140
SO_4	*0.788415*	-0.136676	0.387729
Eigenvalue	2.729783	1.779142	1.195902
Percentage of total variance explained by PC	34.1%	22.2%	14.9%

Notes: Marked loadings are > 0.70; factor loadings are obtained using Varimax normalized rotation.

Table F-9
Factor Loadings for PCA Analysis of Nonfiltered Metal and Major Ion Concentrations (Merged)

	PC 1	PC 2	PC 3	PC 4
B	*0.726283*	0.222900	0.056496	0.466641
Ba	*0.744848*	0.414277	0.064489	0.004392
Cr	-0.135108	-0.469497	-0.571876	-0.326157
Fe	0.182397	*0.908344*	0.041143	0.063893
Mn	0.255470	*0.888172*	0.214634	0.020864
Mo	0.285398	0.378009	0.485456	0.324161
Sr	*0.874344*	0.255134	0.002966	0.103516
V	-0.213978	*-0.894707*	0.014030	-0.172798
Zn	-0.333500	-0.105554	0.324244	-0.072295
Ca	*0.899211*	0.154797	-0.132961	-0.049977
Cl	*0.764816*	-0.078681	0.489185	0.151021
F	0.117445	0.081377	*0.849382*	-0.197914
K	*0.795460*	-0.047325	0.433100	-0.082812
Mg	*0.783550*	0.243308	-0.118619	-0.144974
Alk	*0.747032*	0.225248	0.399817	0.279123
NO_3	-0.169921	*-0.916600*	-0.148265	-0.025560
Na	0.124631	0.210193	-0.206083	*0.899262*
SO_4	-0.116072	-0.495262	0.368039	*0.702218*
U	0.111235	*-0.799212*	0.218876	0.186420
Eigenvalue	5.484344	4.992613	2.310902	1.986998
Percentage of total variance explained by PC	28.9%	26.2%	12.2%	10.5%

Notes: Marked loadings are > 0.70; factor loadings are obtained using Varimax normalized rotation.

Table F-10
Factor Loadings for PCA Analysis of Filtered Metal and Major Ion Concentrations (Merged)

	PC 1	PC 2	PC 3	PC 4
B	-0.312294	0.622434	0.332070	0.388648
Ba	-0.503129	*0.705548*	-0.260051	0.059347
Cr	*0.726939*	-0.203705	-0.177377	0.405587
Fe	*-0.881894*	0.004364	-0.063018	0.224085
Mn	*-0.882466*	0.128361	-0.083291	-0.068239
Mo	-0.493352	0.389201	0.402399	0.395518
Sr	-0.206410	*0.856891*	-0.027044	-0.068316
V	*0.853689*	-0.229530	-0.004773	0.168174
Zn	-0.070135	-0.035986	-0.082311	*0.724448*
Ca	0.007154	*0.795178*	-0.373336	-0.027790
Cl	0.176773	*0.822026*	0.044156	0.108821
F	0.131867	0.454946	0.312487	0.441924
K	-0.072520	*0.844479*	0.103971	-0.075092
Mg	-0.147802	0.238995	*-0.818650*	0.141368
Alk	0.031603	0.626596	0.146402	-0.017122
NO_3	*0.861249*	-0.110071	-0.300013	0.009461
Na	-0.248933	0.496257	*0.708117*	0.097450
SO_4	0.570342	0.127891	0.120669	-0.282706
U	*0.746949*	0.294384	0.041636	-0.237945
Eigenvalue	5.219028	4.922234	1.938862	1.468106
Percentage of total variance explained by PC	0.274686	0.259065	0.102045	0.077269

Notes: Marked loadings are > 0.70; factor loadings are obtained using Varimax normalized rotation.

Table F-11
List of Stations Used for Comparison with Regional Characterization Wells in PCA Analysis

Station	Preparation	PCA Analysis			
		Metals F	Metals UF	Major Ions F	Major Ions UF
G-1A	F and UF	●	●	●	●
G-2A	F and UF	●	●	●	●
G-3A	F and UF	●	●	●	●
G-4A	F and UF	●	●	●	●
G-5A	F and UF	●	●	●	●
PM-1	F and UF	●	●	●	●
PM-2	F and UF	●	●	●	●
PM-3	F and UF	●	●	●	●
PM-4	F and UF	●	●	●	●
PM-5	F and UF	●	●	●	●
Test Well 3	F and UF	—	—	●	●
Test Well 8	F and UF	—	—	●	●
Test Well DT-5A	F and UF	—	—	●	●
Test Well DT-9	F and UF	—	—	●	●
Test Well DT-10	F and UF	—	—	●	●
Spring 1	F	●	—	●	—
Spring 3	F	●	—	●	—
Spring 3A	F	●	—	●	—
Spring 3AA	F	●	—	●	—
Spring 4	F	●	—	●	—
Spring 4A	F	●	—	●	—
Spring 5	F	●	—	●	—
Spring 5A	F	●	—	●	—
Spring 5B	F	●	—	●	—
Spring 6	F	●	—	●	—
Spring 6A	F	●	—	●	—
Spring 8	F	●	—	●	—
Spring 8A	F	●	—	●	—
Spring 9	F	●	—	●	—
Spring 9A	F	●	—	●	—

Notes: F= filtered sample result; UF = nonfiltered sample result; — = not included in the PCA analysis.