

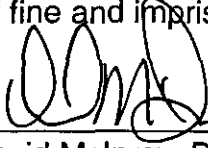
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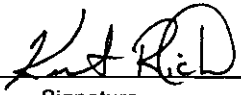
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Los Alamos and Pueblo Canyons Investigation Report

April 2004

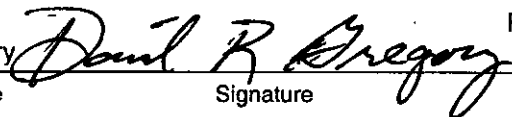
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EXECUTIVE SUMMARY

This investigation report for Los Alamos and Pueblo Canyons presents the results of studies conducted from 1996 to 2003 in Los Alamos, Pueblo, DP, and Acid Canyons (referred to in this report as the Los Alamos and Pueblo watershed). These canyons are partially located within the Los Alamos National Laboratory (the Laboratory) and have received inorganic and organic chemical and radionuclide contaminants since the Laboratory was established in 1943. Most of the contamination related to Laboratory releases is associated with effluent discharged before 1986. The investigations reported herein address sediment, surface water (including springs), alluvial groundwater, and biota potentially impacted by Laboratory solid waste management units (SWMUs) and areas of concern (AOCs) located within the watershed. Investigations occurred along 34 km (21 mi) of canyon bottom downcanyon of SWMUs or AOCs and were supplemented by data collected from areas upcanyon of SWMUs or AOCs. The objectives of the investigations included defining the nature and extent of chemicals of potential concern (COPCs) in sediment, surface water, and alluvial groundwater and assessing the potential risks to human health and the environment from these COPCs. The investigations also address the sources, fate, and transport of COPCs in the canyons and evaluate the need for additional characterization sampling and remedial actions. The Cerro Grande fire of May 2000 occurred during the investigation, and the impact of the fire is discussed in this report.

Sediment investigations included geomorphic mapping, associated geomorphic characterization, and sediment sampling in 34 investigation reaches located both upcanyon and downcanyon from SWMUs or AOCs. Some reaches are located upcanyon from SWMUs or AOCs and downcanyon from paved roads and developed areas in the Los Alamos townsite. Other sediment samples were collected from reaches upcanyon from roads and urban influences to identify contaminant contributions from the townsite. Finally, post-fire flood deposits within or downcanyon from the Cerro Grande burn area were sampled, including sites in the Los Alamos and Pueblo watershed up- and downcanyon of SWMUs or AOCs as well as sites in other watersheds. Analytical data collected in this investigation are supplemented by data collected by the Laboratory's Environmental Surveillance Program and other Laboratory studies to aid in determining spatial and temporal trends in sediment contamination.

Surface water and alluvial groundwater investigations include collecting samples both up- and downcanyon from SWMUs or AOCs to bound these sites spatially. Investigation data collected before and after the Cerro Grande fire were used to characterize potential effects of the fire on sediment and water chemistry. Surface water and alluvial groundwater were sampled concurrently during the most recent four rounds of sampling to assess relations between these media and to characterize potential seasonal effects on hydrology and contaminant concentrations. Surface water investigations focus on areas with persistent water, that is, locations where water occurs frequently enough to potentially contribute to human health risks and adverse ecological effects associated with potential chronic exposure. Alluvial groundwater investigations include using water-level data and a bromide tracer study to characterize the hydrologic system. Analytical data collected in this investigation are supplemented by Environmental Surveillance Program data to provide a longer period of record and a larger data set.

Sediment COPCs in the Los Alamos and Pueblo watershed include 30 inorganic chemicals, 72 organic chemicals, and 15 radionuclides. Surface water and alluvial groundwater COPCs include 46 inorganic chemicals, 51 organic chemicals, and 11 radionuclides. These COPCs are derived from a variety of sources, including Laboratory SWMUs and AOCs, runoff from the Los Alamos townsite, redistribution of ash from the Cerro Grande burn area (which includes elevated levels of fallout radionuclides and naturally occurring chemicals), and uncontaminated soils and sediments. Assessments in this report focus on the subset of these COPCs considered most important for the evaluation of potential ecological or human health risk. The relative importance of the COPCs was determined by comparing COPC concentrations

with ecological screening levels, human health screening action levels, Environmental Protection Agency Region 6 and Region 9 tap water values, or Department of Energy- (DOE-) derived concentration guidelines for drinking water. The sources of the COPCs are also considered in these assessments, to determine whether they partially or largely represent Laboratory sources.

The spatial distribution of contaminants in the Los Alamos and Pueblo watershed indicates that the primary original sources for Laboratory-derived COPCs considered most important for assessing potential human health risk are the former TA-1 and TA-45 outfalls into the South Fork of Acid Canyon (operational from 1944 to 1964) and the SWMU 21-011(k) outfall into DP Canyon (operational from 1952 to 1986). Source areas for Laboratory-derived chemicals of potential ecological concern (COPECs) that are most important for assessing potential adverse ecological effects include the outfalls into the South Fork of Acid Canyon and sites in upper Los Alamos Canyon, such as TA-2 and perhaps former TA-1 and/or TA 21 outfalls. The impacts of several additional Laboratory sources (e.g., outfalls at TA-53 and SWMU 0-030[g] and the former Pueblo Canyon wastewater treatment plant) may also be inferred from the characterization data, although these latter sources are less important than the former as contributors to potential human health risk or adverse ecological effects.

Currently, the primary source areas for Laboratory-derived COPCs are contaminated sediment deposits in the canyon bottoms, rather than the SWMUs and AOCs associated with initial releases. The canyon bottom sediment deposits contain the largest inventory of contaminants susceptible to remobilization and transport in floods and are the primary source for ongoing surface water and alluvial groundwater contamination.

A baseline ecological risk assessment conducted as part of this investigation evaluates the potential for adverse effects by assessing risks to omnivorous mammals, insect-eating birds, plants, earthworms, aquatic invertebrates, and the Mexican spotted owl, a threatened and endangered species. Multiple lines of evidence were used to evaluate potential adverse effects on these ecological receptors. Ecological effects data were collected using small-mammal trapping arrays, a cavity-nesting bird monitoring network, seedling germination tests, earthworm mortality tests, and sediment and water toxicity tests. The assessment lines of evidence are augmented by breeding-bird field surveys, plant surveys, habitat analyses, and spatial modeling of wildlife exposure. The weight of evidence these investigations provides indicates that no adverse effects to terrestrial and aquatic receptors exist from COPECs in the Los Alamos and Pueblo watershed.

The site-specific human health risk assessment uses extended backyard and trail user exposure scenarios to represent the present-day and reasonably foreseeable future land uses in canyons throughout the watershed. Residential and resource user scenarios for San Ildefonso Pueblo land in lower Los Alamos Canyon and the construction worker scenario for Pueblo Canyon in the vicinity of a planned new wastewater treatment plant are also assessed because they represent current or planned land uses. The assessment results indicate that for trail-user and extended-backyard scenarios, no areas in the Los Alamos and Pueblo watershed have contaminant concentrations greater than levels considered to be acceptable for noncarcinogens in sediment or water (hazard index of 1) or radionuclides (dose limit of 4 mrem/yr in water and 15 mrem/yr in sediment). However, combined exposures to sediment and water at two locations, one in Acid Canyon and one in Pueblo Canyon, have estimated reasonable maximum exposure (RME) risks that exceed the cancer risk criterion of 1×10^{-5} . Reach AC-3 has the highest calculated RME risk of 3×10^{-5} for the trail user exposure scenario and 2×10^{-5} for the extended backyard exposure scenario. These potential risks are dominated by polycyclic aromatic hydrocarbons (PAHs) in surface water, with a minor contribution from PAHs in sediment. The Pueblo Canyon location (reach P-2W) has a calculated trail-user RME risk of 2×10^{-5} , also dominated by PAHs in

water. These potential risks result primarily from dermal exposure to PAHs and are probably overestimated because of several protectively biased assumptions related to the exposure assessment.

Investigation data indicate that the dominant source of PAHs is runoff from the Los Alamos townsite, not Laboratory SWMUs or AOCs. The highest concentrations of PAHs in sediment in the Los Alamos and Pueblo watershed were measured in reach AC-1, upcanyon from SWMU 0-030(g) and downcanyon from commercial and residential areas and roads in the Los Alamos townsite. Relatively high concentrations of PAHs are also present in sediment at the head of DP Canyon, which is also downcanyon from developed areas in the townsite. Similarly, the source of PAHs in water is townsite runoff. This conclusion is consistent with studies in other regions that show PAHs to be common contaminants in sediment and surface water near roads and developed areas.

For radionuclides, which are the primary contaminants derived from Laboratory SWMUs or AOCs, the highest combined dose from water and sediment for the extended backyard scenario is in reach ACS in the South Fork of Acid Canyon, at 8 mrem/yr (4×10^{-6} cancer incidence risk); 93% of this dose is from plutonium-239,240 in sediments, 2% is from plutonium-239,240 in surface water, and the remainder is from other radionuclides in sediment, including americium-241 and cesium-137. These estimates for reach ACS use data collected following sediment removal in an interim action in 2001, which met cleanup goals in an interim action plan approved by the New Mexico Environment Department (NMED). For the trail user scenario, the highest calculated dose is in reach DP-2 in DP Canyon, with a potential radionuclide dose of 2 mrem/yr (3×10^{-7} cancer incidence risk); 93% of this dose is from cesium-137 in sediments, 3% is from strontium-90 in surface water, and the remainder is from other radionuclides in sediment.

For the residential and resource user scenarios, COPC concentrations in sediment in lower Los Alamos Canyon on San Ildefonso Pueblo land are below target risk levels. For the residential scenario in this part of the canyon, noncarcinogens and carcinogens in alluvial groundwater have hazard indices ranging from 5 to 8 and incremental lifetime cancer risks (ICR) ranging from 4×10^{-5} to 2×10^{-4} . The noncarcinogen hazard index is attributed to fluoride, nitrite, nitrate, and thallium; the ICR is from arsenic. Radionuclide concentrations in alluvial groundwater are below dose limits of 4 mrem/yr for the residential scenario. The residences in the lower part of the canyon currently use potable water from a regional groundwater well. Additional residences in the area probably use regional groundwater as well. Although the target cancer risk level is exceeded in lower Los Alamos Canyon by the alluvial groundwater pathway, this exposure pathway is not complete and is therefore not representative of actual exposure conditions. Available data indicate that the COPCs are not from Laboratory SWMUs or AOCs but are either naturally occurring or from Bayo wastewater treatment plant discharges. The carcinogen, noncarcinogen, and radionuclide risk results for the construction worker scenario in Pueblo Canyon are below target risk levels.

Evaluations of the concentrations of COPCs in sediment, surface water, and alluvial groundwater indicate that concentrations are either relatively stable or are decreasing over time for COPCs derived from Laboratory SWMUs or AOCs. These decreases are associated with processes that remobilize, transport, and mix sediment- and water-borne constituents. Flooding and changes in sediment and water chemistry resulting from the Cerro Grande fire have not changed the nature of these processes but may have accelerated the rates of transport and mixing because of the increased frequency and magnitude of floods. Only minor post-fire perturbations in COPC concentrations have been observed in surface water and alluvial groundwater. Larger changes in COPC concentrations have been observed in sediment associated with the redistribution of ash derived from the Cerro Grande burn area. Radioactive decay also contributes to decreasing concentrations for some radionuclides (e.g., cesium-137, strontium-90, and tritium). The potential for impacts to human health or ecosystems from these COPCs are expected to decrease over time in the absence of new releases of contaminants. However, the concentrations of

contaminants originating in the townsite, such as PAHs, may not decrease over time because of nonpoint source runoff from urbanized portions of the watershed.

In summary, the results of this investigation indicate that, for contaminants released from Laboratory SWMUs and AOCs, human health risks are below NMED's and DOE's target levels for present-day and foreseeable future land uses, and adverse ecological effects have not been observed within terrestrial and aquatic systems in the watershed. Therefore, remedial actions are not needed to mitigate unacceptable risks. Available data indicate that potential risks or doses from Laboratory-derived COPCs either will remain relatively stable or will decrease in the absence of new contaminant sources. The analyses and conclusions in this report are predicated on present-day and foreseeable future land uses. In the event that the type or extent of land-use changes, the human health risk assessment may need to be reassessed for some parts of the watershed. Continued monitoring of sediment, surface water, alluvial groundwater, and biota is appropriate to document trends in contaminant concentrations over time and to verify conceptual models and risk assessment results. The assessments in this report form the basis for focusing the types, analytical suites, locations, and frequencies of such future monitoring.

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1.0 INTRODUCTION

1.1 Purpose

This investigation report presents the results of investigations conducted from 1996 to 2003 by Risk Reduction and Environmental Stewardship–Remediation Services (RRES-RS), formerly the Environmental Restoration (ER) Project, in Los Alamos, Pueblo, DP, and Acid Canyons (referred to in this report as the Los Alamos and Pueblo watershed). The Los Alamos Canyon watershed also includes Guaje, Rendija, Bayo, and Barrancas Canyons, but these canyons are not addressed in this report; they will be the subject of future investigations under the work plan for the north canyons (LANL 2001, 71060). Figure 1.1-1 shows the entire Los Alamos Canyon watershed and the primary subwatersheds or basins, and Figure 1.1-2 shows more detail within the primary investigation area in the Los Alamos and Pueblo watershed. The investigations reported herein address sediment, surface water (including springs), alluvial groundwater, and biota potentially impacted by solid waste management units (SWMUs) and areas of concern (AOCs) located within the Los Alamos and Pueblo watershed. The media are collectively referred to as canyons media in this report.

The investigations were conducted to fulfill the requirements of a work plan and several work plan addenda. The work plan for Operable Unit (OU) 1049, Los Alamos Canyon and Pueblo Canyon (hereafter called “the Los Alamos and Pueblo Canyons work plan” or “the work plan”) (LANL 1995, 50290), is the initial document that describes work scope and regulatory requirements for characterizing the Los Alamos and Pueblo watershed for the former ER Project. It contains a background review of SWMUs and AOCs in the watershed, the history of releases, and a review of contaminant data collected before the work plan was prepared. The New Mexico Environment Department (NMED) approved the work plan in 1997 following Los Alamos National Laboratory’s (the Laboratory’s or LANL’s) response to a notice of deficiency (NOD) (LANL 1997, 56421; NMED 1997, 56362).

Several addenda have been prepared to supplement the work plan. The sampling plan for DP Canyon (LANL 1998, 59373) and the Acid Canyon sediment sampling and analysis plan (SAP) (LANL 1999, 65144) were prepared in 1998 and 1999, respectively, to provide more complete characterization of tributaries that contain key contaminant sources within the watershed. No requests for supplemental information (RSIs), NODs, or approvals have been received from NMED for either of these addenda. The “Los Alamos and Pueblo Canyons Work Plan Addendum, Surface Water and Alluvial Groundwater Sampling and Analysis Plan” (LANL 2002, 70235) was prepared in 2002 to update the approach and scope of the surface water and alluvial groundwater investigations contained in the work plan. NMED approved this surface water and alluvial groundwater addendum in 2002 (NMED 2002, 73202). A record of communication regarding biota investigations for the Los Alamos and Pueblo Canyons investigation report further supplements the work plan by documenting meetings and agreements with NMED pertaining to a biota sampling and characterization plan (Katzman 2002, 73667).

The investigations conducted for the work plan and addenda also followed the technical strategy presented in the “Core Document for Canyons Investigations” (hereafter called “the canyons core document”, LANL 1997, 55622; LANL 1998, 57666). The canyons core document was prepared after a pilot study in Los Alamos and Pueblo Canyons was implemented in 1996, with the goal of standardizing the technical strategy for work in canyons. The core document was approved by NMED in 1998 following the Laboratory’s response to an RSI (LANL 1998, 57666; NMED 1998, 58638).

Investigations of intermediate and regional groundwater described in the work plan (LANL 1995, 50290; LANL 1997, 56421), and updated in the Laboratory’s hydrogeologic work plan (LANL 1998, 59599) and the “Los Alamos Canyon and Pueblo Canyon Intermediate and Regional Aquifer Groundwater Work Plan” (LANL 2003, 82612), are not included in this report but will be reported at a later date.

Data collected during the investigations included in this investigation report are used to describe the nature and extent of contamination within the canyon bottom; update the conceptual model for contaminant distribution and transport within the canyons; assess present-day human health and ecological risk from contaminants within the canyons; determine and make recommendations for remedial actions that may be appropriate to achieve or maintain site conditions at an acceptable risk level; and provide support for decisions at SWMUs and AOCs. The assessments in this report are conducted using data collected since 1996 by the former ER Project, to evaluate current environmental conditions. Data from prior investigations and from environmental surveillance sampling are used to help identify any temporal trends in contamination, and therefore help evaluate how potential risk may change in the future relative to present day conditions.

This investigation report is the first in the RRES-RS project to address characterization and risk assessment on such a large spatial scale: an entire canyon system, encompassing 34 km (21 mi) of canyon bottom downstream of SWMUs and AOCs. The characterization and assessment approach used in this investigation provides an integrating perspective on historical and current contaminant releases to the canyon floor and subsequent contaminant redistribution resulting from various transport processes. This approach facilitates the development of conceptual models that describe expected spatial and temporal trends in contaminant concentrations and inventory, thus supporting recommendations for long-term monitoring. The results also support the RRES-RS project's watershed approach by providing information on the extent of contamination associated with SWMUs and AOCs and SWMU and AOC aggregates in the watershed and by helping identify and prioritize remedial activities within the watershed.

1.2 Organization of Investigation Report

This investigation report has the following sections. The outline follows a format approved by the NMED on April 23, 2003 (Goering 2003, 85427). Section 1 is an introduction to the report and to the Los Alamos and Pueblo watershed. Section 2 provides background information on the sources and history of contaminant releases, previous investigations of canyons media, and remediation activities that have occurred in the watershed. Section 3 describes the scope of activities in this investigation. Section 4 introduces the field investigations. Section 5 describes the regulatory context of this investigation. Section 6 presents screening-level assessments that identify chemicals of potential concern (COPCs) and chemicals of potential ecological concern (COPECs) and that focus subsequent sections on the subset of the most important COPCs and COPECs for evaluating potential human health or environmental risk. Section 7 presents a physical system conceptual model, including discussions of the nature, sources, extent, fate, and transport of the subset of COPCs identified in Section 6. Section 8 presents baseline ecological and human health risk assessments. Section 9 presents conclusions and recommendations. Section 10 presents references cited in this report.

This investigation report has the following appendices. Appendix A presents a list of acronyms and abbreviations and a table showing conversion of metric units to US customary units. Appendix B presents field investigation methods and results. Analytical results from this investigation are contained on a compact disk and are included as Appendix C. Appendix D presents supporting information on contaminant trends and inventory. Appendix E presents supporting information on statistics and risk. Appendix F presents results from a water-level investigation in upper Los Alamos Canyon.

1.3 Watershed Description

The portion of the Los Alamos and Pueblo watershed addressed in this investigation report includes Los Alamos Canyon, Pueblo Canyon, DP Canyon, and Acid Canyon (inclusive of the South Fork of Acid Canyon [Figure 1.1-2]). The watershed heads on US Forest Service (USFS) land in the Sierra de los

Valles west and northwest of the Laboratory. The entire Los Alamos Canyon watershed, inclusive of Pueblo, Guaje, Rendija, Bayo, and Barrancas Canyons, as well as smaller tributary canyons (e.g., Acid and DP Canyons), has a combined drainage area of 153 km² (59 mi²). The highest point in the watershed is at the summit of Pajarito Mountain at an elevation of 3182 m (10,441 ft) above sea level (asl). The watershed extends eastward from the headwaters across the Pajarito Plateau for approximately 30.4 km (18.9 mi) to the confluence with the Rio Grande at an elevation of 1678 m (5504 ft) asl.

Los Alamos Canyon heads on USFS land, crosses approximately 12.8 km (8 mi) of Laboratory land, and then crosses San Ildefonso Pueblo land for approximately 7.6 km (4.7 mi) before joining the Rio Grande. Los Alamos Canyon drains an area of approximately 27.9 km² (10.8 mi²) upstream from its confluence with Pueblo Canyon and 54.4 km² (21.0 mi²) upstream from its confluence with Bayo Canyon (inclusive of Pueblo Canyon). In this report, the canyon upstream from its confluence with Pueblo Canyon is referred to as upper Los Alamos Canyon, and the canyon downstream as lower Los Alamos Canyon. Bedrock geologic units exposed within upper and lower Los Alamos Canyons include Miocene sedimentary rocks of the Santa Fe Group, Pliocene and Miocene dacites of the Tschicoma Formation, Pliocene fanglomerates of the Puye Formation, Quaternary ignimbrites of the Otowi and Tshirege Members of the Bandelier Tuff, and Quaternary pumice beds and volcanoclastic sediments of the Cerro Toledo interval (Griggs 1964, 8795; Smith et al. 1970, 9752). The part of the canyon within the Laboratory boundary is underlain by the Bandelier Tuff and the Cerro Toledo interval, except for the far eastern end where Pliocene basaltic rocks of the Cerros del Rio volcanic field are exposed.

Pueblo Canyon heads on USFS land, crosses 6.7 km (4.2 mi) of Los Alamos County land, and then crosses 4.1 km (2.5 mi) of Laboratory land where it joins Los Alamos Canyon just upcanyon of the San Ildefonso Pueblo boundary. Pueblo Canyon has a total drainage area of approximately 21.7 km² (8.4 mi²). Bedrock geologic units exposed within the watershed include Pliocene and Miocene dacites of the Tschicoma Formation, Pliocene fanglomerates of the Puye Formation, Quaternary ignimbrites of the Otowi and Tshirege Members of the Bandelier Tuff, and Quaternary pumice beds and volcanoclastic sediments of the Cerro Toledo interval (Griggs 1964, 8795; Smith et al. 1970, 9752).

DP Canyon heads on the Pajarito Plateau in the southeastern portion of the Los Alamos townsite and extends east-southeast for approximately 3.5 km (2.2 mi) to its confluence with Los Alamos Canyon. DP Canyon is located almost entirely within land owned by the US Department of Energy (DOE), except for a segment approximately 40 m (131 ft) long at the head of the canyon, on land owned by Los Alamos County. DP Canyon drains a surface area of approximately 1.5 km² (0.6 mi²) that includes a large portion of paved and developed land west of the canyon head. Bedrock geologic units exposed within DP Canyon include Quaternary ignimbrites of the Otowi and Tshirege Members of the Bandelier Tuff and Quaternary pumice beds and volcanoclastic sediments of the Cerro Toledo interval (Griggs 1964, 8795; Smith et al. 1970, 9752; Goff 1995, 49682).

Acid Canyon heads on the Pajarito Plateau in the southwestern portion of the Los Alamos townsite and extends east-northeast for approximately 1.9 km (1.2 mi) to its confluence with Pueblo Canyon. The South Fork of Acid Canyon is a short north-trending tributary to Acid Canyon with a total length of approximately 290 m (950 ft). Both of these canyons are entirely within land owned by Los Alamos County. Acid Canyon drains a surface area of approximately 1.2 km² (0.4 mi²) that, like DP Canyon, is largely paved or developed. The bedrock geologic units exposed within Acid Canyon include only Quaternary ignimbrites of the Tshirege Member of the Bandelier Tuff (Griggs 1964, 8795; Smith et al. 1970, 9752).

A comprehensive overview of the biological setting of the Los Alamos and Pueblo watershed, including vegetation and wildlife, is provided in the work plan (LANL 1995, 50290). Details on the hydrology are provided in Section 7 and Appendix B of this investigation report.

1.4 Current Land Use

The Los Alamos and Pueblo watershed contains a mosaic of land ownership and land uses. Upper Los Alamos Canyon from the USFS boundary to the San Ildefonso Pueblo boundary is owned by DOE. Currently, few or no active Laboratory operations occur in the canyon, except for environmental work. The lower part of upper Los Alamos Canyon is, however, accessed by the public from State Highway NM 4 for recreational activities such as hiking (Kron 1993, 58665.2). In addition, the Los Alamos County owns and operates an ice rink in upper Los Alamos Canyon west of Omega Bridge and a municipal water supply well just upstream from the canyon's confluence with DP Canyon (well Otowi-4). The eastern part of upper Los Alamos Canyon near State Highway NM 4 (Figure 1.1-2) is planned for conveyance and transfer either to Los Alamos County or to the US Department of the Interior to be held in trust for San Ildefonso Pueblo (DOE 1998, 58671).

Lower Los Alamos Canyon includes a short DOE-owned portion at the upper end with a southern boundary with the Tsankawi unit of Bandelier National Monument (Figure 1.1-2). The part of the canyon on Laboratory land includes a popular rock-climbing area. The remainder of lower Los Alamos Canyon is on San Ildefonso Pueblo land and is used for grazing, hunting, and other activities. It includes a service station and convenience store, as well as residences in two areas. The residential areas include three houses at Totavi above lower Los Alamos Canyon's confluence with Bayo Canyon, and one house (the Halladay House) near the confluence with the Rio Grande. The western part of lower Los Alamos Canyon near its confluence with Pueblo Canyon (within Technical Area [TA-] 72) is planned for conveyance and transfer either to Los Alamos County or to the US Department of the Interior to be held in trust for San Ildefonso Pueblo (DOE 1998, 58671).

Pueblo and Acid Canyons include land owned by Los Alamos County and DOE, all of which is open to the public (Figure 1.1-2). Present land use includes recreational activities such as hiking and bicycle riding. Trails into Pueblo Canyon near Acid Canyon are readily accessible from nearby residential areas in Los Alamos, and trails and dirt roads continue down the length of the canyon (Kron 1993, 58665.2). The lower canyon receives treated effluent from the Bayo Wastewater Treatment Plant (WWTP) located on the divide between Pueblo Canyon and Bayo Canyon. Los Alamos County also owns and operates a municipal water supply well in lower Pueblo Canyon near the White Rock Y (well Otowi-1), and the New Mexico Department of Transportation operates a highway maintenance yard in this area. In the Los Alamos County comprehensive plan, the county-owned part of Pueblo Canyon, which includes its confluence with Acid Canyon, has been designated as "scenic open space" since 1964 (Los Alamos Planning Commission 1964, 56873). The part of Pueblo Canyon on DOE land (TA-74), extending upstream from its confluence with Los Alamos Canyon, is planned for conveyance and transfer either to Los Alamos County or to the US Department of the Interior to be held in trust for San Ildefonso Pueblo (DOE 1998, 58671). There are no active Laboratory operations in TA-74, except for environmental work.

DP Canyon is located almost entirely on DOE-owned land, except for a short portion (approximately 40 m [131 ft]) at the head of the canyon behind the Knights of Columbus Hall. Present-day land use includes hiking and jogging. A trail along the south side of the canyon provides the main access through the length of the canyon (Kron 1993, 58665.2). The trail can be accessed most easily from the western portion of the canyon as well as from the lower canyon, near its confluence with Los Alamos Canyon. Portions of DP Canyon are planned for conveyance and transfer to Los Alamos County.

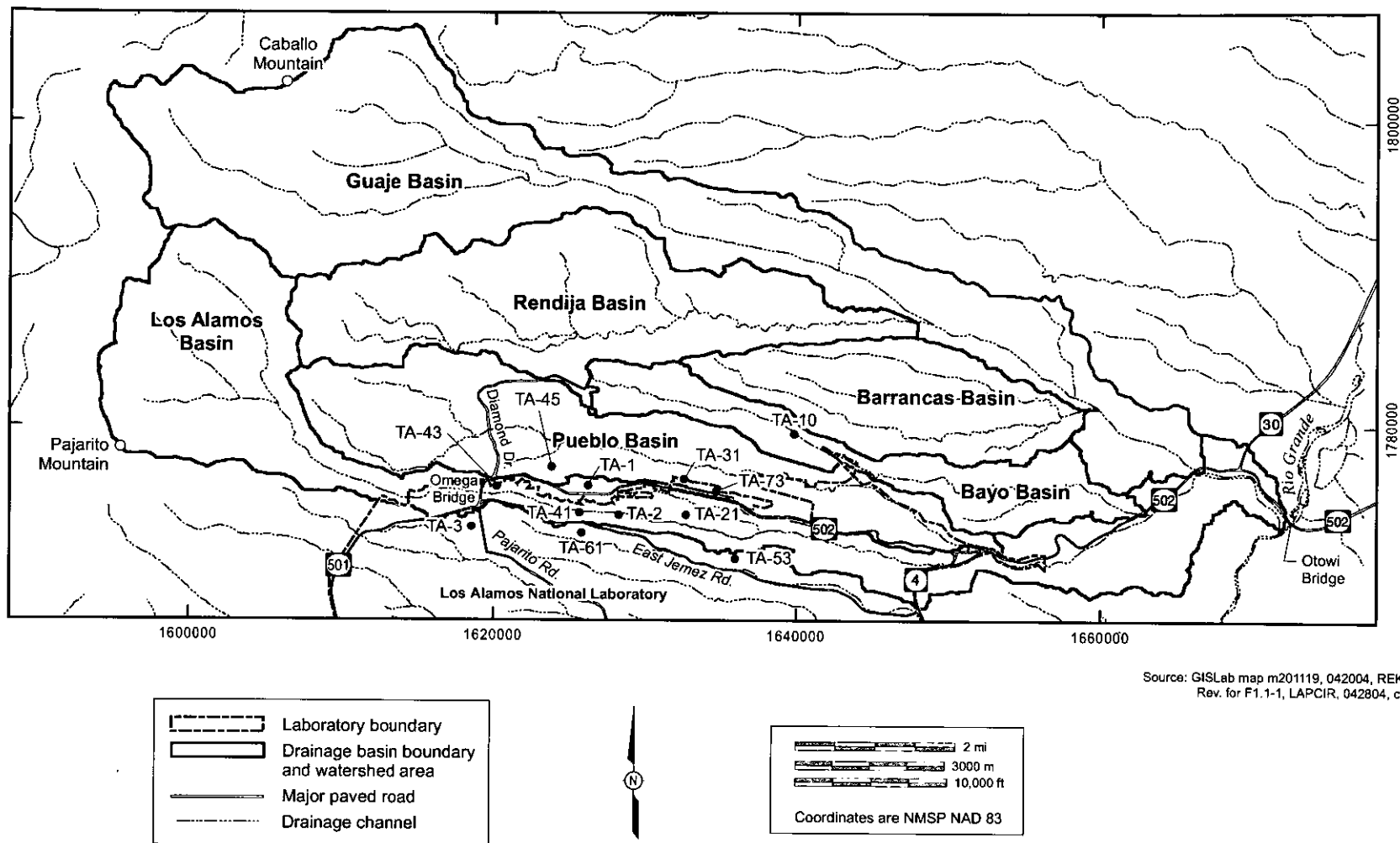


Figure 1.1-1. The Los Alamos Canyon watershed, showing major subbasins

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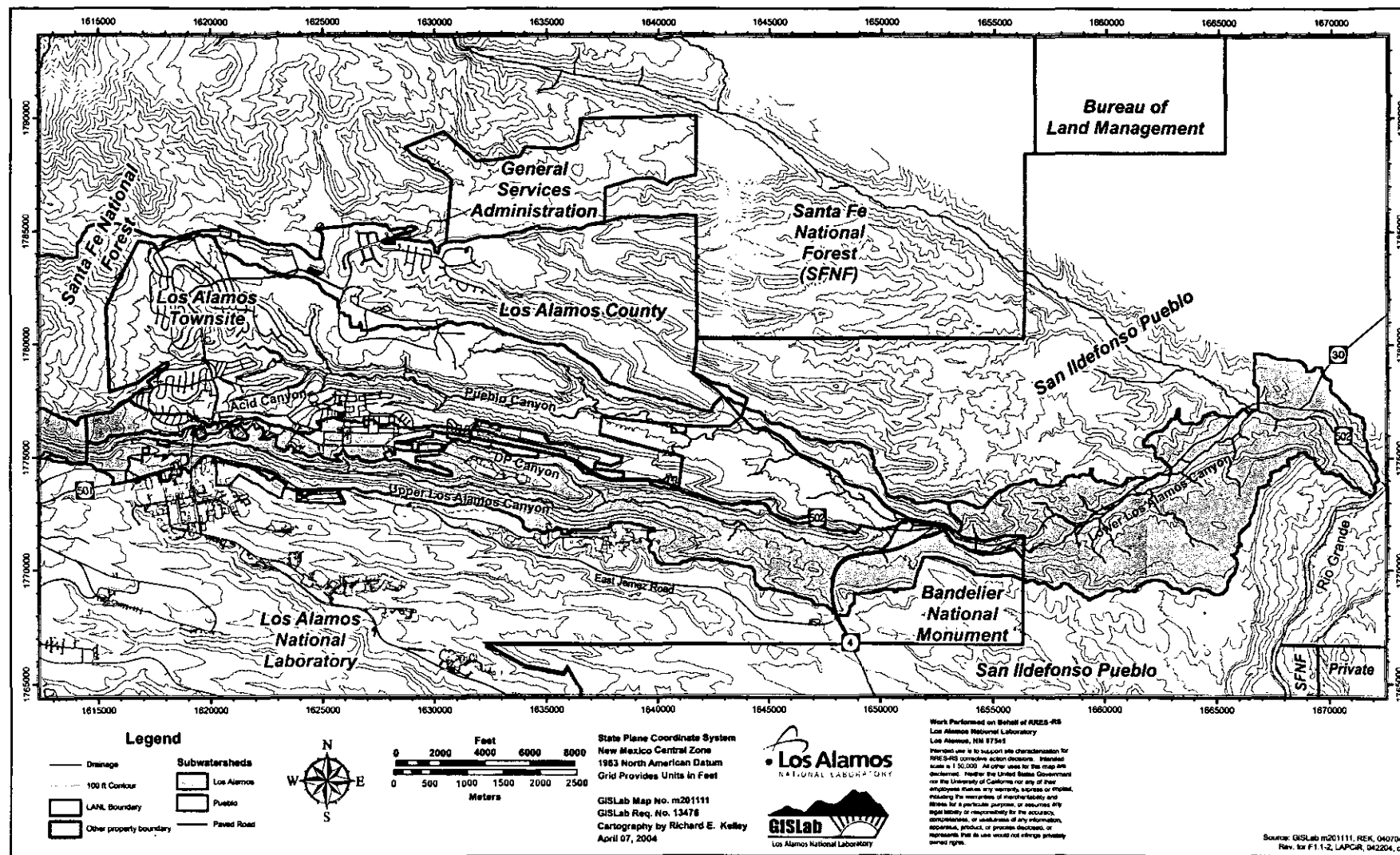


Figure 1.1-2. Los Alamos and Pueblo watershed

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2.0 BACKGROUND

Contaminants consisting of inorganic chemicals, organic chemicals, and radionuclides have been released into the Los Alamos and Pueblo watershed from a variety of sources, including Laboratory operations in several TAs and non-Laboratory sources in the Los Alamos townsite, such as roads and other paved areas, application of pesticides in headwater areas in the Santa Fe National Forest and within the townsite, and atmospheric fallout of radionuclides. Regardless of the source(s), the contaminants have been dispersed downcanyon in sediments, surface water, and alluvial groundwater. Many constituents found naturally or derived from anthropogenic sources were concentrated in ash during the Cerro Grande fire in May 2000 and also were dispersed downcanyon. The following sections summarize the sources and history of contaminant releases as well as investigations that have addressed contaminant distribution and concentration in canyons media. Remediation activities implemented to reduce contamination in the canyon bottom or in source areas are also discussed.

2.1 Sources and History of Contaminant Releases

2.1.1 TA-0

Several SWMUs and AOCs in TA-0 in the Los Alamos townsite have had known releases of contaminants into the Pueblo Canyon watershed. SWMU 0-030(g) (Plate 8) was a septic tank outfall located on the south rim of Acid Canyon in the 1940s. Radionuclides, particularly plutonium-239,240, and polychlorinated biphenyls (PCBs) are some of the primary contaminants from this SWMU and along the downcanyon drainage channel (LANL 1995, 51983; LANL 2001, 70273). SWMU 0-018(a) (Plate 8) consists of the former Pueblo Canyon WWTP located in Pueblo Canyon above the Acid Canyon confluence, which operated from 1951 until 1991. Sludge from the Pueblo Canyon WWTP contained metals above background levels (LANL 1997, 56614). SWMU 0-019 (Plate 1) is the former Central WWTP, located on the south rim of Graduation Canyon above Pueblo Canyon, which operated from 1947 until 1961 (LANL 2001, 71417). Inorganic and organic chemicals, including mercury and dichlorodiphenyltrichloroethane (DDT), are contaminants that have been found at the outfalls.

Several SWMUs or AOCs in TA-0 in Guaje and Rendija Canyons (Figure 1.1-1 and Plate 1) potentially could contribute contaminants to lower Los Alamos Canyon. These include a former pistol range and mortar impact areas in Rendija Canyon and the locations of water-supply wells in Guaje Canyon (LANL 2001, 71060). However, available data from these sites indicate that contaminant releases were small, and no impacts to stream channels have been identified in sediment samples collected downcanyon (LANL 2001, 71060).

2.1.2 TA-1 and TA-45

Outfalls located at former TA-1 and former TA-45 at the head of the South Fork of Acid Canyon and along the north rim of Los Alamos Canyon, in the current Los Alamos townsite (Figure 1.1-1; Plates 2 and 8), are sources of radionuclide and other contamination in the watershed. TA-1 was established in World War II during the Manhattan Project, and initial contaminant releases into both Acid and Los Alamos Canyons may have started as early as 1943. TA-45 was the site of the first radioactive liquid waste treatment facility at the Laboratory, and outfalls from this facility (SWMU 45-001) replaced those from TA-1 into Acid Canyon ([SWMU 1-002] Stoker et al. 1981, 6059; LANL 1992, 7668). Radioactive effluent released into the South Fork of Acid Canyon included untreated liquid waste from TA-1 from 1944 to 1951 and treated liquid waste from TA-45 from 1951 to 1964. These effluent releases are the primary sources of radionuclide contamination in Acid and Pueblo Canyons. Plutonium-239,240 is the primary contaminant of concern downcanyon from these outfalls (LANL 1995, 48856; LANL 1996, 54468;

Reneau et al. 2000, 66867), although other radionuclides and inorganic and organic chemicals are also present as contaminants below these outfalls.

The contaminated areas in TA-1 along Los Alamos Canyon are commonly referred to as Hillsides 137, 138, and 140 (the original septic tank structure numbers) and include SWMUs 1-001(c), 1-001(d), and 1-001(f), now part of consolidated SWMU 01-001(a)-99. These hillsides received discharges from outfalls from 1943 until the late 1950s (LANL 1992, 43454). Radionuclides are the primary contaminants at these hillside sites, although metals such as mercury are also present (LANL 1995, 49703; LANL 1996, 54465; LANL 1996, 54467). Many other SWMUs and AOCs occur within former TA-1 (LANL 1992, 43454), but available information on release history and available analytic data indicate that they are less important as sources of contamination to the canyon bottoms.

2.1.3 TA-2 and TA-41

TA-2 and TA-41 are located within Los Alamos Canyon downcanyon from the Omega Bridge, and both sites began to be used in 1943 (LANL 1993, 15314). TA-2 housed a series of research nuclear reactors, and TA-41 was used to develop weapons and conduct long-term studies of weapon subsystems. The Omega West Reactor (OWR) at TA-2, which operated from 1956 to 1993, was a source of tritium releases into alluvial groundwater. Other SWMUs at TA-2 include leach fields located east of Building 2-1 (SWMU 02-009(c)) and associated with water boiler reactors. Cesium-137 and strontium-90 are the primary contaminants associated with the leach fields. The primary contaminant sources at TA-41 are a septic system (SWMU 41-001) and a sewage treatment plant that operated from 1951 until 1987 (SWMU 41-002(a)-99). These SWMUs have radionuclides above background levels (LANL 1993, 15314), although TA-41 SWMUs have not been completely characterized.

2.1.4 TA-21

TA-21 (Figure 1.1-1 and Plates 1 and 3; LANL 1991, 7528) was established in 1945 on DP Mesa and was the site of a plutonium processing plant and polonium and tritium research laboratories.

SWMU 21-011(k), an outfall that discharged into DP Canyon, is the most important source of contaminants in upper Los Alamos Canyon. Between 1952 and 1986, the outfall received radioactive liquid waste effluent from industrial waste treatment plants (LANL 1991, 7529; LANL 1995, 52350; Reneau 1999, 63138). Cesium-137 and strontium-90 are the primary contaminants discharged from this outfall, although other radionuclides are also present.

SWMU 21-018(a), known as Material Disposal Area (MDA) V, received liquid waste effluent from laundry operations and included three absorption beds on the south side of DP Mesa that sometimes overflowed into Los Alamos Canyon (LANL 1991, 7529; LANL 1996, 54969). Sediment sampling in 1946 documented that plutonium from this source entered the main stream channel in Los Alamos Canyon (Kingsley 1947, 4186). Additional outfalls that discharged off the south rim of DP Mesa include SWMUs 21-023(c), 21-024(b), 21-024(c), 21-024(i), and 21-027(a) (LANL 1991, 7529; LANL 1995, 52350). SWMU 21-026(d) is a former outfall from a sewage treatment plant on the eastern part of DP Mesa, which flowed into a tributary drainage of DP Canyon (LANL 1991, 7529; LANL 1994, 31591).

From 1946 to 1985, SWMU 21-029, known as the DP Tank Farm, was a fuel distribution station with aboveground and underground fuel-storage tanks. Diesel range organic (DRO) and gasoline range organic (GRO) hydrocarbon contamination was found in DP Canyon adjacent to the site, including two areas of hydrocarbon seepage from bedrock in the DP Canyon channel that caused sheens in surface water (LANL 1996, 52270; LANL 1996, 55347.401; LANL 2001, 71303; LANL 2001, 73436).

Stack emissions from the plutonium processing plant (SWMU 21-021) were an additional source of contaminants from TA-21 (LANL 2001, 71303; LANL 2001, 73436), resulting in local levels of plutonium-239,240 in surface soils that exceed levels measured at sites away from TA-21.

Many other SWMUs and AOCs occur within TA-21 (LANL 1991, 7528; LANL 1991, 7529), including several material disposal areas, but available information on release history and available analytic data indicate that other SWMUs and AOCs at TA-21 are less important as potential sources of contaminants to the canyon bottoms than the TA-21 sites discussed above.

2.1.5 TA-53

TA-53 (Plates 1 and 4) includes a proton accelerator and associated experimental and support buildings used for research with subatomic particles and is the current site of the Los Alamos Neutron Science Center (LANL 1994, 34756). The accelerator became fully operational in 1974. Occasional releases occurred from three surface impoundments at the east end of TA-53, referred to as consolidated SWMU 53-002(a)-99 (Plate 4), which have contributed contamination to an unnamed tributary drainage that enters Los Alamos Canyon between reaches LA-2FE and LA-3W (Plates 1 and 5). The impoundments received sanitary, radioactive, and industrial wastewater from various TA-53 buildings as well as septic tank sludge from other Laboratory buildings. The northern impoundments were active from the early 1970s until 1993. The southern impoundment was active from 1985 until 1998. Inorganic chemicals, organic chemicals, and radionuclide contaminants have been found at the impoundments and in the drainage (LANL 1998, 58841; LANL 2004, 85221).

2.1.6 Other Technical Areas

SWMUs and AOCs at several other Laboratory technical areas within the upper Los Alamos Canyon watershed potentially could have contributed contamination to the canyon bottom, including TA-3, TA-43, and TA-61 (Plates 1 and 2; LANL 1993, 51977). However, no SWMUs or AOCs in these technical areas have been confirmed as contaminant sources for Los Alamos Canyon. TA-3, located south of the Omega Bridge, is a heavily developed technical area that includes the Laboratory administration building; only a small part of TA-3 drains into Los Alamos Canyon. TA-43 is a small technical area immediately north of the Omega Bridge that houses the Health Research Laboratory (LANL 1990, 7511). TA-61 is located along East Jemez Road near the Los Alamos County municipal landfill and has a few small support buildings. PCB releases have been documented at one TA-61 SWMU (61-007), located within the topographic extent of the Los Alamos Canyon watershed (LANL 1993, 51977), although surface runoff from this mesa-top site south of east Jemez Road may have been directed southward into Sandia Canyon instead of into Los Alamos Canyon. Pueblo Canyon may also have received contamination from operations at former TA-31 and former TA-73 near the Los Alamos airport (Plates 1 and 4). TA-31 was known as the east receiving yard, and PCBs were detected at the mouth of a former septic tank outfall pipe ([SWMU 31-001] LANL 1995, 57050). Potential contaminant sources at TA-73 include a landfill, a septic system, and an incinerator that burned municipal and Laboratory wastes (LANL 1992, 7667). An ash pile from a former incinerator, SWMU 73-002 (Plate 4), was found to contain inorganic and organic chemical contaminants (LANL 1997, 56606).

SWMUs and at former TA-10 in Bayo Canyon (Figure 1.1-1 and Plate 1) potentially could have contributed contaminants to lower Los Alamos Canyon. However, no impacts to stream channels have been identified in sediment samples collected downcanyon of TA-10 (LANL 2001, 71060).

2.1.7 Urban Runoff

Large parts of the Los Alamos and Pueblo watershed above their confluence are urbanized, and runoff from developed areas transport various contaminants associated with urban areas into the canyons. Contaminants commonly found below urban areas include constituents in motor oil, gasoline, diesel, and asphalt, road salt, PCBs, heavy metals, and pesticides (Edwards 1983, 82302; Lopes and Dionne 1998, 82309; Walker et al. 1999, 82308; Breault and Granato 2000, 82310; van Metre et al. 2000, 82262). Polycyclic aromatic hydrocarbons (PAHs), suspected carcinogens that are frequently associated with vehicle usage and asphalt, are a common class of contaminants associated with urban areas (Edwards 1983, 82302; Lopes and Dionne 1998, 82309; van Metre et al. 2000, 82262). Metals that have been identified as associated with runoff from roads include cadmium, chromium, copper, lead, nickel, and zinc (Walker et al. 1999, 82308; Breault and Granato 2000, 82310).

2.1.8 Pesticide Spraying

DDT was a commonly used insecticide from the 1940s until 1972, when its use was banned in the United States. There is a documented report of aerial spraying of DDT by the USFS in the Santa Fe National Forest east of the Los Alamos townsite for spruce budworm in 1963 (LASL 1963, 64879), which would have been primarily confined to the mixed conifer community in the upper parts of the Los Alamos and Pueblo watershed. Surface runoff and wind may have distributed trace levels of DDT and its metabolites into the canyons. It is also likely that DDT was used by both Laboratory grounds crews and residents of Los Alamos until it was banned. Other pesticides were, and still are, used for landscaping in the watershed, and their use constitutes a potential source of contamination in sediments and water.

2.1.9 Cerro Grande Fire

In May 2000 the Cerro Grande fire burned approximately 18.4 km² (4540 acres) in the headwaters of Los Alamos and Pueblo Canyons (BAER 2000, 72659), constituting 37% of the watershed above their confluence. The fire also burned approximately 45.8 km² (11,330 acres) in the Guaje and Rendija Canyon watershed, which drains into lower Los Alamos Canyon. In total, about 42% of the entire 153 km² (59 mi²) of the Los Alamos Canyon watershed burned. Various naturally occurring inorganic chemicals (e.g., barium, cobalt, and manganese) and anthropogenically created fallout radionuclides (e.g., cesium-137, plutonium-239,240, and strontium-90) were concentrated in ash at levels exceeding that of background sediments before the fire, and the transport of ash has resulted in elevated levels of these materials in post-fire sediment deposits in the canyons (Katzman et al. 2001, 72660; Kraig et al. 2002, 85536; Johansen et al. 2003, 82312). Elevated levels of inorganic chemicals and radionuclides that can be attributed to the transport of ash are also found in stormwater samples in Los Alamos and Pueblo Canyons (Johansen et al. 2001, 82264; Gallaher et al. 2002, 82265).

2.2 Contamination in Canyons Media

Contamination in sediment, surface water, and alluvial groundwater in the Los Alamos and Pueblo watershed has been evaluated in many studies prior to this report, dating back to the first sampling of sediment and surface water in 1946 (Kingsley 1947, 4186). This previous work has documented the presence of elevated levels of inorganic chemicals, organic chemicals, and radionuclides in canyon media and has evaluated the potential effects of contaminants on biota. This work has also documented the transport of contaminants the full length of the watershed from SWMUs and AOCs to the Rio Grande and the dispersion of contaminants laterally away from the stream channels by floods. Some key studies, summarized below, provide background and supplemental data for the investigations presented in this report. Information from these studies is also included in subsequent sections of this report.

2.2.1 Environmental Surveillance Program

The Laboratory's Environmental Surveillance Program has sampled and analyzed sediments, surface water, and alluvial groundwater at numerous locations in the Los Alamos and Pueblo watershed since 1970. This work, reported in annual Environmental Surveillance reports (e.g., ESP 2001, 71301; ESP 2002, 73876; ESP 2004, 83635) and in other reports (e.g., Purtymun 1971, 4795; Purtymun et al. 1990, 6992; Gallaher and Efurd 2002, 82602; Gallaher et al. 2002, 82265; Gallaher et al. 2004, 85438), supports the evaluation of long-term trends in contamination in different media and an understanding of the role of stormwater transport.

2.2.2 Environmental Sciences Group

The Laboratory's Environmental Science Group conducted a series of detailed studies of radionuclides in sediments within the Los Alamos and Pueblo watershed in the 1970s; this group has also conducted ecological investigations in contaminated canyon-bottom areas (Hakonson et al. 1973, 4974; Hakonson and Bostick 1976, 29678; Nyhan et al. 1976, 11746; Nyhan et al. 1976, 11747; Nyhan et al. 1982, 7164). This work included documenting downstream changes in contaminant concentrations and relations between contaminant concentration and sediment particle size in the canyon below the outfalls into the South Fork of Acid Canyon and into DP Canyon.

2.2.3 Formerly Utilized Sites Remedial Action Program

In the late 1970s, the Formerly Utilized Sites Remedial Action Program (FUSRAP) conducted investigations of contamination in sediment deposits downcanyon from the former Manhattan Project outfalls into the South Fork of Acid Canyon (Stoker et al. 1981, 6059). This work estimated the spatial distribution and inventory of plutonium in the watershed, extending to the Rio Grande, and provided an important framework for later studies. A risk assessment derived from the FUSRAP investigations is contained in Ferenbaugh et al. (1994, 58672).

2.2.4 Arizona State University

Graf (1994, 55536), from Arizona State University, prepared an estimated plutonium budget for the northern Rio Grande watershed, including estimated contributions from Los Alamos Canyon relative to the redistribution of atmospheric fallout. Subsequently, Graf (1996, 55537) combined geomorphic mapping with existing data on plutonium concentrations in sediment to prepare a revised estimate of the spatial distribution and inventory of plutonium in the Los Alamos and Pueblo watershed. The basic geomorphic approach used by Graf provides the framework for the investigation of contaminated sediments presented in this report.

2.2.5 Ecology Group

The Laboratory's Ecology Group has conducted studies on the uptake of contaminants by biota in Los Alamos and Pueblo Canyons. These studies include a garden plot experiment in an area in upper Los Alamos Canyon where the highest levels of radionuclides had been found (Fresquez et al. 1998, 58972) and a study addressing potential uptake of contaminants by peregrine falcons (Podolsky 2000, 73477). Additional studies by the Ecology Group were conducted as part of this investigation and are summarized in Section 8.1

2.2.6 Environmental Restoration Project

Since 1996, the former ER Project, now RRES-RS, has conducted detailed studies of canyons media in the Los Alamos and Pueblo watershed. Much of this work has been reported previously (Reneau et al. 1998, 59159; Reneau et al. 1998, 59160; Reneau et al. 1998, 59667; Katzman et al. 1999, 63915; Reneau et al. 2000, 66867; Reneau et al. 2002, 73660; Reneau et al. 2003, 79271). Supplemental data on contamination in canyons media are available through other ER Project reports (e.g., LANL 1995, 48856; LANL 1996, 54468; LANL 2001, 70273). The work presented in this investigation report builds on these previous studies.

2.2.7 NMED and EPA

The NMED and the US Environmental Protection Agency (EPA) and their subcontractors have collected and analyzed samples from canyons media in the Los Alamos and Pueblo watershed as part of oversight activities (e.g., Dale 1996, 58930; Yanicak et al. 1999, 70670; Hanlon-Mayer and Jacquez 2000, 82261; EPA 2001, 70669; EPA 2001, 73292; NMED 2001, 73291; NMED 2002, 73293; NMED 2002, 83421; Ford-Schmid 2003, 82606). These data provide supplemental information about contamination in the watershed.

2.2.8 Post-Cerro Grande Environmental Assessments

A considerable amount of environmental characterization has been conducted in the Los Alamos and Pueblo watershed since the Cerro Grande fire to support assessments of potential impacts to human health and the environment resulting from post-fire floods. Results from the sampling and characterization of potential contaminants in ash, stormwater runoff, sediment, and groundwater have been previously presented in multiple reports (ESP 2001, 71301; Johansen et al. 2001, 82312; Katzman et al. 2001, 72660; ESP 2002, 73876; Gallaher et al. 2002, 82265; Katzman et al., 2002; Kraig et al. 2002, 85536; ESP 2004, 83635). A vadose zone and groundwater monitoring network was installed to determine if downward migration of contaminants occurs behind the low-head weir installed in the lower part of upper Los Alamos Canyon (Stone 2002, 73446), and results of tracer tests at the weir are reported in Newell (2004, 85430). Additional work has been conducted that evaluates erosion and deposition in the canyon bottoms and sediment and contaminant transport (e.g., Lyman et al. 2002, 82608; Malmon et al. 2002, 82648; Crowell et al. 2003, 82666; Wilson et al. 2003, 82549).

In the first two years after the Cerro Grande fire, three risk assessments were conducted to evaluate potential human health exposures. These assessments addressed potential exposures in lower Los Alamos Canyon on San Ildefonso Pueblo land, the Rio Grande, and Cochiti Reservoir resulting from contaminants carried by floods that drained Los Alamos and Pueblo Canyons. One was conducted by the Interagency Flood Risk Assessment Team (IFRAT), a multi-agency group composed of personnel from the NMED, DOE, EPA, the Laboratory, and the New Mexico Department of Health (IFRAT 2002, 85429). The Risk Assessment Corporation (RAC) conducted another assessment (RAC 2002, 85431) on behalf of the NMED DOE Oversight Bureau (OB). A third assessment was conducted by the Laboratory (Kraig et al. 2002, 85536). These assessments provide supplemental information to the assessments presented in this investigation report.

2.3 Remediation Activities

Several remediation activities in the Los Alamos and Pueblo watershed since the beginning of this investigation in 1996 have reduced the concentrations and inventory of contaminants either in canyon

media or in source areas that were susceptible to erosion and transport into a canyon. The activities most relevant to this investigation are summarized below.

2.3.1 Reach LA-2E

Excavation of contaminated sediment deposits occurred in reach LA-2E (Plates 1 and 4) in upper Los Alamos Canyon in June 2000 (MK 2000, 70741). This sediment removal targeted the area with the highest identified concentrations of cesium-137 and strontium-90 in Los Alamos Canyon, which was considered susceptible to erosion by floods following the Cerro Grande fire. An estimated 550 m³ (720 yd³) of sediment were removed with an estimated inventory of about 15.8 mCi of cesium-137.

2.3.2 Reach ACS

Excavation of contaminated sediment deposits occurred in reach ACS in the South Fork of Acid Canyon (Plates 1 and 8) in September through November of 2001 associated with an interim action ([IA] Reneau et al. 2002, 73660). This sediment removal was targeted at the area with the highest identified concentrations of plutonium-239,240 in the Los Alamos and Pueblo watershed, with the goal of reducing potential radiation doses to recreational users of the canyon. An estimated 369 m³ (483 yd³) of sediment were removed, reducing the potential radiation dose by about half.

2.3.3 SWMU 21-011(k) and Reach DP-2

Excavation of contaminated soil below the SWMU 21-011(k) outfall (Plate 3) has occurred in two separate remedial actions. In 1996, approximately 298 m³ (390 yd³) of radioactively contaminated soil and rock on the upper hillslope below the outfall were removed in an IA (LANL 1997, 55648). In 2002 and 2003, an additional 1410 m³ (1845 yd³) of material on the lower hillslope were removed in a voluntary corrective measure (VCM) to reduce potential radiation doses to recreational users of the canyon (LANL 2003, 82260). Cesium-137 was the primary contributor to potential dose. The 2003 activities also included removing about 9 m³ (12 yd³) of sediment with the highest concentrations of cesium-137 in reach DP-2 (Plate 3; LANL, 2003, 82260, p. 25).

2.3.4 TA-2

Various remedial actions, including soil removal and decontamination and decommissioning (D&D), have occurred at TA-2 in the bottom of Los Alamos Canyon (Plates 1 and 3) after the Cerro Grande fire. These actions were taken to reduce the risk of contaminants dispersing from post-fire floods. Approximately 41 m³ (54 yd³) of soil contaminated with cesium-137 was removed in 2000, following an extensive field survey for gross gamma radiation (LANL 2001, 70352). The OWR and associated structures underwent D&D in 2002 and 2003 (WD3 2003, 82646). After all structures at TA-2 were removed, field radiological surveys were conducted to confirm that surface contamination release limits had not been exceeded (WD3 2003, 82646, pp. 18–19).

2.3.5 TA-53 Lagoons

Sludge contaminated with inorganic and organic chemicals and radionuclides was excavated from the TA-53 impoundments (consolidated SWMU 53-002[a]-99; Plate 4), in IAs in 2000 and 2002 (LANL 2004, 85321). In 2002, 68 m³ (90 yd³) of soil and sediment in the most contaminated part of the drainage on the mesa top east of the impoundments were also excavated from a 6-m by 30-m [20-ft by 98-ft] strip along the drainage (LANL 2004, 85321, pp. F-8 and F-14).

2.3.6 DP Tank Farm

Contaminated soil at the DP Tank Farm (SWMU 21-029, Plate 3) was excavated in a voluntary corrective action (VCA) in 1996. Approximately 1315 m³ (1720 yd³) of petroleum-contaminated soil were removed from the site, meeting cleanup levels for benzene, toluene, ethylbenzene, and xylene (BTEX) and total petroleum hydrocarbons (TPHs) [LANL 1996, 55347.401].

2.3.7 Central WWTP

Contaminated soil at the former Central WWTP and associated outfalls into Graduation Canyon (SWMU 0-019; Plate 1) was excavated in VCAs in 1999 and 2001. Approximately 5 m³ (7 yd³) of soil contaminated with metals and organic chemicals, including DDT, were removed from below the outfalls in the VCAs (LANL 2001, 71417, p. 19).

3.0 SCOPE OF ACTIVITIES

The scope of activities of this report include investigations of sediment, surface water, alluvial groundwater, and biota in the Los Alamos and Pueblo watershed, as presented in the NMED-approved Los Alamos and Pueblo Canyons work plan (LANL 1995, 50290; LANL 1997, 56421), subsequent addenda, and related documents (LANL 1998, 59373; LANL 1999, 65144; Katzman 2002, 73667; LANL 2002, 70235). These investigations are discussed below.

3.1 Sediment Investigations

The sediment investigations presented in this report focused on characterizing the nature, extent, concentrations, and inventory of contaminants in post-1942 sediment deposits in a series of reaches in the Los Alamos and Pueblo watershed. Data from these reaches are used to evaluate potential human health and ecological risks and to identify spatial trends in contamination at a watershed scale, including variations in contaminant concentration and inventory at increasing distances from source areas and temporal trends in contamination. The investigation methods are discussed in Section 4 and Appendix B, Section B-1, of this report; in the Los Alamos and Pueblo Canyons work plan (LANL 1995, 50290; LANL 1997, 56421); in the canyons core document (LANL 1997, 55622; LANL 1998, 57666); and in prior reports on sediment investigations in these canyons (Reneau et al. 1998, 59159; Reneau et al. 1998, 59160; Reneau et al. 1998, 59667; Katzman et al. 1999, 63915; Reneau et al. 2000, 66867; Reneau et al. 2002, 73660; McDonald et al. 2003, 76084).

The scope of this investigation originally included nine investigation reaches in Los Alamos and Pueblo Canyons, as presented in Section 7.2.2.1 of the work plan (LANL 1995, 50290; LANL 1997, 56421; pp. 79–7-13). The original scope also included collecting background sediment samples from Guaje, Los Alamos, and Pueblo Canyons. The scope of work subsequently increased, as discussed below. Table 3.1-1 lists the sediment investigation reaches and the years in which samples were collected in each reach. Table 3.1-1 also provides abbreviations for reach names included in this report and the approximate length and distance of each reach from the Rio Grande, as well as additional information on the reaches. Figure 3.1-1 and Plate 1 show the location of the investigation reaches within the Los Alamos and Pueblo watershed.

During initial implementation of the work plan in 1996 and 1997, additional investigation areas were added in Los Alamos and Pueblo Canyons to better identify contaminant sources and to characterize variations in contamination in these canyons. These new areas were designated “subreaches” (Reneau et al. 1998, 59159, p. 1-5; Reneau et al. 1998, 59160, p. 1-11; Reneau et al. 1998, 59667, p. 1-6). Some of the original reaches were also subdivided into subreaches where they spanned tributary confluences (e.g., reach LA-2 was subdivided into LA-2W and LA-2E, up- and downcanyon from DP Canyon, respectively). For simplicity, reaches and subreaches are collectively referred to as “reaches” in the remainder of this report.

The scope of the investigation was further increased in 1998 and 1999 by adding reaches in DP Canyon and Acid Canyon to characterize these important tributary canyons (LANL 1998, 59373; LANL 1999, 65144). Additional reaches were added in upper Los Alamos and Pueblo Canyons in 1999, 2000, and 2001 to address data needs identified in the initial reports (Reneau et al. 1998, 59159, p. 6-6; Reneau et al. 1998, 59160, p. 6-6). These data needs included evaluating a gamma radiation anomaly in Los Alamos Canyon below DP Canyon that was identified in aerial surveys (Fritzsche 1990, 58971); evaluating possible contributions from a tributary canyon draining TA-53 in this same area; evaluating the sources and concentrations of organic chemicals in upper Los Alamos Canyon; and evaluating the sources and concentrations of inorganic and organic chemicals in Pueblo Canyon above Acid Canyon.

This investigation report also includes data from the 2000 and 2001 sampling of sediment deposits that post-date the Cerro Grande fire of May 2000. The Laboratory conducted this sampling outside the scope of the work plan and subsequent addenda to evaluate how post-fire floods affected contaminant concentrations and trends in sediment deposits. Post-fire sediment deposits were sampled in Los Alamos and Pueblo Canyons and in other fire-affected canyons that do not contain Laboratory SWMUs and AOCs. The post-fire sampling was conducted in previously investigated reaches, as well as in reaches not previously sampled. Samples of ash and flood deposits from locations upgradient of the Laboratory or in other canyons were also collected to establish baseline concentrations in ash and post-fire sediment (LANL 2000, 69054). Post-fire sampling is summarized in Section B-4 of Appendix B, and in Katzman et al. (2001, 72660) and Kraig et al. (2002, 85536) present the results of some of this work.

Sediment characterization was also conducted to support the biota investigations according to the study plan presented in Katzman (2002, 73667). This sampling was conducted to provide additional data to support the assessment of potentially unacceptable adverse ecological effects from contamination found in sediment. This characterization included resampling previously sampled sediment layers in some reaches and collecting samples at new locations in other reaches. Details of the methodology are presented in Section B-3 of Appendix B.

3.2 Surface Water and Alluvial Groundwater Investigations

The water investigations presented in this report focus on characterizing the nature, extent, and concentrations of contaminants in persistent surface water and alluvial groundwater in the Los Alamos and Pueblo watershed. Data from these media are used to evaluate potential human health and ecological risk as well as to identify spatial trends in contamination at a watershed scale, including variations in contaminant concentration at increasing distances from the source areas and as a function of seasonal and annual hydrologic variations. Data from these media are also used to identify temporal trends in contamination. This work involved sampling persistent surface water, including springs; drilling and installing alluvial groundwater monitoring wells and piezometers; sampling new and pre-existing alluvial groundwater wells; measuring variations in alluvial groundwater levels; and conducting a potassium-bromide tracer study in DP Canyon. Persistent surface water generally refers to effluent-supported flow, standing water in bedrock pools in the channel, snowmelt runoff, and other surface water not related to short-duration stormwater runoff (Section 7.2 further discusses the hydrology of the watershed). The investigation methods are discussed in Section 4.2 and Appendix B, Section B-2.1, of this report. The scope of the investigation is described in the work plan (LANL 1995, 50290; LANL 1997, 56421) and subsequent addenda (LANL 1998, 59373; LANL 2002, 70235). The investigation activities described above are discussed in the following sections.

3.2.1 Monitoring Well and Piezometer Installations

Alluvial monitoring wells were installed in Los Alamos Canyon in 1994 to fulfill the requirements of the Resource Conservation and Recovery Act (RCRA) facility investigation (RFI) work plan for OU 1098 (LANL 1993, 15314), which addresses TA-2 and TA-41 in Los Alamos Canyon. Additional alluvial monitoring wells were installed from 1996 through 1998 as required by the Los Alamos and Pueblo Canyons work plan (LANL 1995, 50290; LANL 1997, 56421). Piezometers were installed in upper Los Alamos Canyon in 2001 for collecting water-level measurements to evaluate spatial variations in groundwater recharge from alluvium to underlying bedrock units. Well completion diagrams and geologic logs for these wells and piezometers are provided in the report "Alluvial Groundwater Monitoring Well Completions, 1994–2001" (LANL 2001, 73307). Other alluvial monitoring wells installed in Los Alamos Canyon from 1966 to 1970 for surveillance monitoring were used in these investigations (John et al. 1966, 8796; Purtymun 1995, 45344). In 1989, additional wells were installed in Los Alamos Canyon to

increase monitoring coverage. Well completion diagrams and geologic logs for these early wells are compiled in Purtymun (1995, 45344). Plate 1 shows the locations of the alluvial monitoring wells and piezometers in the Los Alamos and Pueblo watershed.

3.2.2 Surface Water and Alluvial Groundwater Sampling

Since 1994, the former ER Project, now RRES-RS, has conducted alluvial groundwater and surface water investigations in the Los Alamos and Pueblo watershed, supplementing years of data collected by the Laboratory's Environmental Surveillance Program. The early ER Project investigations were conducted to address characterization requirements presented in the RFI work plan for OU 1098 (LANL 1993, 15314), the Los Alamos and Pueblo Canyons work plan (LANL 1995, 50290; LANL 1997, 56421), and the sampling plan for DP Canyon (LANL 1998, 59373). The sampling conducted addressed only portions of the watershed and focused primarily on characterizing alluvial groundwater and springs, although some surface water sampling was also performed. More recently, alluvial groundwater and surface water investigations were conducted to meet the characterization requirements described in the "Los Alamos and Pueblo Canyons Work Plan Addendum, Surface Water and Alluvial Groundwater Sampling and Analysis Plan" (LANL 2002, 70235). The addendum updated the approach initially presented in the work plan by selecting wells and surface water locations for sampling based on bounding of key potential contaminant sources and collecting data useful for assessing human health and ecological risk. A list of alluvial groundwater monitoring wells and surface water sites in the addendum and the rationale for selecting each sample site is presented in Table 3.2-1. Other wells and surface water locations in the watershed have been sampled but are not included in Table 3.2-1. Figure 3.2-1 shows the locations of the sample sites listed in Table 3.2-1. Plate 1 shows those same locations as well as additional monitoring wells, surface water sampling locations, and production wells in the Los Alamos and Pueblo watershed.

Additional sampling of alluvial groundwater and surface water was conducted following the Cerro Grande fire to evaluate the potential effects on the nature and extent of contamination related to perturbations in the hydrology and aqueous geochemistry of the alluvial system. In the summer of 2000, following the fire, samples were collected approximately each month from representative alluvial groundwater monitoring wells and surface water locations. The data are presented and evaluated in this report. The first post-fire sampling of alluvial groundwater, surface water, and ash was conducted in June 2000, shortly after the fire, to provide a post-fire baseline for comparison with water-quality data collected after flooding had occurred. The baseline data were presented in several summary reports (LANL 2000, 68304; LANL 2000, 68302; LANL 2000, 68303; LANL 2000, 68690; LANL 2000, 68689).

Surface water sampling was also conducted according to the study plan described in Katzman (2002, 73667) to support the biota investigations discussed in Section 4.3. The sampling sites were selected using the results of a data screen conducted as part of developing the study plan. This surface water sampling was conducted specifically to characterize the site water used in the toxicity tests involving the midge *Chironomus tentans* (Katzman, 2002, 73667, and Section 8.1 of this report).

3.2.3 Water-Level Measurements

Both manual and automated water-level data have been collected from alluvial monitoring wells and piezometers in the Los Alamos and Pueblo watershed. Manual water-level measurements began in 1994 to support a water-balance study in upper Los Alamos Canyon (Gray 1997, 58208). Manual water-level measurements were taken at a series of alluvial groundwater wells in Los Alamos, DP, and Pueblo Canyons. Table 3.2-2 shows the list of wells and period of record for the manual water-level data for each well. Details of the field methodology and results are presented in Section B-2.2 of Appendix B.

Automated, high-frequency water-level data were collected with multiparameter downhole probes installed in alluvial groundwater wells in Los Alamos and Pueblo Canyons. The probes were installed in August 2000 and operated continuously through September 2003. The probes were used to monitor water level, temperature, electrical conductivity, pH, and dissolved oxygen. Pressure transducers were also used to collect high-frequency water-level data in several piezometers and piezometer nests that were installed in upper Los Alamos Canyon in 2001. The pressure transducers were placed in each of these piezometers in 2001 and have operated more or less continuously since, although some probes were removed from some of the piezometers for a few months. Table 3.2-3 lists the wells and piezometers monitored and the period of record for each well. Details of the field methodology and the monitoring results are presented in Section B-2.3 of Appendix B.

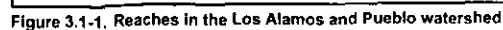
3.2.4 DP Canyon Tracer Study

A tracer study was conducted in DP Canyon to fulfill a requirement in the sampling plan for this canyon (LANL 1998, 59373). The study was conducted to determine the nature of the hydrologic connection between alluvial groundwater in reach DP-2 and DP Spring (Figure 3.1-1). The study used existing alluvial monitoring wells LAUZ-1 and LAUZ-2 and a series of newly-installed multilevel monitoring well nests for collecting groundwater samples, nested piezometers for water-level measurements, and boreholes drilled along the margins of the valley floor in DP-2 to determine the extent of alluvial groundwater saturation. The new wells and boreholes were installed in fall 2002. Well completion diagrams and borehole logs are included in the "Report on Alluvial Well and Piezometer Completions in DP Canyon, Reach DP-2" (LANL 2004, 85537). Automated surface water samplers were also deployed in several locations along the DP Canyon channel to evaluate the hydrologic connection between the alluvial groundwater and surface water. DP Spring was monitored manually and with an automated surface water sampler.

A potassium bromide tracer was injected into the alluvial groundwater in February 2003 and was monitored at all the sampling sites through August 2003. Because bromide is a conservative anion in solution, monitoring variations in concentration over time in numerous multiple-level well nests, surface water, and in DP Spring generated data to characterize the hydrogeology from DP-2 downgradient to DP Spring. A surface direct-current (DC) resistivity survey was conducted in DP-2 to further evaluate the hydrology and to support the tracer study. The results of the resistivity survey are used to evaluate the extent of saturation and to investigate potential groundwater recharge from alluvium to underlying bedrock units. (LANL 2004, 84540). The design and results of the tracer study and the resistivity survey are discussed in Appendix B-2.4.

3.3 Biological Investigations

The biological investigations presented in this report focused on characterizing the potential for adverse effects of contaminants in post-1942 sediment deposits and surface water on terrestrial and aquatic ecological receptors. These investigations fulfill the general objectives identified in the work plan (LANL 1995, 50290; LANL 1997, 56421), in the canyons core document (LANL 1997, 55622; LANL 1998, 57666), and in previous sediment investigation reports on these canyons (Reneau et al. 1998, 59159; Reneau et al. 1998, 59160; Reneau et al. 1998, 59667; Katzman et al. 1999, 63915; Reneau et al. 2000, 66867; Reneau et al. 2002, 73660). These investigations build upon the results obtained from sediment and surface water characterization, and the basis for the investigation approach is documented in Katzman (2002, 73667). The investigation methods are discussed in Section 4.3 and Section B-3.0 in Appendix B of this report.



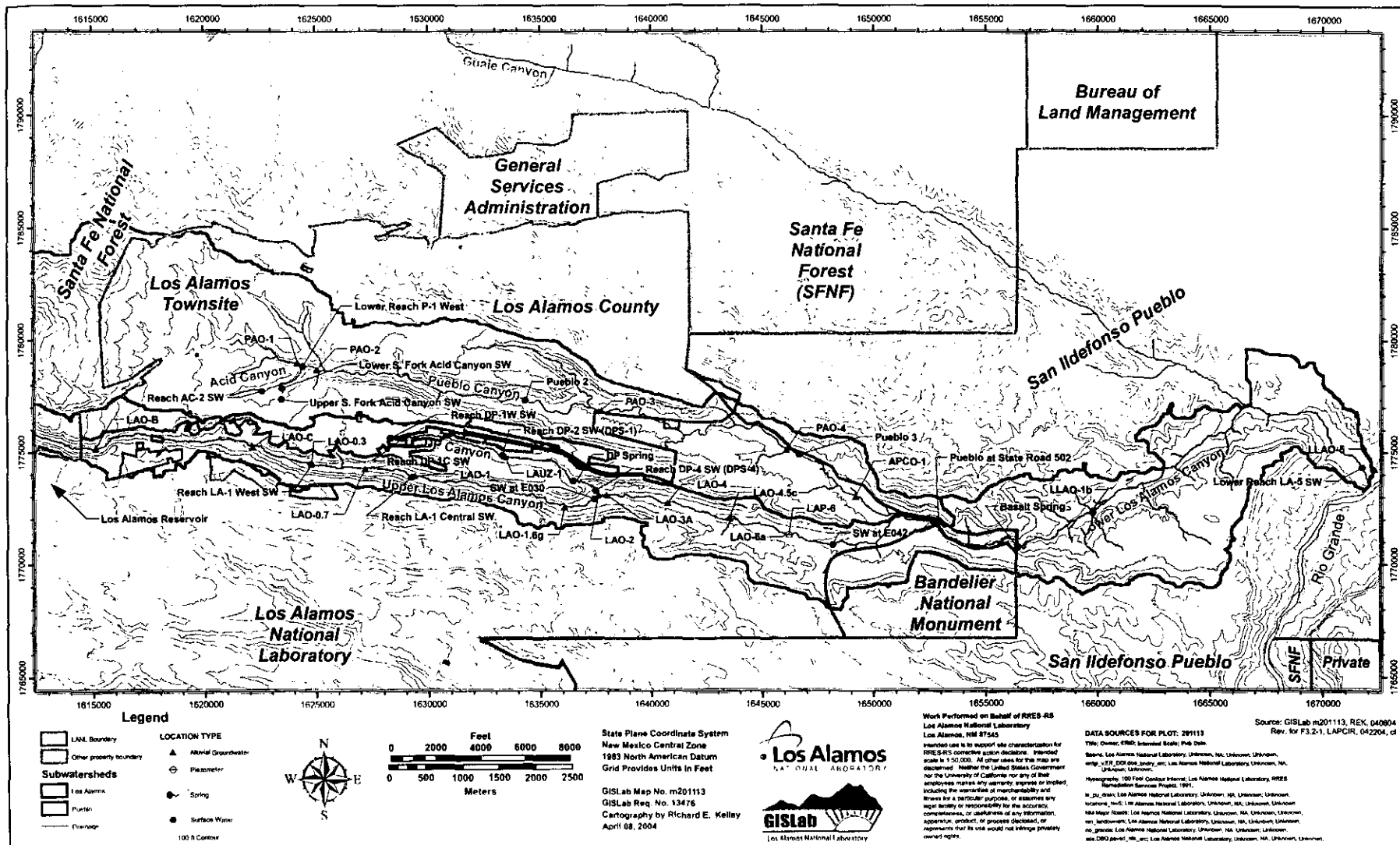


Figure 3.2-1. Water sampling locations in the Los Alamos and Pueblo watershed

Table 3.1-1
Sediment Investigation Reaches in the Los Alamos and Pueblo Watershed

Subwatershed	Investigation Reach ^a	Reach Abbreviation	Approximate Distance from Rio Grande to Midpoint of Reach (km)	Reach Length (km)	Year(s) of Sample Collection	Notes
Acid Canyon	AC-1	AC-1	19.08	0.04	1999, 2000, 2002	Baseline reach upcanyon from SWMU 0-030(g) drainage and downcanyon from townsite
	AC-2	AC-2	18.77	0.09	1999, 2000	Downcanyon from SWMU 0-030(g) drainage (in 2 parts)
	ACS	ACS	18.62	0.29	1999, 2000, 2001	South Fork of Acid Canyon
	AC-3	AC-3	18.27	0.42	1996, 1997, 1999, 2000, 2002	Downcanyon from South Fork of Acid Canyon
DP Canyon	DP-1 West	DP-1W	16.39	0.07	1998, 2002	Baseline reach upcanyon from DP Tank Farm and downcanyon from townsite
	DP-1 Central	DP-1C	16.29	0.10	1998, 2002	Downcanyon from DP Tank Farm
	DP-1 East	DP-1E	15.47	0.10	1997, 1998	— ^b
	DP-2	DP-2	14.69	0.32	1997, 1998, 2002	Downcanyon from SWMU 21-011(k)
	DP-3	DP-3	13.85	0.21	1997, 1998	—
	DP-4	DP-4	13.12	0.45	1996, 1997, 1998, 2002	Up canyon from Los Alamos Canyon
Guaje Canyon	Guaje	Guaje	12.76	0.50	2002	Reference reach for small-mammal trapping; not mapped
	GU-background	GU-BKG	10.85	0.61	1996, 2001	Background reach upcanyon from Rendija Canyon; not mapped
Los Alamos Canyon	LA-background	LA-BKG	20.28	0.86	1996	Background reach upcanyon from West Road; not mapped
	LA-0	LA-0	19.50	0.12	2000, 2001, 2002	Baseline reach upcanyon from ice rink and downcanyon from paved road
	LA-1 Far West	LA-1FW	18.03	0.21	1997, 2000, 2001, 2002	Downcanyon from Omega Bridge (in 2 parts)
	LA-1 West+	LA-1W+	17.47	0.14	1997, 2001	Up canyon from Hillside 137
	LA-1 West	LA-1W	16.00	0.37	1997, 2001, 2002	Downcanyon from Hillside 137
	LA-1 Central	LA-1C	15.66	0.39	1997, 2001, 2002	Downcanyon from TA-2
	LA-1 East	LA-1E	14.80	0.43	1997, 2001	Downcanyon from TA-21 laundry outfall
	LA-2 West	LA-2W	13.00	0.21	1996, 1997, 2001, 2002	Up canyon from DP Canyon
	LA-2 East	LA-2E	12.55	0.68	1996, 1997	Downcanyon from DP Canyon
	LA-2 Far East	LA-2FE	11.22	1.00	2001	Up canyon from TA-53 drainage
	LA-3 West	LA-3W	10.48	0.49	2001, 2002	Downcanyon from TA-53 drainage

Table 3.1-1 (continued)

Subwatershed	Investigation Reach	Reach Abbreviation	Approximate Distance from Rio Grande to Midpoint of Reach (km)	Reach Length (km)	Years of Sample Collection	Notes
Los Alamos Canyon	LA-3 East	LA-3E	9.32	0.44	1997, 2000, 2001, 2002	Original reach LA-3 from Reneau et al. (1998, 59160)
	LA-3 Far East	LA-3FE	8.85	0.23	2000, 2001	Basin behind low-head weir (post-fire); not mapped
	LA-4 West	LA-4W	6.04	0.52	1997, 2002	Downcanyon from Pueblo Canyon
	LA-4 East	LA-4E	5.05	0.29	1997	—
	LA-4 Far East	LA-4FE	4.00	0.22	2000, 2001	Post-fire reach near Totavi; not mapped
	LA-5	LA-5	0.88	1.41	1996, 1997, 2002	Downcanyon from Guaje Canyon
	LA-5 East	LA-5E	0.09	0.17	2000, 2001	Post-fire reach adjacent to Rio Grande
Pueblo Canyon	P-background	P-BKG	21.04	0.65	1996	Background reach upcanyon from Diamond Drive; not mapped
	P-1 Far West	P-1FW	18.51	0.10	1999, 2002	Baseline reach upcanyon from Pueblo Canyon WWTP and downcanyon from townsite
	P-1 West	P-1W	18.26	0.32	1996, 1997, 1999, 2001	Downcanyon from Pueblo Canyon WWTP (in 2 parts)
	P-1 East	P-1E	17.65	0.51	1996, 1997, 1999, 2001	Downcanyon from Acid Canyon
	Walnut Canyon	WC	17.50	0.06	1999	Baseline reach adjacent to P-1E and downcanyon from townsite
	P-2 West	P-2W	14.61	0.51	1997, 2002	Upcanyon from Kwage Canyon
	P-2 East	P-2E	13.34	0.46	1997	Downcanyon from Kwage Canyon
	TA-74-1 West	TA-74-1W	12.26	0.14	None	Land transfer parcel; mapped but not sampled
	P-3 West	P-3W	11.42	0.51	1997, 2001, 2002	Upcanyon from Bayo WWTP and downcanyon from airport
	P-3 Central	P-3C	10.92	0.45	None	Mapped but not sampled
	P-3 East	P-3E	10.42	0.54	1997, 1998, 2001, 2002	Downcanyon from Bayo WWTP
	P-3 Far East	P-3FE	9.95	0.40	None	Mapped but not sampled
	P-4 West	P-4W	9.49	0.52	1996, 1997	—
	P-4 Central	P-4C	9.07	0.33	None	Mapped but not sampled
	P-4 East	P-4E	8.60	0.60	1996, 1997, 2001	Upcanyon from Los Alamos Canyon
	P-4 Far East	P-4FE	7.94	0.73	None	Mapped but not sampled

^a See Plate 1 for location of reaches.^b — = No notes.

Table 3.2-1
Water Sampling Locations and Rationale for
Selection for the Los Alamos and Pueblo Canyon Surface Water and Alluvial Groundwater Addendum

Location Name	Location ID	Location and Rationale
Los Alamos Canyon Alluvial Groundwater Wells		
LAO-B	41-01045	Reach LA-BKG. Provides baseline alluvial groundwater quality for groundwater moving onto the Laboratory from the upper Los Alamos Canyon watershed.
LAO-C	41-01004	Reach LA-1FW. Provides secondary baseline data with respect to Laboratory contaminants, but the well is located below some paved areas and areas that are salted periodically during winter. Also situated to provide baseline to assess potential impact from TA-1 mesa slope SWMUs.
LAO-0.3	41-01003	Reach LA-1W. Characterizes potential impact of TA-1 SWMUs and situated upcanyon of TA-41 SWMUs.
LAO-0.7	LA-10066	Between reaches LA-1W and LA-1C. Characterizes potential impact of TA-41 SWMUs and provides baseline for characterizing potential impact of TA-2 SWMUs.
LAO-1	02-01076	Reach LA-1C. Characterizes potential impact from TA-2 SWMUs.
LAO-1.6g	LA-00001	Between reaches LA-1E and LA-2W. Characterizes potential impact to Los Alamos Canyon from past molybdenum releases from TA-53 outfalls (03A 047, 03A 048, 03A 049).
LAO-2	LA-10067	Reach DP-4. Characterizes alluvial groundwater quality in lower DP Canyon immediately above confluence with Los Alamos Canyon.
LAO-3a	LA-10035	Reach LA-2E. Characterizes the mixing of Los Alamos and DP Canyon alluvial groundwater and potential groundwater contamination associated with contaminants in adjacent reaches.
LAO-4	LA-10068	Between reaches LA-2E and LA-2FE. Characterizes downcanyon trends in groundwater contaminant concentrations associated with contaminant transport and interaction with contaminated sediments in Los Alamos Canyon.
LAO-4.5c	LA-10069	Reach LA-2FE. Characterizes downcanyon trends in groundwater contaminant concentrations associated with contaminant transport and interaction with contaminated sediments in Los Alamos Canyon.
LAO-6a	LA-10070	Between reaches LA-3W and LA-3E. Characterizes downcanyon trends in groundwater contaminant concentrations associated with contaminant transport and interaction with contaminated sediments in Los Alamos Canyon. Last alluvial groundwater monitoring well in upper Los Alamos Canyon.
LAUZ-1	21-01811	Reach DP-2. Situated adjacent to SWMU 21-011(k). Characterizes the residual contaminants associated with the 21-011(k) outfall.
LLAO-1b	LA-00215	Reach LA-4E. Situated in the upper portion of lower Los Alamos Canyon. Characterizes waters originating from upper Los Alamos and Pueblo Canyons.
LLAO-5	LA-00002	Next to reach LA-5. Situated near the confluence of lower Los Alamos Canyon and the Rio Grande. Characterizes potential effects of interaction with sediments in lower Los Alamos Canyon. Water quality may indicate influences of upwelling regional groundwater.

Table 3.2-1 (continued)

Location Name	Location ID	Location and Rationale
Los Alamos Canyon Surface Water and Springs		
Los Alamos Reservoir	LA-10033	Los Alamos Reservoir. Provides baseline surface water quality and characterizes potential geochemical changes resulting from post-Cerro Grande fire runoff.
Reach LA-1 West Surface Water	LA-10064	Reach LA-1W. Los Alamos Canyon above SWMUs or contaminated sediment and thus provides baseline for comparison to downcanyon water quality.
Reach LA-1 Central Surface Water	LA-10065	Reach LA-1C. Located below TA-2 to measure potential impact from SWMUs and contamination in canyon floor sediments.
Surface Water at Gaging Station E030	LA-10036	Reach LA-2W. Located just above DP Canyon confluence. Characterizes water quality prior to mixing with water from DP Canyon.
Surface Water at Gaging Station E042	LA-10038	Reach LA-3E. Located upcanyon from Pueblo Canyon and eastern Laboratory boundary. Characterizes potential effects of interactions with contaminated sediments in reaches LA-2E, LA-3W, and LA-3E.
Basalt Spring	LA-00219	Reach LA-4W. Characterizes water that discharges into lower Los Alamos Canyon derived primarily from the Bayo WWTP.
Reach LA-4E Surface Water	LA-00218	Reach LA-4E. Characterizes potential effects of interactions with contaminated sediments in reach LA-4W and establishes baseline for upper end of lower Los Alamos Canyon.
Lower Reach LA-5 Surface Water	LA-10058	Reach LA-5. Situated near the confluence of lower Los Alamos Canyon and the Rio Grande and characterizes Los Alamos Canyon surface water above the Rio Grande. Water quality may be influenced by upwelling regional groundwater.
Reach DP-1 West Surface Water	21-10929	Reach DP-1W. Characterizes townsite runoff impact and provides baseline for DP Tank Farm.
Reach DP-1 Central Surface Water	21-11226	Reach DP-1C. Located below the DP Tank Farm seeps. Bounds the DP Canyon segment with hydrocarbon seeps related to the DP Tank Farm.
Reach DP-2 Surface Water	21-11269	Reach DP-2. Located within the uppermost portion of DP Canyon that has contamination from SWMU 21-011(k).
Reach DP-4 Surface Water	21-11270	Reach DP-4. Located at the mouth of DP Canyon immediately above the confluence with Los Alamos Canyon and characterizes cumulative impact of all DP Canyon reaches.
DP Spring	21-01854	Reach DP-4. Located in DP Canyon at west end of reach DP-4. Characterizes water quality associated with impacts from SWMU 21-011(k) and related contaminated sediments distributed along reaches DP-2 and DP-3.

Table 3.2-1 (continued)

Location Name	Location ID	Location and Rationale
Pueblo Canyon Alluvial Groundwater Wells		
PAO-1	PU-00178	Reach P-1W. Provides characterization of former Pueblo WWTP upgradient of Acid Canyon confluence and provides a baseline for key contaminants in Acid Canyon and the South Fork of Acid Canyon.
PAO-2	PU-10174	Reach P-1E. Located in Pueblo Canyon just below Acid Canyon confluence. Characterizes influence of surface water runoff originating in Acid Canyon and the South Fork of Acid Canyon.
PAO-3	PU-00181	Reach P-2E. Characterizes potential impact to alluvial groundwater from contaminated sediments in Pueblo Canyon and TA-0 SWMUs located along this section of Pueblo Canyon.
PAO-4	PU-00182	Reach P-3E. Characterizes potential impact to alluvial groundwater from contaminated sediments in Pueblo Canyon and the Bayo WWTP.
APCO-1	PU-10228	Reach P-4C. Characterizes potential impact to alluvial groundwater from contaminated sediments in Pueblo Canyon and the Bayo WWTP.
Pueblo Canyon Surface Water		
Reach AC-2 Surface Water	00-10241	Reach AC-2. Located just above the SWMU 0-030(g) confluence. Characterizes water quality associated with townsite runoff.
Upper South Fork Acid Canyon	PU-10175	Reach ACS. Characterizes surface water quality in South Fork upcanyon of areas with highest levels of sediment contamination.
Lower South Fork Acid Canyon	PU-10176	Reach ACS. Characterizes surface water quality in South Fork within areas with highest levels of contaminated sediment.
Lower Reach P-1W (Pueblo 1R)	PU-10070	Reach P-1W. Located in Pueblo Canyon above the Acid Canyon confluence. Characterizes water quality associated with townsite runoff.
Pueblo 2	PU-10231	Reach P-2W. Characterizes water quality associated with contaminated sediments in Pueblo Canyon and the impact of surface water runoff from Acid Canyon.
Pueblo 3	PU-10230	Reach P-3FE. Characterizes water quality resulting from interaction of surface water runoff with contaminated sediments in upcanyon reaches, and discharges from the Bayo WWTP.
Pueblo at State Road 502	PU-10229	Reach P-4FE. Last monitoring point in Pueblo Canyon above confluence with Los Alamos Canyon. Characterizes water quality resulting from interaction of surface water runoff with contaminated sediments in upcanyon reaches and discharges from the Bayo WWTP.

Table 3.2-2
Period of Record for Manual Water-Level Data in Los Alamos and Pueblo Canyons Alluvial Wells

Canyon	Well	Period of Record
Los Alamos Canyon	LAO-B	4/94–8/94; 1/95–4/95; 11/95–7/96; 11/96–9/99; 6/00–9/02
	LAO-0.3	6/94–10/94; 1/95–4/95; 11/95–7/96; 11/96–9/99; 6/00–9/02
	LAO-0.6	5/94–10/94; 1/95–4/95; 11/95–7/96; 11/96–9/99; 6/00–9/02
	LAO-0.8	5/94–10/94; 1/95–4/95; 11/95–7/96; 11/96–9/99; 7/00–9/02
	LAO-0.91	6/94–10/94; 1/95–4/95; 11/95–7/96; 11/96–9/99; 6/00–9/02
	LAO-1.6(g)	11/96–9/99; 6/00–9/02
	LLAO-1(b)	8/97–9/99; 6/00–9/02
	LLAO-2	11/96–9/99; 6/00–9/02
	LLAO-3	8/97–9/99; 6/00–9/02
	LLAO-4	11/96–9/99; 6/00–9/02
	LLAO-5	11/96–9/99; 6/00–9/02
Pueblo Canyon	PAO-1	11/98–9/99; 6/00–9/02
	PAO-2	11/98–9/99; 6/00–9/02
	PAO-2.5	12/98–9/99; 8/00–1/01; 6/01–9/02
	PAO-3	11/98–9/99; 8/00–9/02
	PAO-4	8/97–9/99; 6/00–9/02
	PAO-5S	3/98–9/99; 6/00–9/02
	PAO-5N	3/98–9/99; 6/00–9/02

Table 3.2-3
Period of Record for
Automated Water-Level Data in Los Alamos and Pueblo Canyons Alluvial Wells

Canyon	Well	Period of Record
Los Alamos Canyon (alluvial wells)	LAO-B	8/00–9/03
	LAO-0.3	8/00–9/03
	LAO-0.91	8/00–9/03
	LAO-1.6(g)	8/00–9/03
Los Alamos Canyon (piezometers)	LAP-1 ^a	7/01–9/03
	LAP-1.5 ^a	7/01–9/03
	LAP-3	7/01–12/01; 8/02–9/03
	LAP-3.5 ^a	11/01–6/02; 8/02–9/03
	LAP-4 ^a	4/01–9/03
	LAP-5.7#1 ^b	7/01–9/03
	LAP-6	3/01–12/01; 3/02–6/02; 8/02–9/03
Pueblo Canyon	PAO-1	8/00–9/03
	PAO-3	8/00–9/03
	PAO-4	8/00–9/03
	PAO-5N	8/00–9/03

^a Denotes a nest of three piezometers with three transducers.

^b Denotes a nest of three piezometers with one transducer.

4.0 FIELD INVESTIGATIONS

Field investigations in the Los Alamos and Pueblo watershed included investigations of sediment, surface water, alluvial groundwater, and biota. The approaches and methods of these investigations are briefly discussed in the following subsections. A more detailed discussion of the methods and the results of the field investigations is presented in Appendix B.

4.1 Sediment

Sediment investigations in the Los Alamos and Pueblo watershed included detailed geomorphic characterization and sediment sampling in a series of discrete reaches, following the general process described in the NMED-approved work plan and canyons core document (LANL 1995, 50290; LANL 1997, 55622; LANL 1997, 56421; LANL 1998, 57666). The geomorphic characterization in most reaches included preparing a detailed geomorphic map delineating the horizontal extent of geomorphic units with varying physical characteristics, contaminant concentrations, and/or age. Field radiological screening measurements were used to help delineate geomorphic units in reaches where the levels of radionuclide contamination in post-1942 sediment exhibited higher levels of radiation than nearby pre-1943 sediment. The geomorphic characterization also included measuring the thicknesses of potentially contaminated post-1942 sediment deposits to estimate the volume of contaminated sediment and the contaminant inventory in each reach. Several methods were used to identify the bottom of post-1942 sediment deposits, including determining the depth of burial of trees and associated buried soils, and noting the presence or absence of materials imported to the watershed after 1942 (e.g., quartzite gravel, coal).

Field data on the volume and radiation levels in the different geomorphic units in a reach were used to help allocate samples for analysis at off-site laboratories. In most reaches, samples were collected in multiple phases, and analytical results from initial sampling phases were used to help guide subsequent sampling. The process used to allocate samples in the phased investigations is discussed in Rytí et al. (2004, 85206). Most of the results from these field investigations are presented in previous reports (Reneau et al. 1998, 59159; Reneau et al. 1998, 59160; Reneau et al. 1998, 59667; Katzman et al. 1999, 63915; Reneau et al. 2000, 66867; Reneau et al. 2002, 73660). These reports also include more detailed discussion of the investigation methods. All analytical results of the sediment sampling incorporated in this investigation report are discussed in Appendix C and provided on a CD included with this report.

Plates 2 to 11 present geomorphic maps for reaches in the Los Alamos and Pueblo watershed and sample locations within these reaches. The horizontal extent of contaminated or potentially contaminated sediment deposits in each reach is delineated by the extent of the channel ("c") and floodplain ("f") units in these maps. Section B-1 of Appendix B includes field investigation results that were not included in the previous reports, including field radiological screening results, along with additional discussion of investigation methods. Field radiological measurement locations for new reaches are shown in Plates 2 through 11, and field radiological measurement locations from the other reaches are presented in previous reports. Field results from the following reaches are included in Section B-1: AC-1, AC-2, AC-3, ACS, LA-0, LA-1FW, LA-2FE, LA-3W, P-1FW, P-1W, and WC.

Additional field investigations of sediment in the Los Alamos and Pueblo watershed occurred in several tasks that included less detailed field characterization than the standard reach investigations discussed above. The collection of background samples (McDonald et al. 2003, 76084) and the collection of post-fire sediment samples (e.g., LANL 2000, 69054; Katzman et al. 2001, 72660; Kraig et al. 2002, 85536) included an examination of stratigraphic sections at multiple locations to select samples that spanned the range of particle size and geomorphic setting in each sampling area but did not include detailed mapping

and characterization of geomorphic units. Collection of post-fire sediment samples is discussed further in Section B-4 of Appendix B. Collection of sediment samples to support the biota investigation in a reference reach in Guaje Canyon included descriptions of the geomorphic units and characteristics of sediment samples but did not include geomorphic mapping. The sediment samples collected as part of the biota investigation are discussed in more detail in Section B-3. An additional task involved assessing a potential land transfer parcel between reaches P-2E and P-3W (TA-74-1 West), including geomorphic mapping and related characterization, but no samples were collected (Tardiff et al. 2002, 73566). Plate 1 shows the investigation areas for these tasks.

4.2 Surface Water and Alluvial Groundwater

As described in Section 3.2, alluvial groundwater and surface water investigations involved sampling for four rounds during a year at designated locations described in the Los Alamos and Pueblo Canyons work plan addendum (LANL 2002, 70235). Under this addendum, alluvial groundwater monitoring wells and surface water locations were sampled concurrently (typically within a period of less than three weeks) to obtain a comprehensive and current data set and a synoptic perspective of the hydrology and contaminants present in water within the watershed. A key objective was to characterize potential contaminant variability associated with variations in surface water and alluvial groundwater conditions. Sampling surface water and alluvial groundwater concurrently also allows for evaluating of the relation between surface water and alluvial groundwater quality. Sampling was attempted at designated locations in each of the four sampling rounds, and samples were collected if sufficient water was present. Table 4.2-1 summarizes the sampling conducted during the four rounds required under the addendum, as well as other sampling conducted as part of the post-Cerro Grande characterization efforts and during early RFI sampling in the watershed conducted under the work plan for OU 1049 (LANL 1995, 50290), and the sampling plan for DP Canyon (LANL 1998, 59373).

Most of the alluvial groundwater and surface water samples were collected in accordance with ER Project standard operating procedures (SOPs), and a few were collected as part of annual surveillance monitoring using RRES–Water Quality and Hydrology (WQH) procedures. The procedures for sample collection are described in Appendix B, and the analytical results of the sampling are discussed in Appendix C and provided on a CD included with this report. A water-level measurement was collected from each well prior to purging for a sampling event. The water-level measurements associated with sampling are also presented in Appendix B. Water-quality parameters including pH, specific conductance, temperature, and turbidity were measured in the field for each surface water and alluvial groundwater sample collected. Measurements of field-parameters are taken as part of groundwater sampling to evaluate the effectiveness of purging. Field parameters data are also collected for surface water and alluvial groundwater samples to provide data potentially useful for evaluating contaminant variability. These field parameters were logged in a water quality stabilization record form for each sample and are presented in tables in Section B-2 of Appendix B. The methodology for collecting field parameters and results are also described in Section B-2.0.

4.3 Biota

Biological data were collected to evaluate the potential for adverse ecological effects from contaminants in sediment and surface water. The biological data were collected following the EPA's "Ecological Risk Assessment Guidance for Superfund" (EPA 1997, 59370) for the COPECs identified in sediment and persistent surface water. This process involved personnel from NMED and started with a screening level ecological risk assessment (LANL 1999, 64783), which was applied to sediment and water data, much of which have been presented in previous reports (Reneau et al. 1998, 59159; Reneau et al. 1998, 59160; Reneau et al. 1998, 59667; Katzman et al. 1999, 63915). Subsequent steps included developing baseline

risk assessment problem formulation and completing a study design. These steps led to developing a plan for collecting biological data that was documented in Katzman (2002, 73667). Aspects of this plan were modified based on field verification of the design; deviations to the original plan are summarized in Section 8.1. Information on the conceptual exposure model and the selection of assessment endpoints and associated measures of effect are discussed in more detail in Section 8.1 (the baseline ecological risk assessment). A detailed rationale for these lines of evidence and for the intended use of these data for evaluating adverse effects is provided in Katzman (2002, 73667). The data were collected for evaluating the potential for adverse effects on terrestrial ecological and aquatic receptors.

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Table 4.2-1
Summary of Water Samples Taken, 1997–2002, Los Alamos and Pueblo Canyons

Location Name	Location ID	Early-Phase (Pre-Cerro Grande) Characterization ^a				Post-Cerro Grande Characterization				RFI Sampling				
		1997	1998	1999	2000	Round 1 6/17/00– 6/27/00	Round 2 7/24/00– 7/27/00	Round 3 8/30/00– 9/6/00	Round 4 10/3/00– 10/11/00	Round 1 3/15/01– 4/11/01	Round 2 6/18/01– 7/12/01	Round 3 10/30/01– 11/20/01	"Dry Round" ^b 3/26/02	Round 4 5/21/02– 6/11/02
Upper Los Alamos Canyon Alluvial Wells														
LAO-B	41-01045				√√	√	√	√	√	√	√	√	√	√
LAO-C	41-01004									√	√	√		√
LAO-0.3	41-01003					√	√	√	√	√	√	√		√
LAO-0.6	41-01002					√	√	√	√					
LAO-0.7	LA-10066									√	√	√		√
LAO-0.91	02-01022					√	Dry	Dry	Dry					
LAO-1	02-01076									√	√	√		Dry
LAO-1.2	LA-10008					Dry	√	Dry	Dry					
LAO-1.6g	LA-00001	√				√	√	√	√	√	√	√		Dry
LAO-2	LA-10067									√	√	Dry		Dry
LAO-3a	LA-10035								√	√	√	Dry		√
LAO-4	LA-10068									√	√	√		Dry
LAO-4.5c	LA-10069									√	√	√		Dry
LAO-6a	LA-10070									√	Dry	Dry		Dry
DP Canyon Alluvial Wells														
LAUZ-1	21-01811	√√	√√√							√	√	√	√	√
LAUZ-2	21-01812	√√	√√√											
Lower Los Alamos Canyon Alluvial Wells														
LLAO-1(b)	LA-00215			√		√	√	√	√	√	√	√		√
LLAO-2	LA-00045	√												
LLAO-4	LA-00046	√				√	√	√	√					
LLAO-5	LA-00002	√				√	√	√	√	√	√	√		√

Table 4.2-1 (continued)

Location Name	Location ID	Early-Phase (Pre-Cerro Grande) Characterization ^a				Post-Cerro Grande Characterization				RFI Sampling				
		1997	1998	1999	2000	Round 1 6/17/00– 6/27/00	Round 2 7/24/00– 7/27/00	Round 3 8/30/00– 9/6/00	Round 4 10/3/00– 10/11/00	Round 1 3/15/01– 4/11/01	Round 2 6/18/01– 7/12/01	Round 3 10/30/01– 11/20/01	"Dry Round" ^b 3/26/02	Round 4 5/21/02– 6/11/02
Upper Los Alamos Canyon Surface Water														
LA Creek upstream of LA Reservoir	LA-10126											√		
Los Alamos Reservoir	LA-10033									√ ^c	√	Dry ^d		Dry ^d
Los Alamos Creek below LA Reservoir	LA-10034													√
Reach LA-Bkgd SW	LA-10006					Dry	√	Dry	√					
SW at E026	LA-10040											√ ^e		
Reach LA-1 West SW	LA-10064									√	√	√		Dry
SW at LAO-0.6	LA-10005					√	√	Dry	√					
Reach LA-1 Central SW	LA-10065									√	√	√		Dry
SW at E030	LA-10036									√	Dry	Dry		Dry
SW at E042	LA-10038									√	Dry	Dry		Dry
Lower Los Alamos Canyon Surface Water and Springs														
Basalt Spring	LA-00219					√	√	√	√	√	√ ^f	√		√
Reach LA-4E SW	LA-00218					√	√	√	√	√	Dry	√		√
Guaje SW at LA Confluence	GU-10004									√		√ ^g		
LA SW at Guaje Confluence	LA-10057									√	√			
Lower Reach LA-5 SW (at Rio Grande)	LA-10058									√	Dry	√ ^g		Dry

Table 4.2-1 (continued)

Location Name	Location ID	Early-Phase (Pre-Cerro Grande) Characterization ^a				Post-Cerro Grande Characterization				RFI Sampling				
		1997	1998	1999	2000	Round 1 6/17/00– 6/27/00	Round 2 7/24/00– 7/27/00	Round 3 8/30/00– 9/6/00	Round 4 10/3/00– 10/11/00	Round 1 3/15/01– 4/11/01	Round 2 6/18/01– 7/12/01	Round 3 10/30/01– 11/20/01	"Dry Round" ^b 3/26/02	Round 4 5/21/02– 6/11/02
LA Spring	BG-00081											√		
Otowi Spring	LA-10179											√		
DP Canyon Surface Water and Springs														
Reach DP-1W SW	21-10929									√	√	√		√
Reach DP-1C SW	21-11226									√	√	√		√
Reach DP-2 SW (DPS-1)	21-11269									√	Dry	Dry		Dry
DP Spring	21-01854	√√	√√√							√	√	Dry		Dry
Reach DP-4 SW (DPS-4)	21-11270									Dry	Dry	Dry		Dry
Pueblo Canyon Alluvial Wells														
PAO-1	PU-00178					√	√	√	√	√	√	√		√
PAO-2	PU-10174					Dry	Dry	Dry	Dry	Dry	√	√		Dry
PAO-3	PU-00181									√	√	√		Dry
PAO-4	PU-00182		√			√	√	√	√	√	√	√		√
APCO-1	PU-10228									√	√	√		Not sampled ^b
PAO-5N	PU-00177			√		√	√	√	√					√
Acid Canyon Surface Water														
Reach AC-2 SW	00-10241									√	Dry	Dry		Dry
Upper Reach ACS SW	PU-10175									√	√	Dry		Dry
Lower Reach ACS SW	PU-10176									√	Dry	Dry		Dry
Lower Reach AC-3 SW	PU-10155							√	√	√	√	Dry		Dry

Table 4.2-1 (continued)

Location Name	Location ID	Early-Phase (Pre-Cerro Grande) Characterization ^a				Post-Cerro Grande Characterization				RFI Sampling				
		1997	1998	1999	2000	Round 1 6/17/00– 6/27/00	Round 2 7/24/00– 7/27/00	Round 3 8/30/00– 9/6/00	Round 4 10/3/00– 10/11/00	Round 1 3/15/01– 4/11/01	Round 2 6/18/01– 7/12/01	Round 3 10/30/01– 11/20/01	"Dry Round" ^b 3/26/02	Round 4 5/21/02– 6/11/02
Pueblo Canyon Surface Water														
Reach P-1 Far West	PU-10068					√	√	√	√					
Upper Reach P-1 West	PU-10069					√	√	√	√					
Lower Reach P-1 West/Pueblo 1R	PU-10070					√	√	√	√	√	√	Dry		Dry
Upper Reach P-1 East	PU-10071					√	√	√	√					
Pueblo 2	PU-10231									√	Dry	Dry		Dry
Pueblo 3	PU-10230									√	√	√		√
Pueblo at NM State Road 502	PU-10229									√	√	√		√

Note: Gray shading highlights sample locations for RFI sampling conducted under the "Los Alamos and Pueblo Canyons Work Plan Addendum, Surface Water and Alluvial Groundwater Sampling and Analysis Plan" (LANL 2002, 70235).

^a Multiple checks (√) represent number of sampling events in a year.

^b An extra sampling round was conducted at two locations during an extreme dry period in March 2002.

^c Sample collected on May 1, 2001.

^d Sample not collected because reservoir was drained for dredging.

^e Sample collected on August 30, 2001.

^f Sample collected on July 27 2001.

^g Sample collected on September 13, 2001.

^h APCO-1 not sampled at State Highway NM 4 because of a mouse nest in the well. PAO-5N sampled instead.

5.0 REGULATORY CRITERIA

5.1 Regulatory Context

Regulatory requirements governing the RRES-RS canyons investigations are discussed in Section 1.4 of the NMED-approved canyons core document (LANL 1997, 55622, LANL 1998, 57666). In particular, these investigations address requirements of the Laboratory's Hazardous Waste Facility Permit (Module VIII) under the RCRA, including "the existence of contamination and the potential for movement or transport to or within Canyon watersheds" (EPA 1990, 1585; EPA 1994, 44146). RCRA and the New Mexico Hazardous Waste Act (HWA) regulate releases of hazardous wastes and hazardous waste constituents, and DOE Order 5400.1, "General Environmental Protection Program," establishes requirements for managing residual radioactivity at DOE facilities. The regulatory requirements for conducting these investigations in the Los Alamos and Pueblo watershed are incorporated into Module VIII through work plans approved by the NMED. The approved work plans include: the Los Alamos and Pueblo Canyons work plan (LANL 1995, 50290, LANL 1997, 56421), and the surface water and alluvial groundwater addendum (LANL 2002, 70235).

The assessments in this report are risk-based for all media and contaminants. Surface water and groundwater standards are not used to support the decision-basis land-use scenarios in this report. Concentrations of chemicals and radionuclides are compared to various risk-based screening levels, which are described in Sections 5.2 and 5.3. These screening levels do not constitute cleanup levels.

5.2 Human Health Screening Levels

Screening action levels (SALs) are media-specific concentrations for COPCs derived based on residential exposure using conservative exposure assumptions. If environmental concentrations of contaminants are below SALs, then the potential for adverse human health effects is considered highly unlikely. For sediment, the chemical SALs are calculated based on the methodology provided in Appendix C of the draft installation work plan (LANL 2000, 66802) and in the "Human Health Risk-Based Screening Methodology" (LANL 2002, 72639). They are also based on guidance in the "Technical Background Document for Development of Soil Screening Levels" (NMED 2000, 68554) and in "EPA Region 6 Human Health Medium-Specific Screening Levels," (EPA 2002, 73691). The SALs for noncarcinogens are based on a hazard quotient (HQ) of 1.0. The SALs for carcinogens are based on a cancer risk level of 10^{-6} ($10E-6$). For radionuclides in sediment, the SALs are developed according to the "Derivation and Use of Radionuclide Screening Action Levels" (LANL 2001, 69683), and RESRAD Version 6.21 (LANL 2002, 73705). The radionuclide SALs for sediment have a target dose limit of 15 millirem per year (mrem/yr). This dose limit is consistent with guidance from the EPA (EPA 1997, 58693) and DOE (DOE 2000, 67153).

Screening values for water are the EPA Region 6 and Region 9 tap-water standards for carcinogens and non-carcinogens, and DOE-derived concentration guidelines (DCGs) for radionuclides. The screening levels for carcinogens and noncarcinogens in water are based on the same HQ and cancer risk levels as the sediment SALs. The screening values for radionuclides in water were calculated using a target dose limit of 4 mrem/yr which is based on the radiation dose limit for a public drinking-water supply in DOE Order 5400.5, "Radiation Protection of the Public and the Environment."

Some chemicals (acenaphthylene, benzo[g,h,i]perylene, alpha chlordane, gamma chlordane, endrin ketone, endosulfan II, and isopropyltoluene) do not have toxicity values published in the EPA's Integrated Risk Information System (IRIS) database (EPA 2003, 76870); the EPA's Health Effects Assessment Summary Tables ([HEAST] EPA 1997, 58968), or by EPA's National Center for Environmental Assessment (NCEA). For those chemicals, surrogate chemical toxicity values are used, and are based on

similarity in chemical structure (LANL 2002, 72639, NMED 2003, 81172). The SALs for these surrogates were used to evaluate whether the COPCs should be retained for further evaluation in a risk assessment.

5.3 Ecological Screening Levels

Ecological screening levels (ESLs) are used to determine the list of COPECs for water and sediment data. The ESLs are media-specific concentrations that represent the lowest no observed adverse effect level (NOAEL) for a variety of ecological receptors. Some water ESLs are selected from EPA or NMED water quality criteria. The NOAEL is the maximum concentration of a COPC that represents no potential adverse impacts to a receptor. The Laboratory report "Screening Level Ecological Risk Assessment Methods" (LANL 1999, 64783) contains information about how ESLs are derived. ESLs are developed for a suite of receptors designed to represent individual feeding guilds, such as invertivorous mammal or carnivorous bird. Receptors such as robins and kestrels are modeled with multiple diets to represent multiple feeding guilds. The representative concentration of each COPC was compared with ESLs from the September 2002 version (Version 1.5) of the Ecorisk Database (LANL 2002, 73702). Soil ESLs for antimony, uranium, and zinc were revised in March 2003 (LANL 2003, 74012).

6.0 CANYONS CONTAMINATION

This section describes the methodology and results of analytical data screening assessments for samples collected in this investigation to identify COPCs in sediment, surface water, springs, and alluvial groundwater. Identifying the COPCs forms the basis for evaluating contamination in canyons media. In these screening assessments, surface water and springs are considered collectively as surface water. The term "sediment" includes all post-1942 sediment deposits in the canyon bottoms, including deposits in abandoned channels and floodplains as well as in active stream channels; therefore, sediment includes alluvial soils as defined in some other studies. The COPC screen is conducted using a tiered approach to determine which contaminants are carried forward into the conceptual model and human health risk assessments discussed in Sections 7 and 8, respectively. This section also screens analytical results to determine which analytes are COPECs and should be considered in assessments of potential ecological risk. Analytical results from some samples of canyons media obtained in other investigations are included in this screen (e.g., samples from Acid Canyon near SWMU 0-030[g] reported in LANL 2001, 70273, and samples in DP Canyon near the DP Tank Farm (LANL 2001, 71303). Table 6.0-1 summarizes the data used in this investigation, presenting the number of samples analyzed by suite and by medium. Section 6.1 briefly describes how the data were prepared for the screening processes. Section 6.2 presents the screens for sediments, and Section 6.3 presents the screens for surface water and alluvial groundwater.

6.1 Data Preparation

The data used in the following assessments were obtained from the Environmental Restoration Database (ERDB) and subjected to a process of quality assurance and subsetting that is prescribed by Desk Instructions (DI-) 4.26, Revision 0, Legacy Field Data Review Process; and DI-4.28, Revision 0, Quality Assurance Checklist for Preparation of Data Sets from the ER Project Technical Database. All data residing in the ERDB have undergone routine validation according to SOPs specific to the analyte type (inorganic chemicals, organic chemicals, or radionuclides). These SOPs include the following:

- SOP-15.01, Revision 1, Routine Validation of Volatile Organic Data
- SOP-15.02, Revision 1, Routine Validation of Semivolatile Organic Data
- SOP-15.03, Revision 1, Routine Validation of Organochlorine Pesticides and Polychlorinated Biphenyls Data
- SOP-15.04, Revision 1, Routine Validation of High Explosives Organic Data
- SOP-15.05, Revision 1, Routine Validation of Inorganic Data
- SOP-15.06, Revision 1, Interim Change Notice 1, Routine Validation of Gamma Spectroscopy Data
- SOP-15.07, Revision 1, Interim Change Notice 1, Routine Validation of Chemical Separation Alpha Spectrometry, Gas Proportional Counting, and Liquid Scintillation Data

Prior to analysis, a technical review of both analytical chemistry and field data was performed, resulting in a list of questions to be resolved either through focused validation by a chemist or review of the sample collection logs. If data corrections were required, updates were made to, and verified in, the ERDB. Analytical results from sediment and water samples were divided into subsets to allow screening at levels finer than that of the entire watershed. This subdivision involved separating samples by geographic area, by status, and by sample preparation, as discussed below.

Reaches are the primary geographic subdivisions for sediment results because field investigations focused on obtaining sufficient data at the reach scale. For organic chemicals, the initial screening was done by applying a 5% frequency-of-detects rule because there are no background values (BVs) for these

chemicals. To make meaningful use of the 5% frequency-of-detects rule, a minimum sample size of 21 is desirable. Because fewer than 21 results for organic chemicals are available from most reaches, a larger spatial scale was used, and the initial screening was done at the subwatershed scale. Following this initial screen of organic chemicals in sediment, these data were screened at the reach scale. Organic chemicals identified as COPCs within a subwatershed were retained as COPCs for reach/status combinations within that subwatershed if the chemical was detected. The term "status" is defined below.

The 5% frequency-of-detects rule is consistent with guidance from EPA (EPA 1989, 8021) and NMED (NMED 2000, 70107), and with the process agreed to with NMED for evaluating potential ecological risk in the Los Alamos and Pueblo watershed (Katzman 2002, 73667). The subwatersheds used in this step consist of Acid Canyon, DP Canyon, Pueblo Canyon, upper Los Alamos Canyon, and lower Los Alamos Canyon. Groupings of reaches by subwatershed are provided in Table 3.1-1.

Secondary subdivisions for sediment results were made to separate data in reaches for two types of samples for which the term "status" is used in this section:

- results from analyses of Cerro Grande fire-impacted samples (samples collected from post-fire sediment deposits within or downstream from the burn area), and
- results from sample locations that have been excavated subsequently during remediation activities (called "removed samples").

Fire-impacted samples were separated from non-fire impacted samples because analyte concentrations in the former are strongly affected by the presence of reworked ash. Removed samples were separated from other samples because they are not relevant for assessing present-day risk, although they are useful in understanding the sources of contaminants.

An additional grouping consisted of post-fire sediment samples collected within or downstream from the Cerro Grande burn area in areas either upstream from SWMUs or AOCs or not affected by them. These are referred to as "baseline" samples in this report. These baseline samples were combined for the purpose of applying the 5% frequency-of-detects rule for organic chemicals.

During the planning stage of the surface water and alluvial groundwater investigation, described in the Los Alamos and Pueblo Canyons work plan addendum (LANL 2002, 70235), a general conceptual model for watershed hydrology and contaminant distribution was developed that led to delineating portions of the watershed with unique combinations of hydrology and contaminant sources. The term "hydrosegment" is used in this report for these geographic areas. This term was not explicitly used in the work plan addendum but was used to select sampling locations in this investigation. The basis for the approach is similar to that of the sediment investigation reaches in that it assures appropriate spatial representation of surface water and alluvial groundwater quality with respect to known or suspected contaminant sources (a sample site rationale is presented in Table 3.2-1). The hydrosegment approach is particularly relevant to the screening methodology because it provides a basis for screening the data at a spatial scale small enough to distinguish areas of unique hydrology and contaminant sources. The following is a list of the hydrosegments:

- Upper Los Alamos Canyon is the portion of Los Alamos Canyon above the confluence with DP Canyon.
- Middle Los Alamos Canyon includes DP Canyon and the portion of Los Alamos Canyon from the DP confluence to the confluence with Pueblo Canyon.
- Lower Los Alamos Canyon is the portion of Los Alamos Canyon below the confluence with Pueblo Canyon.
- Upper Pueblo Canyon is the portion of Pueblo Canyon above the confluence with Acid Canyon.

- Middle Pueblo Canyon includes Acid Canyon and the portion of Pueblo Canyon above the Bayo WWTP.
- Lower Pueblo Canyon is the portion of Pueblo Canyon below the Bayo WWTP down to the confluence with Los Alamos Canyon.

Additional specific information about the screening methodology for surface water and alluvial groundwater is provided in Section 6.3.

Certain analytical results are not evaluated in the screens and subsequent risk assessments for the following reasons.

- Semivolatile organic compound (SVOC) results from samples analyzed by a volatile organic compound (VOC), PAH, or high explosives (HE) analytical method. These duplicate results are excluded from the screen because the VOC, PAH, and HE analytical methods provide lower detection limits than the SVOC method.
- Field duplicate results. These results are from samples obtained for quality assurance/quality control (QA/QC) purposes and not as primary characterization data.
- Uranium-235 results by gamma spectroscopy. For sediment, these results are excluded because gamma spectroscopy analysis yields results that cannot be directly compared to sediment BVs. For water, these results are excluded because the detection limits are too high to provide useful data and because sufficient data are provided through alpha spectroscopy analyses.
- Results from resampling of sediment layers that resulted in duplicate analyses, unless the later results need to be retained, for reasons described in the next item.
- Sediment results superceded by a resampling result. Results from the resampling of sediment layers supercede initial results for several reasons, including replacing analyses with high detection limits for initial samples and replacing anomalous results (e.g., questionable results in initial samples that could not be confirmed upon resampling).
- Results from sediment samples from noncontaminated areas collected to determine background concentrations and calculate BVs by Rytí et al. (1998, 59730) and McDonald et al. (2003, 76084).
- Results from composite sediment samples collected to support ecological risk studies. These composite samples are used to support the ecological risk assessment in Section 8.1, but they cannot be compared to the other samples in this investigation; therefore, they have been excluded from the screens and from the subsequent human health risk assessments.
- Results from sediment samples from f2 and Qt geomorphic units. These results are excluded because an initial data review indicated that analyte concentrations are at or near background levels in these units, with results either below or only slightly above BVs. Including these results would introduce a low bias in calculated average COPC concentrations; therefore, these results are excluded to provide more protective estimates of contaminant concentrations for use in risk assessments.
- Gross alpha, beta, and gamma radiation results. These results are excluded because they are screening data, and no risk-based screening levels are available for gross radiation data.
- PCB congener results. These results are excluded because there are no risk-based screening levels for PCB congener data. Although such screening values could be calculated by using a toxicity equivalency method, screening of PCB congeners is not needed since they would be redundant; specifically, all samples analyzed for congeners were also analyzed for PCB Aroclors and Aroclor results are compared to risk-based screening levels in this report.

- Dioxin and furan results. These results are excluded because these analytes were obtained only from post-fire samples to evaluate potential constituents derived from the Cerro Grande burn area, and an agreement was reached with NMED not to include them in risk assessments for Los Alamos and Pueblo Canyons (Katzman 2002, 73667).
- Humic substances for water samples. These results are excluded because there are no risk-based screening levels for humic substances.
- Results from intermediate groundwater or stormwater samples. Intermediate groundwater results are excluded because intermediate groundwater is out of the scope of this investigation. Stormwater results are excluded because stormwater is transient and does not occur frequently enough to result in chronic exposures.
- Results from water samples collected before 1997. These results are not used because in many instances the concentrations in older data are not representative of current conditions. However, pre-1997 data are used in the trend analyses presented in the conceptual model in Section 7.2.

6.2 Contaminants in Sediment

This section presents the process for screening sediment sample results from the Los Alamos and Pueblo watershed. Analytical results from sediment samples were first screened to develop a list of COPCs, as presented in Section 6.2.1. In Section 6.2.2, all sediment COPCs are screened against ESLs to identify COPECs, which are assessed for potential ecological risk. In Section 6.2.3, all sediment COPCs are screened against SALs to identify analytes to be evaluated in the human health risk assessments. The results of these screens are presented in tables in Section E-1.0 of Appendix E.

6.2.1 Identification of Sediment COPCs

Sediment COPCs are identified by a screening process that includes comparing the results to BVs and taking into account the frequency of detection. This process is performed at the reach level for inorganic chemicals and radionuclides and at the subwatershed and reach/status level for organic chemicals, as described previously. Analytes are retained as COPCs using rules specific to the class of analyte. This process is depicted in Figure 6.2-1 and is discussed below. The BVs for sediment used here are presented in Rytí et al. (1998, 59730) and McDonald et al. (2003, 76084), and are either upper tolerance limits (UTLs) for frequently detected analytes or detection limits for infrequently detected analytes. The COPCs resulting from this screen are presented in Tables E-1.0-1 through E-1.0-3. Table E-1.0-1 presents the list of organic COPCs screened at the reach/status level. Tables E-1.0-2 and E-1.0-3 present the COPCs for radionuclides and inorganic chemicals, respectively.

For inorganic chemicals, an analyte is retained as a COPC in a reach if

- the analyte has a BV and a detected or nondetected result in the reach exceeds the BV, or
- the analyte does not have a BV, but there is at least one detected result in the reach.

For radionuclides, an analyte is retained as a COPC in a reach if

- the analyte has a BV and at least one detected result in the reach exceeds the BV, or
- the analyte does not have a BV but has at least one detected result in the reach.

There are no BVs for organic analytes, and retaining an organic chemical as a COPC is based solely on its frequency of detection. For organic chemicals, an analyte is retained as a COPC in a reach/status if

- the frequency of detection is greater than or equal to 5% for the subwatershed in which the reach is located, and
- there is at least one detected result in the data from a reach/status combination.

6.2.2 Identification of Sediment COPECs for Ecological Risk Assessment

The identification of sediment COPECs to be evaluated in the baseline ecological risk assessment includes comparing sediment concentrations to soil ESLs and sediment ESLs, as discussed in Sections 6.2.2.1 and 6.2.2.2. Comparison of sediment concentrations to soil ESLs evaluates the potential for adverse ecological effects from COPECs on terrestrial ecological receptors. Comparing sediment concentrations to sediment ESLs evaluates the potential for adverse ecological effects from COPECs on aquatic ecological receptors and through aquatic exposure pathways. The ecological screen presented in this section uses ESLs from the Ecorisk Database, Version 1.5 (LANL 2002, 73702; LANL 2003, 74012). This screen uses only comparisons to maximum sample results in reaches. Further refinement using more representative concentrations was not necessary because potential ecological effects were evaluated directly in the biota investigation presented in Section 8.1.

6.2.2.1 Terrestrial Ecological Screen

The terrestrial ecological screen involves comparing the maximum concentration for a COPC to its soil ESL (LANL 2002, 73702; LANL 2003, 74012), as depicted in Figure 6.2-2. A list of screened analytes and the associated ESLs is presented in Table E-1.0-4. If surrogate values are used, the surrogate and its source are noted. HQs are used in this screen, which are ratios of sample results to ESLs. This screen is performed by reach and status, and the results of the screen are presented Table E-1.0-5. A COPC is included in this table if the maximum HQ is greater than 0.3 (LANL 1999, 64783).

Terrestrial COPECs are determined using the following process:

1. For a reach and status combination, individual analytes are not retained as COPECs if the HQ for detected results is less than or equal to 0.3.

The list of COPECs for terrestrial receptors is presented in Table E-1.0-6. Section 8.1 provides further evaluation of these COPECs.

6.2.2.2 Aquatic Receptor and Pathway Ecological Screen

The aquatic ecological receptors and aquatic exposure pathways ecological screen involves comparing the maximum concentration for a COPC in active channel sediment deposits (c1 geomorphic unit) to its sediment ESL (LANL 2002, 73702; LANL 2003, 74012) as depicted in Figure 6.2-2. A list of screened analytes and the associated ESLs is presented in Table E-1.0-7. This screen is performed by reach and status, and the results of the screen are presented Table E-1.0-8. An analyte is included in these tables if it is identified as a COPC in Section 6.2.1, and if the maximum HQ is greater than 0.3 (LANL 1999, 64783).

COPECs for aquatic ecological receptors and aquatic exposure pathways are determined using the following process:

1. For a reach and status combination, individual analytes are not retained as COPECs if the HQ for detected results is less than or equal to 0.3.

The list of COPECs for aquatic receptors and pathways is presented in Table E-1.0-9. Section 8.1 provides further evaluation of these COPECs.

6.2.3 Identification of Sediment COPCs for Human Health Risk Assessment

The identification of sediment COPCs to be carried forward to the human health risk assessment includes a two-tiered screening process, as discussed below. COPCs retained in the Tier 2 screen are evaluated in Section 6.2.3.3 to determine whether they represent contaminant releases into the Los Alamos and Pueblo watershed, in which case they are retained for further assessment.

6.2.3.1 Tier 1 Human Health Screen

The Tier 1 human health screen involves comparing the maximum concentration for a sediment COPC to its SAL, as depicted in Figure 6.2-3. A list of COPCs, the associated SALs, and the source of the SALs are presented in Table E-1.0-10. If surrogate values are used, the surrogate and its source are noted. The chemical SALs were calculated based on the methodology provided in Appendix C of the NMED-approved installation work plan (LANL 1998, 62060; LANL 2002, 72639). The methodology is based on guidance from EPA Region 6 and NMED (EPA 2003, 81724; NMED 2000, 68554). For radionuclides, the SALs are derived using RESRAD, Version 6.21, according to the process delineated in a Laboratory report on the derivation and use of radionuclide SALs (LANL 2001, 69683) and in a report describing the methodology for human health risk-based screening (LANL 2002, 73705). The SALs for noncarcinogens are based on a HQ of 1; SALs for carcinogens are based on a target cancer risk of 10^{-6} , and SALs for radionuclides in sediment are based on a dose of 15 mrem/yr. Because SALs are based on a 10^{-6} cancer risk, which is 1/10th the NMED target level of 10^{-5} , the HQ/HI criteria for carcinogens presented below are an order of magnitude higher than for noncarcinogens and radionuclides.

HQs and hazard indices (HIs) are used in this screen. An HQ is the ratio of sample result to the SAL for that analyte, and an HI is the sum of HQs for a risk type, i.e., carcinogens, noncarcinogens, and radionuclides. This screen is performed by reach and status.

Results of the Tier 1 screen are presented in Table E-1.0-11. An analyte is carried forward as a Tier 1 human health COPC in a reach if it is identified as a COPC in Section 6.2.1, and if the maximum HQ exceeds 0.1 for noncarcinogens and radionuclides or 1 for carcinogens, in accordance with Laboratory human health risk-based screening methodology (LANL 2002, 72639). HIs for each risk type are calculated as the sum of all HQs for COPCs of that type. HQs for COPCs identified in Section 6.2.1 but not carried forward as Tier 1 human health COPCs are included in the HI, and the sums by risk type in Table E-1.0-11 can be higher than the sum of the analytes presented in this table.

Tier 1 COPCs are determined using the following process:

1. All COPCs within a risk type (carcinogens, noncarcinogens and radionuclides) are not retained as Tier 1 COPCs for a reach and status combination if the HI is less than or equal to 1 for noncarcinogens and radionuclides or less than or equal to 10 for carcinogens.
2. Within a risk type retained in Step 1 for a reach and status combination, individual analytes are not retained as Tier 1 COPCs if the HQ for detected results is less than or equal to 0.1 for noncarcinogens and radionuclides or less than or equal to 1 for carcinogens.

The list of Tier 1 COPCs is presented in Table E-1.0-12.

6.2.3.2 Tier 2 Human Health Screen

The Tier 2 human health screen compares SALs to exposure point concentrations (EPCs) for each sediment COPC retained from Tier 1. The 95% upper confidence limit (UCL) on the arithmetic average of the entire data set in a reach is used to represent the EPC for each COPC in this screen. This approach is intended to focus the risk assessment on COPCs that potentially present a human health risk. Further refinements for calculating EPCs are used in Section 8.2 to better represent the geomorphic characteristics of the reaches. UCLs are calculated for each combination of reach, status, and Tier 1 COPC identified in Section 6.2.3.1. The methodology for calculating UCLs is documented in Section E-2 of Appendix E. As in the previous section, HQs and HIs are used in the Tier 2 screen. The Tier 2 screen uses the HQ of the 95% UCL on the average concentration or the maximum value for a COPC, whichever is smaller. This screening process is consistent with the COPC evaluation methods presented by EPA (EPA 1989, 8021). The process is depicted in Figure 6.2-4. Results of the Tier 2 screen are presented in Table E-1.0-13.

Tier 2 COPCs are determined using the following process:

1. All analytes within a risk type (carcinogens, noncarcinogens, and radionuclides) are not retained as Tier 2 COPCs for a reach and status combination if the HIs are less than or equal to 1 for noncarcinogens and radionuclides or 10 for carcinogens.
2. Within a risk type retained in Step 1 above for a reach and status combination, individual analytes are not retained as Tier 2 COPCs if the HQs are less than or equal to 0.1 for noncarcinogens and radionuclides or less than or equal to 1 for carcinogens.

The list of Tier 2 COPCs is presented in Table E-1.0-14.

6.2.3.3 Evaluation of Tier 2 Sediment COPCs for Human Health Risk Assessment

This section addresses sediment COPCs that are identified in the Tier 2 screen whose spatial distribution and/or frequency of detection indicate that they do not represent contaminant releases into the Los Alamos and Pueblo watershed. This evaluation supports the identification of important COPCs that are discussed in more detail in Section 7.1 and carried forward into the human health risk assessment discussed in Section 8.2.

Inorganic Chemicals in Sediment

Available data indicate that four inorganic COPCs in sediment identified in the Tier 2 screen in Section 6.2.3.2 do not have sources at Laboratory SWMUs or AOCs: aluminum, iron, manganese, and thallium.

Aluminum is a Tier 2 COPC only in the post-fire baseline data set and was detected above the BV in a single sediment sample downcanyon from Laboratory sources. This sample from reach P-4W (04-PU-96-0030) also contains relatively high iron, and its composition is consistent with background variability, as discussed in Reneau et al. (1998, 62050, p. 3-3). Therefore, no evidence exists of aluminum releases from Laboratory sources, and the analyte is not evaluated further in Sections 7.1 or 8.2.

Iron, manganese, and thallium are Tier 2 COPCs only in reach P-4E or in post-fire baseline samples. The maximum values for iron and thallium are in a P-4E sample that was rich in black magnetite sands (sample 04PU-96-0026), and manganese was also greater than the BV in this sample (Reneau et al. 1998, 59159, p. 3-3). Magnetite sands have naturally elevated levels of several metals (Reneau et al. 1998, 62050, pp.

12–14); therefore, these elevated values from P-4E are consistent with natural background variability. The maximum values of manganese occur in the post-fire baseline data set, and the maximum value in sediment downcanyon from SWMUs and AOCs occurs in post-fire sediment in reach LA-3FE. Thus, the elevated manganese values are primarily associated with the concentration of naturally occurring manganese in ash and its redistribution by post-fire floods (e.g., Katzman et al. 2001, 72660; Kraig et al. 2002, 72658). For these reasons, iron, manganese, and thallium are not evaluated further in this report in the context of potential human health risk. Potential human health risks associated with these metals in post-fire sediment deposits are evaluated in Kraig et al. (2002, 72658).

Radionuclides in Sediment

Available data indicate that four radionuclide COPCs in sediment identified in the Tier 2 screen in Section 6.2.3.2 do not have sources at Laboratory SWMUs or AOCs: europium-152, thorium-228, thorium-230, and thorium-232. These four COPCs are not discussed in Section 7.1 or evaluated in the human health risk assessment in Section 8.2.

Europium-152 is a gamma spectroscopy analyte that has no BV and is carried forward as a COPC wherever it is detected. It is a fission product present in trace levels in atmospheric fallout. It has a very low frequency of detects (1.2%) in the Los Alamos and Pueblo watershed, consisting of 6 out of 487 samples analyzed for gamma spectroscopy radionuclides from contaminated geomorphic units. It was detected only in reaches LA-2E, LA-3E, LA-4E, LA-4W, and P-1E and is a Tier 2 COPC only in LA-2E. In LA-2E, it was detected in 1 out of 47 samples (sample 04LA-97-0075) for a detection frequency of 2%. The detected europium-152 sample results fall within the range of nondetect sample results, as indicated in a previous report (Reneau et al. 1998, 59160, p. 3-23). In addition, the geographic distribution of detects indicates that it does not represent Laboratory releases because europium-152 was not detected closer to potential sources in Acid, DP, or Los Alamos Canyons upcanyon from DP Canyon. It was also not detected in the 58 gamma spectroscopy analyses obtained in 2001 from contaminated geomorphic units in reaches LA-2FE and LA-3W. Because of its low frequency of detects and the absence of detected results close to potential sources, europium-152 is not evaluated further in this report.

Thorium-228, thorium-230, and thorium-232 were detected at concentrations greater than BVs in one sample collected in reach LA-3E in 1997 (sample 04LA-97-0147), and thorium-230 was detected at a concentration greater than the BV in one sample collected in reach LA-2E in 1996 (sample 04LA-96-0145). The maximum LA-3E thorium values are only 13% to 27% greater than BVs and were analyzed at a different laboratory than the other thorium samples in the background data set, indicating that these detected results may be related to an analytical bias between laboratories (Reneau et al. 1998, 59160, p. 3-24). The maximum LA-2E thorium-230 value is only 7% greater than the BV, which indicates only a slight difference from background data. These isotopes were not detected at concentrations greater than BVs in 11 samples collected in 2001 in contaminated geomorphic units in the intervening reaches (LA-2FE and LA-3W), supporting the conclusion that the results from LA-2E and LA-3W do not represent Laboratory releases. For these reasons, thorium-228, thorium-230, and thorium-232 are not evaluated further in this report.

6.3 Contaminants in Surface Water and Alluvial Groundwater

This section presents the process for screening surface water and alluvial groundwater sample results from the Los Alamos and Pueblo watershed. Analytical results from water samples were first screened to develop a list of COPCs, as presented in Section 6.3.1. In Section 6.3.2, all water COPCs are screened against water ESLs to identify COPECs. In Section 6.3.3, all water COPCs are screened against either an EPA tap water value (Region 6 or 9 [EPA 2002, 76866; EPA 2002, 76867]) or a DOE-derived concentration guideline (DCG, DOE Order 5400.5, "Radiation Protection of the Public and the

Environment") to identify the subset of COPCs that are important for assessing potential human health risk. The results of these screens are presented in tables in Section E-1.0 of Appendix E.

6.3.1 Identification of Surface Water and Alluvial Groundwater COPCs

There are no BVs for water data; thus, COPCs are identified by a screening process that considers only the frequency of detection. This process is performed for groups of data defined by hydrosegments and field preparation for all analyte types (inorganic chemicals, organic chemicals, and radionuclides). The basis for using hydrosegments as a screening level is explained in Section 6.1. The samples are prepared in the field as either filtered or unfiltered. The screening process is depicted in Figure 6.3-1 and discussed below. The COPCs resulting from this screen are presented in Tables E-1.0-15 to E-1.0-17 for organic, radionuclide, and inorganic COPCs, respectively.

For all analyte types, a specific analyte is retained as a COPC for a hydrosegment and field preparation combination if

- the frequency of detection is greater than or equal to 5% for any water type in that hydrosegment and field preparation combination.

6.3.2 Identification of Surface Water COPECs for Ecological Risk Assessment

The subset of water COPCs, identified in Section 6.3.1, to be evaluated in the baseline ecological risk assessment includes comparison of surface water concentrations to water ESLs, as discussed in Section 6.3.2.1. Comparing water concentrations to water ESLs evaluates the potential for adverse ecological effects from COPCs to aquatic ecological receptors and aquatic exposure pathways. Concentrations measured in surface water and springs are compared to water ESLs. Alluvial groundwater data are not evaluated in the ecological screen, because no exposure pathways to ecological receptors from alluvial groundwater exist (except for springs, which are evaluated for ecological risks as just noted). The source of the ESLs is documented in the Ecorisk Database, Version 1.5 (LANL 2002, 73702; LANL 2003, 74012).

6.3.2.1 Aquatic Receptor and Pathway Ecological Screen

The aquatic ecological receptors and aquatic exposure pathways ecological screen involves comparing the maximum value for a COPC in water to its ESL as depicted in Figure 6.2-2. A list of screened analytes, the associated ESLs, and the source of the ESL values are presented in Table E-1.0-18. If surrogate values are used, the surrogate and its source are noted.

HQs are used in this screen, which is performed by canyon, hydrosegment, water type, and field preparation. The results of the screen are presented in Table E-1.0-19. An analyte is included in these tables if it was identified as a COPC in Section 6.2.1 and if the maximum HQ is greater than 0.3 (LANL 1999, 64783).

COPECs are determined using the following process:

1. For a canyon, hydrosegment, water type, and field preparation combination, individual analytes are retained as COPECs if the HQs are greater than 0.3.

The list of COPECs is presented in Table E-1.0-20. Section 8.1 presents further evaluation of these COPECs.

6.3.3 Identification of Surface Water and Alluvial Groundwater COPCs for Human Health Risk Assessment

The identification of the subset of water COPCs to be carried forward into the human health risk assessment includes a two-tiered screening process, as discussed below.

6.3.3.1 Tier 1 Human Health Screen

The Tier 1 human health screen involves comparing the maximum concentration for a COPC to either an EPA tap water value (Region 6 or 9 [EPA 2002, 76866; EPA 2002, 76867]) or a DOE-DCG (DOE Order 5400.5, "Radiation Protection of the Public and the Environment") as depicted in Figure 6.3-2. In this section, EPA tap water values and DOE-DCGs are collectively referred to as screening levels. A list of screened analytes, the associated screening levels, and the source of the screening level is presented in Table E-1.0-21. If surrogate values are used, the surrogate and its source are noted. Chromium is measured as total chromium for which there is no EPA Region 6 tap water value. There are tap water values for Chromium+3 (Cr+3) and Chromium+6 (Cr+6), of 5.5×10^4 and 1.2×10^2 , respectively (EPA 2002, 73691). Assuming total chromium exists as a 1:6 ratio of Cr+6 and Cr+3, the Cr+6 tap water value was chosen to be protective. For analytes that do not have screening values, the NMWQCC-published standards were evaluated to determine if they are applicable.

Chloride does not have an EPA Region 6 tap water value but has a groundwater standard (other standards for domestic water); thus, the groundwater standard was used as a surrogate. The EPA Region 6 or 9 tap water values for noncarcinogens are based on a HQ of 1; EPA Region 6 or 9 tap water values for carcinogens are based on a target cancer risk of 10^{-6} . Because SALs are based on a 10^{-6} cancer risk, which is 1/10th the NMED target level of 10^{-5} , the HQ/HI criteria for carcinogens presented below are an order of magnitude higher than for noncarcinogens and radionuclides. The DOE-DCG for radionuclides in water is based on a dose of 4 mrem/yr. The Tier 1 screen is performed at the level of canyon hydrosegment, water type (e.g., surface water, alluvial groundwater), and field preparation.

Results of the Tier 1 screen are presented in Table E-1.0-22. An analyte is carried forward as a Tier 1 human health COPC if it is identified as a COPC in Section 6.3.1 and if the maximum HQ exceeds 0.1 for noncarcinogens and radionuclides, or 1 for carcinogens in accordance with Laboratory guidance (LANL 2002, 72639). HIs for each risk type are calculated as the sum of all HQs for COPCs of that type. HQs for COPCs identified in Section 6.3.1 but not carried forward as Tier 1 human health COPCs are included in the HI, and the sums by risk type in Table E-1.0-22 can be higher than the sum of the analytes presented in this table.

Tier 1 COPCs are determined using the following process:

1. All COPCs within a risk type (carcinogens, noncarcinogens and radionuclides) are not retained as Tier 1 COPCs for a canyon hydrosegment, water type, and field preparation combination if the HIs for detected results are less than or equal to 1 for noncarcinogens and radionuclides or less than or equal to 10 for carcinogens.
2. Within an risk type retained in Step 1 for a canyon hydrosegment, water type, and field preparation, individual analytes are not retained as Tier 1 COPCs if the HQs for detected results is less than or equal to 0.1 for noncarcinogens and radionuclides or less than or equal to 1 for carcinogens.

The list of Tier 1 COPCs is presented in Table E-1.0-23.

6.3.3.2 Tier 2 Human Health Screen

The Tier 2 human health screen involves comparing screening levels to initial estimates of chronic EPCs, as opposed to maximum values, for each analyte retained as a Tier 1 COPC. The 95% UCL on the average of the data set for a sampling location is used to represent the EPC for each analyte in this screen. This approach is intended to focus the risk assessment on analytes that are more important in assessing human health risk. UCLs are calculated by location and field preparation for each COPC identified in Section 6.3.3.1. As in the previous section, HQs and HIs are used in the Tier 2 screen. The Tier 2 screen uses the HQ of the 95% UCL on the average concentration or the maximum value for an analyte, whichever is smaller. This screening process is consistent with the COPC evaluation methods presented in EPA guidance (EPA 1989, 8021) and is shown in Figure 6.3-3. Results of the Tier 2 screen are presented in Table E-1.0-24.

Tier 2 COPCs are determined using the following process:

1. All analytes within a type (carcinogens, noncarcinogens, and radionuclides) are eliminated as Tier 2 COPCs for each location and field preparation combination if the HIs are less than or equal to 1 for noncarcinogens and radionuclides or less than or equal to 10 for carcinogens.
2. Within a type of analytes retained in Step 1 above for a location and field preparation combination, individual analytes are eliminated as Tier 2 COPCs if the HQs are less than or equal to 0.1 for noncarcinogens and radionuclides or less than or equal to 1 for carcinogens.

The list of Tier 2 COPCs is presented in Table E-1.0-25.

6.3.3.3 Evaluation of Tier 2 Water COPCs for Human Health Risk Assessment

This section addresses COPCs detected infrequently in either groundwater or surface water. In addition to the low rates of detection, there is also no evidence of trends from contaminant source areas. Several of the COPCs were detected at locations that are upcanyon from Laboratory releases. The low rates of detection and the locations where COPCs were detected indicate no relation of these COPCs to Laboratory sources.

6.3.3.3.1 Groundwater

Available data indicate that five COPCs in alluvial groundwater do not represent contaminant releases in Los Alamos and Pueblo watershed based on low frequency of detections, false positive analytical results, and/or occurrences upgradient from known Laboratory releases: benzene, dieldrin, methylene chloride, trichloroethene, and chloride.

Benzene was detected in two samples from two locations. One is a background groundwater location, LAO-B, and the other is in lower Los Alamos Canyon, at LLAO-1b. These detects are not associated with any known releases from the Laboratory and are not repeated in other samples at the same locations. Benzene is not evaluated further.

Dieldrin was detected once at PAO-1 at 0.0054 µg/L. Other samples from that location did not detect this analyte. Dieldrin is not evaluated further.

Methylene chloride is a common analytical laboratory contaminant. It was detected eight times at concentrations of 0.93 to 38 µg/L in locations that include LAO(b), a background groundwater location. These values are all less than ten times the estimated quantitation limit of 5 µg/L. Methylene chloride is not

evaluated further. Trichloroethene was detected once at LLAO-1b at 1.7 µg/L. Other samples from this sampling location do not show detections of this analyte. Trichloroethene is not evaluated further.

Chloride data were collected as a part of the anion suite used for geochemical analysis of groundwater and surface water. With a maximum detected concentration of 10 µg/L in groundwater, it is not considered to be a risk relevant contaminant and is not evaluated further.

6.3.3.3.2 Surface Water

Available data indicate that seven COPCs in surface water do not represent contaminant releases in Los Alamos and Pueblo watershed based on low frequency of detection and/or occurrences upcanyon from known Laboratory releases: dichlorodiphenyldichloroethylene (DDE), [4,4'-], bromodichloromethane, chloroform, bromomethane, dichloroethane[1,2-], methylene chloride, and chloride.

DDE[4,4'-] was detected once in reach LA-2W at 0.57 µg/L; however, this analyte was not detected in other samples. DDE[4,4'-] is not evaluated further.

Bromodichloromethane was detected once at DP-1W at 0.21 µg/L. Chloroform was detected once at DP-1W (2.8 µg/L) and twice at Pueblo 3 (0.24 and 0.20 µg/L). Both of these analytes are disinfection byproducts from water treatment. The National Primary Drinking Water Regulations: Disinfectants and Disinfection Byproducts, Final Rule (40 CFR 141.64) establishes 80 µg/L as the acceptable limit for disinfection byproducts. The values reported in this section are well below this standard. Bromodichloromethane and chloroform are not evaluated further.

Bromomethane was detected at DP Spring at 2.7 µg/L and was not detected again at this location or at any other locations. Bromomethane is not evaluated further.

Dichloroethane[1,2-] was detected once at DP Spring at 7.6 µg/L. A follow-up sample and other samples collected from DP Spring did not detect this analyte. Dichloroethane[1,2-] is not evaluated further.

Methylene chloride was detected once in the Los Alamos Reservoir at 37 µg/L and twice in reach LA-1W at 40 and 1.4 µg/L. This compound is a common analytical laboratory contaminant. These values are less than ten times the detection limit of 5 µg/L. Methylene chloride is not evaluated further.

Chloride data were collected as a part of the anion suite used for geochemical analysis of groundwater and surface water. With a maximum detected concentration of 8 µg/L in surface water, it is not considered a risk-relevant contaminant and is not evaluated further.

6.4 Summary

Table 6.4-1 presents a summary of the COPCs and COPECs in sediment and water samples from the Los Alamos and Pueblo watershed. Table 6.4-1 indicates which analytes were retained for further assessment after each step of the screening process discussed above. The analytes retained are discussed further in Section 7 and evaluated as part of the ecological and human health risk assessment presented in Section 8.

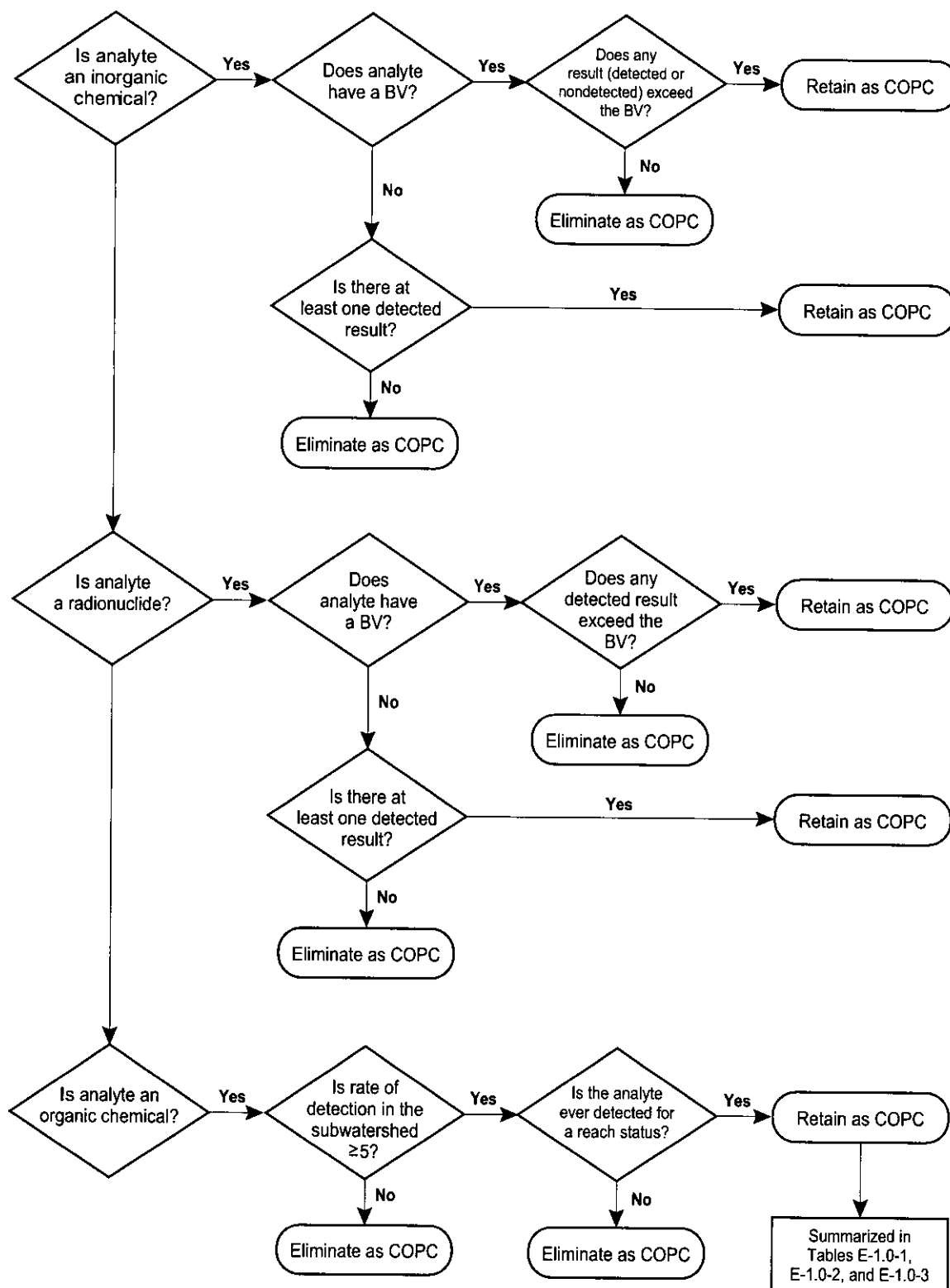


Figure 6.2-1. BV and frequency-of-detection screen performed by reach for inorganic chemicals and radionuclides and by subwatershed reach/status for organic chemicals

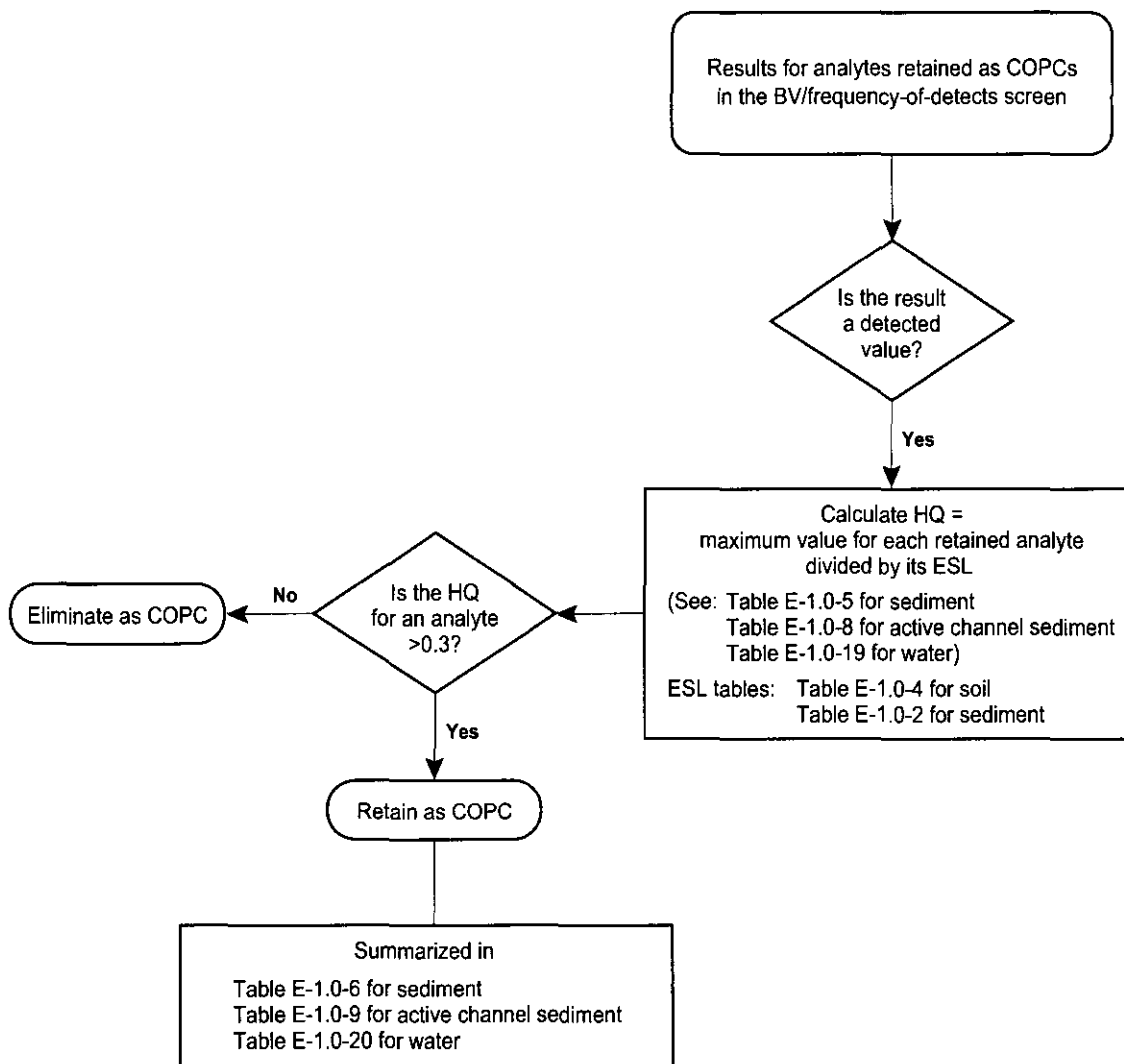


Figure 6.2-2. Ecological screen (based on maxima) performed by reach and status for sediment and active channel sediment and performed by canyon hydrosegment, water type, and field preparation for water

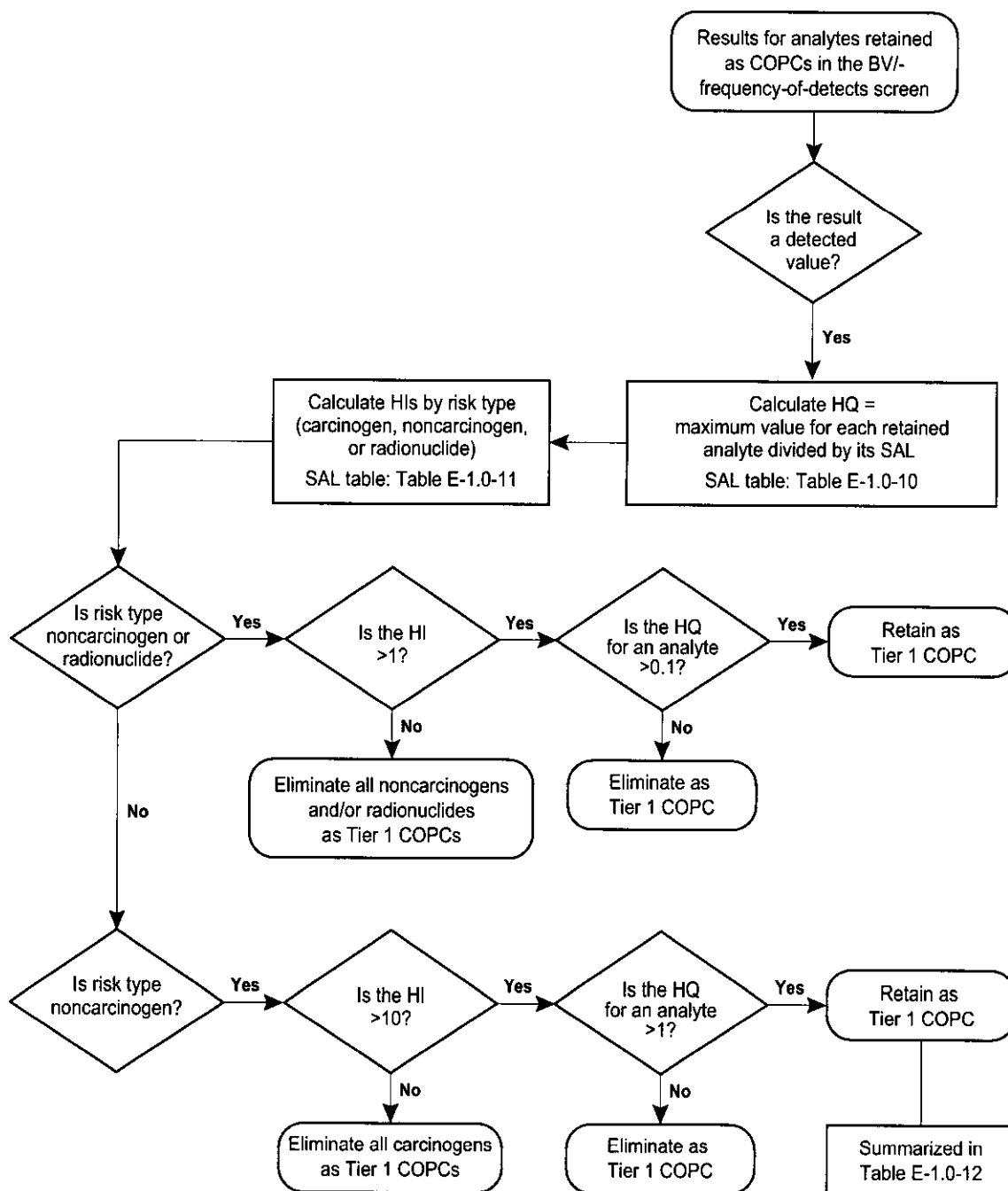


Figure 6.2-3. Human health screen (based on maxima) performed by reach and status

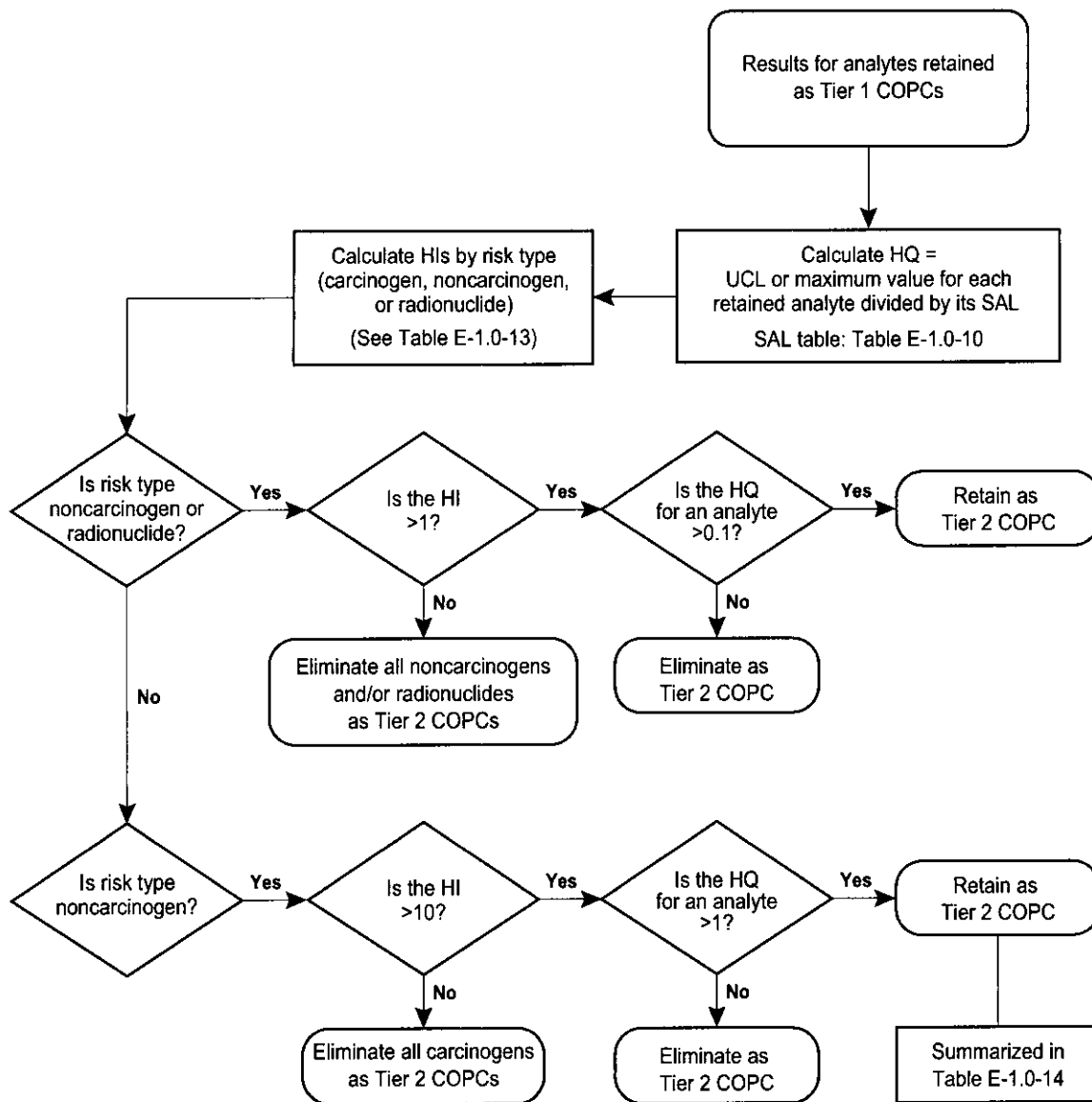


Figure 6.2-4. Human health screen (based on UCLs or maxima) performed by reach and status

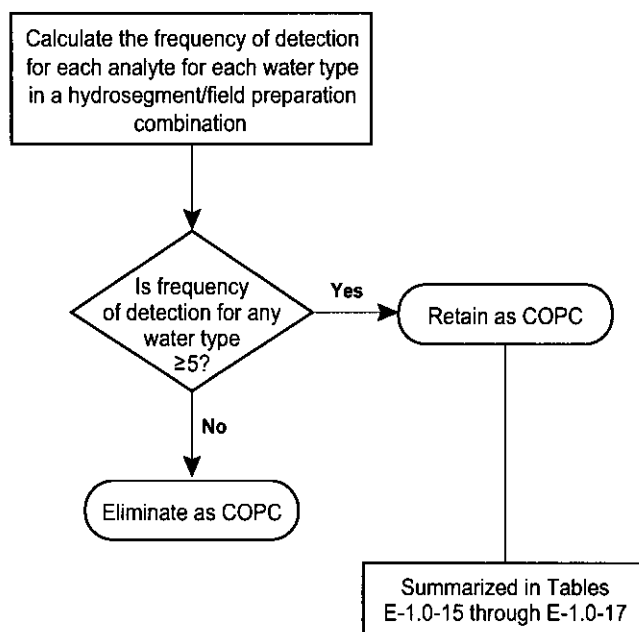


Figure 6.3-1. Frequency-of-detection screen performed by hydrosegment and field preparation

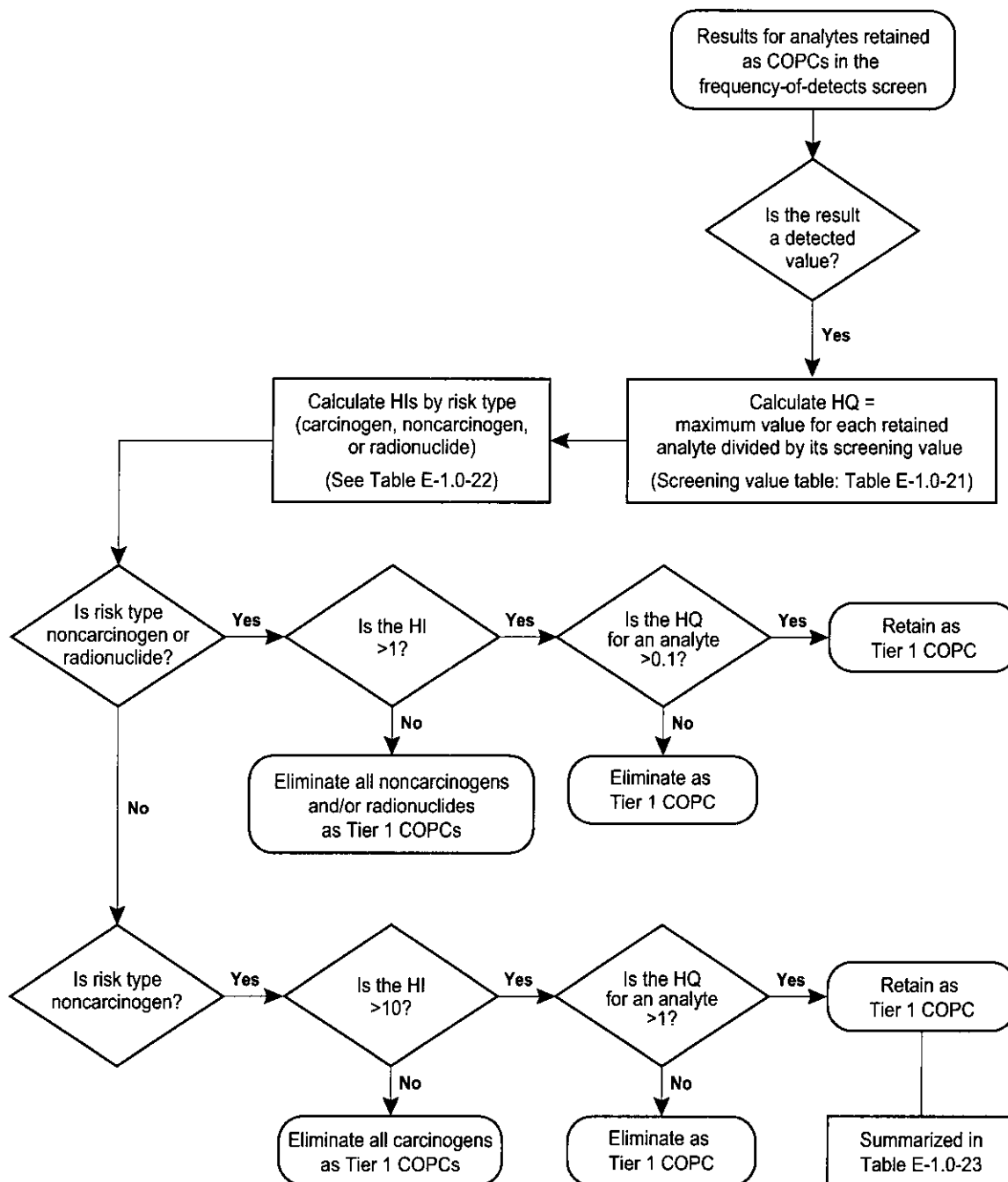


Figure 6.3-2. Human health screen (based on maxima) performed by canyon hydrosegment, water, type, and field preparation

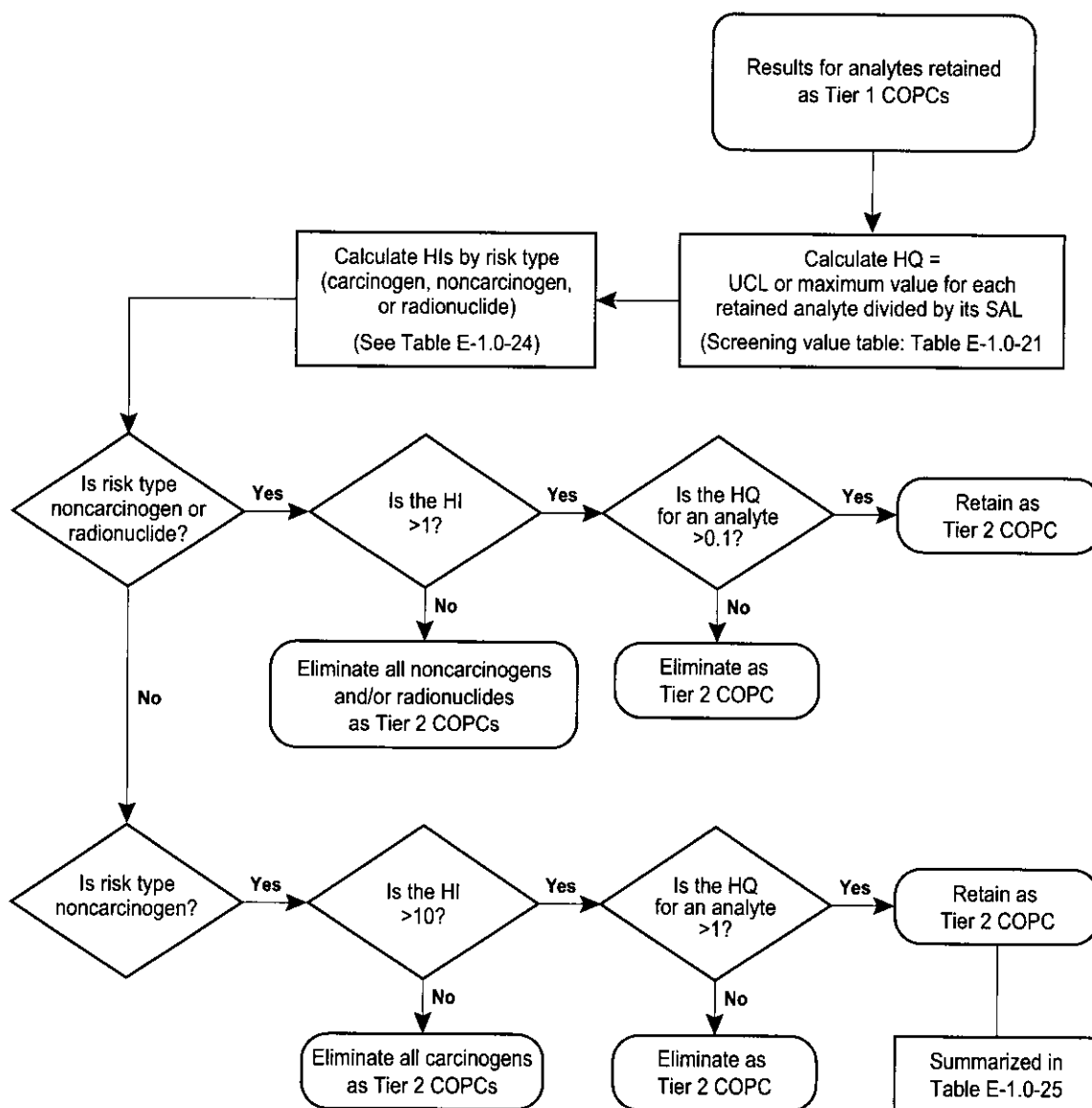


Figure 6.3-3. Human health screen (based on UCLs or maxima) performed by location and field preparation

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Table 6.0-1
Number of Samples Analyzed by Suite

Analytical Suite	Sediment Samples	Alluvial Groundwater Samples	Surface Water/Springs Samples	Cerro Grande Ash Samples	Total
Dioxins/Furans	28	2	1	7	38
High explosives	3	n/c	n/c	n/c ^a	3
Humic acids	1	27	19	n/c	47
Methyl mercury	8	n/c	n/c	n/c	8
PAHs	32	26	24	n/c	82
PCBs	327	76	66	n/c	469
PCB congeners	7	n/c	n/c	n/c	7
Pesticides	279	59	53	n/c	391
SVOCs	245	76	61	7	389
Total petroleum hydrocarbons	62	12	11	n/c	85
VOCs	48	72	53	n/c	173
Cyanide (total or amenable to chlorination)	142	91	68	1	302
Metals	475	262	198	14	949
Perchlorate	13	114	86	n/c	213
Other soil parameters ^b	75	n/a ^c	n/a	8	83
Other water parameters ^d	n/a	249	195	n/a	444
Americium-241 ^e	117	167	126	7	417
Gamma spectroscopy radionuclides ^f	673	174	144	17	1008
Gross alpha/beta	63	34	2	n/c	99
Gross gamma	8	14	n/c	n/c	22
Isotopic plutonium	1051	214	178	17	1460
Isotopic thorium	78	n/c	n/c	4	82
Isotopic uranium	199	187	124	4	514
Strontium-90	517	246	187	17	967
Technetium-99	n/c	60	41	n/c	101
Tritium	171	95	60	n/c	326

^a n/c = Suite not analyzed.

^b Other soil parameters include alkalinities, bromide, carbon, chlorate, chloride, fluoride, perchlorate, sulfate, and total organic carbon.

^c n/a = Not applicable.

^d Other water parameters include alkalinities, ammonia, ammonium, bromide, chlorate, chloride, conductivity, dissolved organic carbon, fluoride, hardness, nitrate, nitrite, oxalate, total dissolved solids, total suspended solids, sulfate, total kjeldahl nitrogen, total organic carbon, pH

^e Americium-241 by alpha spectroscopy.

^f Gamma spectroscopy radionuclides include Am-241, Cs-134, Cs-137, Co-60, Eu-152, Ru-106, Na-22, and U-235.

Table 6.4-1
Summary of Water and Sediment COPCs and COPECs

Analyte Name	Sediment						Water				
	COPCs	Tier 1 Human Health COPCs	Tier 2 Human Health COPCs	Final COPCs for Human Health Risk Assessment	Ecological Assessment - Terrestrial COPECs	Ecological Assessment - Aquatic COPECs	COPCs	Tier 1 Human Health COPCs	Tier 2 Human Health COPCs	Final COPCs for Human Health Risk Assessment	Ecological Assessment - COPECs
Alkalinity-CO3	nc ^a	nc	nc	nc	nc	nc	X ^b	nv ^c	nv	nv	ne ^d
Alkalinity-CO3+HCO3	na ^e	na	na	na	na	na	X	nv	nv	nv	ne
Alkalinity-HCO3	X	nv	nv	nv	ne	ne	X	nv	nv	nv	ne
Aluminum	X	X	X	ef ^f	X ^g	no ^h	X	X	X	X	X
Antimony	X	nh ⁱ	nh	nh	X	no	X	X	X	X	no
Arsenic	X	X	X	X	X	X	X	X	X	X	no
Barium	X	X	e2 ^j	e2	X	X	X	X	X	X	X
Beryllium	X	nh	nh	nh	X	X	X	nh	nh	nh	X
Boron	X	nh	nh	nh	X	no	X	X	X	X	X
Bromide	X	nv	nv	nv	ne	ne	X	nv	nv	nv	ne
Cadmium	X	nh	nh	nh	X	X	X	nh	nh	nh	X
Calcium	X	nv	nv	nv	ne	ne	X	nv	nv	nv	ne
Chloride	X	nh	nh	nh	ne	ne	X	X	X	ef	X
Chromium	X	nh	nh	nh	X	X	X	X	X	X	no
Cobalt	X	nh	nh	nh	X	X	X	nh	nh	nh	X
Copper	X	nh	nh	nh	X	X	X	X	e2	e2	X
Cyanide (Total)	X	nv	nv	nv	X	X	X	nv	nv	nv	X
Cyanide, Amenable to Chlorination	nc	nc	nc	nc	nc	nc	X	nh	nh	nh	ne
Fluoride	nc	nc	nc	nc	nc	nc	X	X	X	X	X
Iron	X	X	X	ef	ne	ne	X	X	X	X	ne
Lead	X	X	e2	e2	X	X	X	nv	nv	nv	X
Lithium	nc	nc	nc	nc	nc	nc	X	nh	nh	nh	ne
Magnesium	X	nv	nv	nv	ne	ne	X	nv	nv	nv	ne
Manganese	X	X	X	ef	X	X	X	X	X	X	X
Mercury	X	X	e2	e2	X	no	X	nh	nh	nh	no
Molybdenum	nc	nc	nc	nc	nc	nc	X	X	X	X	ne
Nickel	X	nh	nh	nh	X	X	X	nh	nh	nh	X
Perchlorate	nc	nc	nc	nc	nc	nc	X	X	X	X	ne
Potassium	X	nv	nv	nv	ne	ne	X	nv	nv	nv	ne
Selenium	X	nh	nh	nh	X	X	X	nh	nh	nh	X

Table 6.4-1 (continued)

Analyte Name	Sediment						Water				
	COPCs	Tier 1 Human Health COPCs	Tier 2 Human Health COPCs	Final COPCs for Human Health Risk Assessment	Ecological Assessment - Terrestrial COPECs	Ecological Assessment - Aquatic COPECs	COPCs	Tier 1 Human Health COPCs	Tier 2 Human Health COPCs	Final COPCs for Human Health Risk Assessment	Ecological Assessment - COPECs
Silicon	nc	nc	nc	nc	nc	nc	X	nv	nv	nv	ne
Silver	X	nh	nh	nh	X	no	X	nh	nh	nh	X
Sodium	X	nv	nv	nv	ne	ne	X	nv	nv	nv	ne
Strontium	nc	nc	nc	nc	nc	nc	X	nh	nh	nh	X
Sulfate	X	nv	nv	nv	ne	ne	X	nv	nv	nv	ne
Thallium	X	X	X	ef	X	X	X	X	X	X	no
Titanium	X	nv	nv	nv	X	no	X	nv	nv	nv	no
Uranium	X	X	e2	e2	X	no	X	X	X	X	X
Vanadium	X	nh	nh	nh	X	X	X	X	e2	e2	X
Zinc	X	nh	nh	nh	X	X	X	nh	nh	nh	X
Ammonia	na	na	na	na	na	na	X	nv	nv	nv	ne
Ammonium	na	na	na	na	na	na	X	nv	nv	nv	ne
Nitrate	na	na	na	na	na	na	X	X	X	X	ne
Nitrate+Nitrite (as N)	na	na	na	na	na	na	X	nv	nv	nv	ne
Nitrite	na	na	na	na	na	na	X	X	X	X	ne
Phosphorus	na	na	na	na	na	na	X	nv	nv	nv	ne
Phosphorus, Orthophosphate (Expressed as PO ₄)	na	na	na	na	na	na	X	nv	nv	nv	ne
Silicon Dioxide	na	na	na	na	na	na	X	nv	nv	nv	ne
Total Kjeldahl Nitrogen	na	na	na	na	na	na	X	nv	nv	nv	ne
Acenaphthene	X	nh	nh	nh	X	no	X	nh	nh	nh	no
Acenaphthylene	nc	nc	nc	nc	nc	nc	X	nh	nh	nh	no
Acetone	X	nh	nh	nh	no	no	X	nh	nh	nh	no
Aldrin	X	nh	nh	nh	ne	ne	nc	nc	nc	nc	nc
Amino-2,6-dinitrotoluene[4-]	X	nh	nh	nh	no	no	na	na	na	na	na
Amino-4,6-dinitrotoluene[2-]	X	nh	nh	nh	no	no	na	na	na	na	na
Anthracene	X	nh	nh	nh	no	X	X	nh	nh	nh	X
Aroclor-1248	X	nh	nh	nh	X	no	nc	nc	nc	nc	nc
Aroclor-1254	X	X	X	X	X	X	nc	nc	nc	nc	nc
Aroclor-1260	X	X	X	X	X	X	nc	nc	nc	nc	nc
Benzene	X	nh	nh	nh	no	no	X	X	X	ef	no
Benz(a)anthracene	X	X	X	X	X	X	X	X	X	X	X

Table 6.4-1 (continued)

Analyte Name	Sediment						Water				
	COPCs	Tier 1 Human Health COPCs	Tier 2 Human Health COPCs	Final COPCs for Human Health Risk Assessment	Ecological Assessment - Terrestrial COPECs	Ecological Assessment - Aquatic COPECs	COPCs	Tier 1 Human Health COPCs	Tier 2 Human Health COPCs	Final COPCs for Human Health Risk Assessment	Ecological Assessment - COPECs
Benzo(a)pyrene	X	X	X	X	X	X	X	X	X	X	X
Benzo(b)fluoranthene	X	X	X	X	X	X	X	X	X	X	no
Benzo(g,h,i)perylene	X	nh	nh	nh	X	X	X	nh	nh	nh	no
Benzo(k)fluoranthene	X	nh	nh	nh	no	X	X	nh	nh	nh	no
Benzoic Acid	X	nh	nh	nh	X	X	X	nh	nh	nh	X
Benzyl Alcohol	X	nh	nh	nh	ne	ne	X	nh	nh	nh	ne
BHC[beta-]	nc	nc	nc	nc	nc	nc	X	X	X	X	no
BHC[gamma-]	nc	nc	nc	nc	nc	nc	X	nh	nh	nh	no
Bis(2-ethylhexyl)phthalate	X	nh	nh	nh	X	X	X	X	X	X	no
Bromodichloromethane	nc	nc	nc	nc	nc	nc	X	X	X	ef	ne
Bromomethane	nc	nc	nc	nc	nc	nc	X	X	X	ef	ne
Butanone[2-]	X	nh	nh	nh	no	no	X	nh	nh	nh	no
Butylbenzylphthalate	X	nh	nh	nh	no	no	X	nh	nh	nh	no
Carbazole	X	nh	nh	nh	ne	ne	nc	nc	nc	nc	nc
Carbon Disulfide	nc	nc	nc	nc	nc	nc	X	nh	nh	nh	ne
Chlordane[alpha-]	X	nh	nh	nh	no	X	nc	nc	nc	nc	nc
Chlordane[gamma-]	X	nh	nh	nh	no	X	nc	nc	nc	nc	nc
Chlorobenzene	X	nh	nh	nh	no	no	nc	nc	nc	nc	nc
Chloroform	nc	nc	nc	nc	nc	nc	X	X	X	ef	no
Chloromethane	X	nh	nh	nh	ne	ne	nc	nc	nc	nc	nc
Chloronaphthalene[2-]	nc	nc	nc	nc	nc	nc	X	nh	nh	nh	ne
Chrysene	X	nh	nh	nh	X	X	X	nh	nh	nh	no
DDD[4,4'-]	X	nh	nh	nh	ne	ne	X	nh	nh	nh	ne
DDE[4,4'-]	X	nh	nh	nh	X	X	X	X	X	ef	no
DDT[4,4'-]	X	nh	nh	nh	X	X	X	X	X	X	X
Dibenz(a,h)anthracene	X	X	X	X	no	no	X	X	X	X	no
Dibenzofuran	X	nh	nh	nh	no	no	nc	nc	nc	nc	nc
Dichlorobenzene[1,2-]	X	nh	nh	nh	ne	ne	nc	nc	nc	nc	nc
Dichlorobenzene[1,4-]	X	nh	nh	nh	no	no	X	nh	nh	nh	no
Dichloroethane[1,2-]	nc	nc	nc	nc	nc	nc	X	X	X	ef	no
Dieldrin	X	X	e2	e2	X	no	X	X	X	ef	no
Diethylphthalate	nc	nc	nc	nc	nc	nc	X	nh	nh	nh	ne

Table 6.4-1 (continued)

Analyte Name	Sediment						Water				
	COPCs	Tier 1 Human Health COPCs	Tier 2 Human Health COPCs	Final COPCs for Human Health Risk Assessment	Ecological Assessment - Terrestrial COPECs	Ecological Assessment - Aquatic COPECs	COPCs	Tier 1 Human Health COPCs	Tier 2 Human Health COPCs	Final COPCs for Human Health Risk Assessment	Ecological Assessment - COPECs
Dimethylphenol[2,4-]	X	nh	nh	nh	ne	ne	nc	nc	nc	nc	nc
Di-n-butylphthalate	nc	nc	nc	nc	nc	nc	X	nh	nh	nh	no
Diphenylamine	X	nh	nh	nh	ne	ne	nc	nc	nc	nc	nc
Endrin	X	nh	nh	nh	X	no	nc	nc	nc	nc	nc
Endrin Aldehyde	X	nh	nh	nh	X	no	X	nh	nh	nh	X
Ethylbenzene	nc	nc	nc	nc	nc	nc	X	nh	nh	nh	ne
Fluoranthene	X	nh	nh	nh	X	X	X	nh	nh	nh	no
Fluorene	X	nh	nh	nh	X	no	X	nh	nh	nh	X
Heptachlor Epoxide	X	nh	nh	nh	ne	ne	nc	nc	nc	nc	nc
HMX	X	nh	nh	nh	no	no	na	na	na	na	na
Indeno(1,2,3-cd)pyrene	X	X	X	X	no	X	X	X	X	X	no
Iodomethane	X	nh	nh	nh	ne	ne	nc	nc	nc	nc	nc
Isopropylbenzene	X	nh	nh	nh	ne	ne	nc	nc	nc	nc	nc
Isopropyltoluene[4-]	X	nh	nh	nh	ne	ne	X	nh	nh	nh	ne
Methyl-2-pentanone[4-]	X	nh	nh	nh	ne	ne	nc	nc	nc	nc	nc
Methylene Chloride	X	nh	nh	nh	no	no	X	X	X	ef	no
Methylmercury(+1) Ion	X	nv	nv	nv	X	no	na	na	na	na	na
Methylnaphthalene[2-]	X	nh	nh	nh	no	no	X	nh	nh	nh	no
Methylphenol[2-]	X	nh	nh	nh	ne	ne	nc	nc	nc	nc	nc
Methylphenol[4-]	X	nh	nh	nh	ne	ne	nc	nc	nc	nc	nc
Naphthalene	X	nh	nh	nh	X	X	X	nh	nh	nh	no
Nitrobenzene	X	nh	nh	nh	no	no	nc	nc	nc	nc	nc
Nitrotoluene[2-]	X	nv	nv	nv	no	no	na	na	na	na	na
Phenanthrene	X	nh	nh	nh	X	X	X	nh	nh	nh	no
Phenol	X	nh	nh	nh	X	no	X	nh	nh	nh	no
Propylbenzene[1-]	X	nh	nh	nh	ne	ne	nc	nc	nc	nc	nc
Pyrene	X	nh	nh	nh	X	X	X	nh	nh	nh	no
Pyridine	X	nh	nh	nh	ne	ne	nc	nc	nc	nc	nc
Tetryl	X	nh	nh	nh	X	no	na	na	na	na	na
Toluene	X	nh	nh	nh	no	no	X	nh	nh	nh	no
TPH, Diesel Range	X	nv	nv	nv	ne	ne	X	nv	nv	nv	ne
TPH, Gasoline Range	X	nv	nv	nv	ne	ne	na	na	na	na	na

Table 6.4-1 (continued)

Analyte Name	Sediment						Water				
	COPCs	Tier 1 Human Health COPCs	Tier 2 Human Health COPCs	Final COPCs for Human Health Risk Assessment	Ecological Assessment – Terrestrial COPECs	Ecological Assessment – Aquatic COPECs	COPCs	Tier 1 Human Health COPCs	Tier 2 Human Health COPCs	Final COPCs for Human Health Risk Assessment	Ecological Assessment – COPECs
Trichloroethene	X	nh	nh	nh	no	no	X	X	X	ef	no
Trichlorofluoromethane	X	nh	nh	nh	ne	ne	nc	nc	nc	nc	nc
Trimethylbenzene[1,2,4-]	X	nh	nh	nh	ne	ne	X	nh	nh	nh	ne
Xylene (Total)	X	nh	nh	nh	no	no	X	nh	nh	nh	no
Xylene[1,2-]	X	nh	nh	nh	ne	ne	X	nh	nh	nh	ne
Xylene[1,3-]+Xylene[1,4-]	X	nv	nv	nv	ne	ne	X	nh	nh	nh	no
Americium-241	X	X	X	X	X	X	X	X	X	X	no
Cesium-134	X	nv	nv	nv	no	X	nc	nc	nc	nc	nc
Cesium-137	X	X	X	X	X	X	X	nh	nh	nh	no
Cobalt-60	X	X	e2	e2	no	no	nc	nc	nc	nc	nc
Europium-152	X	X	X	ef	no	X	X	nh	nh	nh	no
Plutonium-238	X	nh	nh	nh	X	X	X	nh	nh	nh	no
Plutonium-239,240	X	X	X	X	X	X	X	X	X	X	X
Strontium-90	X	X	X	X	no	X	X	X	X	X	no
Technetium-99	na	na	na	na	na	na	X	nh	nh	nh	ne
Thorium-228	X	X	X	ef	no	no	nc	nc	nc	nc	nc
Thorium-230	X	X	X	ef	no	no	nc	nc	nc	nc	nc
Thorium-232	X	X	X	ef	X	no	nc	nc	nc	nc	nc
Tritium	X	nh	nh	nh	no	no	X	nh	nh	nh	no
Uranium-234	X	X	X	X	X	no	X	X	X	X	X
Uranium-235	X	nh	nh	nh	no	no	X	nh	nh	nh	no
Uranium-238	X	nh	nh	nh	X	no	X	X	X	X	no

^a nc = Not a COPC.^b X = A COPC or COPEC.^c nv = No HH screening value.^d ne = No Eco screening value.^e na = Not measured in this medium.^f ef = Eliminated as HH COPC during final evaluation.^g X = A final COPC or COPEC.^h no = Not an Eco COPEC.ⁱ nh = Not a human health COPC.^j e2 = Eliminated as human health COPC during Tier 2 screen.

7.0 PHYSICAL SYSTEM CONCEPTUAL MODEL

This section discusses the nature, sources, extent, fate, and transport of select COPCs in the Los Alamos and Pueblo watershed. It focuses on COPCs that are shown to be most important for evaluating potential present-day human health risk based on the Tier 2 screens in Section 6 and Section E-1 of Appendix E and that represent known contaminant releases into the watershed. These are COPCs are considered also in evaluations of potential human health risk in Section 8.2. This section also includes discussion of other COPCs that were identified as study design COPECs in Katzman (2002, 73667) and are relevant for evaluating potential present-day ecological risk. Some additional COPCs are discussed to provide insights into sources and trends of contaminants historically or otherwise important in the watershed.

Spatial and temporal trends in contamination in sediments, surface water, and alluvial groundwater are important for identifying contaminant sources and understanding the effects of subsequent transport away from the source areas. Thus, trends in contamination are an important part of the conceptual model of the physical system discussed here. Supporting information about trends in contamination is presented in Appendix D.

The spatial variations in contaminants discussed in this section reflect conditions during the periods when samples were collected. Because media in the canyon bottoms change over time, resulting from both natural and anthropogenic processes, conditions at the time this report was written differ to varying degrees from the conditions encountered when the investigation data were collected.

Most of the sediment data used in this report reflect conditions prior to the Cerro Grande fire. Post-fire floods have caused some changes to the distribution of contaminants in sediment because of erosion and deposition, primarily in Pueblo and lower Los Alamos Canyons. In addition, parts of Pueblo Canyon have been affected by sewer line reconstruction following post-fire floods. Changes in other canyons resulting from floods since the time the investigation data were collected are of lesser magnitude than in Pueblo and lower Los Alamos Canyons. In Acid, DP, and upper Los Alamos Canyons, changes associated with remediation activities that removed contaminated sediment have been more important than changes from floods. Some data were collected from post-fire sediment deposits in Los Alamos and Pueblo Canyons, and the discussion in Section 7.1 compares pre- and post-fire contaminant concentrations and shows how concentrations changed as a result of the fire.

The water data used in this report represent conditions both before and after the Cerro Grande fire and thus characterize changes in hydrology and aqueous geochemistry associated with post-fire floods and the transport of ash as discussed in Section 7.2. The persistence of effects of post-fire floods and ash is variable but is generally expected to diminish over time.

7.1 Contaminants in Sediments

This section discusses general aspects of contaminants associated with sediment in the Los Alamos and Pueblo watershed, including how the distribution and concentration of contaminants are affected by fluvial processes acting over decadal time periods after releases. Subsequent sections discuss details of the distribution and concentration of specific contaminants in the watershed that are important for evaluating potential human health or ecological risk.

Most contaminants in sediment in the Los Alamos and Pueblo watershed that were derived from Laboratory sources were originally released in wastewater from outfalls (Kingsley 1947, 4186; Purtymun 1971, 4795; Hakonson and Bostick 1976, 29678; Stoker et al. 1981; 6059; Nyhan et al. 1982, 7164; Graf 1996, 55537; Reneau et al. 1998, 59159; Reneau et al. 1998, 59160; Katzman et al. 1999, 63915;

Reneau et al. 2000, 66867). Because streambeds on the Pajarito Plateau are usually dry, effluent that did not infiltrate into soils between the outfalls and the channel generally infiltrated into the streambeds. The downcanyon extent of effluent flow is not known but would have varied with release volume and prior moisture conditions along the channel. A small fraction of the effluent may have been mixed with snowmelt or stormwater runoff, and associated contaminants may have been transported relatively far downcanyon or to the Rio Grande.

Once in the streambed, dissolved contaminants commonly adsorb to sediment particles or organic matter because of the geochemical behavior of most radionuclides, metals, and organic chemicals that are of concern in this investigation (Watters et al. 1983, 11888; Salomons and Forstner 1984, 82304; Lopes and Dionne 1998, 82309). (Exceptions include molybdenum and tritium, which occur naturally as a dissolved phase, and are discussed in Section 7.2.) Many contaminants preferentially bind to clay minerals or organic particles, but they will also bind to other mineral particles. Contaminants will preferentially bind to smaller particles because of their larger ratio of surface area to mass and greater electrostatic attractions, and Nyhan et al. (1976, 11747) have documented a general inverse relation between contaminant concentration and particle size of streambed sediment on the Pajarito Plateau. Preferential adsorption to finer particles and organic matter also occurs when wastewater infiltrates into soils on hillslopes. Because of the general inverse correlation of contaminant concentrations with sediment particle size, concentrations can be an order of magnitude higher in the finest grained sediment deposits, which contain up to 80% silt and clay, than in coarse-grained sediment deposits that contain < 5% silt and clay (Reneau et al. 1998, 59159, p. 4-8; Reneau et al. 1998, 59160, p. 4-6; Reneau et al. 1998, 59667, p. 4-4; Katzman et al. 1999, 63915, p. 4-3; Reneau et al. 2003, 79271, pp. 8-9).

Once adsorbed to sediment particles in the streambed, contaminants can subsequently be redistributed by floods that scour the streambed and mobilize the bed sediment. Contaminants in the streambed that originated as solid particles will behave similarly to those originally released as dissolved components in wastewater. Contaminants associated with coarse size fractions (coarse sand and coarser; >0.5 mm [0.02 in.]) are generally transported as bed load along the streambed, whereas contaminants associated with fine size fractions (fine sand and finer; <0.25 mm [0.01 in.]) are generally transported in suspension (Malmon 2002, 76038, pp. 108-114; Malmon et al. 2003, 82311, pp. 11-14). Contaminants associated with medium sand (0.25-0.5 mm [0.01-0.02 in.]) can be either transported as bed load or as suspended load. The coarse sediment fractions typically travel shorter distances during a flood than fine fractions, because of their interactions with other sediment particles on the streambed, and are usually redeposited within the channel during waning stages of a flood. The fate of fine particles in transport is more varied. In floods that overtop stream banks, some of the suspended sediment and associated contaminants are deposited on adjacent abandoned channels or floodplains as flow depth and velocity decreases relative to the main channel. In large flood events, contaminants can be distributed across the entire width of floodplains in canyon bottoms. If flood discharge is high enough to exceed transmission losses into the streambed and leave the watershed, some of the suspended sediment and associated contaminants are directly transported to the Rio Grande. Additional fine particles are deposited on or infiltrate into the streambed during waning stages of flow, to be potentially scoured and resuspended in subsequent events.

During floods, sediment from a variety of sources is mixed, changing contaminant concentrations longitudinally along a channel. Where runoff from a contaminant source area enters a stream draining noncontaminated or less-contaminated areas, contaminant concentrations in sediment carried by the flood decrease relative to the source area while they increase relative to areas upstream from the contaminant source. Downcanyon, where runoff from tributaries draining noncontaminated or less-contaminated areas joins a stream in flood, concentrations may be further reduced. Some of the sediment transported in floods is eroded from the bed and banks of the channel, and this erosion can also change

contaminant concentrations in a flood. As a flood from noncontaminated areas erodes contaminated sediment downcanyon from source areas, contaminant concentrations in transported sediment increase. Similarly, when a flood draining contaminated areas erodes noncontaminated or less-contaminated material along the channel, concentrations in transported sediment decrease. The net result is a general downcanyon decrease in contaminant concentrations in sediment with distance from a contaminant source area (e.g., Marcus 1987, 82301; Graf 1996, 55537) and an increase in contaminant concentrations along main channels where significant amounts of contaminants are provided from tributaries.

Contaminant concentrations in sediment carried in floods also change over time in relation to the history of contaminant releases. Concentrations are generally highest during the period of peak contaminant releases and decrease over time as a result of the mixing processes discussed above. Such decreases over time have been documented in the Los Alamos and Pueblo Canyon system (Reneau et al. 1998, 59159, pp. 4-8-4-12; Reneau et al. 1998, 59160, pp. 4-6-4-12; Katzman et al. 1999, 63915; Malmon 2002, 76038, pp. 315-322; Reneau et al. 2003, 79271, p. 8), as well as in other regions (Lewin et al. 1977, 82306, p. 357; Rowan et al., 1995, 82303, p. 61). Removing or stabilizing contaminants in source areas can help accelerate these natural decreases in contaminant concentrations over time.

Contaminant concentrations in sediments may also be affected by the relative contributions of different source areas for sediment during floods. For example, the primary source area for runoff and sediment in the Pueblo Canyon watershed before the Cerro Grande fire was the Pajarito Plateau; however, after the fire, the burn area in the eastern Jemez Mountains became more important (e.g., Malmon et al. 2002, 76038). The increased flux of sediment from the burn area was expected to further reduce the concentrations of contaminants released from Laboratory activities in the watershed, while concentrations of some analytes derived from the burn area were expected to increase. Increases or decreases in erosion rates in other contaminated or noncontaminated parts of the Los Alamos and Pueblo watershed can be expected to have similar effects, although perhaps of lesser magnitude than changes caused by the fire.

Multiple floods occurring over decadal time periods result in sediment deposits in each reach that have a range in age and particle size distribution and hence in contaminant concentration. Schematic cross sections illustrating the distribution of coarse and fine sediment in reaches in the Los Alamos and Pueblo watershed are shown in Figures 7.1-1 and 7.1-2. The term "coarse facies" is used to refer to sediment with median particle size in the less than 2 mm (0.08 in.) fraction of medium to very coarse sand, and these deposits commonly have a high gravel content. The term "fine facies" is used to refer to sediment with median particle size of silt to medium sand. The active channel (c1 geomorphic unit) is typically dominated by relatively young coarse facies sediment deposits. Abandoned channels (c2 and c3 units), which are areas occupied by the channel sometime after 1942 but subsequently abandoned following channel migration and/or channel incision, typically include fine facies sediment overlying older coarse facies sediment. Abandoned channels can also include coarse deposits as the uppermost, youngest layer. Post-1942 floodplains (f1 unit) typically include thinner layers of post-1942 fine facies sediment which bury pre-1943 soils. (See Section B-1 of Appendix B for additional discussion of sediment facies and geomorphic units.)

As shown in Figures 7.1-1 and 7.1-2, the layers with the highest contaminant concentration in a reach are often at depth, buried by younger sediment layers with lower concentrations. These figures also show how the relation of sediment layers to trees provides one means of estimating the thickness and age of different sediment layers (tree age determined from tree-ring dating [dendrochronology]; see Section B-1 for more discussion of field investigation methods). Plates 2 through 11 show the distribution of geomorphic units in the investigation reaches.

Volumes of contaminated post-1942 sediment vary longitudinally along the canyons, resulting in part from variations in channel gradient and the width of post-1942 geomorphic units, as shown in Figure 7.1-3. Pueblo Canyon contains relatively large volumes of post-1942 sediment, associated with wide areas of the canyon bottom. Width and volume in Pueblo Canyon increase beginning in reach P-2W downstream of Graduation Canyon, where the channel gradient decreases, and increase to maximums in reaches P-4W and P-4E downstream from the Bayo WWTP. Width and volume are also high in reach LA-5 in lower Los Alamos Canyon near the Rio Grande, where gradients are lower than upcanyon in reach LA-4W. In contrast, width and volume are generally lowest in relatively steep reaches, such as ACS, DP-1W, and DP-4.

Most of the contaminants in sediments in the Los Alamos and Pueblo watershed occur in areas of post-1942 sediment deposition outside the active stream channels (Stoker et al. 1981, 6059; Graf 1996, 55537; Reneau et al. 1998, 59159; Reneau et al. 1998, 59160; Reneau et al. 1998, 59667; Katzman et al. 1999, 63915; Reneau et al. 2000, 66867; Reneau et al. 2003, 79271). At present, these deposits probably constitute the primary source for contaminants carried by floods, as observed in other regions (e.g., Rowan et al. 1995, 82303, pp. 63–64), with active channels and erosion from hillslopes constituting lesser sources. The concentrations and inventory (amount) of contaminants in deposits outside the active channel vary longitudinally within the canyons. Concentrations are typically highest in fine sediment deposits near the sources that date to the period of contaminant releases and decrease in younger deposits, in coarser deposits, and downcanyon. Contaminant inventory displays more irregular patterns than contaminant concentrations and is related to longitudinal variations in the volume, grain size, and age of sediment deposits within a canyon. The next section provides examples of the variations in contaminant concentration and inventory within the Los Alamos and Pueblo watershed.

Variations in background concentrations of some analytes in sediment can complicate the identification and evaluation of contaminants related to Laboratory releases. For example, background concentrations of fallout radionuclides in sediments have been shown to vary between regional rivers and reservoirs (McLin and Lyons 2002, 82305), and between these settings and local streams (Ryti et al. 1998, 59730; McDonald et al. 2003, 76084). Background concentrations of some inorganic chemicals in sediments have also been shown to vary between different areas on the Pajarito Plateau as a result of local variations in soils or bedrock (Drakos et al. 2000, 68739). Because soils on the Pajarito Plateau have higher concentrations of many inorganic chemicals than sediments (Ryti et al. 1998, 59730), deposition of sediment derived from locally eroded soils provides a possible source for elevated concentrations of inorganic chemicals in sediments.

Mineralogic variations within naturally occurring sediment can also contribute to background variations, for example the higher concentrations of many metals in black magnetite-rich sands on the Pajarito Plateau (Reneau et al. 1998, 62050, pp. 12–14). Additional variations in background concentrations are the result of ash transported from the Cerro Grande burn area, since ash contains higher concentrations of fallout radionuclides and many inorganic chemicals than pre-fire sediment (Katzman et al. 2001, 72660; Gallaher et al. 2002, 82265; Kraig et al. 2002, 85536; Johansen et al. 2003, 82312). Finally, concentrations of various inorganic and organic chemicals in sediment may be elevated near urban areas as a result of runoff from roads and other developed areas (Edwards 1983, 82302; Lopes and Dionne 1998, 82309; Walker et al. 1999, 82308; Breault and Granato 2000, 82310; van Metre et al. 2000, 82262), further complicating the identification and evaluation of contaminants related to Laboratory releases. The topics of variations in background concentration and contributions from urban areas as they relate to key contaminants in the Los Alamos and Pueblo Canyon system are discussed in subsequent sections.

7.1.1 Radionuclides in Sediments

7.1.1.1 Sources and Spatial Variations in Radionuclide Concentrations

Radionuclides in sediments in the Los Alamos and Pueblo watershed have several sources, as indicated by their spatial distribution, and concentrations typically decline downcanyon from the source areas. Subsequent discussions focus on the radionuclides that are most important for the evaluation of potential human health or ecological risk: americium-241, cesium-137, plutonium-239,240, strontium-90, and uranium-234. Figure D-1.1.1 in Appendix D includes additional plots that show all sample results for radionuclide COPCs plotted against distance from the Rio Grande. Figure D-1.1.1 plots help to identify sources, although these data are biased high because fine-grained sediment layers from the most contaminated geomorphic units in a reach were preferentially sampled.

Figures 7.1-4 to 7.1-8 show the estimated average concentrations of americium-241, cesium-137, plutonium-239,240, strontium-90, and uranium-234 in post-1942 fine facies sediment in investigation reaches. These are volume-weighted averages, where average radionuclide concentrations in a geomorphic unit in a reach are weighted by the volume of fine facies sediment in that unit, removing most of the bias introduced during sample collection. (Sample collection is biased towards geomorphic units and sediment facies with relatively high contaminant concentrations, as discussed in Section B-1 of Appendix B, and straight averages of all sample results from a reach are overestimates of true averages.) Results from locations removed in remediation activities are included in these averages to better display spatial trends, and present-day averages in reaches ACS, DP-2, and LA-2E are less than shown in these figures (see Appendix E of Reneau et al. [2002, 73660] for comparisons of pre- and post-IA data for reach ACS). Averages for fine facies sediment are shown because average concentrations in this type of sediment are, with rare exceptions, higher than in coarse facies sediment, and fine facies deposits are more important for evaluating risk. Averages for both fine and coarse facies sediment in each reach are presented in Tables D-1.5-1 to D-1.5-5. In these figures, the average concentration from the background sediment data set (averages from McDonald et al. 2003, 76084, Table 11, p. 50) is plotted when the radionuclide is not a COPC in a reach. BVs are also shown in these plots for comparison, except for americium-241 and plutonium-239,240 whose BVs are too low to show at the scales used in the figures.

The most important source areas for radionuclides in the Los Alamos and Pueblo watershed are the former TA-1 and TA-45 outfalls into the South Fork of Acid Canyon and the SWMU 21-011(k) outfall into DP Canyon, as shown in Figures 7.1-4 to 7.1-8. Average concentrations of americium-241, plutonium-239,240, strontium-90, and uranium-234 are highest in reach ACS in the South Fork of Acid Canyon, and cesium-137 is also present there above background concentrations. Average concentrations of cesium-137 are highest in DP Canyon downcanyon from the 21-011(k) outfall, and americium-241, plutonium-239,240, strontium-90, and possibly uranium-234, are also above background concentrations downcanyon from this outfall. Uncertainty exists concerning uranium-234 because only a single sample result was detected above the BV downstream from the SWMU 21-011[k] outfall, in reach DP-4, and the average from this reach is only slightly above the background average.

Additional Laboratory sources that can be recognized in the sediment data include the SWMU 0-030(g) outfall into Acid Canyon for americium-241 and plutonium-239,240, Hillside 137 in upper Los Alamos Canyon below TA-1 for plutonium-239,240, possibly TA-2 and/or the TA-21 laundry outfall into upper Los Alamos Canyon for cesium-137, and possibly TA-21 outfalls into upper Los Alamos Canyon for uranium-234. The Cerro Grande burn area is also an important source for cesium-137 and strontium-90, and the concentrations of these radionuclides in post-fire sediment deposits in many Los Alamos and Pueblo Canyon reaches are higher than in pre-fire deposits because these fallout radionuclides were

concentrated in ash and subsequently were transported downcanyon in floods (Katzman et al. 2001, 72660; Gallaher et al. 2002, 82265; Kraig et al. 2002, 85536; Johansen et al. 2003, 82312).

The pattern of downcanyon decline in radionuclide concentrations is notably different between the different sources. Although americium-241 and strontium-90 have higher average concentrations in fine facies sediment in the South Fork of Acid Canyon than in DP Canyon, concentrations attenuate rapidly downcanyon from the former, and these analytes are present at much lower concentrations in Pueblo Canyon than in Los Alamos Canyon. Cesium-137, plutonium-239,240, and uranium-234 also rapidly decrease in concentration downcanyon from the South Fork of Acid Canyon. This rapid attenuation indicates that sediment and associated radionuclides transported out of the South Fork are mixed with much larger volumes of sediment first in lower Acid Canyon and then in Pueblo Canyon, greatly reducing concentrations. Although the South Fork of Acid Canyon is the main source of radionuclide contaminants in the Pueblo Canyon watershed, these data indicate that it is a relatively minor source of sediment, and as a result its signature decreases rapidly downcanyon. In contrast, the relatively gradual downcanyon attenuation in upper Los Alamos Canyon of radionuclides derived from DP Canyon indicates that DP Canyon is a major source of sediment as well as radionuclides for upper Los Alamos Canyon. A relatively high sediment flux from DP Canyon is consistent with the observation that DP Canyon is a primary source of floods in upper Los Alamos Canyon because of rapid runoff from the Los Alamos townsite during storms (Katzman et al. 1999, 63915; Malmgren 2002, 76038).

Several deviations from the general downcanyon decline in average radionuclide concentrations are seen in Figures 7.1-4 to 7.1-8 that reflect some of the complexity in the present distribution of contaminants. This complexity results from the combined effects of temporal variations in contaminant releases and spatial and temporal variations in downcanyon sediment erosion and deposition during floods in the subsequent decades. One example is an increase in the average concentration of plutonium-239,240 in reach P-4W relative to upcanyon reaches (Figure 7.1-6) because of the relatively high percentage of sediment in P-4W that dates to the period of effluent releases, when the concentrations of plutonium-239,240 carried by floods were highest (Reneau et al. 1998, 59169; Reneau et al. 2003, 79271). A second example of this complexity is in DP Canyon, where the highest average concentrations of americium-241, cesium-137, and strontium-90 do not occur in the reach closest to the source (DP-2) but instead occur in downcanyon reaches ([DP-3 and DP-4] Figures 7.1-4, 7.1-5, and 7.1-7). These spatial patterns may indicate that DP-3 and DP-4 contain a higher percentage of relatively old sediment deposits, where radionuclide concentrations are relatively high, than DP-2.

General downcanyon declines in radionuclide concentration in coarse facies sediment also occur in the Los Alamos and Pueblo watershed, with some deviations that indicate secondary contaminant sources along the channels. Figures 7.1-9 and 7.1-10 show the average concentrations of plutonium-239,240 and cesium-137 in coarse facies sediment from the 1990s, which was sampled during this investigation, plotted against distance from the Rio Grande. Also shown are the averages of results from environmental surveillance stations from the 1990s, which are presumed to consist largely of coarse facies sediment. Error bars on these plots indicate 1 standard deviation of the analyses. The y-axis scale is logarithmic to better show variations where concentrations are low in the eastern part of the watershed.

Plutonium-239,240 concentrations in coarse facies sediment from the 1990s decrease by over 2 orders of magnitude in the 19 km (12 mi) from the South Fork of Acid Canyon to the eastern end of Los Alamos Canyon (Figure 7.1-9). The same general average values and trends are shown by the reach and the surveillance data, with both sets indicating two areas where concentrations increase relative to upcanyon reaches. The first area is at the eastern end of Pueblo Canyon (reach P-4E and Pueblo at SR-4 surveillance station), downcanyon of an area where the stream channel is incised through older post-1942 sediments. These data indicate that erosion of the older sediment deposits locally increased the

concentration of plutonium-239,240 in the active channel and support the conceptual model that such sediment deposits constitute sources for contaminants carried by floods. The second area is near the eastern end of Los Alamos Canyon, where concentrations increase relative to samples from LA-4E. These data also suggest that erosion of post-1942 sediment deposits contributes plutonium-239,240 to the channel between LA-4E and LA-5.

Cesium-137 concentrations in coarse facies sediment from the 1990s also show a nonlinear trend in concentration along the 15 km (9 mi) of channel from the SWMU 21-011(k) outfall to the Rio Grande and show similar patterns in the reach data and the surveillance data (Figure 7.1-10). Cesium-137 concentrations are relatively low in reach DP-2, immediately downcanyon from the source, and increase to maximums in DP-4 in the surveillance data and in LA-2E in the reach data. The relatively low concentrations in DP-2 probably indicate the dominance of sediment derived upcanyon from SWMU 21-011(k), and the downcanyon increases indicate remobilization of older sediment deposits. As with plutonium-239,240, cesium-137 also has lowest concentrations in LA-4E and slightly higher concentrations downcanyon, suggesting contributions from the erosion of post-1942 sediment deposits between LA-4E and LA-5.

7.1.1.2 Collocation of Radionuclides and Timing of Releases

The different radionuclide COPCs are generally collocated in sediment deposits in the different reaches in the Los Alamos and Pueblo watershed, primarily occurring in post-1942 sediment deposits and preferentially occurring in fine rather than coarse facies sediment. However, the maximum concentrations of each radionuclide may not occur in the same sediment layers in each reach because the relative concentrations of radionuclides in effluent released from outfalls varied over time both as a result of changes in research activities at the Laboratory and changes in wastewater treatment methods. Additional variations result from the mixing of sediment and associated contaminants from different sources and probably from variable geochemical behavior between radionuclides.

In upper Los Alamos Canyon, strong positive correlations exist between cesium-137 and strontium-90 in sediment (Reneau et al. 1998, 59160, p. 3-21, 3-23), indicating that these radionuclides share a similar history of release and transport. In contrast, a poor correlation exists between these isotopes and americium-241 and plutonium-239,240, reflecting different release histories. Available data indicate that peak releases of cesium-137 and strontium-90 occurred early in the history of SWMU 21-011(k), in the 1950s, while the peak releases of americium-241 occurred later, after 1962 and perhaps in 1978 or later (Reneau 1999, 63138). Thus, americium-241 concentrations are highest in younger sediment deposits than deposits where peak cesium-137 and strontium-90 concentrations occur. The poor correlation between plutonium-239,240 and these other radionuclides reflects both a different source and a different period of releases. Data from sediment deposits indicates that TA-1 outfalls at Hillside 137 were the most important source of plutonium-239,240 in upper Los Alamos Canyon (Reneau et al. 1998, 59160, p. 4-1). These releases would have occurred between the mid-1940s and the mid-1950s (LANL 1992, 43454), largely pre-dating releases from the SWMU 21-011(k) outfall.

In Pueblo Canyon, strong positive correlations exist between americium-241 and plutonium-239,240 in sediment (Reneau et al. 1998, 59159, p. 3-23–3-24), indicating that these radionuclides share a similar history of release and transport. In contrast, cesium-137 and strontium-90 do not show strong correlations with these analytes, and data from the South Fork of Acid Canyon also indicate variable release histories. In reach ACS, maximum concentrations of americium-241 and plutonium-239,240 were measured in the c3 and f1a geomorphic units, whereas maximum concentrations of cesium-137 and strontium-90 were found in the c2a unit (Reneau et al. 2002, 73660). Stratigraphic relations indicate that peak releases of

cesium-137 and strontium-90 occurred later than that of americium-241 and plutonium-239,240, perhaps during the period of releases from former TA-45 (1951–1964). Maximum concentrations of uranium-234 were measured in the c3 and f1a units, suggesting a similar release history as for americium-241 and plutonium-239,240 and maximum releases from the former TA-1 outfalls (1944–1951).

7.1.1.3 Temporal Variations in Radionuclide Concentration

Data from both the Acid and Pueblo Canyon and the DP and Los Alamos Canyon systems show that the concentrations of radionuclides in both fine- and coarse-grained sediment generally decreased over time following peak contaminant releases (Reneau et al. 1998, 59159, pp. 4-8–4-12; Reneau et al. 1998, 59160, pp. 4-6–4-12; Katzman et al. 1999, 63915; Malmon 2002, 76038, pp. 315–322; Reneau et al. 2003, 79271, p. 8). Some examples of these data are presented below.

Figure 7.1-11a shows data on the concentration of plutonium-239,240 in coarse facies sediment sampled from reach P-4W and P-4E, and from samples of active channel sediment from the Environmental Surveillance Program (station Pueblo at SR-502; ESP 2002, 73876, and previous reports) and from other investigations (Stoker et al. 1981, 6059), plotted against year of deposition or sample collection. Ages for coarse facies sediment deposits sampled in the reach investigations were obtained using an examination of sequential aerial photographs (Reneau et al. 1998, 59159). Plutonium-239,240 concentrations were highest in this part of Pueblo Canyon prior to 1965, during the period of effluent releases from TA-1 and TA-45, and have been lower and relatively constant since then. Upcanyon surveillance stations in Pueblo Canyon also show no systematic changes over the past 30 years (Figure D-1.2-2). In contrast, data from reach AC-3, including the surveillance station Acid above Pueblo (previously called Acid Weir), show an overall progressive decrease in plutonium-239,240 concentration from 1970 to present (Figure 7.1-11b).

Figure 7.1-12 shows data on cesium-137 concentrations from the active channel at four environmental surveillance stations in DP and upper Los Alamos Canyons, plotted against year of sample collection. The highest concentrations at all four stations occurred during the period of effluent releases, which ended in 1986. The concentrations either have remained relatively constant since 1990 or have declined gradually.

Figure 7.1-13(a-d) shows a reconstruction of the concentration of cesium-137 transported through lower DP Canyon between 1950 and 2000 in both fine- and coarse-grained sediment. This reconstruction uses data from sediment samples from reaches DP-3 and DP-4 (Katzman et al. 1999, 63915), from the environmental surveillance station in DP Canyon above Los Alamos Canyon (previously called DPS-4), and suspended sediment data from the NMED (see Malmon 2002, 76038, Appendix C, pp. 315–322, for a full discussion of this reconstruction). The upper plots (a and b) show estimated averages and uncertainties (1 standard deviation) on these averages for fine and coarse facies sediments, respectively, at the time of deposition. The lower plots (c and d) show the same estimated averages adjusted for radioactive decay to 2004, the year of this report (using a half-life of 30.1 years for cesium-137, Parrington et al. 1996, 58682). These figures illustrate that in addition to the progressive decreases in cesium-137 concentrations over time because of mixing, substantial decreases have also occurred by radioactive decay. Concentrations in sediment deposits dating to 1986, the last year of releases from SWMU 21-011(k), have decreased by 34% as a result of radioactive decay, and concentrations in deposits dating to 1952, the year of initial releases, have decreased by 70%.

7.1.1.4 Radionuclide Inventory

Data collected in this investigation define the general geographic variations in the amount, or inventory, of radionuclides contained in sediment deposits in different parts of the Los Alamos and Pueblo watershed. Table 7.1-1 summarizes the geographic distribution of americium-241, cesium-137, plutonium-239,240, strontium-90, and uranium-234 in the watershed, which updates and expands on estimates in previous reports (Reneau et al. 1998, 59159, p. 4-9; Reneau et al. 1998, 59160, p. 4-8; Reneau et al. 1998, 59667, p. 4-6; Katzman et al. 1999, 63915, p. 3-85; Reneau et al. 2003, 79271, p. 29). Supporting data for Table 7.1-1 are presented in these previous reports and in Section D-1. No estimates are presented for inventories in reaches where these analytes are not COPCs (which would largely represent inventories associated with background concentrations), although this amount may be relatively significant for some analytes. Table 7.1-1 shows estimated inventories prior to remediation activities in reaches LA-2E (MK 2000, 70741), ACS (Reneau et al. 2002, 73660), and DP-2 (LANL 2003, 82260). Estimated inventories in each subwatershed for cesium-137 and strontium-90 are adjusted for radioactive decay to values in 1997, the year when most of the original characterization work was conducted. Table 7.1-1 also shows estimates of the amount of these key radionuclides removed in the remediation activities and lost by radioactive decay since 1997. Estimates of the amount removed or redistributed by floods since characterization was done are not included, although the effects of post-fire floods are discussed in the next section.

Table 7.1-1 shows that DP and upper Los Alamos Canyons downcanyon from SWMU 21-011(k) contain the largest amounts of americium-241, cesium-137, and strontium-90 in the watershed (an estimated 64%, 84%, and 86% of these isotopes in ca. 1997, respectively). Acid and Pueblo Canyons downcanyon from the TA-1 and TA-45 outfalls and from SWMU 0-030(g) contain the largest amount of plutonium-239,240 (an estimated 86%). Uranium-234 has an irregular distribution that may reflect releases from several SWMUs and/or AOCs, although the total estimated inventory of 10 mCi is small, and only four reaches have maximum results greater than the BV (ACS, AC-3, DP-4, and LA-2W). The estimated percentages of these analytes removed in remediation activities range from 4% for cesium-137 to 12% for plutonium-239,240. From 1997 to 2004, 15% of the cesium-137 and 16% of the strontium-90 in the watershed were also lost as a result of radioactive decay.

Figures 7.1-14 and 7.1-15 show the inventory of cesium-137 in DP and upper Los Alamos Canyons and plutonium-239,240 in Acid and Pueblo Canyons, respectively, plotted against distance from the Rio Grande. Inventories in these figures are plotted both as normalized inventories in each reach per km of channel ([a] units of mCi/km), and as cumulative amounts from the sources to the confluence of Los Alamos and Pueblo Canyons (b). The cumulative plots extrapolate between sampled reaches. The figures show the estimated inventories in coarse and fine facies sediment deposits as well as the total inventory. Cesium-137 and plutonium-239,240 were chosen for these plots because they are the most important radionuclides in the watershed from the perspective of potential human health risk, and because they illustrate the distribution of key radionuclides downcanyon from the two major source areas.

Figures 7.1-14 and 7.1-15 show that the radionuclide inventory varies considerably between reaches, and that the total inventory is dispersed for many kilometers downcanyon from the sources in both systems. Most of the inventory is contained within fine facies sediment deposits. An estimated 75% of the cesium-137 in DP and upper Los Alamos Canyons and an estimated 61% of the plutonium-239,240 in Acid and Pueblo Canyons are in deposits of fine facies sediment. Short reaches near the sources, ACS and DP-2, have relatively high inventories associated with high concentrations, and additional reaches with relatively high inventories occur several kilometers downcanyon. The most significant area for cesium-137 inventory in Los Alamos Canyon is reach LA-2FE, 1 to 2 km (0.6 to 1.2 mi) downcanyon from the confluence of DP and Los Alamos Canyons; for plutonium-239,240, the most important areas in

Pueblo Canyon are reaches P-4W and P-4E, 8 to 10 km (5 to 6 mi) downcanyon from the confluence of Acid and Pueblo Canyons. The inventories are relatively high in these areas partially because the post-1942 geomorphic units are wider than average, leading to large volumes of sediment (Figure 7.1-3). In addition, much of the sediment deposition in these areas occurred when effluent was being released and contaminant concentrations in sediment were highest, contributing to the relatively high inventories. In LA-2FE the radionuclides are predominantly contained in fine facies sediment deposits; in P-4W and P-4E they occur predominantly in large deposits of coarse facies sediment.

7.1.1.5 Effect of the Cerro Grande Fire on Radionuclides in Sediment

The Cerro Grande fire of May 2000 and runoff from the burn area have had several effects on the concentrations and distribution of radionuclides in sediment in Los Alamos and Pueblo Canyons. These effects include the redistribution of fallout radionuclides that were concentrated in ash in the burn area, the erosion of contaminated sediment deposits and downcanyon transport of this material, and the deposition of new sediment layers in the active channel and on the adjacent abandoned channels and floodplains.

Concentration of fallout radionuclides in ash has been documented in the Cerro Grande burn area (Katzman et al. 2001, 72660; Katzman et al. 2002, 82611; Johansen et al. 2003, 82312) and in other regions (Paliouris et al. 1995, 82647). Data from ash samples collected in the Cerro Grande burn area are summarized in Appendix C and in Figure D-1-7. Maximum values measured in ash in the Cerro Grande burn area exceed the pre-fire BVs for americium-241 (maximum detect of 0.31 pCi/g versus BV of 0.04 pCi/g), cesium-137 (19.7 versus 0.9 pCi/g), plutonium-239,240 (0.70 versus 0.068 pCi/g), and strontium-90 (3.95 versus 1.04 pCi/g). The erosion of ash from the burn area and its transport and deposition downcanyon have resulted in concentrations of cesium-137 and strontium-90 in post-fire sediment deposits that exceed pre-fire concentrations in many reaches, as discussed in Section 7.1.1.2 and shown in Figures 7.1-5 and 7.1-7. Most of the redistribution of ash from the burn area occurred within two years after the fire (e.g., Johansen et al. 2003, 82312), and sediment deposits from 2000 and 2001 are expected to have the highest concentrations of ash and associated radionuclides, with concentrations decreasing in subsequent years due to the greatly reduced availability of ash in the system. Data from environmental surveillance sediment samples in Los Alamos and Pueblo Canyons supports this expected decrease in fallout radionuclides associated with ash (Figure D-1.2-1).

Downcanyon effects of the fire have been more pronounced in Pueblo Canyon than in upper Los Alamos Canyon, including both larger floods and greater sediment transport in Pueblo Canyon. In Los Alamos Canyon, the Los Alamos Reservoir has been maintained to capture and temporarily store floodwaters generated in the burn area to reduce downcanyon flooding, and the reservoir has trapped large amounts of sediment and greatly reduced peak flows. Smaller amounts of ash-rich sediment have accumulated behind the low-head weir (reach LA-3FE; Plate 1), largely related to periodic draining of the reservoir to maintain its ability to reduce flood peaks. In contrast, a 2.2-m- (86-in.-) diameter culvert installed beneath the Diamond Drive fill bridge in July 2000 allowed floods generated in the upper Pueblo Canyon watershed to continue downcanyon, leading to erosion of the channel bed and banks, overbank flooding and associated sediment deposition outside the channel, and higher sediment transport rates. Lower Los Alamos Canyon has been affected by sediment deposition and some erosion by post-fire floods out of both Pueblo and Guaje Canyons, the latter also receiving floodwaters from burned areas in Rendija Canyon.

Field observations, repeat cross section surveys (Lyman et al. 2002, 82608), and analysis of airborne laser swath mapping (ALSM) data (Crowell et al. 2003, 82666; Wilson et al. 2003, 82649) indicate areas

of both erosion and deposition in Pueblo Canyon caused by post-fire floods. Greater than 1 m (~3 ft) of vertical incision of the channel and greater than 1 m (~3 ft) of widening have occurred in some areas, remobilizing some of the contaminants present along the channel. These contaminants were either redeposited downcanyon in Pueblo or lower Los Alamos Canyon or transported to the Rio Grande. Post-fire sediment deposits are common in Pueblo Canyon, and up to 1 m (~3 ft) of deposition has occurred in some channel and floodplain areas.

Several estimates have been made of plutonium-239,240 transport out of the watershed since the fire. Personnel from RRES-WQH originally estimated 20 to 40 mCi were transported out of Pueblo Canyon in 2001 (ESP 2002, 73878, p. 189), the year with the largest post-fire flood; subsequently, this estimate has been revised to 16 mCi (Reneau 2004, 84460). RRES-WQH personnel also estimated transport of 28 mCi in 2002. Similarly, personnel from the NMED DOE OB estimated that 18 mCi or more of plutonium-239,240 was transported out of Pueblo Canyon in the largest flood in 2002 (Ford-Schmid 2003, 82606). The RRES-WQH estimate of 44 mCi in 2001 and 2002 represents about 5% of the estimated inventory in Pueblo Canyon before the fire, supporting field observations indicating that most of the pre-fire sediment deposits and associated plutonium-239,240 have not been eroded and that a portion of the eroded sediment has been redeposited downcanyon in Pueblo Canyon.

Post-fire sediment deposits in Pueblo Canyon and lower Los Alamos Canyon include a mixture of sediment supplied from upcanyon of the primary contaminant sources in Acid Canyon and sediment eroded from the streambed and banks downcanyon of Acid Canyon, the latter containing plutonium-239,240 derived from Laboratory sources. The relative amounts of contaminated and noncontaminated sediment that are mixed together in floods controls the contaminant concentration in resulting sediment deposits, and after the fire the upper watershed became much more important as a sediment source (Malmon et al. 2002, 82648). Surveys of the Los Alamos Reservoir indicate greater than a hundredfold increase in sediment yield from the burn area relative to pre-fire conditions in the first year after the fire (Lavine et al. 2001, 82665). This increased sediment supply from the burn area contributes to a decrease in the average concentration of Laboratory-derived contaminants in sediments carried by the floods and deposited in downcanyon parts of the watershed.

Data collected from post-fire sediment deposits in Pueblo and lower Los Alamos Canyons document that concentrations of plutonium-239,240 in fine facies sediment are low compared to pre-fire concentrations, which is consistent with the large input of sediment from the burn area. Figure 7.1-16 shows the average plutonium-239,240 concentrations in fine facies and coarse facies samples longitudinally in these canyons and compares them to pre-fire averages. Average post-fire concentrations along the length of these canyons are less than 1 pCi/g in both coarse and fine facies deposits, with relatively little variation with distance. The minor variations with distance in post-fire deposits contrast with the overall downcanyon decrease in pre-fire sediment deposits and also indicate a significant input of sediment from areas upcanyon from Acid Canyon. The result of sediment deposition on floodplains and abandoned channels after the fire is an overall reduction in average concentrations of plutonium-239,240 in these areas compared to pre-fire conditions because pre-fire sediment with higher concentrations was buried by post-fire sediment with lower concentrations.

The similarity of plutonium-239,240 concentrations in fine and coarse facies sediment deposits after the fire also contrasts with pre-fire conditions, where concentrations are consistently higher in fine facies sediment (Figure 7.1-16). This contrast suggests that after the fire a larger percentage of the fine sediment transported by floods was derived from parts of the Pueblo watershed upcanyon from Acid Canyon than the coarse sediment. After the fire, more dilution of Laboratory-derived plutonium-239,240 has occurred in fine sediment than in coarse sediment, and more dilution occurred after the fire than before.

7.1.1.6 Future Fate and Transport of Radionuclides in Sediment

The concentrations and distribution of radionuclides present in sediment deposits in the Los Alamos and Pueblo watershed will continue to change over time as a result of redistribution by floods and radioactive decay. Available data that show progressive decreases in radionuclide concentration over time, and supporting modeling indicate that, barring significant inputs of radionuclides from new sources, concentrations will generally continue to decline over time. Therefore, the present state of the watershed represents "worst case" conditions from the perspective of potential future radionuclide contamination.

A state-of-the-art probabilistic modeling approach was developed and applied to the problem of the future fate and transport of cesium-137 in upper Los Alamos Canyon (Malmon 2002, 76038; Malmon et al. 2002, 82604; Malmon et al. 2003, 82603). Using a reconstruction of the cesium-137 input into upper Los Alamos Canyon from DP Canyon, the model predicts a general distribution of cesium-137 in upper Los Alamos Canyon consistent with that determined in the reach investigations (Malmon 2002, 76038, p. 257). Figure 7.1-17 shows the modeled future cesium-137 concentrations using updated cesium-137 inventory estimates from this investigation report and based on the assumption that concentrations in sediment leaving DP Canyon will decline linearly between 2000 and 2050. This figure shows predicted declines in the concentration of cesium-137 in sediment transported by floods past the confluence of Los Alamos and Pueblo Canyons. Because concentrations leaving DP Canyon will probably decrease faster than assumed here, as a result of the combined effects of continued sediment transport, mixing, and radioactive decay, this is a conservative assumption that will underestimate the rate of decrease over time. This model also predicts that 49% of the cesium-137 contained in sediment deposits in upper Los Alamos Canyon as of 1997 will decay radioactively while still in this part of the watershed (Malmon 2002, 76038, p. 271), with the remainder being transported downcanyon at progressively slower rates over time. Earlier models that were applied to the transport of plutonium-239,240 out of Pueblo Canyon also predicted decreasing concentrations in transported sediment over time (Lane et al. 1985, 6604, pp. 44-46; Graf 1996, 55537, p. 1352).

This model has also been applied to the topic of how total cesium-137 inventory in upper Los Alamos Canyon changes over time (Malmon et al. 2004, 85526) shows the modeled inventory in the active channel and adjacent abandoned channels and floodplains in 1950 (before initial releases from SWMU 21-011[k]), in 1969 (when inventory is estimated to have been highest), in 1997 (when most of the characterization was conducted), and in 2050 (when most of the inventory has either decayed or been transported downstream). The estimated inventory in 1997 is 50% of the 1969 inventory, and the estimated inventory in 2050 is 12% of the 1997 inventory.

Future transport of plutonium-239,240 out of Pueblo Canyon will be strongly affected by floods generated from the Cerro Grande burn area, although available studies indicate that the frequency and magnitude of these floods will decrease over time. A comprehensive study conducted by the US Geological Survey in Rendija Canyon after the Cerro Grande fire, a watershed that was as severely burned as Pueblo Canyon, indicated that runoff for a given intensity rain storm was much less in 2001 and 2002 than in 2000, demonstrating amelioration of runoff relative to immediate post-fire conditions (Moody et al. 2002, 82610, p. 73). A study of floods after the nearby 1977 La Mesa fire and the 1996 Dome fire found the highest discharges in the first one to two years after the fires, approximately 100 times pre-fire levels, with progressive declines after that (Veenhuis 2002, 82605). The study also found that although conditions ameliorated quickly, flood discharges in Frijoles Canyon were still elevated three to five times pre-fire levels 22 years after the La Mesa fire. These observations indicate that flood sizes for given intensity storms will decline in Pueblo Canyon over time, although they are expected to remain elevated over pre-fire conditions for decades. Therefore, the transport rates of plutonium-239,240 are also expected to decline over time, although they will remain above immediate pre-fire conditions.

7.1.2 Inorganic Chemicals in Sediments

Eleven inorganic chemicals detected in sediments in the Los Alamos and Pueblo watershed have been identified as being most important for assessing potential ecological or human health risk: antimony, arsenic, barium, cadmium, chromium, cobalt, manganese, mercury, selenium, silver, and zinc. These chemicals are derived from a variety of sources, including Laboratory TAs, the Los Alamos townsite, and the Cerro Grande burn area, in addition to naturally occurring soils and bedrock, as indicated by their spatial distribution (discussed below). Once in the canyon bottoms, most of these inorganic chemicals adsorb to sediment particles and organic matter, and their subsequent fate and transport by fluvial processes is expected to be similar to that of radionuclides discussed in Section 7.1.1. However, inorganic chemicals derived from urban runoff or from erosion of natural soils in the watershed differ from radionuclides in that inorganic chemicals will not show the same decreases over time, and the concentrations of constituents derived from urban runoff may actually increase over time.

This section focuses on spatial variations in inorganic chemicals in the Los Alamos and Pueblo watershed, and supporting information is included in Appendix D. Table D-1.6-1 presents average concentrations in each reach for the inorganic chemicals that are discussed in this section, substituting one-half of the detection limit for nondetected sample results. Table D-1.6-1 presents the upper and lower bounds on these averages using either the detection limit or zero for nondetects, respectively, which indicate uncertainties in the average values. This table shows that, on average, concentrations of these inorganic chemicals are lower in coarse facies sediment than in fine facies sediment, and Figure 7.1-19 and the discussions in the following sections focus on data from fine facies sediment. Figure 7.1-19 and Table D-1.6-1 also indicate that considerable uncertainty in the average concentration of some inorganic chemicals exists in some reaches because of elevated detection limits, for example with antimony and selenium.

The plots in Figure 7.1-19 include both the BV for each inorganic chemical, which is an estimate of the upper level of background concentrations, and the average value from the background sediment data set (averages from McDonald et al. 2004, 76084, Table 10, p. 49–50). The background averages are included to be consistent with the presentation of averages from potentially contaminated samples.

7.1.2.1 Inorganic Chemicals Derived from Laboratory Sources

The spatial distribution of inorganic chemicals indicates that the former TA-1 and/or TA-45 outfalls into the South Fork of Acid Canyon were the most important Laboratory sources for these constituents in the Los Alamos and Pueblo watershed. The plots in Figure 7.1-19 show that average concentrations in fine facies sediment are highest in reach ACS for cadmium, chromium, mercury, and silver, with concentrations of these metals decreasing rapidly downcanyon. Maximum sample results for these metals and for antimony and arsenic were also found in ACS, along with other metals that are less important for assessing potential ecological or human health risk in the watershed (copper, lead, and nickel). Maximum concentrations for these analytes were found in the geomorphic unit (c2a) that also contained the highest concentrations of cesium-137 and strontium-90, indicating that the peak releases for these metals and radionuclides were roughly contemporaneous. (It should be noted that the locations with the maximum concentrations of these metals were removed in the ACS IA, and average concentrations at present are less than shown in Figure 7.1-15. Appendix E of Reneau et al. [2002, 73660] provides comparisons of pre- and post-IA data.)

The sediment data indicate that the former Pueblo Canyon WWTP (SWMU 0-018[a]) may have been an additional source of mercury in the Pueblo Canyon watershed. The average mercury concentrations in

reach P-1W, downcanyon from the WWTP and upcanyon from Acid Canyon, are similar to concentrations downcanyon from Acid Canyon in P-1E. In contrast, mercury concentrations upcanyon from the WWTP in P-1FW cannot be distinguished from background levels. The sediment data also show an increase in zinc concentrations downcanyon from the Pueblo Canyon WWTP.

No other Laboratory sources for inorganic chemicals in the Pueblo Canyon watershed are indicated by the sediment data, with the possible exception of an increase in selenium in reach P-2W, downcanyon from the former Central WWTP (SWMU 0-019). However, selenium was not reported to be a major COPC at the Central WWTP (LANL 2001, 71417), and evidence for a non-Laboratory source for selenium in P-2W is provided by the similarity of average selenium concentrations between P-2W and AC-1 and AC-2 (Figure 7.1-19). AC-1 is located upstream from SWMU 0-030(g), and the selenium here and in the other reaches probably represents background variations or contributions from urban runoff.

The sediment data indicate that one or more Laboratory sources for inorganic chemicals may exist in the upper Los Alamos Canyon watershed, although the sources are not clear. Several metals are relatively high in reach LA-2W, upcanyon from DP Canyon, but lower upcanyon in reach LA-1E, suggesting a source at one or more TA-21 outfalls into Los Alamos Canyon. Silver is most notable in LA-2W, although the high average concentration shown in Figure 7.1-19 is controlled by a single detected result in a small data set (only four samples of fine facies sediment were analyzed in LA-2W). Chromium, mercury, zinc, and other metals are also relatively high in this sample (04LA-97-0570), resulting in relatively high averages in LA-2W. The average concentrations of chromium and zinc are also relatively high downcanyon in LA-2E, supporting the interpretation that a Laboratory source for these metals exists between LA-1E and LA-2W.

It is notable that other SWMUs or AOCs in the upper Los Alamos Canyon watershed were important sources for radionuclides but are not recognized as important sources for inorganic chemicals in sediment. No increases in average concentrations of metals are seen downcanyon from the SWMU 21-011(k) outfall into DP Canyon. Increases in the concentrations of some metals are indicated downcanyon from the TA-1 hillsides; for example, the average silver concentrations increase in reach LA-1W downcanyon from Hillside 137. However, these increases are small, and the sediment data do not provide evidence for any major releases.

7.1.2.2 Inorganic Chemicals Derived from Townsite Sources

Several inorganic chemicals have spatial distributions that indicate sources in the Los Alamos townsite, which is consistent with previous studies showing that urban runoff is a source of many metals for streams. For example, the highest average zinc concentrations in fine facies sediment occurs in the upper parts of Acid and DP Canyons in reaches AC-1, AC-2, and DP-1W (Figure 7.1-19), downcanyon from largely urbanized parts of the townsite. Zinc is commonly found in urban runoff, and one important source for zinc is tire-wear particulates (Walker et al. 1999, 82308, p. 364; Breault and Granato 2000, 82310, p. 49; Callender and Rice 2000, 82307, p. 232). Arsenic, cadmium, chromium, cobalt, manganese, and mercury are also relatively high in some or all of these reaches and have also been reported in urban runoff in these studies. Selenium is also relatively high in these reaches but is not mentioned in these studies as a common constituent in urban runoff. Therefore, although the spatial distribution of selenium suggests a possible townsite source, the elevated values in the upper parts of Acid and DP Canyons may be related to background variations.

7.1.2.3 Inorganic Chemicals Derived from the Cerro Grande Burn Area

Many inorganic chemicals have been identified as having higher concentrations in post-fire sediment deposits that contain reworked ash from the Cerro Grande burn area than in sediment not affected by the fire (Katzman et al. 2001, 72660; Kraig et al. 2002, 85536). This finding is illustrated in box plots in Figure D-1.7-1 in Appendix D, which compare sample results from post-fire baseline sediment samples with pre-fire background sediment data as well as with ash and soil background data. In Los Alamos and Pueblo Canyons, the average concentrations of barium, cobalt, and manganese are consistently higher in post-fire sediment deposits that contain ash than in pre-fire deposits (Figure 7.1-19). Arsenic, chromium, selenium, and zinc are also higher in post-fire sediment than in pre-fire sediment in some reaches, but not in all. Ash was largely stripped from the burn area within two years after the fire (e.g., Johansen et al. 2003, 82312); therefore, the effects of the Cerro Grande fire on the overall concentrations of inorganic chemicals in sediment deposits would have been greatest in 2000 to 2002. Subsequent floods can erode or bury the early post-fire sediment deposits with sediment containing lower quantities of ash, thereby reducing the overall average concentration of ash-derived constituents on the landscape over time. However, average concentrations of these inorganic chemicals in the canyon bottoms will remain above pre-fire levels as long as ash-bearing sediment persists in the landscape.

The concentrations of several inorganic chemicals in post-fire sediment deposits are highest in reaches LA-3FE and/or P-4E (e.g., arsenic, barium, cobalt, manganese, selenium, zinc; Figure 7.1-19). As shown in Figure 7.1-20, there are positive correlations of barium, cobalt, and manganese and the percent of clay-sized particles and organic matter in the samples, with the correlations being better for percent organic matter (which is probably directly correlated with ash content). The higher average concentrations in reaches LA-3FE and P-4E are related to higher average clay and organic matter content in samples from these reaches. These reaches have relatively low-energy conditions associated with either the low-head weir (LA-3FE) or with wide floodplains where overbank floodwaters spread out (P-4E), and ash particles would preferentially settle out in these areas.

7.1.3 Organic Chemicals in Sediments

Three types of organic chemicals detected in sediments in the Los Alamos and Pueblo watershed are important for assessing potential ecological or human health risk: PAHs, PCBs, and pesticides. These chemicals are derived from a variety of sources, including Laboratory TAs, the Los Alamos townsite, and the Santa Fe National Forest west of the Laboratory, as indicated by their spatial distribution (discussed below). Once in the canyon bottoms, most of these organic chemicals will adsorb to sediment particles and organic matter, and their subsequent fate and transport by fluvial processes is expected to be similar to that for the radionuclides, which were discussed in detail in Section 7.1. Similar to some of the radionuclides, the organic chemicals discussed here have relatively short "half-lives" associated with biodegradation and/or volatilization in the environment. Therefore, the concentrations will decrease over time unless contaminants are added to the canyon bottoms (such as from urban runoff). However, the degradation rates are not well constrained and will vary with local environmental conditions.

This section focuses on spatial variations in organic chemicals in the Los Alamos and Pueblo watershed, and supporting information is included in Appendix D. Tables D-1.6-2 through D-1.6-4 present average concentrations in each reach for the organic chemicals that are discussed in this section, substituting one-half of the detection limit for nondetected sample results. Tables D-1.6-2 through D-1.6-4 also present the upper and lower bounds on these averages, using either the detection limit or zero for nondetects, respectively. These tables indicate that, on average, concentrations of these chemicals are lower in coarse than in fine facies sediment, and the discussions and figures in the following sections

focus on data from fine facies sediment. Tables D-1.6-2 through D-1.6-4 also indicate that considerable uncertainty exists in the average concentration of organic chemicals in some reaches because of elevated detection limits.

7.1.3.1 PAHs

Six PAHs in sediments were identified in Section 6 as most important in assessing human health or ecological risk in the Los Alamos and Pueblo watershed: benz(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenz(a,h)anthracene, indeno(1,2,3-cd)pyrene, and naphthalene. PAHs have a range of chemical properties with some being less volatile and less soluble, and these chemicals are more likely to become adsorbed to and persist in sediments (Neff 1979, 83420). Naphthalene is a relatively volatile PAH and of the PAHs listed above should have the lowest affinity for sediments, whereas the other five PAHs are less volatile and less soluble and have a stronger affinity for sediments. Naphthalene is also the most important of these PAHs from the perspective of assessing potential ecological risk, as indicated in Section 6.2.2; the others are more important for assessing potential human health risk, particularly benzo(a)pyrene, as indicated in Section 6.2.3. The different PAHs also have somewhat different spatial distributions in the watershed, indicating different sources, as discussed below.

Benz(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, and naphthalene have maximum detected results in reach AC-1, in upper Acid Canyon upcanyon from SWMU-0-030(g). Dibenz(a,h)anthracene and indeno(1,2,3-cd)pyrene have maximum detected results in reach DP-1W, at the head of DP Canyon and upcanyon from the DP Tank Farm. The highest average concentrations of these chemicals in fine facies sediment are also in reaches AC-1, AC-2, and DP-1W, although estimating average concentrations is confounded by elevated detection limits in some reaches, particularly in DP Canyon. The spatial distributions of benzo(a)pyrene and naphthalene are shown in Figure 7.1-21 as examples of the PAHs, showing average concentrations in fine facies sediment in the reaches, substituting one-half of the detection limit for nondetected sample results and showing the upper and lower bounds on these averages. Additional figures showing the spatial distribution of the four other PAHs mentioned above are included in Appendix D. These figures show that Acid and DP Canyons have relatively high concentrations of PAHs and that concentrations in Los Alamos and Pueblo Canyons are lower.

The spatial distribution of PAHs in sediments in the watershed indicates that these analytes have multiple sources, primarily from different parts of the Los Alamos townsite. Both Acid and DP Canyons are largely urbanized upcanyon of the investigation reaches, and the higher concentrations of PAHs in these areas are consistent with a source in urban runoff. Concentrations decrease downcanyon, indicating that Laboratory SWMUs or AOCs are not major downcanyon sources of PAHs compared to the urban baseline. This association with the townsite is consistent with studies in other regions that have documented that PAHs are common contaminants derived from urban runoff (Edwards 1983, 82302; Lopes and Dionne 1998, 82309; Walker et al. 1999, 82308; van Metre 2000, 82262). Some studies have indicated that PAHs can also be a product of forest fires (Edwards 1983, 82302), although five of the six PAHs discussed above were not detected in post-fire baseline sediment samples. Only naphthalene was detected in the fire-impacted baseline samples, and the average naphthalene concentration in these samples (0.1-0.6 mg/kg) was less than measured in reach AC-1 (0.8-0.9 mg/kg) but higher than measured in most other investigation reaches. Therefore, naphthalene appears to have a secondary source in the Cerro Grande burn area, although the most important source in the watershed is urban runoff.

7.1.3.2 PCBs

PCBs have low solubilities and a strong affinity for organic material and sediment particles (Chou and Griffin 1986, 83419). PCBs were widely used in electric transformers and other industrial applications (e.g., Walker et al. 1999, 82308, pp. 364–365), and their wide use is consistent with their spatial distribution in sediments in the Los Alamos and Pueblo watershed. Figure 7.1-22 presents average concentrations of Aroclor-1254 and Aroclor-1260 in fine facies sediment in the reaches, substituting one-half of the detection limit for nondetected sample results and showing upper and lower bounds on these averages. These data indicate that PCBs come from multiple sources in the watershed and that concentrations generally decrease downcanyon from these sources, as discussed below.

Aroclor-1254 has highest concentrations in reaches AC-3 and ACS, suggesting a source at either the former TA-1 or the former TA-45 outfalls into the South Fork of Acid Canyon, although releases could also have occurred from sources other than effluent discharges at these outfalls. Aroclor-1260 is also present in AC-3 and ACS at lower concentrations. The highest concentrations of PCBs in ACS were found in geomorphic units that also contain the highest concentrations of radionuclides (c2a, c3, and f1a units), indicating that the PCBs were released contemporaneously with radioactive effluent discharges (1944–1964). (It should be noted that the present PCB concentrations in ACS are lower than shown in Figure 7.1-22 because these geomorphic units were removed during an IA.)

PCBs are also notable in several reaches in upper Los Alamos Canyon, although distributions vary between Aroclor-1254 and Aroclor-1260, and the exact sources are not known. Aroclor-1254 has highest average concentrations in upper Los Alamos Canyon in reaches LA-1W and LA-1W+ and was not detected farther upcanyon in reach LA-1FW, suggesting releases from TA-1 SWMUs or AOCs west of LA-1W+ (e.g., at Hillside 140 or into Bailey Canyon). In contrast, Aroclor-1260 has the highest average concentrations downcanyon in reaches LA-1C and LA-2FE, suggesting a different source or sources (e.g., the former TA-2 or TA-41). Compounds in Aroclor mixtures weather at different rates, potentially resulting in poor matches between reference spectra and the spectra from environmental samples (e.g., Valoppi et al. 2000, 83424). Therefore, Aroclor analyses alone may be insufficient to distinguish the number and locations of sources. To help address this uncertainty, sediment samples from a series of upper Los Alamos Canyon reaches were analyzed for PCB congeners. Figure 7.1-23 shows a scatterplot matrix with selected congeners and Aroclor analyses from these samples. The congener results display three distinct populations that support multiple primary sources of PCBs in upper Los Alamos Canyon. The PCB congeners 105 and 118, which are characteristic of Aroclor-1254, are highest in the LA-1W and LA-1W+ samples, indicating a source upcanyon from these reaches. In contrast, the PCB congeners 170, 180, and 187, which are characteristic of Aroclor-1260, are highest in the LA-1C sample and indicate a source upcanyon at TA-2 or TA-41. A third cluster in the congener results is associated with trace levels of congeners in samples where Aroclors were not detected (reach LA-0 and LA-1E samples).

Figure 7.1-22 indicates that the average concentration of Aroclor-1260 is also relatively high in reach DP-1C, although this average is based on only one detect out of three samples for fine facies sediment and is relatively poorly constrained. PCBs were not detected in five samples of coarse facies sediment from DP-1C and in four samples from reach DP-1W (3 fine and 1 coarse). Therefore, although the detected result indicates a source for PCBs upcanyon from DP-1C, the location of this source is poorly constrained because of the low detection frequency and small number of samples.

Pueblo Canyon has lower concentrations of PCBs than Acid, upper Los Alamos, or DP Canyons, and the highest average concentrations in fine facies sediment were measured in reach P-1W, upcanyon from Acid Canyon (Figure 7.1-22, Table D-1.6.3). Therefore, the former Pueblo Canyon WWTP was a possible source for PCBs, although they were also detected upcanyon of the WWTP (reach P-1FW) and multiple

sources may be present in upper Pueblo Canyon. A source upcanyon from the Pueblo Canyon WWTP, presumably in the Los Alamos townsite, is also indicated by analysis of PCB congeners in stormwater in Pueblo Canyon west of Diamond Drive (NMED 2002, 83421).

7.1.3.3 Pesticides

Three chemicals in the pesticide suite in sediments have been identified as potentially important in assessing the ecological risk in the Los Alamos and Pueblo watershed: DDE, DDT, and endrin aldehyde. These chemicals have low solubilities and a strong affinity for organic material and sediment particles (Pionke and Chesters 1973, 83423; Nowell et al. 1999, 83422). The spatial distribution of pesticides in sediments in the Los Alamos and Pueblo watershed indicates that these analytes have multiple sources both at the Laboratory and elsewhere, which is consistent with their expected dispersed use in pest-control efforts. However, understanding their spatial distribution and sources is in part complicated by elevated detection limits in some samples. Figure 7.1-24 presents average concentrations of DDE, DDT, and endrin aldehyde in fine facies sediment in the reaches, substituting one-half of the detection limit for nondetected sample results and showing upper and lower bounds on these averages.

DDT is the most important pesticide in the watershed from the perspective of potential ecological risk, and it has its highest average concentration in fine facies sediment in reach LA-1C, downcanyon from TA-2 and TA-41, with much lower concentrations upcanyon. DDT concentrations also generally decrease downcanyon from LA-1C, indicating a primary source at one or both of these TAs, presumably from historical use as an insecticide by Laboratory groundskeepers. However, DDT in upper Los Alamos Canyon shows considerable spatial variability, and interpretation of sources is complicated by elevated detection limits in reach LA-2W samples. One or more sources for DDT in upper DP Canyon are indicated by elevated average concentrations in reaches DP-1W and DP-2. Data from DP-1W indicate a source in the Los Alamos townsite, and possible additional contributions downcanyon from TA-21 are suggested by data from DP-2. An additional source for DDT in upper Los Alamos Canyon upcanyon from the Laboratory is indicated by data from reach LA-0, and an upcanyon source is consistent with documented spraying of DDT in the Santa Fe National Forest (LASL 1963, 64879).

The distributions of DDE, which is a degradation product of DDT, and endrin aldehyde in upper Los Alamos Canyon and DP Canyon are also consistent with the primary sources indicated by the DDT data, although interpretations are less certain because of the lower frequency of detects for these analytes and problems with elevated detection limits. In particular, the presence of DDE in reach LA-0 indicates a source for this chemical upcanyon from the Laboratory, and the presence of endrin aldehyde in reach LA-1C suggests a source at TA-2 and/or TA-41.

In the Pueblo Canyon watershed, DDE and DDT have their highest average concentrations in fine facies sediment in reach ACS and their second highest average concentrations in reach AC-1. The AC-1 data indicate a source in the Los Alamos townsite, as the DP Canyon data showed, and the ACS data suggest a townsite source and/or a source from the former TA-1 or TA-45 outfalls. No correlation between pesticides and radionuclides is seen in the data from ACS, suggesting separate release histories (i.e., effluent discharges for the radionuclides and insecticide use by groundskeepers for the pesticides). The highest average concentrations of DDE and DDT in Pueblo Canyon were measured in reaches P-1W and P-1FW, upcanyon from Acid Canyon, which indicates a source or sources in the Santa Fe National Forest or in the Los Alamos townsite, with possible additional contributions from the former Pueblo Canyon WWTP. However, concentrations of pesticides in Pueblo Canyon are low compared to Acid, DP, and upper Los Alamos Canyons.

7.2 Surface Water and Alluvial Groundwater Conceptual Model

The conceptual model for surface water and alluvial groundwater addresses general hydrology of the Los Alamos and Pueblo watershed with an emphasis on the conditions observed during the investigation of nature and extent of contamination conducted in 2001 and 2002. A period of extended drought during the time this investigation was conducted had an observable impact on the amount and extent of surface water in the canyons and the extent of alluvial groundwater saturation. The Cerro Grande fire also caused perturbations in the hydrology related to flood frequency, flood magnitude, the natural geochemistry of flood water, and the potential for contaminant transport during floods. The conceptual model discussed here describes the key COPCs identified in Section 6 in the context of these hydrologic variables to evaluate the relation of the key contaminants to source and hydrology. Specific discussions of a tracer study conducted in DP Canyon and a water-level study conducted in Los Alamos Canyon are presented in Appendix B, Section B-2.4, and in Appendix F, respectively.

7.2.1 Watershed Hydrology

The surface water and alluvial groundwater hydrology of the Los Alamos and Pueblo watershed is related to several primary factors including the location and discharge volume of natural and anthropogenic water sources, seasonal events (e.g., snowmelt runoff and storm-water runoff resulting from summer rainfall), and general regional climatic conditions. The surface water discussion is organized by sub-basin. Upper Los Alamos Canyon is the portion of the watershed from the headwaters to the confluence with Pueblo Canyon and includes DP Canyon. Pueblo Canyon is the portion of the watershed from the headwaters to the confluence with Los Alamos Canyon and includes Acid Canyon and the South Fork of Acid Canyon. Lower Los Alamos Canyon is the portion of the watershed from the confluence of Los Alamos and Pueblo Canyons to the confluence with the Rio Grande.

7.2.1.1 Surface Water Hydrology

The conceptual model for surface water hydrology is based on gaging station data and visual observations made during the last several years. Flow data are collected within a "water year," which is the period from October 1 through September 30. A water year is designated by the calendar year in which it ends. Figure 7.2-1 shows the different types of surface water occurrences throughout the watershed and reflects the discussion below. Various terms are used in this report to describe water occurrences in the watershed. The term "perennial" describes segments where water flow is continuous throughout the year. "Intermittent" describes segments that are predominantly dry throughout the year but that have some extended periods of flow from snowmelt runoff, spring discharge, or groundwater discharge associated with high groundwater levels. "Ephemeral" refers to segments with short periods of flow (i.e., hours to days) in response to storm events, particularly summer thunderstorms. "Interrupted" describes spatially discontinuous flow resulting in alternating wet and dry channel segments. "Persistent flow" is not quantitatively defined but the term is useful for describing areas with flowing or standing water roughly 50% of the time and includes perennial reaches and bedrock pools.

Upper Los Alamos and DP Canyons

In upper Los Alamos Canyon, perennial flow originates from springs and interflow through hillslope soils in the upper watershed. This perennial flow is sometimes interrupted. The downcanyon extent of perennial flow is variable but generally terminates in the upper portions of Los Alamos Canyon west of TA-41. The remainder of upper Los Alamos Canyon down to the confluence with Pueblo Canyon is characterized by intermittent or ephemeral surface water flow that is seasonally dependent. The

magnitude of winter and spring snowmelt runoff is the predominant factor affecting the duration and extent of surface water flow in upper Los Alamos Canyon. Figure 7.2-2 shows the number of days of flow at a series of stream gages in upper Los Alamos Canyon for water years 1995 through 2002 (Shaull and Alexander 1996, 56019, Shaull and Alexander 1996, 56020, Shaull et al. 1998, 57581, Shaull et al. 1999, 63505, Shaull et al. 2000, 66648, Shaull et al. 2001, 72609.112, Shaull et al. 2002, 84599, Shaull et al. 2003, 76042), and the snow-water equivalent precipitation from the Quemazon snowpack telemetry (SNOTEL) station in upper portion of the Los Alamos Canyon basin. In upper Los Alamos Canyon, the magnitude of inter-annual variability is illustrated in Figure 7.2-2 by comparing the number of flow-days per water year at E025 and E026, the upper-most routinely monitored gaging stations in the watershed. Years with greater than 150 days of flow occurred in 1995, 1997, 1998, and 2001. More recent drought conditions resulted in only 47 and 53 days of flow at E025/026 in water year 2000 and 2002, respectively. The number of surface water flow-days measured at E025/026 in water year 2001 is largely to the result of an extended period of snowmelt runoff from a significant 2000–2001 winter snowpack in the upper basin.

Figure 7.2-2 also shows that the total number of surface water flow days at each stream gage in upper Los Alamos Canyon decreases progressively downcanyon as a result of infiltration into alluvium. Segments that have persistent flow for most of the year or during periods of extended snowmelt runoff sometimes exhibit interrupted flow. This interrupted or discontinuous flow probably results from longitudinal variations in alluvial aquifer storage capacity and/or the thickness of alluvium that cause convergence and divergence between the elevations of the streambed and the alluvial groundwater table. Persistent surface water flow is typically present below TA-41 only during the late winter and spring and is related to snowmelt runoff. The downstream extent of the intermittent flow is highly variable and dependent on the amount of winter precipitation. The lower portion of upper Los Alamos Canyon from near the DP Canyon confluence to the Pueblo Canyon confluence is best described as ephemeral, since surface water flow is dominated by short-duration (generally less than several hours) floods associated with summer rainfall events. Most of the upper canyon surface water sampling stations had water during the first three sampling rounds conducted during 2001–2002. In the fourth round, all the upper stations were dry.

The DP Canyon stream channel is also largely ephemeral, with the following exceptions. Some persistent surface water exists as small bedrock pools less than a few meters across. These bedrock pools are periodically filled by floods and snowmelt runoff originating in the southeastern portion of the Los Alamos townsite. Intermittent surface water flow sometimes occurs in short segments in DP Canyon from discharge of groundwater stored within alluvium in reach DP-2 and at the west end of reach DP-4 where local groundwater discharges from DP Spring. Short-duration intermittent flow can also occur from snowmelt runoff. Figure 7.2-3 shows high interannual variability in the number of flow days at gaging stations E038, E039, and E040 for water years 1999 through 2002. Figure 7.2-3 also shows that surface water runoff into DP Canyon is generally maintained from E038 near the head of the canyon down to E039, which is immediately east of reach DP-2 (Figure 7.2-1). Comparable surface water flow between the two stations is expected since the channel between them is largely underlain by bedrock or thin alluvium. A decrease in the number of flow days occurs between E039 and E040, suggesting transmission loss into alluvium. The infiltration probably first occurs in a deposit of older alluvial sediments just above reach DP-4. Water stored in these deposits discharges as DP Spring at a headwall exposure of the contact of the older alluvium with unit 1g of the Tshirege Member of the Bandelier Tuff (Reneau in LANL 1995, 58207). Discharge at DP Spring is highly variable, generally ranging from zero to less than one gal./minute, and has been observed to respond rapidly to stormwater runoff from upper DP Canyon. Surface water flow generally extends for less than approximately 15 m (49 ft) downcanyon from the point where spring flow joins the stream channel. DP Spring was dry during the first, third, and fourth rounds of

sampling conducted during 2001–2002, although it appeared to be more persistent in some prior, wetter years.

Acid and Pueblo Canyons

Surface water flow in Acid and upper Pueblo Canyons, upstream from the Bayo WWTP, is generally ephemeral and occurs primarily as short-duration stormwater runoff from summer rainfall. Locally persistent surface water flow has been observed in bedrock pools or where alluvial groundwater discharges. Intermittent flow also occurs during snowmelt runoff or alluvial groundwater discharges, but gage data are limited for quantifying the frequency or duration of surface water flow. Data are available for the upper Pueblo Canyon gaging station (E055) only for water years 2002 and 2003 because the gaging station was installed in late 2001. Surface water flow was not observed flowing through the length of upper Pueblo Canyon during the investigation period, with the exception of floods that occurred since the Cerro Grande fire. For water year 2002, the E055 gaging station measured only 14 days of flow (Katzman 2004, 85532). In the South Fork of Acid Canyon, the channel is largely bedrock dominated, and stormwater runoff, other townsite runoff (e.g., from lawn watering), and periodic releases of water from the Larry Walkup Aquatic Center result in small pools that have been observed to persist for several weeks or even months. The bedrock pools were most persistent in narrow and confined, or shaded canyon areas with a low duration of direct sunlight. In main Acid Canyon, persistent or intermittent water has been observed a short distance upstream from Pueblo Canyon where alluvial groundwater emerges. Farther upstream in Acid Canyon, water was most commonly observed in bedrock pools. In lower Pueblo Canyon, persistent (effectively perennial) flow is the result of effluent discharge from the Bayo WWTP. Flow from the WWTP is maintained through approximately 3 km (1.86 mi) of lower Pueblo Canyon to and beyond the confluence with Los Alamos Canyon. In water year 2002, gaging station E060 below the WWTP measured 357 days of flow (Shaull et al. 2003, 76042). The amount of flow from the WWTP and the downcanyon extent of surface water flow vary daily as a result of WWTP operations and seasonally as a result of water diversions for uses such as watering the Los Alamos County golf course.

Lower Los Alamos Canyon

Surface water flow in lower Los Alamos Canyon originates as discharges from springs or alluvial groundwater, as discharges from the Bayo WWTP in Pueblo Canyon, as snowmelt runoff from upper Los Alamos Canyon, and as stormwater runoff. Perennial flow occurs for varying distances below Basalt Spring, which is hydrologically connected to surface water discharges from the WWTP (LANL 1995, 50290). Basalt Spring has variable discharge rates with estimates from 1 to 10 gal./minute, which may be partially or largely related to variations in discharge from the WWTP. A small amount of additional surface water originates at LA Spring, which discharges along the south slope of the canyon approximately 300 m (984 ft) downstream of Basalt Spring. Essentially, perennial flow occurs for varying distances downstream from the confluence with Pueblo Canyon, as a result of WWTP discharges. Since the Cerro Grande fire, essentially perennial flow has also occurred related to discharge of alluvial groundwater beginning in lower Guaje Canyon at State Highway NM 502, typically flowing into lower Los Alamos Canyon and to the Rio Grande. Water was not observed at this location before the fire, suggesting that recharge into an alluvial aquifer in Guaje Canyon increased as a result of the increased magnitude and frequency of stormwater runoff events in the Guaje watershed after the fire. When diversion from the WWTP is low, flow can be continuous throughout all of lower Los Alamos Canyon to the confluence with the Rio Grande. During periods of high diversion, flow may extend for less than 1 km (0.62 mi) from Basalt Spring (observations from 1997). Within approximately 1 to 2 km (0.62 to 1.24 mi) of the confluence with the Rio Grande, surface water flow is common and may be related to discharge of alluvial groundwater from Guaje Canyon. Intermittent flow supplied by snowmelt runoff from upper Los Alamos Canyon can also

occur for varying distances, reaching the Rio Grande in wet years, and stormwater runoff from upper Los Alamos, Pueblo, Bayo, or Guaje Canyons can also reach the Rio Grande in larger floods.

7.2.1.2 Alluvial Groundwater

The alluvial groundwater conceptual model is based on water-level, streamflow, and precipitation data. The model addresses spatial variations in the nature of the water-level record and the relation of water level responses to precipitation and streamflow. A series of plots shown in Figures 7.2-4(a–d) for Los Alamos Canyon and 7.2-5(a–d) for Pueblo Canyon, incorporate these data and are used to describe the system. These plots are specifically referenced in the subsections below. The plots include a parameter called integrated precipitation, whose values are estimates of average daily precipitation that falls on the portion of the basin upgradient from each groundwater monitoring location, thus potentially influencing groundwater-level responses at the monitoring location. Average daily precipitation is estimated using a Thiessen weighted-average process (Dunne and Leopold 1978, 84459, p. 75). This process weights the daily rainfall value at each precipitation gage proportional to the fraction of the total area in the basin that is closest to each gage. Because of the high spatial variability in precipitation (especially summer thunderstorms), integrated precipitation estimates are considered more representative and less biased than either showing all precipitation data on such plots or selecting one (even the closest) station. For the months of May through October, when precipitation is dominated by rain, all available precipitation gages are used in these calculations, including data from gages in the Laboratory network (accessible at <http://weather.lanl.gov>), remote area weather stations (RAWS) installed after the Cerro Grande fire (accessible at <http://www.losalamos.dri.edu>), and the Quemezón SNOTEL gage (accessible at <http://www.wcc.nrcs.usda.gov/snote/>). For the months of November through April, when snowfall is common, only the Laboratory gages and the Quemezón SNOTEL gage are used because the RAWS gages do not measure snowfall accurately.

Upper Los Alamos and DP Canyons

A series of alluvial groundwater monitoring wells with continuous-record water-level data provide the basis for examining the nature and causes of water-level variations in upper Los Alamos Canyon. These wells, LAO(b), LAO-0.3, LAO-0.91, and LAO-1.6(g), are located in Los Alamos Canyon between the Los Alamos Reservoir and DP Canyon (Figure 3.2-1 and Plate 1). Figure 7.2-4(a–d) shows the water-level record plotted for comparison to the integrated precipitation data and the streamflow record at gaging stations E025/026, E030, and E042. In all four plots, two basic observations are apparent. One observation is that groundwater level generally rises rapidly in response to summer and fall precipitation events and associated stormwater runoff. Rises in groundwater level occur instantaneously and generally correlate well with the streamflow record at gaging stations E025/026, E030, and E040, indicating that recharge from the streambed occurs during floods. This effect is less pronounced in LAO(b) presumably because this well has a water level that is consistently at or near the elevation of the adjacent streambed. Aquifer transmissivity also may play a role in the damped water-level responses at LAO(b); however, low transmissivity would probably be manifested as a lagged response between streamflow and water-level response, which has not been observed. Recharge via streambed infiltration is best represented by the data from the summers of 2001, 2002, and 2003. The rate of water-level decline following the recharge events varies, and differences in rates between wells are probably associated with variations in aquifer conductivity. Several small but distinct increases in water-level recorded during late spring and summer months are not related to precipitation events but rather are related to draining of the Los Alamos Reservoir for dredging and maintenance following the Cerro Grande fire. Data from early June 2001 and the middle of March 2003 exemplify these events.

A second key observation is that of groundwater-level rise observed in wells during the late winter to early spring. The water-level rise during all three winter/spring periods in the water-level record occurs prior to initiation of sustained streamflow at even the most upcanyon gaging station, E025/026. This type of water-level response is best demonstrated by the record from the winter and spring of 2000–2001, which had the only appreciable winter snowpack during the three years of automated water-level measurements. The conceptual model for this type of response is that recharge within the alluvium is associated with early-season snowmelt that infiltrates into alluvium in the upper canyon and creates an underflow recharge front that advances downcanyon. Once the aquifer saturation has reached capacity (i.e., the elevation of the adjacent stream channel), streamflow is initiated, suggesting that streamflow during these periods represents discharge of the aquifer to the surface. All four wells shown in Figure 7.2-4(a-d) show this relation. The travel time of the recharge pulse can be estimated from the data shown in a compilation of the continuous water-level records for these wells (Figure 7.2-6). The timing of the initiation of the water-level rise in the winter/spring of 2001 at each progressively downcanyon well suggests a travel time for the recharge pulse of approximately 100 m (328 ft) per day, which is significantly greater than computed flow velocities obtained using the hydraulic conductivities indicated from slug test data from alluvial wells in upper Los Alamos Canyon (hydraulic conductivity values are presented in Table F-2.4-1).

The rapid travel time for the recharge pulse is probably related to groundwater flow within preferential horizontal pathways in coarse-grained and/or well-sorted facies in the alluvium. This travel time approximation is supported by computations of average linear velocity for groundwater flow (Fetter 1994, 70942, p. 145) using representative values of hydraulic conductivity (K) and porosity (n) from literature sources for well-sorted coarse sand and mixed coarse sand and gravel and the average bedrock gradient of 0.03 in upper Los Alamos Canyon. Assuming K is 0.5 cm/sec (median value for clean sand [Freeze and Cherry 1979, 64057, p. 29]) and n is 0.35 (average value for mixed sand and gravel [Freeze and Cherry, 1979, 64057, p. 37,]) yields an average linear velocity of 37 m (121 ft) per day. Assuming K is 3 cm/sec (maximum value for well-sorted coarse sand [Spitz and Moreno 1996, 85503, p. 348]) and n is 0.30 (minimum value for uniform sand and for gravel [Spitz and Moreno 1996, 85503, pp. 342–343]) yields an average linear velocity of 259 m (850 ft) per day. Thus, the travel time estimated by the water-level data analysis falls well within a range of plausible horizontal groundwater flow velocity values for coarse-grained and/or well-sorted facies in the alluvial aquifer in upper Los Alamos Canyon. This analysis indicates that preferential pathways in the alluvium support high groundwater flow velocities that significantly exceed average rates for the alluvial system (by two to three orders of magnitude).

The downcanyon extent of alluvial groundwater saturation varies significantly from year to year and season by season. During dry years, and especially during years with limited spring snowmelt runoff, saturation may not extend appreciably beyond the area around monitoring well LAO-4.5c (Figure 3.2-1 and Plate 1). Alluvial monitoring wells as far down upper Los Alamos Canyon as LAO-4.5c were sufficiently saturated to allow sampling in the first three of four rounds conducted in 2001 and 2002. LAO-6a, the most downcanyon alluvial monitoring well in upper Los Alamos Canyon, had sufficient saturation for sampling only during the round conducted in the spring of 2001, the same period as the snowmelt response described above.

In DP Canyon, two separate alluvial aquifers exist: one in reach DP-2 and the second in reach DP-4 (Plate 1). Water-level variations in DP Canyon are directly related to runoff events generated in the Los Alamos townsite, which can happen in any season (see Section 7.2.1). Maximum water-level elevations are limited by streambed elevation. Investigations conducted as part of the tracer study (described in Appendix B-2.4) indicate that a complex recharge/discharge process occurs during flood events where initial recharge from the streambed to the alluvial aquifer is rapidly followed by discharge from the aquifer back to the streambed during the recessional stage of the flood, thereby causing extended surface water

flow. The basis for this model is the detection of the bromide tracer in surface water flow collected near gaging station E039 following several flood events in 2003.

Intermittent flow from DP Spring and runoff from farther upstream recharges the alluvium in reach DP-4. This alluvial groundwater is a component of the groundwater observed in well LAO-2 near the confluence of DP and Los Alamos Canyons (Figure 3.2-1 and Plate 1). Contaminants unique to the portion of upper Los Alamos Canyon above the confluence with DP Canyon (e.g., molybdenum) are detected in LAO-2 (as discussed later), indicating that mixing of groundwater from each canyon occurs at the confluence.

Pueblo Canyon

Figure 7.2-5(a–d) shows continuous-record water-level data for alluvial monitoring wells PAO-1, PAO-3, PAO-4, and PAO-5n compared to the integrated precipitation data and the streamflow record for gaging station E060. The plots show two distinct modes of alluvial groundwater saturation within Pueblo Canyon. Wells located upcanyon of the Bayo WWTP show a water-level record similar to the wells in upper Los Alamos Canyon in that water-level variations are closely tied to precipitation and associated flood events, and to winter and spring snowmelt. For wells PAO-1 and PAO-3, immediate groundwater-level response is well illustrated for the precipitation and flood events of July 2, 2001, June 21–22, 2002, and August 23, 2003. Those same events resulted in a damped response in the two lower canyon wells, PAO-4 and PAO-5n. Saturation in the lower canyon is primarily the result of infiltration of surface water discharged to the canyon from the WWTP. The variation in water-level elevations downcanyon of the WWTP is controlled primarily by seasonal rerouting of effluent for “downstream” uses such as watering at the Los Alamos County golf course.

In Pueblo Canyon, the most important snowmelt period over the last few years is related to the winter of 2000–2001. The water-level record at PAO-1 shows a steady increase in water level during the winter and spring of 2001 without a corresponding increase in streamflow at E060. The water-level record for PAO-3 shows a more abrupt rise in water level that is also related to the same snow melt period. It is possible streamflow occurred through this portion of Pueblo Canyon, but no gage data are available for comparison. The early onset of the 2001 (and subsequent) snowmelt period(s) is believed to be related to the loss of canopy during the fire and the large amount of south-facing aspect in the upper Pueblo basin, both resulting in rapid snowmelt following snow storms.

Lower Los Alamos Canyon

No continuous automated water-level data were collected for lower Los Alamos Canyon, so manual water-level measurements made approximately every month are used to develop the conceptual model. Manual water-level plots for wells LLAO-1, LLAO-2, LLAO-4, and LLAO-5 are shown in Figures B-2.2-1d through B-2.2-1g in Appendix B. Groundwater saturation in most of lower Los Alamos Canyon down to the area around LLAO-4 is partially related to infiltration of surface water discharged from Basalt Spring, which is hydrologically connected to surface water discharged from the Bayo WWTP into Pueblo Canyon (LANL 1995, 50290). Water levels in this portion of lower Los Alamos Canyon are highly variable and presumably related to seasonal variations in discharge rates from the WWTP and to snowmelt and floods in Los Alamos and Pueblo Canyons. A pronounced water-level increase associated with post-fire floods in Los Alamos and Pueblo Canyons in October 2000 is recorded in lower Los Alamos Canyon and continued into the period of snowmelt runoff from upper Los Alamos Canyon in spring 2001. In the lower-most portion of lower Los Alamos Canyon, the water-level record from LLAO-5 shows relatively constant saturation with much less variability than higher in lower Los Alamos Canyon. The geochemistry of groundwater from LLAO-5 (discussed later in this section) indicates that alluvial groundwater in the lower-

most portion of the watershed represents mixing of waters from Los Alamos Canyon and regional groundwater discharging to the Rio Grande. Alluvial groundwater saturation in lower Los Alamos Canyon was persistent during the sampling period for all four sampling rounds conducted in 2001 and 2002.

Post-Cerro Grande Hydrology

The Cerro Grande fire produced significant hydrologic changes in the watersheds west of the Laboratory (BAER 2000, 72659). These changes were primarily the result of altered soil conditions in the upper portions of the watersheds. Loss of vegetation and forest litter, development of ash covers, and extreme hydrophobic soil conditions greatly reduced the capacity for infiltration and storage of precipitation. The reduced infiltration rates resulted in rapid surface-water runoff during thunderstorms and numerous floods with high ash content. Ash produced from the Cerro Grande fire consisted of a complex mixture of inorganic and organic compounds. Calcium, magnesium, silica, potassium, sodium, and carbonate were among the constituents concentrated in the ash (Longmire et al. 2002, 71274). The presence of these constituents resulted in increased pH and changes in major ion chemistry in the alluvial groundwater induced by the ash-rich runoff and may have influenced the distribution and mobility of contaminants in alluvial groundwater, including strontium-90, uranium, plutonium, and americium. Additionally, radionuclides associated with fallout from aboveground nuclear testing were also present in ash at concentrations elevated above the BVs in sediment (Katzman et al. 2001, 72660). The ash data are summarized in (Appendix D-1.7). Interaction of surface water with ash resulted in elevated concentrations of several constituents in water, most notably strontium-90, manganese, calcium, and arsenic. The constituents and potential effects of Cerro Grande ash on their distribution are discussed in the following sections that evaluate contaminants in surface water and alluvial groundwater.

A series of plots showing water level compared to a set of parameters measured using downhole multi-parameter probes are presented in Figures B-2.2-2(a-h) in Appendix B, and an overview derived from the data is presented in Section B-2.3. The parameters include pH, specific conductance, temperature, and dissolved oxygen. To summarize, considerable variability in the nature of the groundwater response to floods occurs between monitoring wells within a canyon, and between canyons. Regardless of the variability in response, it is apparent that groundwater was affected physically and geochemically by post-fire floods. The physical effect is manifested as rapid water-level response to numerous floods, and the geochemical effect is manifested as flood-related excursions in the measured water-quality parameters. These findings are important because they indicate that the results of the hydrologic and contaminant characterization presented in this report may, in part, represent perturbations in contaminant trends that occurred after the fire. It is not known how long such perturbations will persist, although the effects of the fire are expected to progressively decrease over time as the upper watershed recovers.

7.2.2 Radionuclides in Water

7.2.2.1 Spatial Distribution and Sources of Radionuclides in Water

The human health screen conducted in Section 6 identifies several radionuclide COPCs in surface water and alluvial groundwater in the Los Alamos and Pueblo watershed, including strontium-90, plutonium-239,240, uranium-234 and -238, and americium-241. A series of plots in Appendix D provides a high-level overview of the spatial trends of the radionuclide COPCs by canyon. The discussion below provides additional information on the spatial distribution of these contaminants in key areas of the watershed using box plots that show the data for surface water and alluvial groundwater sampling locations in relation to distance from the Rio Grande. Data collected from 1994 to 2002 under the investigations described in Section 3 are used in the box plots. The upper and lower ends of the boxes

are the 75th and 25th percentiles of the data distribution, and upper and lower lines outside the boxes indicate 90th and 10th percentiles, respectively. The sampling locations included in the plots were selected to bound known or suspected contaminant sources and generally include locations that have enough data to show variability in contaminant concentrations. Nondetect values are included in the plots. The paired numbers below each box indicate the number of detects (left) and nondetects (right) at each location. Detected values are represented in the plots with filled symbols, and the nondetect values are open symbols. Filtered and unfiltered results are combined in the data sets shown in each plot, providing a conservative depiction of contaminant trends. Filtered and unfiltered concentrations of relatively soluble constituents such as strontium-90 are comparable. For less soluble constituents such as plutonium, the concentrations in unfiltered samples are generally higher.

Overall, the spatial distribution of radionuclide concentrations indicates only a few key sources of radionuclides in water. The most important sources include the former outfall at SWMU 21-011(k) adjacent to reach DP-2; the former TA-45 outfalls (SWMUs 45-001 and 1-002) adjacent to reach ACS; and the former leach field (SWMU 02-009[c]) east of the decommissioned OWR in TA-2 in upper Los Alamos Canyon, adjacent to reach LA-1C (Plate 1). An additional, but minor, Laboratory source is the former TA-1 Hillside outfalls (SWMUs 1-001[c], 1-001[d], and 1-001[f]) that discharged into Los Alamos Canyon in the area of reaches LA-1W+ and LA-1W. Ash from the Cerro Grande fire is also recognized as a minor source of radionuclide constituents measured in water.

Strontium-90

The spatial trends of strontium-90 concentrations shown in Figure 7.2-7(a-d) indicate that SWMU 21-011(k) is the most important Laboratory source and that the former leach field at TA-2 is a minor source. Concentrations of strontium-90 are highest in LAUZ-1, the groundwater monitoring well located closest to the SWMU 21-011(k) outfall (Figure 7.2-7[a]). Concentrations generally decrease downcanyon to low detected concentrations in LAO-6a. Persistent surface water was uncommon in this portion of the watershed during the investigation period; therefore, contamination was generally limited to alluvial groundwater, although historical data from the Environmental Surveillance Program indicate elevated strontium-90 concentrations in surface water sampled in reaches DP-2 (surveillance station DPS-1) and DP-4 (surveillance station DPS-4 at the mouth of DP Canyon) in the 1960s (LANL 1995, 50290, p. 3-51). The temporal trend in strontium-90 concentrations in DP Canyon surface water are described below in Section 7.2.2.3.

The spatial distribution of strontium-90 concentrations in surface water and alluvial groundwater in upper Los Alamos Canyon above the DP Canyon confluence indicate that the former leach field at TA-2 (SWMU 02-009[c]) is the most important source in this portion of the canyon (Figure 7.2-7[b]). A report on the decommissioning of the TA-2 water boiler reactor does not explicitly identify strontium-90 as a contaminant associated with the leach field (Elder and Knoell 1986, 6670). However, data from two alluvial groundwater monitoring wells located immediately east of the footprint of the leach field (LAOR-1 and LAOR-2) show historically elevated strontium-90 concentrations in alluvial groundwater. Elevated strontium-90 concentrations are present in monitoring wells LAO-0.91 and LAO-1 located downcanyon of the leach field. Monitoring well LAO-0.91 is closest to the leach field source but shows lower concentrations than LAO-1, probably because it is located on the south side of the channel (across the channel from the leach field source) and apparently out of the preferential dispersion pathway for the strontium-90. Strontium-90 contamination from the TA-2 area extends downcanyon beyond LAO-1 for a short distance. The data from monitoring well LAO-1.6(g) (approximately 2.25 km [1.4 mi] downcanyon) are almost entirely nondetect values for strontium-90. The increase in strontium-90 concentrations in

alluvial groundwater at LAO-2 represents mixing of alluvial groundwater from upper Los Alamos Canyon and DP Canyon.

Figure 7.2-7(b) shows that strontium-90 is also detected in upper Los Alamos Canyon surface water upcanyon of Laboratory sources. Strontium-90 in surface water in the upper canyon is related to elevated concentrations of strontium-90 found in Cerro Grande ash (Katzman et al. 2001, 72660, and Appendix D-1.7). Samples collected from the Los Alamos Reservoir show the highest strontium-90 concentrations in the upper canyon, higher than concentrations observed in surface water samples collected immediately upstream of the reservoir, suggesting that longer residence time of water with ash-rich sediments resulted in increased leaching of strontium-90. Gallaher et al. (2002, 82265) suggest a similar scenario for surface water samples collected after the fire. Samples collected immediately downstream of the reservoir show slightly lower concentrations than samples collected within the reservoir, suggesting some mixing of water with lower concentrations. Downcanyon detections of strontium-90 in surface water, including at the sampling location LA-Background SW in the background sediment investigation reach, are interpreted to be related to the presence of ash deposited within channel sediments.

Spatial trends in strontium-90 in the Pueblo watershed indicate that the former outfalls into reach ACS are the primary source (Figure 7.2-7[c] and Plate 1). Strontium-90 is first identified in surface water samples from the persistent bedrock pool in lower reach ACS but is highest at the surface water sampling locations in lower reach AC-3 (near Acid Weir) and upper reach P-1E, and in monitoring well PAO-2 located approximately 230 m (755 ft) below the confluence of Acid and Pueblo Canyons. The sampling locations with the highest strontium-90 concentrations are at or near the confluence of Acid and Pueblo Canyons. The concentrations of strontium-90 in surface water and alluvial groundwater decrease substantially downcanyon of PAO-2 and remain relatively constant with low spatial variability. The elevated strontium-90 concentrations in lower reach AC-3 are interpreted to be related to the emergence of shallow alluvial groundwater that has interacted with contaminated sediments in reach AC-3. Strontium-90 detections in surface water and alluvial groundwater in Pueblo Canyon, upcanyon of the Acid Canyon confluence, are also probably related to the presence of Cerro Grande ash deposited with channel sediments.

In lower Los Alamos Canyon, detected concentrations of strontium-90 are sporadically located in surface water and alluvial groundwater throughout the canyon. The highest detected strontium-90 is from the surface water location, LA SW at Guaje Confluence, located in Los Alamos Canyon immediately upcanyon of the Guaje Canyon confluence (Figure 7.2-7[d]). Strontium-90 values at surface water sampling location, Guaje SW at LA confluence (located just upstream of the confluence with Los Alamos Canyon), are all nondetects. The detected concentrations of strontium-90 observed in lower Los Alamos Canyon surface water and alluvial groundwater may be related to the presence of Cerro Grande ash deposited within channel sediments and on floodplains. Although ash was also deposited by floods in Guaje Canyon, the surface water at the Guaje Canyon location discharges from alluvium in the scoured channel below the highway culvert under State Highway NM 502 and may not be in contact with post-fire flood deposits that contain ash. In Los Alamos Canyon, the surface water in this reach commonly persists as streamflow over a large distance, often reaching the Rio Grande, and the strontium-90 contamination in surface water may be derived from interaction with channel-bed or -bank sediments with low concentrations of strontium-90 in ash. Elevated concentrations of strontium-90 are detected in post-fire sediments that were collected in lower Los Alamos Canyon (see Figure 7.1-4). All but one of the values for strontium-90 in alluvial groundwater in lower Los Alamos Canyon are nondetects, suggesting that little strontium-90 exists in deeper alluvium.

Plutonium-239,240

Plutonium-239,240 in upper and lower Los Alamos Canyon is detected at very low frequency and is not identified in the screen in Section 6 as important for assessing human health risk because of its low frequency of detection. However, plutonium-239,240 is present locally in the watershed at low concentrations, and the distribution of detected values is attributed to two primary sources: SWMU 21-011(k) and the former TA-1 Hillside outfalls (Figure 7.2-8[a, b, and d]). In DP Canyon, the highest frequency of detected plutonium-239,240 concentrations occurs in alluvial groundwater at LAUZ-1. The concentrations and frequency of detection decrease immediately downcanyon. From monitoring well LAUZ-2 down DP Canyon into the lower portion of Los Alamos Canyon, only scattered detected concentrations occur in surface water and alluvial groundwater. Overall, a higher frequency of detection occurs in unfiltered samples, indicating the presence of plutonium-contaminated suspended solids in the samples.

In upper Los Alamos Canyon, above the confluence with DP Canyon, plutonium-239,240 is first identified in alluvial groundwater at monitoring well LAO-0.6. As in DP Canyon, the frequency of detected concentrations at downcanyon surface water and groundwater sampling locations is very low and extends to the next sampling location below monitoring well LAO-1. The maximum detected concentration is 0.073 pCi/L in surface water in reach LA-1C. The most significant source of plutonium-239,240 in this portion of the canyon is Hillside 137, the outfalls associated with SWMUs 01-006(c) and 01-006(d), although plutonium-239,240 is also identified at Hillside 138 (SWMU 1-006[h] (LANL 1995, 49703; LANL 1996, 54465; Reneau et al. 1998, 59160). Monitoring well LAO-0.6 is located approximately 900 m [3000 ft] downcanyon of Hillside 137, and 750 m (2500 ft) downcanyon of Hillside 138. The low concentrations of plutonium detected in water in upper Los Alamos Canyon are probably related to the presence of plutonium-contaminated sediments redistributed downcanyon of the Hillside SWMU sources.

Plutonium-239,240 in Pueblo Canyon is identified in the screen in Section 6 as potentially important for assessing human health risk. Figure 7.2-8(c) shows the distribution of plutonium-239,240 concentrations in surface water and alluvial groundwater in Acid Canyon and Pueblo Canyon. The concentrations of plutonium-239,240 are highest in surface water in reach ACS (upper and lower reach ACS SW) near the initial location of discharges from TA-45. Concentrations are lower in surface water in reach AC-3 and remain low in surface water and alluvial groundwater throughout the rest of Pueblo Canyon. Detections of plutonium-239,240 occur in both filtered and unfiltered samples throughout the Pueblo watershed, but the highest concentrations are from unfiltered surface water samples, indicating the preference for plutonium to adsorb to fine-grained sediment and organic matter, and the presence of plutonium-contaminated suspended solids in the samples.

Plutonium-239,240 is present in lower Los Alamos Canyon at very low concentrations in surface water and alluvial groundwater (Figure 7.2-8[d]). The highest detected concentration is 0.25 pCi/L in a turbid surface water sample (74.5 NTU) collected in lower reach LA-5. The sporadic detections in surface water and alluvial groundwater in lower Los Alamos Canyon are primarily in unfiltered samples and probably relate to the presence of plutonium-contaminated suspended solids in the samples.

Uranium-234 and Uranium-238

The box plots presented in Figure 7.2-9(a–d) show the spatial distribution of uranium-234 and uranium 238 data from sampling locations in relation to distance from the Rio Grande for each canyon in the watershed. Uranium was a constituent in discharges at several locations within the Los Alamos and Pueblo watershed but is currently present in high enough concentrations to be important for assessing

human health risk in surface water only in reach ACS. Uranium isotopes are detected elsewhere in surface water and alluvial groundwater, particularly downstream of SWMU 21-011(k) and the former TA-1 Hillside outfalls.

Figure 7.2-9(a) shows that in DP Canyon uranium is initially detected in surface water from persistent bedrock pools near the head of the canyon. The sample with the maximum concentration has 0.712 and 0.544 pCi/L for uranium-234 and uranium-238, respectively, suggesting natural isotopic composition. The sampling locations at the head of DP Canyon are upcanyon of known sources of uranium contamination. Below SWMU 21-011(k), concentrations of uranium-234 in alluvial groundwater increase slightly, and the sample from monitoring well LAUZ-1 with the maximum concentration of uranium-234 (1.73 pCi/L) has a uranium-238 concentration of 0.20 pCi/L. The uranium-234 to uranium-238 ratios in alluvial groundwater below SWMU 21-011(k) indicate slight enrichment in uranium-234. Concentrations of uranium-234 decrease downcanyon away from the initial outfall source, whereas uranium-238 concentrations do not change significantly.

In upper Los Alamos Canyon, above the DP Canyon confluence, slightly elevated concentrations of uranium-234 and uranium-238 occur in surface water in reach LA-1W downcanyon of the former TA-1 Hillside outfalls (Figure 7.2-9[b]). Maximum concentrations of uranium-234 and uranium-238 at that location are 1.5 and 1.39 pCi/L, respectively, suggesting natural isotopic composition. The most important source of uranium contamination in this portion of the canyon was the former outfall at Hillside 140 (SWMU 01-001([f])). Elevated concentrations occur primarily in surface water, indicating either an interaction of surface water with contaminated sediment in the canyon or continued contributions to the canyon associated with stormwater runoff across SWMU 01-001(f). However, uranium isotopes were not identified as COPCs in sediment in these reaches (see Section 6), and the reason for their presence in surface water but not sediment is not certain.

In Pueblo Canyon, the elevated concentrations of uranium isotopes are limited in extent to the surface water in the upper portion of reach ACS (Figure 7.2-9[c]). The ratios of uranium-234 to uranium-238 in the sample data indicate slight enrichment in uranium-234. Concentrations decrease rapidly downcanyon from that location but persist at generally low concentrations in surface water and alluvial groundwater throughout the rest of Acid and Pueblo Canyons. The limited spatial distribution of elevated uranium concentrations in surface water in reach ACS is related to locally elevated concentrations of uranium in sediment in the upper portion of the reach. Isotopic ratios in surface water in lower Pueblo Canyon (at the Pueblo at 502 station) indicate progressive mixing with naturally occurring uranium.

Isotopic uranium data from lower Los Alamos Canyon shows significantly higher concentrations present in groundwater from monitoring well LLAO-5 (Figure 7.2-9[d]). The major ion chemistry of alluvial groundwater in monitoring wells LLAO-1, LLAO-4, and LLAO-5 in the Otowi House well (a regional groundwater well located adjacent to the Rio Grande) indicates that groundwater in LLAO-5 represents a mixture of alluvial groundwater from the upper canyon and regional aquifer water. Detailed characterization of uranium isotopes in regional groundwater samples from the Otowi House well using thermal ionization mass spectroscopy shows that the isotopic ratios indicate naturally occurring uranium in the regional groundwater (Gallaher 2004, 85428). The data presented in Figure 7.2-10 show that the concentrations of the major ions increase downcanyon along the alluvial groundwater flow path, particularly between LLAO-4 and LLAO-5, indicating that regional aquifer groundwater discharge to the shallow system occurs in that area.

Americium-241

Americium-241 is identified as important assessing for human health risk in DP Canyon and in reaches ACS and AC-3. The release history of americium-241 from the former TA-1 and TA-45 outfalls and SWMU 21-011(k) is similar to that of plutonium-239,240, although the peak releases of americium-241 occurred later than for plutonium-239,240 at SWMU 21-011(k) (see Section 7.1.1.1). The spatial distribution of americium-241 in water is similar to plutonium-239,240 in that highest concentrations detected in water are near the source, and the concentrations and frequency of detection decrease rapidly downcanyon (Figures 7.2-11[a and b]). Americium-241 is detected only sporadically in upper Los Alamos Canyon, above the confluence with DP Canyon, and in lower Los Alamos Canyon. Detections of americium-241 are more common in unfiltered samples, and, as with plutonium, indicate its high potential to adsorb to fine-grained sediment and organic matter.

7.2.2.2 Relation of Radionuclides in Water and Sediment

The analysis presented in Section 7.2.2.1 focused on identifying sources of radionuclide contamination in surface water and alluvial groundwater, and the extent of that contamination. A more detailed examination of the spatial distribution of radionuclides in surface water and alluvial groundwater indicates a closer relation to the present-day distribution of contaminants in sediment. Figures 7.2-12(a–c) and 7.2-13(a–c) show the spatial relation between concentrations of strontium-90 and plutonium-239,240, respectively, in fine facies sediment and surface water and alluvial groundwater in different portions of the watershed. Filtered and unfiltered water data are combined in the calculations of average concentrations in water. Average contaminant concentrations in sediment are estimated using fine facies sediment data, as opposed to averages of fine and coarse facies, because the fine-grained fraction generally contains the highest contaminant concentrations in a reach.

Strontium-90

Figure 7.2-12(a) shows the relation of strontium-90 in sediment, surface water, and alluvial groundwater in DP Canyon and upper Los Alamos Canyon below the DP Canyon confluence. Strontium-90 concentrations in sediment and alluvial groundwater generally correlate. However, a more detailed assessment of the spatial distribution of average strontium-90 concentrations sediment and alluvial groundwater shown in Figure 7.2-12(a) suggests a more complex relation between the two media. The spatial distribution of the highest concentrations of strontium-90 in alluvial groundwater may be more closely related to its distribution at depth in alluvium rather than within near-surface sediments. The highest average concentrations of strontium-90 in alluvial groundwater at LAUZ-1 and LAUZ-2 do not correlate with the two reaches showing the highest average concentrations in fine facies sediment deposits, which typically lie above the water table. In this instance, the highest concentrations of strontium-90 in water are interpreted to be related to significant infiltration of effluent from the former outfall at SWMU 21-011(k) directly into alluvium near the location where effluent initially entered the channel in DP Canyon. This process would result in high concentrations of strontium-90 at depth related to the early period of discharges from the outfall as opposed to subsequent flood remobilization of surface inventory or groundwater transport.

Strontium-90 concentrations in alluvial groundwater at LAO-1 also appear to indicate a strontium-90 inventory at depth within alluvium. Neither surface water nor sediment show elevated concentrations in that portion of the canyon (Figure 7.2-12[b]). As discussed in Section 7.2.2.1, the strontium-90 in the vicinity of LAO-1 is associated with subgrade releases of strontium-90 from a leach field east of TA-2. Thus, the inventory was dispersed at depth in a relatively localized area. Importantly, strontium-90

concentrations in the next downcanyon monitoring well are low, suggesting that the strontium-90 inventory adsorbed to alluvium at depth has not migrated far from the initial release point.

Figure 7.2-12(c) shows a strong correlation between strontium-90 concentrations in surface water and sediment in Acid Canyon. However, the two surface water locations in reach ACS do not correlate with sediment concentrations because these surface water locations are bedrock pools and, therefore, direct extended contact of surface water with contaminated sediment is limited. The highest concentrations of strontium-90 in water occur in surface water in reach AC-3, which represents the emergence of alluvial groundwater. Elevated concentrations of strontium-90 also occur in alluvial groundwater at monitoring well PAO-2 in reach P-1E. As with the model proposed for strontium-90 contamination associated with effluent releases in DP Canyon, the strontium-90 contamination in AC-3 and the vicinity of PAO-2 may be related to infiltration of strontium-90 present in effluent during the period of active discharges from former TA-1 and TA-45, and its subsequent mobilization by alluvial groundwater.

Plutonium-239,240

Plutonium-239,240 in water and sediment in DP and Los Alamos Canyons shows good correlation overall, even though the concentrations in water are mostly nondetects or show very low concentrations (Figure 7.2-13[a and b]). In DP Canyon, the best correlation is between plutonium-239,240 concentrations in sediment and alluvial groundwater. In Los Alamos Canyon, all three media correlate well. The anomalous increase in average plutonium-239,240 concentrations in surface water in lower Los Alamos Canyon is the result of a single elevated detection. Since plutonium is a highly adsorbing constituent, good correlations between sediment and either surface water or alluvial groundwater probably indicate the presence of even very small amounts of fine-grained particles (or colloids) with adsorbed plutonium. The good spatial correlation of concentrations in water and sediment suggests that the plutonium in the water samples is derived from sediment sources in the general vicinity of the water sampling locations.

Figure 7.2-13(c) shows that the average concentrations of plutonium-239,240 in both surface water and sediment drop dramatically below the confluence of Acid and Pueblo Canyons. The best correlation is between surface water and sediment in reach ACS and AC-3. Low average concentrations in all media downcanyon of the confluence make it difficult to discern the nature of the correlations. As in DP and Los Alamos Canyons, the close relation of plutonium concentrations in surface water and sediment is interpreted to be related to concentrations of plutonium in suspended solids derived from areas adjacent to the surface water sampling location.

7.2.2.3 Relation of Radionuclides to Time and Hydrology

This section discusses the trends in contaminant concentrations observed over time and addresses possible explanations for variations in the concentration of contaminants in surface water and alluvial groundwater. Figures B-2.2-1 and B-2.2-3 in Appendix B show that samples were collected across the range of water-level conditions observed during the investigation period and that there is also good representation of high and low water-level conditions at most wells. The data shown in Figures B-2.2-2 illustrate the considerable variation in the key water-quality parameters observed during the investigation period, specifically since the Cerro Grande fire. In all, the sample data presented here are representative of the range of potential conditions in these canyons, and they adequately characterize potential perturbations caused by post-fire geochemistry and hydrology. The discussion below focuses on strontium-90 and plutonium-239,240 because they are the most significant radionuclide COPCs for assessing human health risk. Tritium is also discussed because of its history of releases and its historically elevated concentrations in water within the Los Alamos and Pueblo watershed. Tritium is also

a key indicator of potential Laboratory impact in intermediate-perched groundwater and regional groundwater.

Strontium-90

Time-series plots for strontium-90 in water in DP Canyon and Los Alamos Canyon are presented in Figures 7.2-14(a–d) and 7.2-15(a–d), respectively. Monitoring well LAO-2 at the mouth of DP Canyon has a long enough record to show the initial decrease in strontium-90 concentrations in alluvial groundwater following cessation of releases from the former outfall at SWMU 21-011(k) in 1986, with the exception of a single anomalous value in 1993. Data from monitoring well LAO-1 in Los Alamos Canyon suggest an initial decrease in strontium-90 concentrations after contaminated soil was removed from the leach field at TA-2 in 1986. After the initial decreases, strontium-90 concentrations at LAO-1 and LAO-2 and the other sampling locations in DP and Los Alamos Canyons have remained relatively constant but with some variability over time. Concentrations of strontium-90 measured during the several years of this investigation do not show an apparent increasing or decreasing trend at any of the locations. The persistent concentrations of strontium-90 appear to now be related to the source term in young (post-1940s) sediment and possibly in older alluvium that underlies the young sediment.

The generally low variability in strontium-90 concentrations observed in monitoring wells seasonally and interannually in recent years may relate to variations in water level. Figure 7.2-16 is a series of plots showing decay-corrected strontium-90 concentrations in relation to water level for a set of monitoring wells in DP and Los Alamos Canyons. Only analytical results with corresponding water-level data are represented in these plots. The strontium-90 data are decay-corrected to January 1, 2004, for use in these plots to normalize the concentrations for samples collected during the period represented by the data. Data from monitoring well LAO-1 show that lower strontium-90 concentrations correlate with higher groundwater levels, although the range in concentrations may not be sufficiently high to account for possible analytical uncertainty. The relation of water level to concentration at LAO-1 is interpreted to be associated with the nature of strontium-90 releases into the canyon.

The source of the strontium-90 in well LAO-1 was localized in the area of the leach field east of TA-2, which would have released contaminants directly into alluvium below the streambed. Strontium-90 probably infiltrated vertically into alluvium where it was subsequently transported downcanyon in alluvial groundwater, resulting in a distribution of a secondary strontium-90 inventory at depth within the alluvium. Higher groundwater levels in alluvium relate to seasonal recharge events and would result in the addition of noncontaminated water and, therefore, lower strontium-90 concentrations.

For monitoring wells LAUZ-1 and LAO-3a, no clear relation between concentrations and water level can be discerned. The strontium-90 inventory in sediment where LAUZ-1 and LAO-3a are located is associated with deposition of strontium-contaminated sediment by floods and with infiltration of effluent discharge water or flood water containing strontium-90. These mechanisms of contaminant transport may have resulted in a secondary strontium-90 inventory that is vertically dispersed, and variations in water level apparently do not affect strontium-90 concentrations.

In Pueblo Canyon, strontium-90 is present primarily in surface water and is highest in the upper canyon near the source. Figure 7.2-17(a) shows the long-term trend of strontium-90 in surface water collected at the Acid Weir location in lower reach AC-3. Strontium-90 concentrations initially decreased in the early 1960s probably related to a reduction in “unidentified gross beta” activity in effluent that began in 1962, prior to the eventual cessation of effluent releases at TA-45 in 1964 (Stoker et al. 1981, 6059). An additional decrease may have occurred following D&D activities that took place in late 1966 to mid-1967,

although this relation is less clear from the data. Figure 7.2-17(b) shows the strontium-90 data collected over the last few years as part of this investigation at a surface water sampling location in lower reach AC-3, a few meters upcanyon from Acid Weir. The strontium-90 concentrations in surface water in lower AC-3 are slightly higher than concentrations in samples from prior years at Acid Weir. The higher concentrations are probably not related to a temporal variable and may be explained by the Acid Weir sampling location having a component of noncontaminated water from upper Pueblo Canyon resulting in slightly lower concentrations. The variability in strontium-90 concentrations is further assessed in relation to the field parameters data collected during sampling (Figure 7.2-18[a-d]). No strong correlations exist for any of the parameters, but the best relation is between strontium-90 concentration and specific conductance. The basis for this correlation is not immediately apparent, but higher conductance (i.e., higher concentration of dissolved solids) and higher strontium-90 concentrations may relate to a relatively long residence time of water within Acid Canyon alluvium.

Plutonium-239,240

Time-series plots of plutonium-239,240 in unfiltered water in DP Canyon show a pattern of elevated but highly variable concentrations dating to the period of active releases from the former outfall at SWMU 21-011(k) (Figure 7.2-19[a-c]). The highest historical concentrations are associated with the long-term surveillance station DPS-1 in reach DP-2. Variations in plutonium-239,240 concentrations in surface water before the outfall ceased to operate in 1986 may be related to variations in the concentration or inventory of plutonium-239,240 in effluent. The variations may also be related to the amount of suspended sediment in samples; however, suspended sediment concentrations are not available for the early samples. Concentrations have remained very low, and values in recent years are almost entirely nondetects. Nearly all of the samples collected under this investigation are nondetect values, and the few sporadic detections occur in unfiltered samples. In upper Los Alamos Canyon above the confluence of DP Canyon, plutonium-239,240 concentrations have been low since measurements began in 1967, with a few slightly elevated values occurring prior to major cleanup activities conducted in TA-1 from 1974 to 1976 (Figure 7.2-20).

In Pueblo Canyon, plutonium concentrations have historically been highest close to the initial source at the former TA-1 and TA-45 outfalls and decreased in surface water and alluvial groundwater downcanyon (Figure 7.2-21). It should be noted that Figure 7.2-21(c and d) shows a change of two orders of magnitude in the y-axis scale for downcanyon locations. Concentrations near the source decreased dramatically following cessation of releases from TA-45 in 1964. Variations throughout the canyon since 1964 are assumed to relate to differing amounts of suspended solids in samples. A slight perturbation in plutonium-239,240 concentrations in surface water and alluvial groundwater appears to have occurred following the Cerro Grande fire. The increase in concentrations in surface water is probably related to greater amounts of suspended solids in samples. The highest post-fire concentration measured at the surface water sampling location, "Pueblo at 502," was collected on July 3, 2001, the day after the largest post-fire flood in Pueblo Canyon.

Figures 7.2-21(e and f) show slight variations in plutonium concentrations in alluvial groundwater in monitoring wells PAO-4 and APCO-1/PAO-5n over time. The data from APCO-1 and PAO-5n are combined because the wells are adjacent to one another and provide a longer time-series for evaluation of potential trends. The data indicate a slight increase in concentrations following the Cerro Grande fire. Unlike the surface water data, concentrations in filtered and unfiltered groundwater samples from these wells are comparable. The presence of detectable concentrations in unfiltered samples suggests the possibility of colloid transport, or at a minimum, plutonium sorption to particles smaller than 0.45 microns, which is the pore size of filters used to prepare filtered samples. Plutonium may have complexed with ash

to form colloids. Natural colloids formed from weathering of Bandelier Tuff generally have a surface area of $3 \text{ m}^2/\text{g}$ (Longmire et al. 1996, 56030). In contrast, the Cerro Grande ash had a surface area ranging from 12.83 to $30.25 \text{ m}^2/\text{g}$ (McGraw et al. 2003, 85425). The physical processes associated with post-fire flood recharge may also be a factor in mobilizing colloidal plutonium within alluvium.

Tritium

Although not retained as a COPC in Section 6, tritium was a significant contaminant associated with historical Laboratory operations in the Los Alamos and Pueblo watershed. Releases at the former TA-1 and TA-45 outfalls (1944–1964), at the former outfall at SWMU 21-011(k) (1952–1986), and leakage from the closed-loop cooling system at the decommissioned OWR (ca. 1970–1993) are the most significant sources of tritium in the watershed. Figures 7.2-22(a–g) and 7.2-23(a–d) are time-series plots that illustrate the temporal trend in tritium concentrations measured in surface water and alluvial groundwater in the Los Alamos and Pueblo watershed. These data are taken largely from the historical surveillance record, and are supplemented by data from this investigation for the more recent years. The period of record for tritium data varies across locations.

At monitoring well LAO-1, the elevated concentrations relate to the period during which the reactor cooling-water delay line leaked (Figure 7.2-22[d]). With the exception of the higher peak concentrations measured in the early 1970s, peak tritium concentrations remained relatively constant until the early 1990s and dropped dramatically following shutdown of the reactor and elimination of the leak in 1993. Field parameters data (including water-level measurements) are not available for the early period, so their relation to variations in concentration cannot be assessed. However, variations in the concentrations of tritium in groundwater are probably related to groundwater level. Higher groundwater levels associated with spring runoff or infiltration of stormwater runoff probably resulted in dilution of the tritium source term which was estimated to have leaked from the delay line at approximately 75 gal./day (LANL 1993, 15314). Thus, the variations in measured tritium concentrations may be related to seasonal groundwater-level variations or possibly to the timing of sampling events relative to the water-level variations.

Tritium data from two surface water locations in DP Canyon, DPS-1 (near the SWMU 21-011[k] outfall), and DPS-4 (near the confluence with Los Alamos Canyon), show significant variability in tritium concentrations, particularly during the early to mid 1970s (Figure 7.2-22[a and b]). Releases at SWMU 21-011(k) began in 1952, and routine monitoring at these locations began in 1967. Tritium concentrations declined in the mid-1970s, indicating less tritium was being discharged from the outfall in DP Canyon. A short-term increase in concentrations occurred at both stations in the early 1980s. Alluvial groundwater monitoring well LAO-2 is situated at the mouth of DP Canyon within approximately 20 m (66 ft) of DPS-4. The tritium concentrations at LAO-2 show a pattern very similar to DPS-1 and DPS-4 (Figure 7.2-22[c]), indicating that DP Canyon surface water and alluvial groundwater are sources of recharge for LAO-2.

Monitoring wells located below the confluence of Los Alamos and DP Canyons, depicted in Figure 7.2-22(e–g), appear to show patterns in tritium concentrations in the 1970s that are similar to both the DP Canyon surface water data and to data from LAO-1, making it difficult to attribute the tritium to either the OWR source or SWMU 21-011(k). However, a relatively sharp decline in concentration occurs in each of the wells following cessation of releases in DP Canyon in 1986, indicating that the SWMU 21-011(k) outfall was a more important source of tritium in the lower portions of upper Los Alamos Canyon.

Tritium time-series data are presented in Figure 7.2-23(a–d) for locations in Acid and Pueblo Canyons, and for Basalt Spring below the confluence of Pueblo and Los Alamos Canyons. The monitoring data shown in these plots begin in the late 1960s or early 1970s. There are no records of the concentrations or inventory of tritium released at the former TA-1 or TA-45 outfalls, but measured concentrations in Acid and Pueblo Canyons are generally significantly lower than those in DP or Los Alamos Canyons, suggesting that much less tritium was released into Pueblo Canyon. However, a key difference is seen in the long-term trends in tritium concentrations in Acid and Pueblo Canyons compared to DP and Los Alamos Canyons. The tritium data in Acid and Pueblo Canyons show significant variability in concentrations throughout the canyon extending for at least two decades following cessation of releases from TA-45 in 1964. The overall pattern in tritium concentrations extends to Basalt Spring, supporting a hydrologic connection between Pueblo Canyon and Basalt Spring with relatively rapid travel time for groundwater.

Contaminant Concentration Decay Rates

A series of plots were constructed to show the rate of change in concentration in water for tritium and strontium-90 (Figures 7.2-24[a–d] and 7.2-25[a–d], respectively). Each plot uses data that post-dates cessation of releases from one or more sampling locations to describe the rate of change for specific portions of the watershed (e.g., DP Canyon). For example, Figure 7.2-24(a) shows the natural log of tritium concentrations from combined DP Canyon water locations DPS-1, DP-2 SW, LAO-2, and DPS-4 plotted against date. Log concentrations decrease over time, as shown by the linear regression, although there is considerable scatter in the data. The generally linear relationship indicates that the change in concentration over time follows a general decay model where the concentration is reduced by one-half over a constant time interval. According to this decay model, the amount of time required for the concentration to diminish from 1000 to 500 is the same as the amount of time it takes to reduce the concentration from 500 to 250 and from 250 to 125, etc.

The natural log transformation of the concentration data is used because the transformed data can then be related to the half-life of the radionuclide. The time units on the x-axis are given in years to correspond to the time units of the radionuclide half-life of tritium of 12.28 years. A regression line was fitted to serve two purposes: first, the plotted line allows a visual inspection of how well the data are represented by a decay relationship, and, second, the slope of the line is also used to calculate the half-life of change in contaminant concentration. The slope of the line is the decay constant for the decay relationship. The natural log of two divided by the slope will result in the half-life. In the example, the slope of the line is -0.187. The natural log of two is 0.693. The half-life for tritium concentration for these locations is $0.693 / -0.187 = -3.7$ years. Since the convention for expressing a negative half-life is to make it a positive number, the half-life for tritium concentration reduction at these locations is 3.7 years. This half-life of 3.7 years includes the changes in concentration resulting from hydrologic processes as well as from the radioactive decay of tritium.

To evaluate the rate of decline in concentrations related to different release sources, the plots in Figure 7.2-24(a–d) show the tritium data plotted against time for four groups of locations: surface water stations DPS-1, reach DP-2 SW, and DPS-4, and monitoring well LAO-2, to evaluate the decay rate for tritium associated with SWMU 21-011(k); monitoring well LAO-1 for tritium from the delay-line leak at the OWR; monitoring wells LAO-3, LAO-3a, LAO-4, LAO-4.5, and LAO-4.5c to evaluate tritium decay rate at a downcanyon location below the confluence of the two sources described above; and a fourth group that includes surface water data from Acid Weir and reach AC-3 to evaluate tritium decay rates associated with releases from outfalls at TA-45. The plots show that for all four groups, the rate of decline in tritium concentrations ranges from a system half-life of 3.7 to 4.7 years compared to a radioactive half-life of

12.28 years, indicating that the temporal trends in the concentrations of tritium in alluvial groundwater are highly affected by mixing from surface and underflow recharge that is not contaminated with tritium. Since tritium is entirely conservative, meaning it occurs as an aqueous phase, the system half-life for tritium approximates a long-term average rate of recharge or mixing of equal volumes of noncontaminated and contaminated groundwater. Comparable decay rates in all the areas indicate similar proportional rates of recharge.

The plots in Figure 7.2-25(a–d) show the strontium data for the same four groups of locations as used in the tritium plots described above. The regression lines for the strontium-90 data in the DP Canyon group and two upper LA Canyon groups indicate that the system half-life represented by the data in each of these groups is longer than the radioactive half-life. The longer system half-lives support the model that strontium-90 concentrations do not show significant decline over time in the areas assessed for the period after releases ceased and support the concept that a strontium-90 source term in alluvium is functioning as a nondepleting source of contamination for water. In Pueblo Canyon, the calculated system half-life for strontium-90 of 6.5 years since releases at TA-45 ceased is shorter than the radioactive half-life of 28.6 years. Variations in the rate of decline in different areas may be a function of site-specific conditions affecting sorption of strontium-90 (e.g., percent of organic matter) or may relate to variations in the long-term flux rates between the canyons.

7.2.3 Inorganic Chemicals in Water

Several inorganic chemicals are identified in Section 6 as being most important for assessing human health risk. The inorganic chemicals with the highest HQs are arsenic and manganese. These two inorganic constituents generally constitute an order of magnitude higher HQ than any other detected inorganic constituent. Therefore, the conceptual model presented below focuses on those constituents. Molybdenum and perchlorate are also discussed since they are recognized as additional contaminants with a known release history in the watershed.

Arsenic

Figure 7.2-26(a–d) shows a series of box plots for arsenic in different portions of the watershed. Detected concentrations (shown as the number on the left below each box) are widely distributed and are commonly present in surface water and alluvial groundwater. Detected concentrations of arsenic are also present at background locations in upper Los Alamos Canyon, specifically surface water from the Los Alamos Reservoir, and alluvial groundwater from monitoring well LAO(b) (Figure 7.2-26[b]), and surface water in upper DP Canyon (Figure 7.2-26[a]). Arsenic concentrations are naturally elevated in Bandelier Tuff and in soils and sediments derived from the tuff (Longmire et al. 1995, 52227; McDonald et al. 2003, 76084); thus, concentrations of arsenic in water are expected given its relatively high solubility at the circumneutral pHs observed in the Los Alamos and Pueblo watershed. The spatial distribution of arsenic concentrations shown in Figure 7.2-26 indicate that arsenic in surface water and alluvial groundwater in the Los Alamos and Pueblo watershed are predominantly, if not entirely, naturally occurring. Shifts towards higher arsenic concentrations in some portions of the watershed (e.g., below the Bayo WWTP) correlate with areas of persistent saturation in alluvium and probably indicate weathering of rock and sediments containing arsenic. Alluvial groundwater data from PAO-4 and PAO-5 are used to evaluate the temporal trend in arsenic concentrations (Figure 7.2-27[a and b]). The data trend suggests a slight increase in arsenic concentrations in alluvial groundwater following the Cerro Grande fire, although the perturbation is not particularly notable in the context of the high naturally occurring concentrations. Gallaher et al. (2002, 82265) documented elevated concentrations of arsenic (and other inorganic chemicals) in filtered and unfiltered stormwater runoff following the fire. Recharge from floods may be the

cause of slight increases in arsenic concentrations in alluvial groundwater. Most of the ash was stripped from the burn areas in the first two years following the fire (e.g., Johansen et al. 2003, 82312), and any perturbations caused by the ash in the system may have largely diminished.

Manganese

Manganese has a spatial distribution that is, in part, similar to that of arsenic throughout the watershed. The highest concentrations of manganese are associated with persistently saturated areas near the Acid and Pueblo Canyon confluence, below the Bayo WWTP, in the Los Alamos Reservoir, in reach DP-2 (Figure 7.2-28[a-d]). Manganese has been detected in alluvial groundwater at background monitoring well LAO(b) for years prior to the fire, indicating its natural occurrence within the watershed. Significantly elevated manganese concentrations in surface water and alluvial groundwater coincident with portions of the watershed that have persistently saturated alluvium suggest a relation with water/sediment interaction and biological activity. It is widely accepted that bacterially mediated reduction of manganese depends upon sediment moisture conditions, the availability of labile organic carbon, and the presence of poorly crystalline manganese oxides (Lovely 1991, 85523; Lovely and Chapelle 1995, 85506). In alluvial aquifers such as in Pueblo Canyon below the Bayo WWTP and in sections of Los Alamos Canyon, abundant organic carbon has been observed in groundwater. Persistent saturated conditions in these reaches ensure environmental stability for microbial communities, and abundant manganese oxides associated with volcanic rocks, especially weathered tuffs, on the Pajarito Plateau provide optimal conditions for manganese reduction in alluvial ground water. In addition, the slow oxidation kinetics of manganese and the progressively longer residence time of groundwater along the groundwater flow paths result in an accumulation of soluble manganese in groundwater as it flows downgradient (Hem 1981, 85505). Figures 7.2-28(a) and 7.2-28(c) provide examples of the effects of groundwater/sediment interaction and residence time on manganese concentrations. In DP Canyon, the increase in manganese concentrations between monitoring wells LAUZ-1 and LAUZ-2 occurs over a distance of approximately 200 m (650 ft) within the alluvial aquifer in reach DP-2. In Pueblo Canyon, the data show a systematic increase in manganese concentrations in a series of alluvial wells, two upstream and two downstream from the WWTP, PAO-2, PAO-3, PAO-4, and PAO-5n, indicating progressively increasing persistence of alluvial groundwater saturation downcanyon. There are no known Laboratory sources of manganese in either of these canyons.

Manganese was detected in Cerro Grande ash at concentrations up to an order of magnitude higher than the sediment BV (Kraig et al. 2002, 85536). Additionally, several of the highest concentrations detected in water within the watershed are in surface water from the Los Alamos reservoir (Figure 7.2-28[b]). The potential effects of infiltration of ash-rich flood water are illustrated in Figure 7.2-29(a). Following the fire, concentrations in unfiltered alluvial groundwater samples from monitoring well LAO-0.6 show a significant increase relative to filtered sample results for some sampling events. The higher concentrations in unfiltered samples are interpreted to be from the presence of ash in the groundwater samples collected from the well. Several observations of ash in purge water from wells were made during post-fire sampling of wells in 2000. Concentrations of inorganic constituents were also generally higher in unfiltered than filtered stormwater runoff following the fire (Gallaher et al., 2002, 82265) supporting the model that the presence of ash in samples affects concentrations of constituents elevated in ash. In contrast, Figure 7.2-29(b) shows a time series of manganese data from monitoring well PAO-4 in Pueblo Canyon where the filtered and unfiltered results are comparable even across the change in concentrations that occurs after the fire. Pre-fire conditions are represented by only one sample, so it is not possible to discern whether the values from 2000 and 2001 fall within the range of historical variability or result from an actual perturbation cause by the fire. However, the close tracking of the filtered and unfiltered manganese values at PAO-4 suggests a different process may control manganese concentrations at that

location. Manganese is present at significantly higher concentrations in the wetland below the Bayo WWTP where PAO-4 is located than in most locations elsewhere in the watershed. Thus, potential contributions posed by infiltration of ash in runoff may not be as significant of a contribution as in locations with lower manganese concentrations.

Molybdenum

Molybdenum also has a spatial distribution that is similar to arsenic and manganese, suggesting it, too, is present as a naturally occurring constituent in surface water and alluvial groundwater in the Los Alamos and Pueblo watershed. A series of box plots in Figure 7.2-30 show molybdenum concentrations from water sampling locations throughout the watershed. Molybdenum is detected in surface water from the Los Alamos Reservoir, from LAO(b), and from surface water in reach DP-1W at the head of DP Canyon. All these locations are considered representative of background conditions. An exception is the elevated molybdenum concentrations in upper Los Alamos Canyon alluvial groundwater at monitoring wells LAO-1.6(g), LAO-2, LAO-3a, and LAO-4. The molybdenum detected in this portion of the watershed is related to historical discharges from permitted outfalls at TA-53 where sodium molybdate was used as a corrosion inhibitor for cooling towers. Figure 7.2-31 shows a time series of molybdenum data for alluvial monitoring wells downcanyon of the locations where the permitted discharges entered the Los Alamos Canyon stream channel. Molybdenum use was discontinued at TA-53 in June 2002, so these data represent only the variations in concentration over time for the period that molybdenum was discharged. The highest molybdenum concentrations are in monitoring well LAO-3a approximately 1 km (0.6 mi) from the area where the outfalls discharged. Molybdenum is highly water soluble and, therefore, a rapid decline in concentrations is expected to occur in association with surface and underflow recharge of molybdenum-free water. The rate of decline for molybdenum may approximate the system half-life of tritium of 4 to 5 years (see Section 7.2.2.3).

Perchlorate

Perchlorate is known to have been discharged into DP Canyon from the former SWMU 21-011(k) outfall and into Acid Canyon from the former TA-1 and TA-45 outfalls. In response to recent concerns about the potential health risks from perchlorate in drinking water, sampling conducted over the last few years has included perchlorate in the analytical suite. Perchlorate was detected in several surface water and alluvial groundwater sample collected in Los Alamos and Pueblo Canyons. However, all of these samples were collected in 2000 and 2001 when analytical laboratories contracted by the Laboratory used an ion chromatography analytical method that resulted in false positive detections for perchlorate (Rogers et al. 2002, 73876). The two highest detected values are 15.3 µg/L in a sample collected at the background monitoring well LAO(b), and 11.5 µg/L in surface water collected from Los Alamos Creek upcanyon of the reservoir. The surface water location above the reservoir is approximately 3 km (1.9 mi) upcanyon of the Laboratory boundary. Four of five additional detected values are from monitoring wells PAO-4 and PAO-5n (below the Bayo WWTP), and one is from surface water in reach P-1E. In fall 2000, sediment samples were also collected from reach ACS, near the source of initial releases, and also in reaches AC-1 and AC-2, and analyzed for perchlorate. The results of the sediment sampling were all nondetects. A thorough analysis of the issues associated with historical perchlorate analytical problems is presented in the 2001 surveillance report (Rogers et al. 2002, 73876, pp. 187, 204.). The historical analytical problems and the locations of the detected values collectively indicate that perchlorate is probably not present at elevated concentrations in surface water or alluvial groundwater in the Los Alamos and Pueblo watershed.

7.2.4 Organic Chemicals in Water

PAHs

Two PAHs, specifically benzo(a)pyrene, and benzo(b)fluoranthene, are identified as the most significant organic chemicals contributing to the HQs in the human health screen in Section 6. However, because of elevated detection limits in the data set for PAHs at all locations in the watershed, only surface water in lower reach AC-3 and surface water at Pueblo 2 were identified as significant, and, more specifically, from only one set of sample results with sufficiently low detection limits to identify the presence of these PAHs in water. However, as discussed in Section 7.1.3.1, the spatial distribution of PAHs in sediment indicates that the dominant source of these contaminants is runoff from developed portions of the watershed. In fact, the highest concentrations of benzo(a)pyrene and benzo(b)fluoranthene in sediment are in reach AC-1 at the head of Acid Canyon, indicating a source in the townsite and not Laboratory operations (see Section 7.1.3.1). These PAHs are highly adsorbing and the spatial distribution of PAHs in water should be closely related to concentrations in sediment.

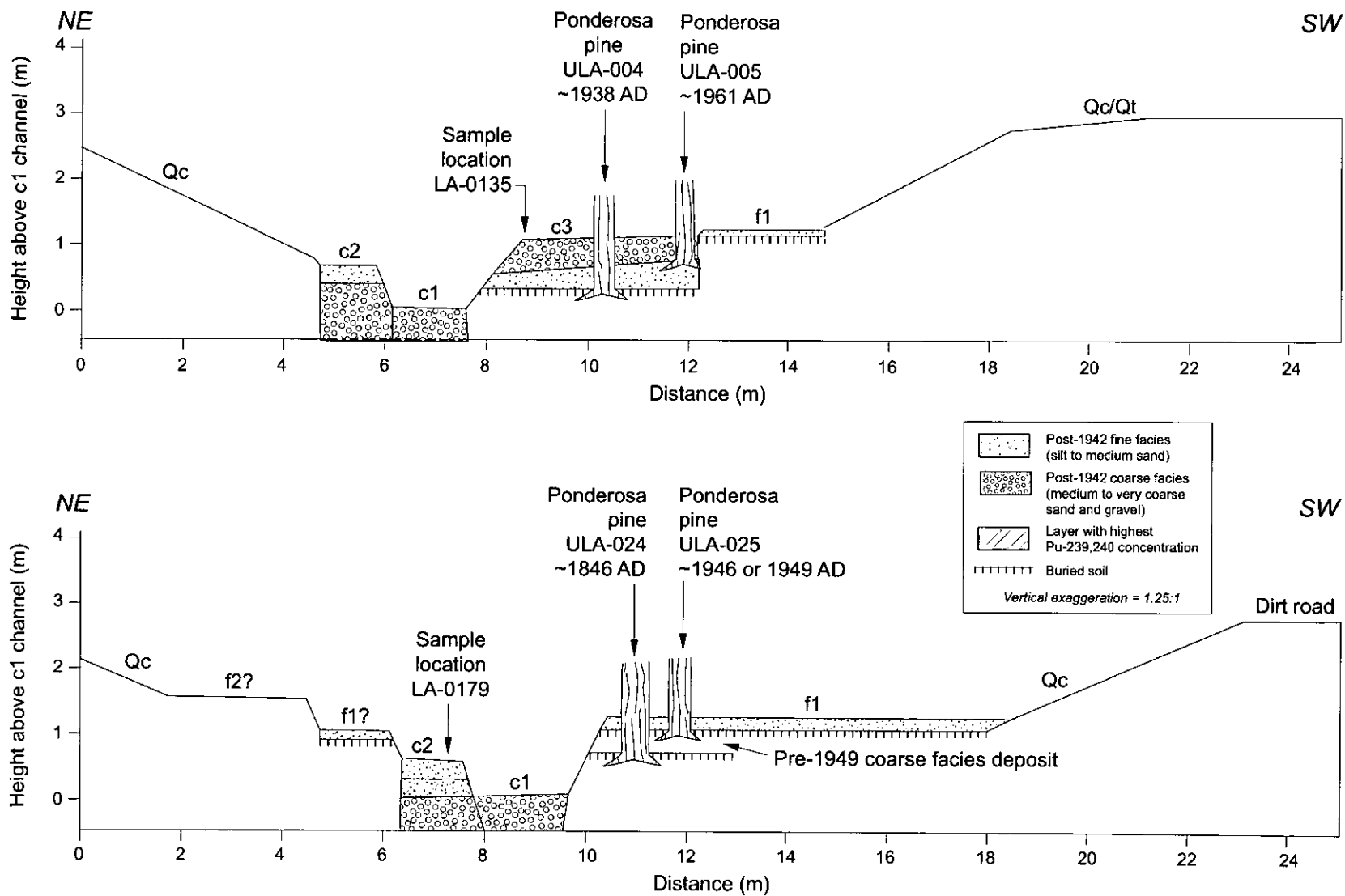
Diesel-Range Organics

Samples of surface water and alluvial groundwater in DP Canyon were analyzed for diesel-range organics (DRO) to support monitoring activities and investigation results associated with identified hydrocarbon seepage from bedrock in reach DP-1C in upper DP Canyon. The source of the hydrocarbon seepage, consisting primarily of weathered diesel fuel, is the DP Tank Farm (SWMU 21-029), a former fuel distribution station that operated from 1946 to 1985. Monthly visual observations conducted in reach DP-1 for almost five years (since July 1999) indicate that hydrocarbon seepage is highly variable. In general, during wet or cold periods, no sheen is observed; during dry or warm periods, a sheen is sometimes present, and, on occasion, a faint diesel smell is noticeable.

Much of the DRO data collected during this investigation has high detection limits. However, sample results from the fourth of four rounds of samples collected in May 2002 in accordance with the surface water and alluvial groundwater addendum (LANL 2002, 70235) show detected concentrations of DRO at multiple locations along the length of DP Canyon. The highest detected concentration, 1400 µg/L, is from a surface water sample collected from a bedrock pool in reach DP-1W, at the very head of DP Canyon and upcanyon of the hydrocarbon seepage area. The pool collects water from a concrete-lined channel that conveys stormwater runoff from the townsite storm drain system to the head of DP Canyon. Concentrations of DRO at downcanyon surface water sample locations decreased to 700 µg/L in DP-1C, and 82 µg/L in alluvial monitoring well LAUZ-1. Both locations are downcanyon of the DPTF. A previous sampling round conducted in November 2001 showed detected DRO concentrations of 0.5µg/L in DP-1W, and 2.2 µg/L in DP-1C. The data are inconclusive because of the limited set of detected values, but the identification of highest detected DRO concentrations in surface water at the head of the canyon, upgradient of the DP Tank Farm, suggests that the low DRO concentrations may be related to runoff from the townsite.

The Laboratory conducted sediment and alluvial groundwater investigations in DP Canyon during 1998 and 1999 (LANL 1999, 63915). Sediment and surface water samples collected within the DP Canyon stream channel both upgradient and downgradient of DP Tank Farm did not match the "signature" from the petroleum hydrocarbon contamination originating from the DP Tank Farm. Investigation results indicated that low DRO concentrations are present in sediment throughout the entire length of DP Canyon and show a decreasing trend from the head of DP Canyon to the confluence with Los Alamos Canyon.

Phase II RFI results for subsurface samples collected from tuff beneath the former fueling station and within and beneath the stream channel were fingerprinted for petroleum type and were all characterized as weathered diesel consistent with historic releases from DP Tank Farm. All sediment sample results reported in the DP Canyon reach report (LANL 1999, 63915) were analyzed for DRO. Of particular importance in relating the TPH contamination in DP Canyon with DP Tank Farm are the sediment samples collected from reaches DP-1W and DP-1C. The samples from these two canyon reaches are important because they may be used to characterize and differentiate between the hydrocarbon contamination from the townsite and from the tank farm. Analytical results from the 11 sediment samples collected during the Phase II RFI indicate that the petroleum contamination in reaches DP-1W and DP-1C is primarily motor oil. Only one sample, CA21-98-0060, had a chromatograph that showed a weathered diesel profile (59 mg/kg). The other ten samples had a motor oil TPH signature seen at comparable concentrations (240–680 mg/kg). The source of the motor oil contamination in DP Canyon is believed to be townsite runoff (LANL 1999, 63915).



Source: Reneau et al. 1998, 59160, F2.3-6_Rev. for F7.1-1, LAPCIR, 041204, cf

Figure 7.1-1. Schematic cross sections showing post-1942 coarse facies and fine facies sediment deposits in geomorphic units in reach LA-1C

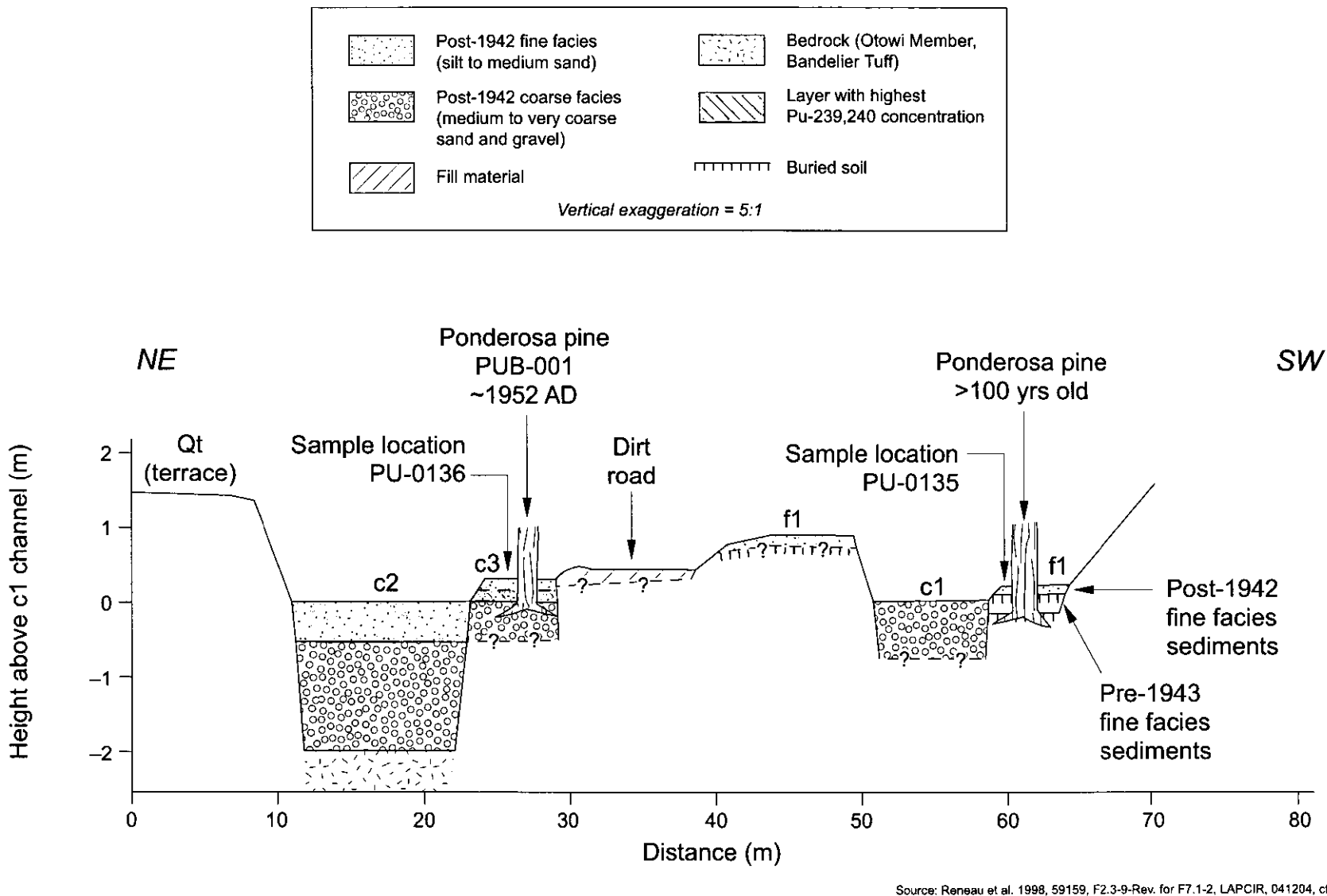


Figure 7.1-2. Schematic cross sections showing post-1942 coarse facies and fine facies sediment deposits in geomorphic units in reach P-2E

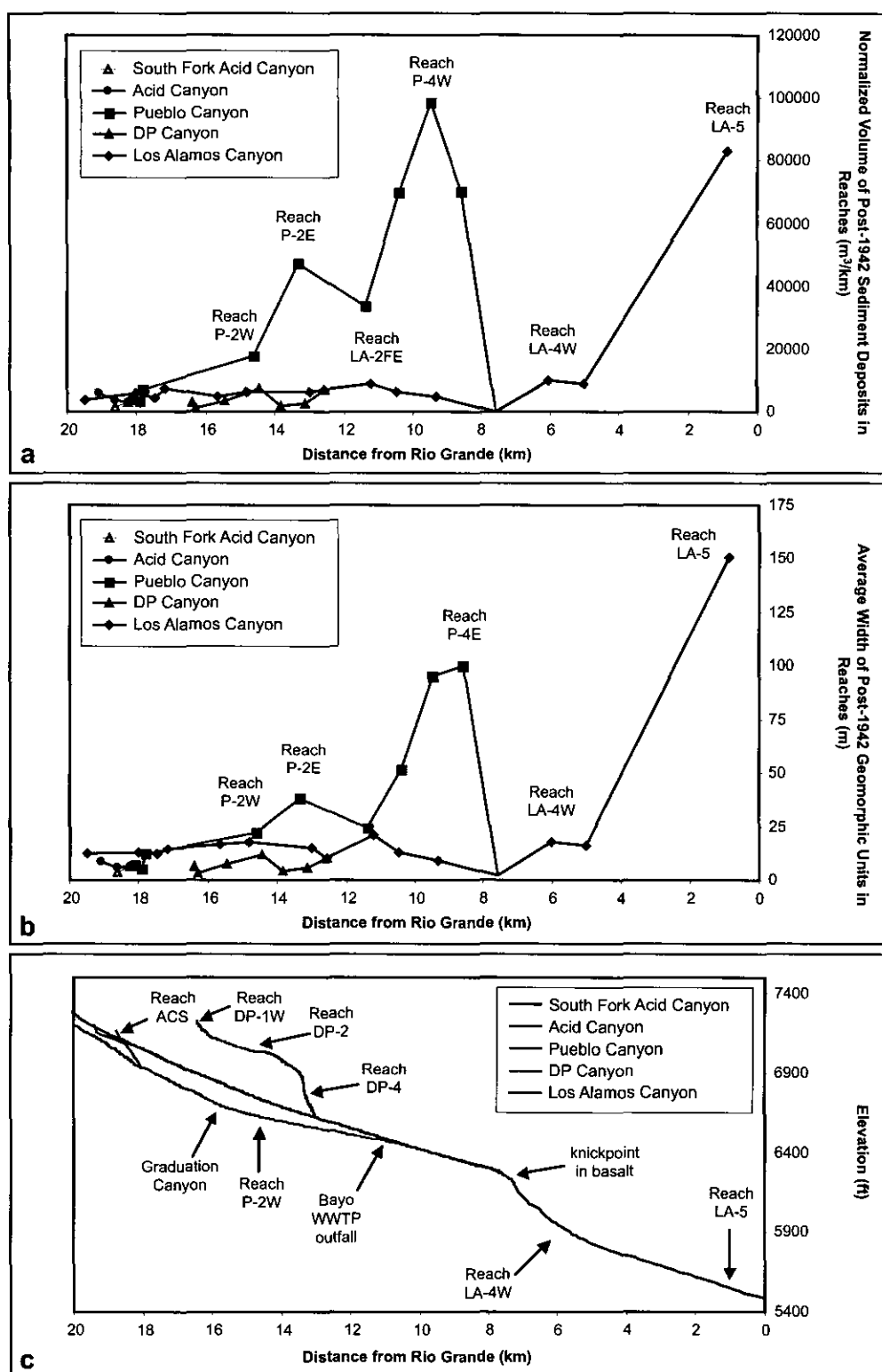


Figure 7.1-3. Longitudinal variations in normalized volume ([a] in units of m³/km) and width (b) of post-1942 sediment and geomorphic units, and stream profiles (c) in the Los Alamos and Pueblo watershed

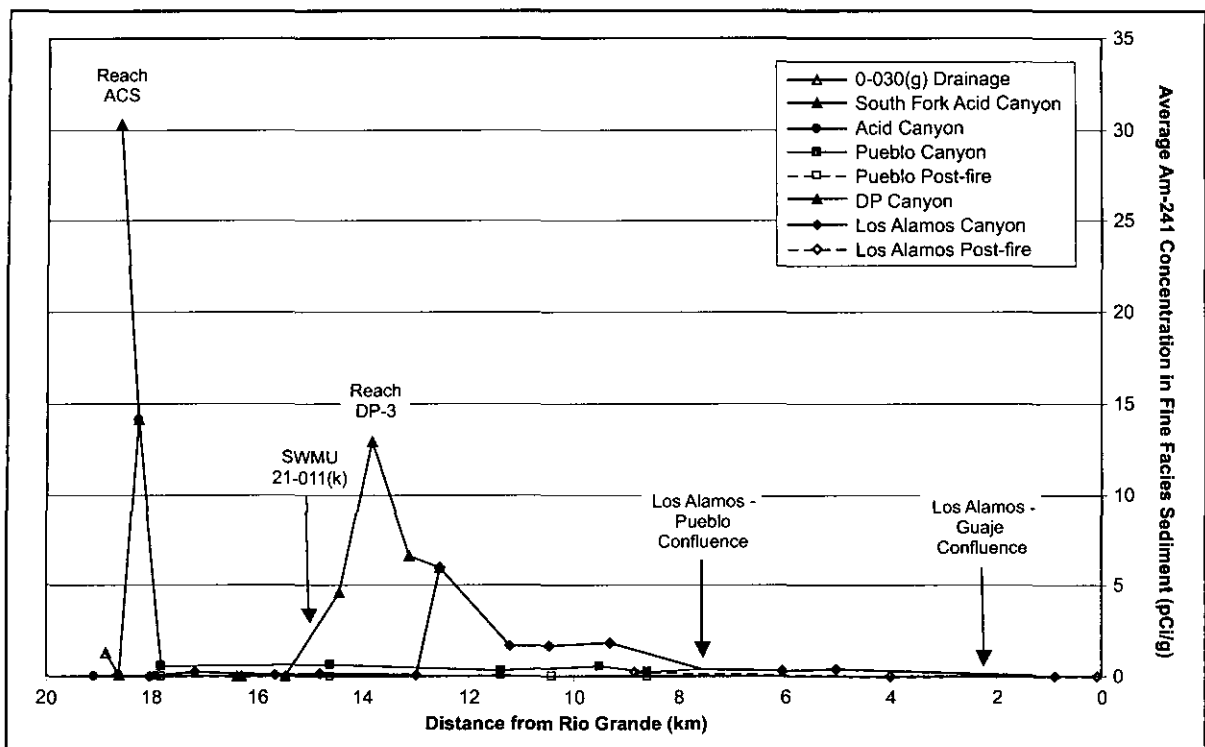


Figure 7.1-4. Estimated average concentrations of americium-241 in fine facies sediment in the Los Alamos and Pueblo watershed

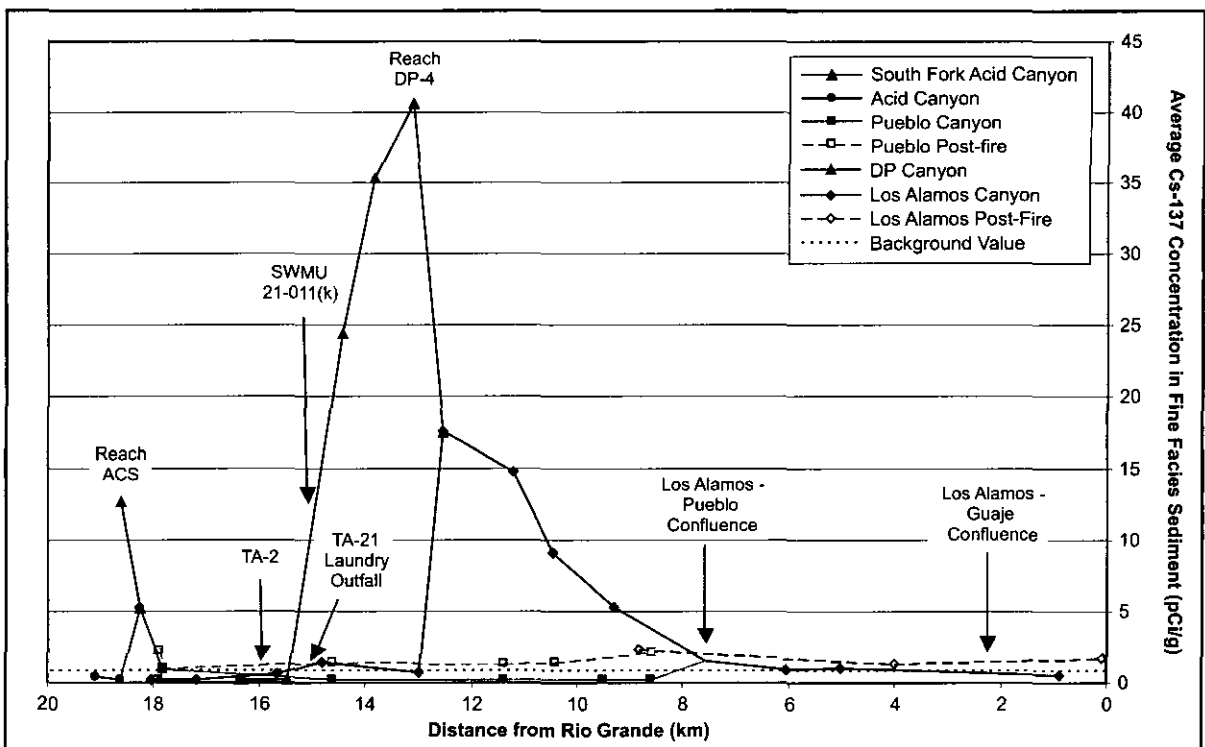


Figure 7.1-5. Estimated average concentrations of cesium-137 in fine facies sediment in the Los Alamos and Pueblo watershed

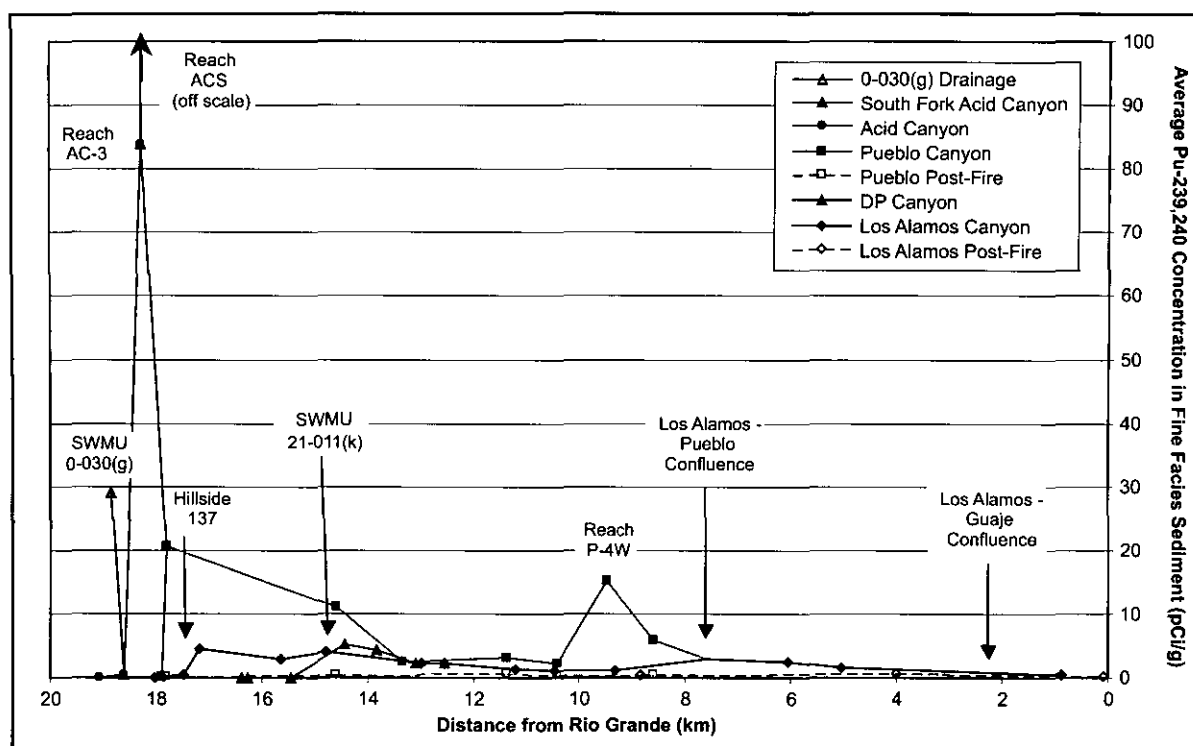


Figure 7.1-6. Estimated average concentrations of plutonium-239,240 in fine facies sediment in the Los Alamos and Pueblo watershed

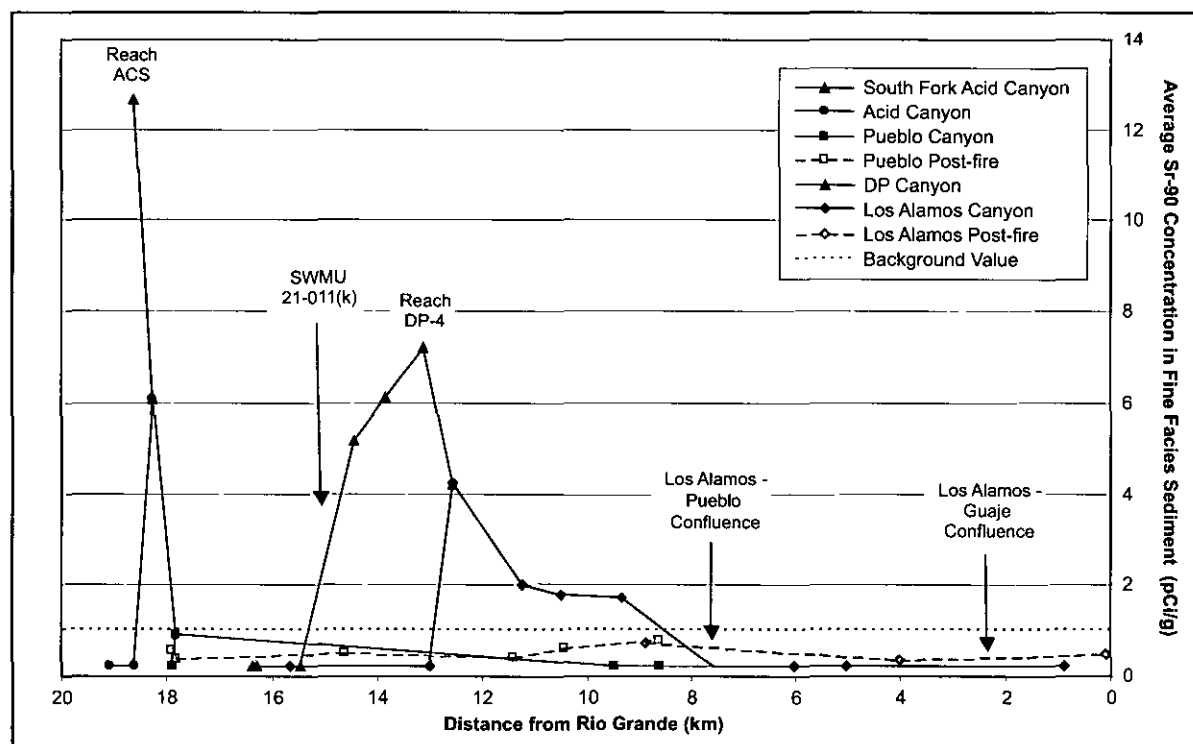


Figure 7.1-7. Estimated average concentrations of strontium-90 in fine facies sediment in the Los Alamos and Pueblo watershed

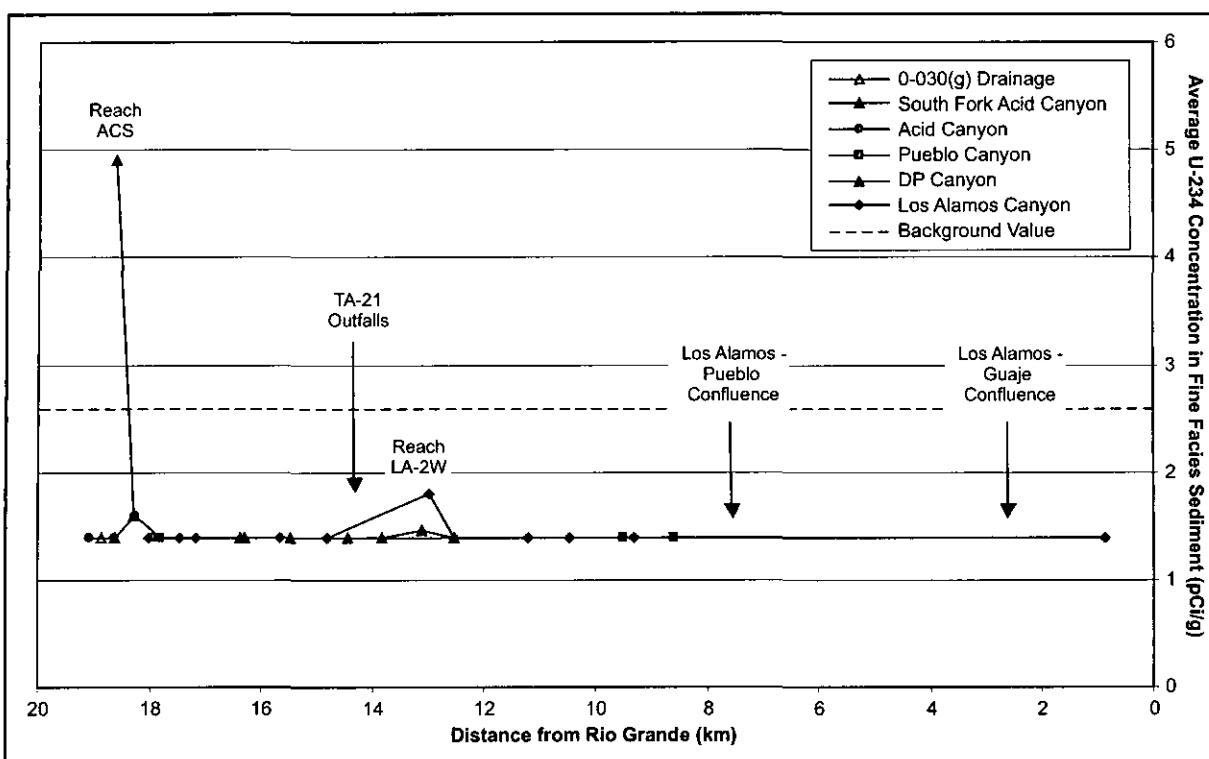
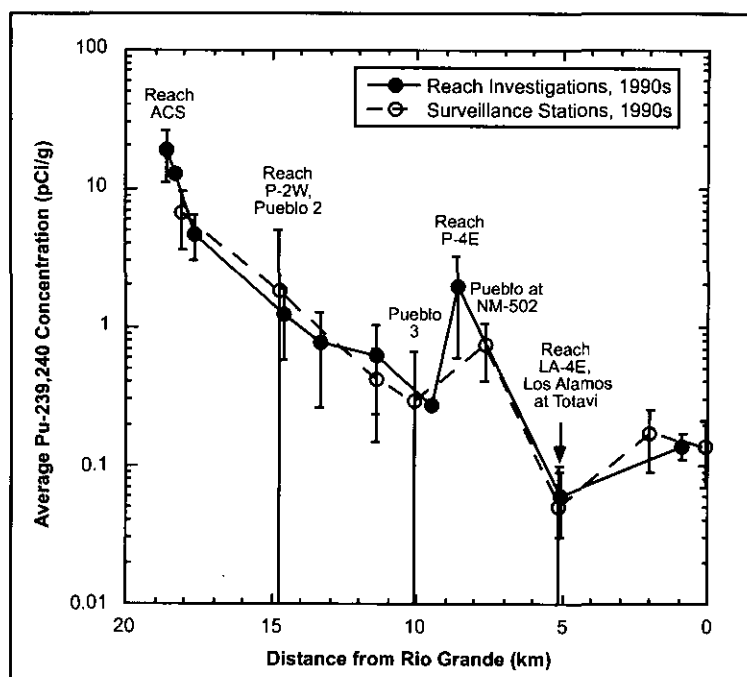
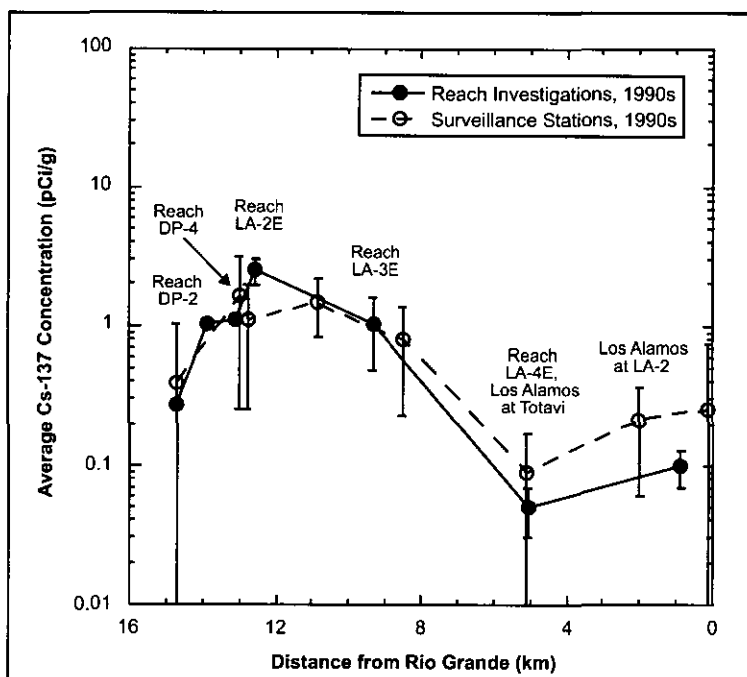


Figure 7.1-8. Estimated average concentrations of uranium-234 in fine facies sediment in the Los Alamos and Pueblo watershed



Note: Error bars indicate 1 standard deviation of measurements.

Figure 7.1-9. Estimated average concentrations of plutonium-239,240 in coarse facies sediment and active channel sediment downstream from the former TA-1 and TA-45 outfalls into Acid Canyon



Note: Error bars indicate 1 standard deviation of measurements.

Figure 7.1-10. Estimated average concentrations of cesium-137 in coarse facies sediment and active channel sediment downstream from the SWMU 21-011(k) outfall into DP Canyon

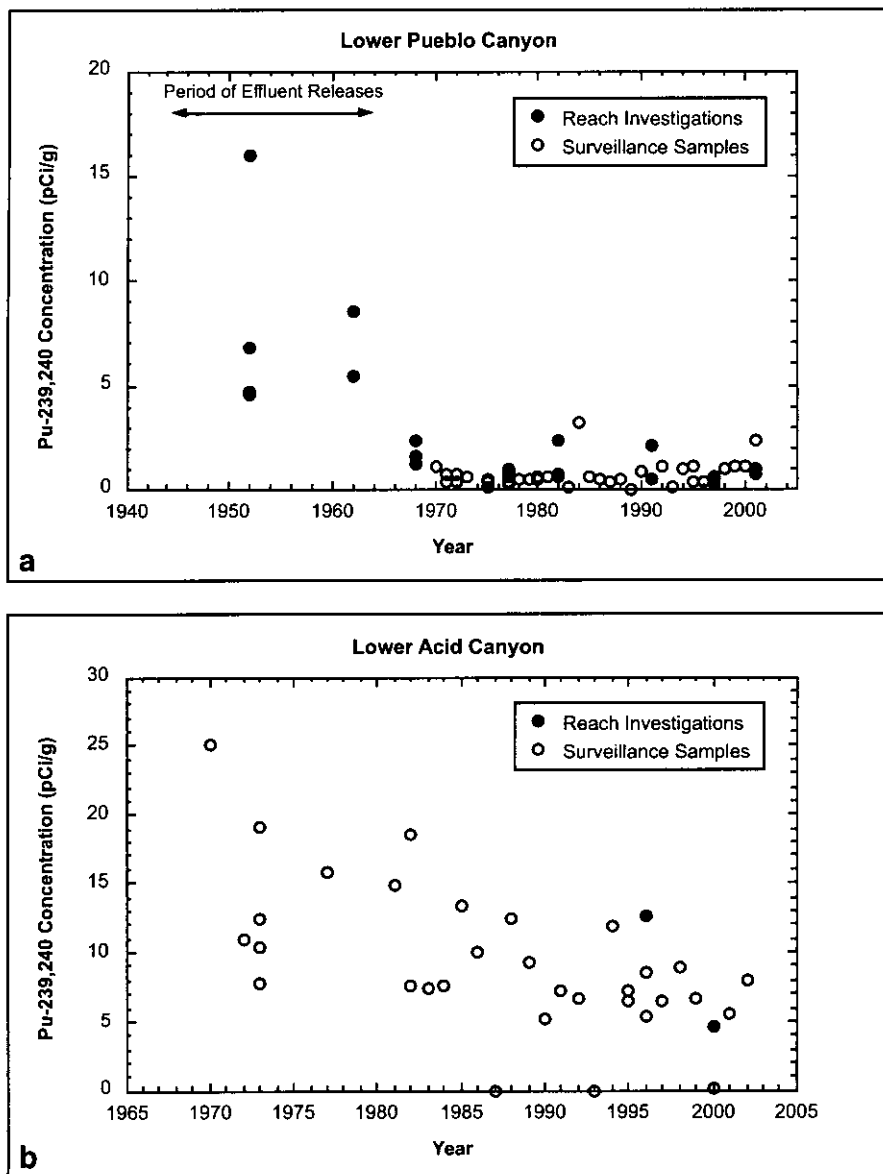
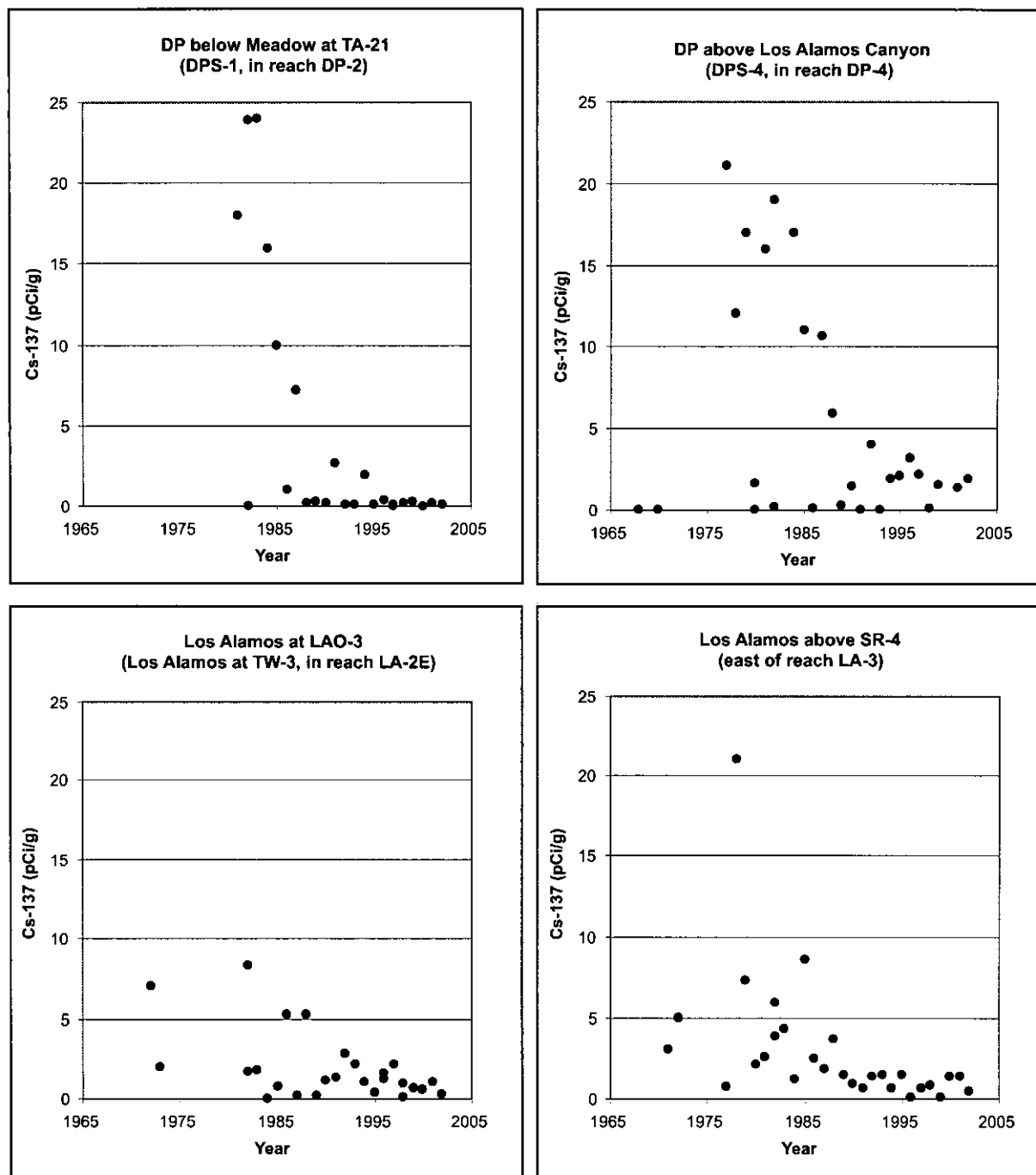
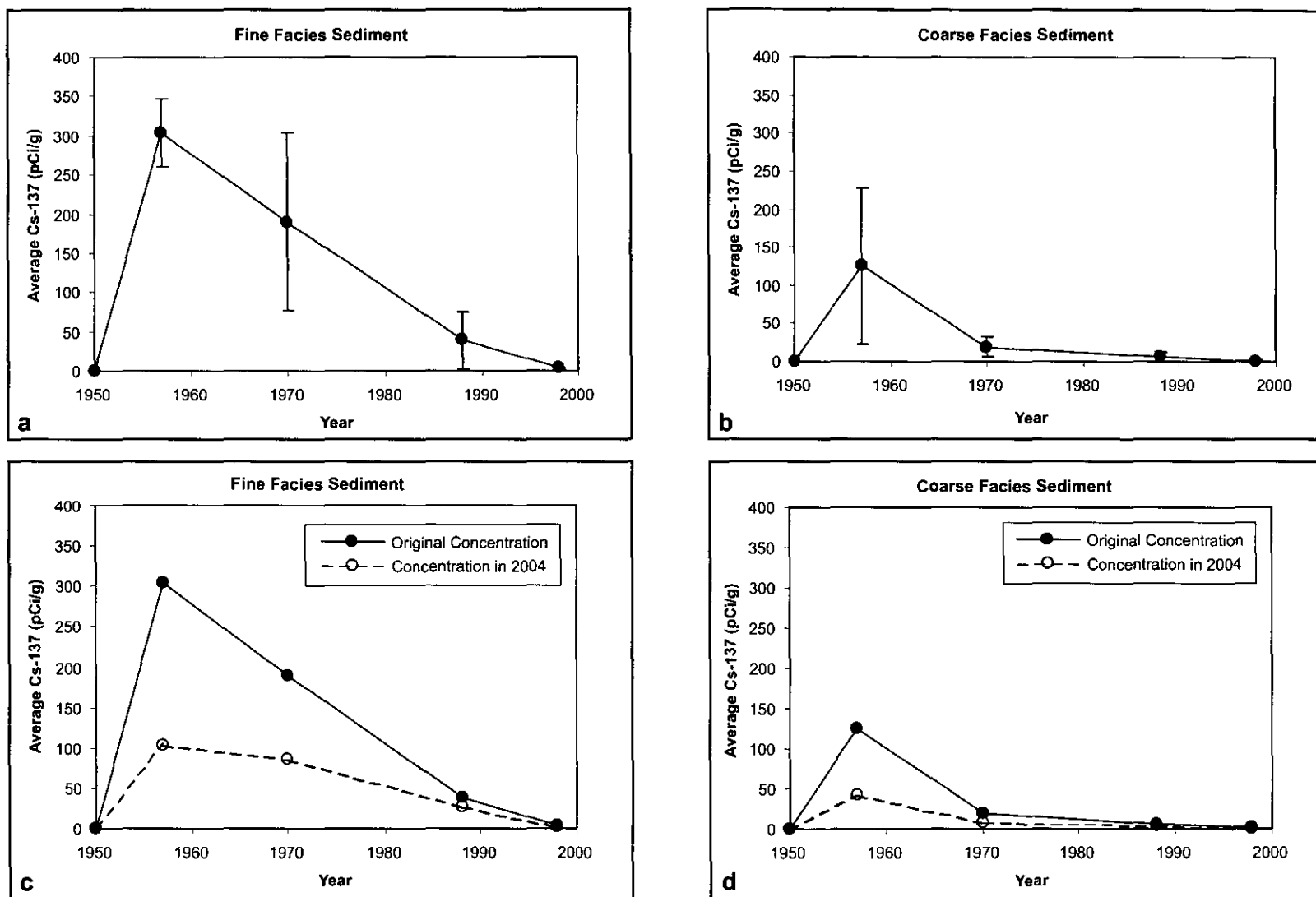


Figure 7.1-11. Concentrations of plutonium-239 in coarse facies sediment and active channel sediment in (a) lower Pueblo Canyon (reach P-4), and (b) lower Acid Canyon (reach AC-3), plotted against year of sample collection or sediment deposition (for some reach investigation samples in [a])



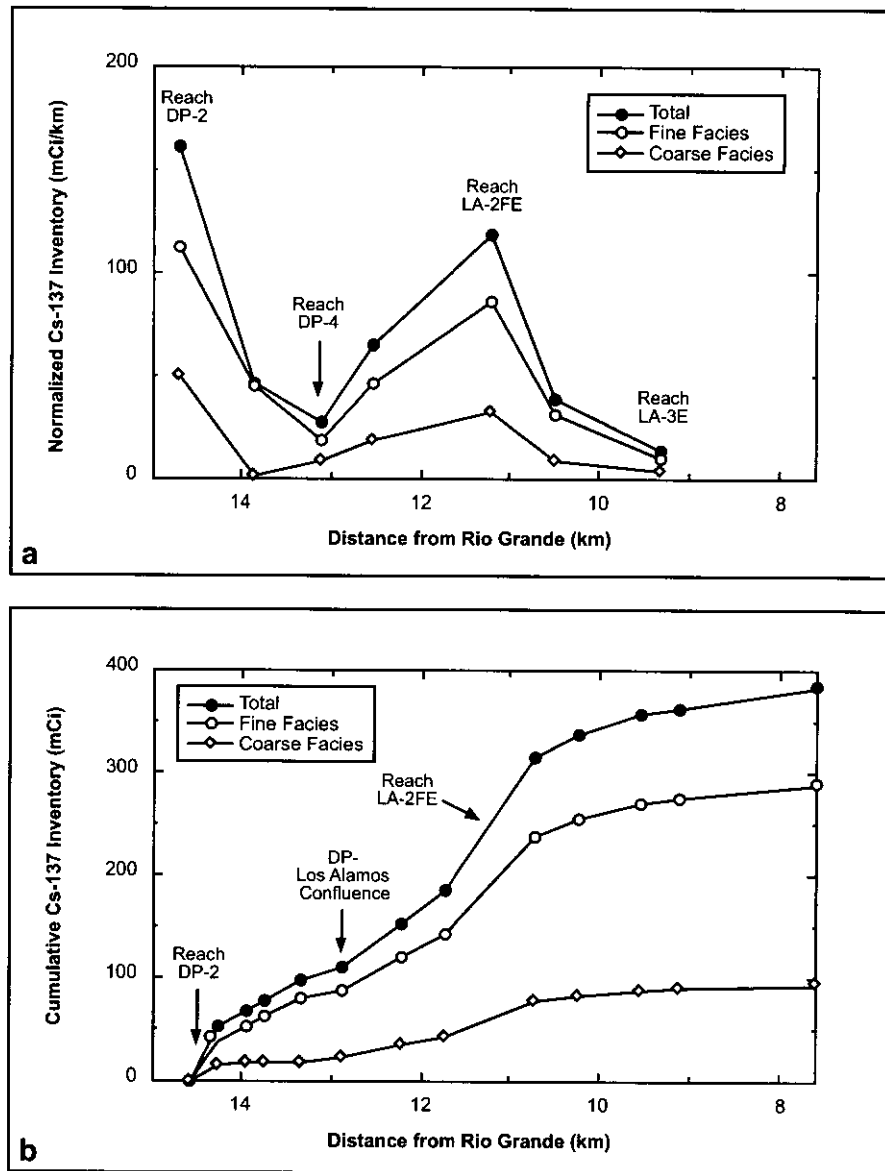
Note: Previously used names for stations indicated in parentheses, along with nearest reaches.

Figure 7.1-12. Concentrations of cesium-137 in active channel sediment from four environmental surveillance stations in DP and upper Los Alamos Canyons, plotted against year



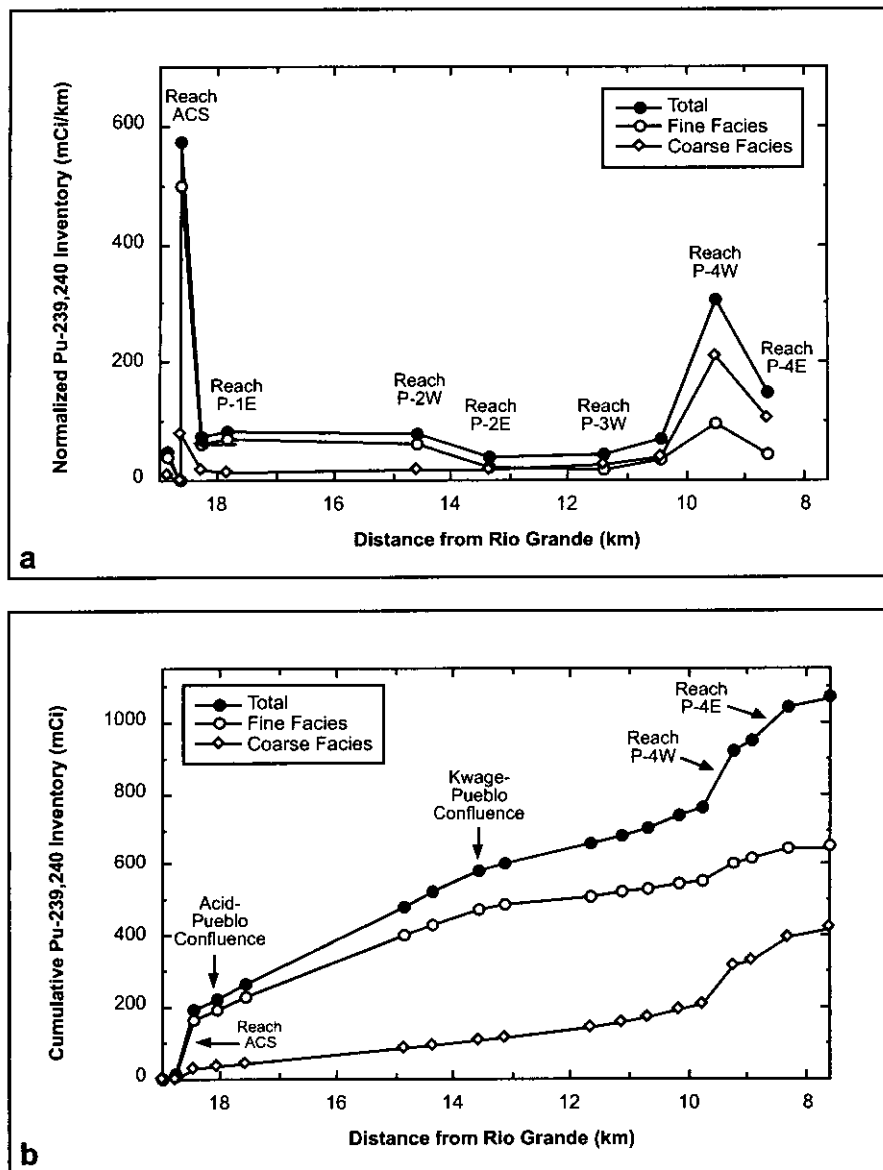
Notes: Upper plots (a and b) show estimated means and uncertainties in cesium-137 concentration (1 standard deviation of measurements). Lower plots (c and d) show estimated values at time of deposition (solid lines) and these same values corrected for radioactive decay to 2004 (dashed lines).

Figure 7.1-13. Reconstructed concentrations of cesium-137 in fine and coarse facies sediment in lower DP Canyon, plotted against year



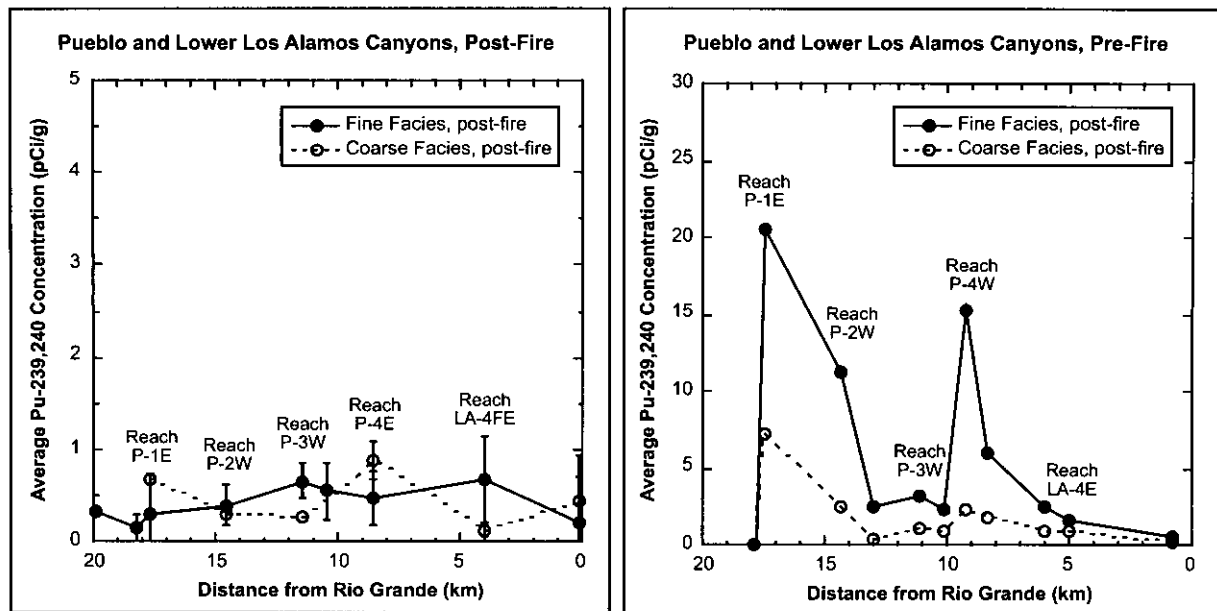
Note: Inventory extrapolated between reaches.

Figure 7.1-14. Estimated cumulative cesium-137 inventory in DP and upper Los Alamos Canyons downstream from the SWMU 21-011(k) outfall



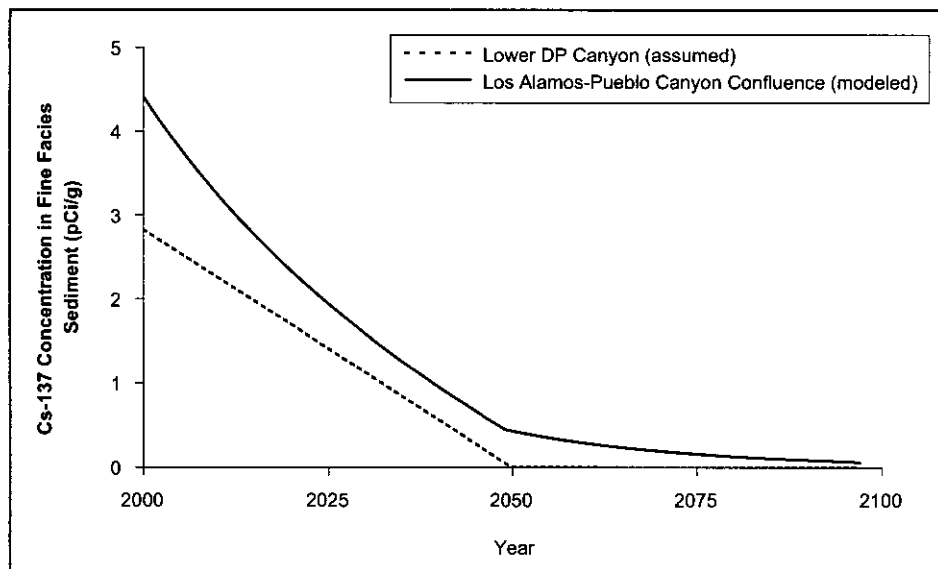
Note: Inventory extrapolated between reaches.

Figure 7.1-15. Estimated cumulative plutonium-239,240 inventory in Acid and Pueblo Canyons downstream from the former TA-1, former TA-45, and SWMU 0-030(g) outfalls



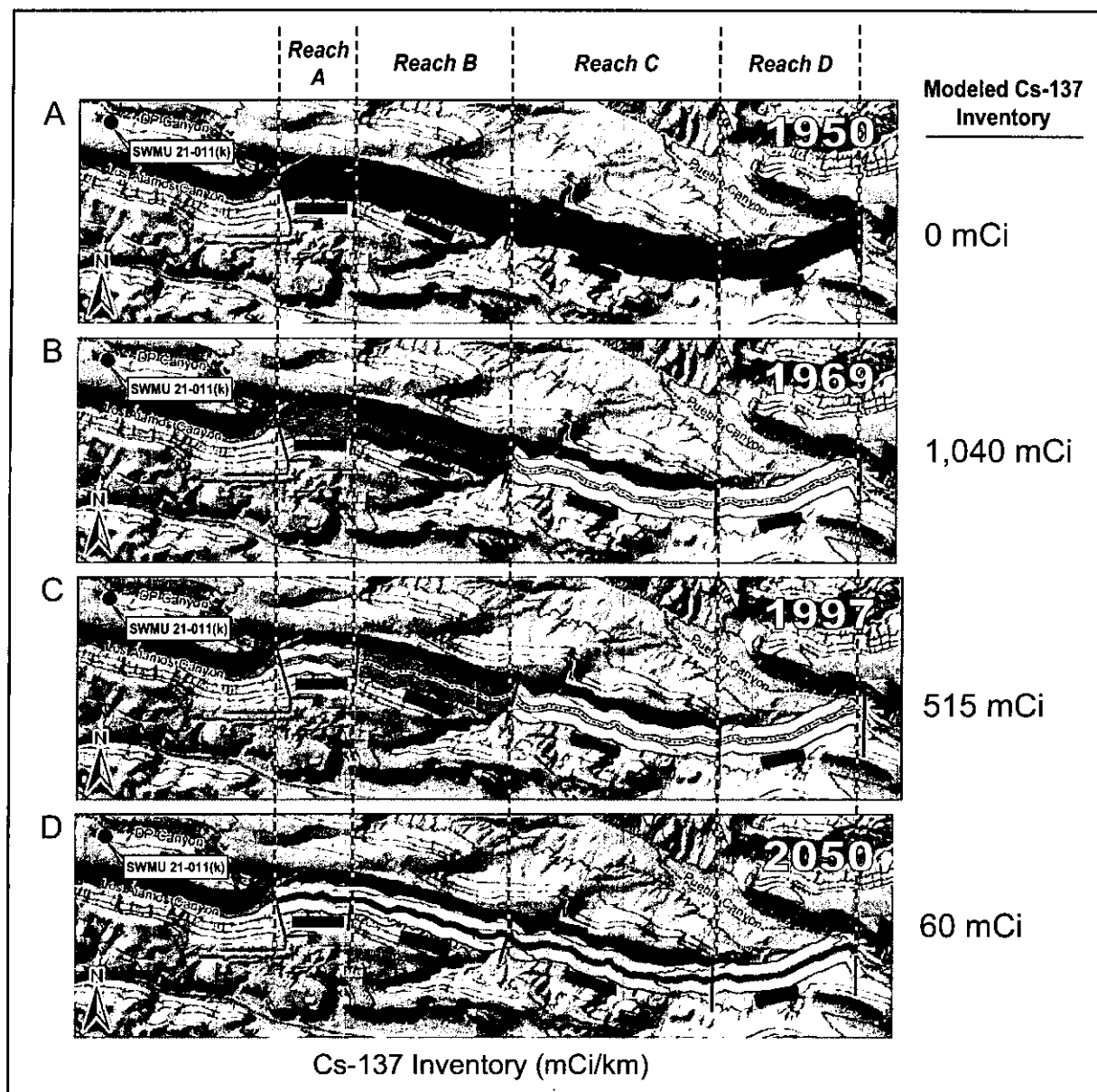
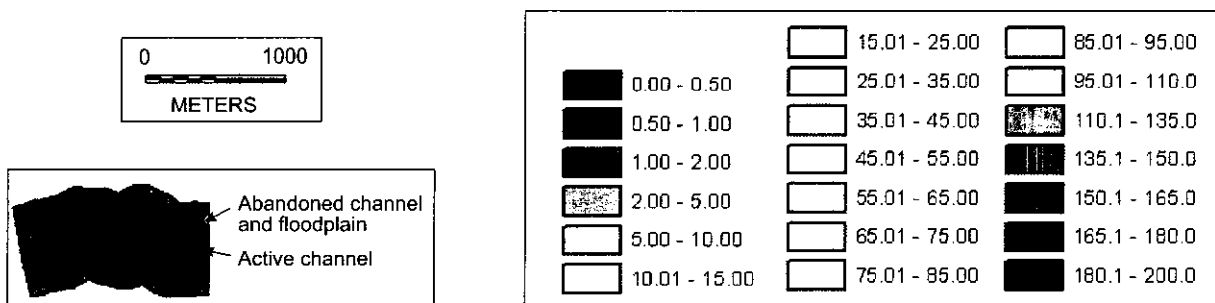
Notes: Separate plots are shown for post-fire deposits and pre-fire deposits. Error bars for post-fire data indicate 1 standard deviation of measurements.

Figure 7.1-16. Estimated average plutonium-239,240 concentration in fine facies and coarse facies sediment deposits in Pueblo and lower Los Alamos Canyons



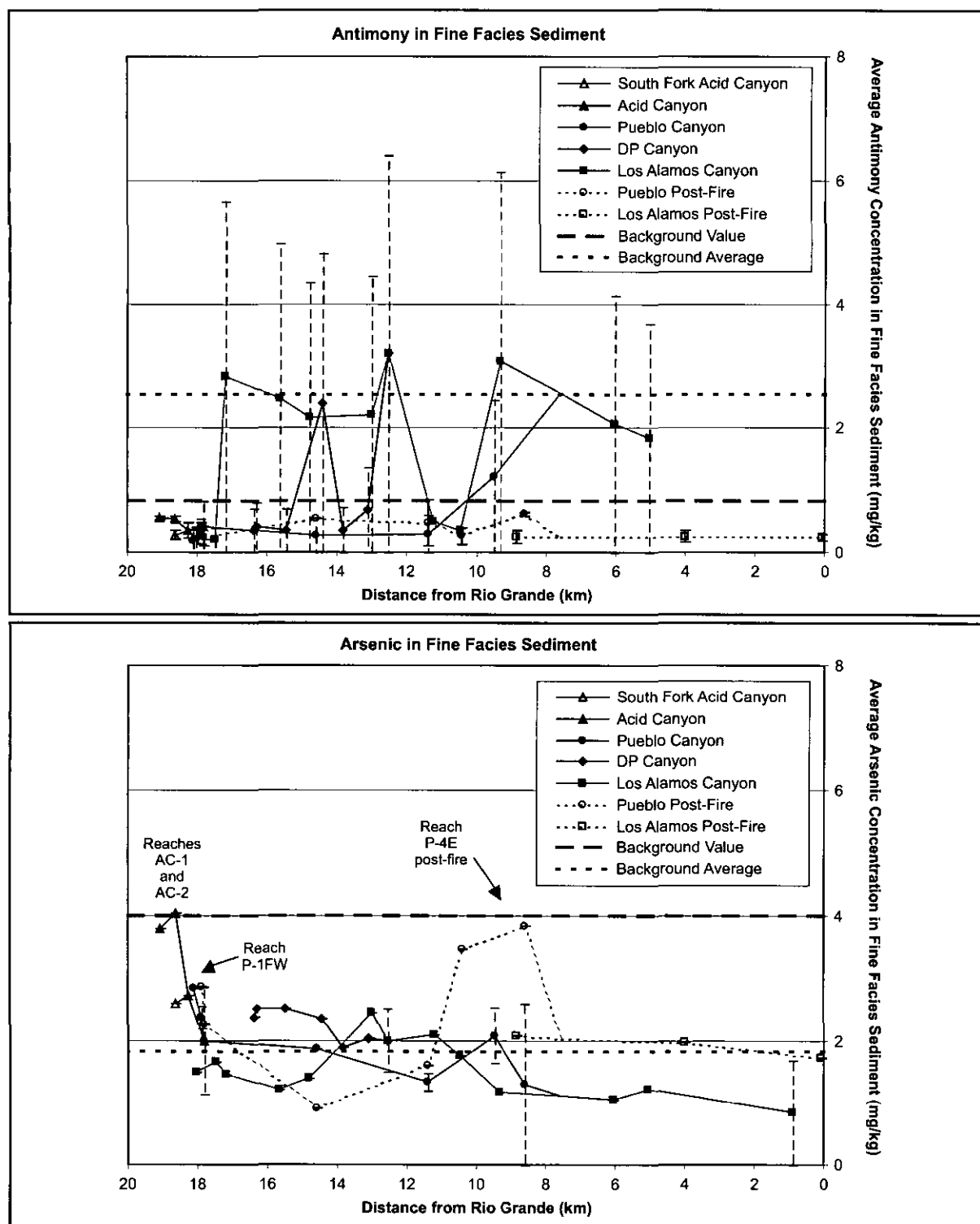
Source: Modified from Figure 4.14, Malmom 2002, 76038

Figure 7.1-17. Modeled concentrations of cesium-137 in fine facies sediment transported out of upper Los Alamos Canyon between 2000 and 2100



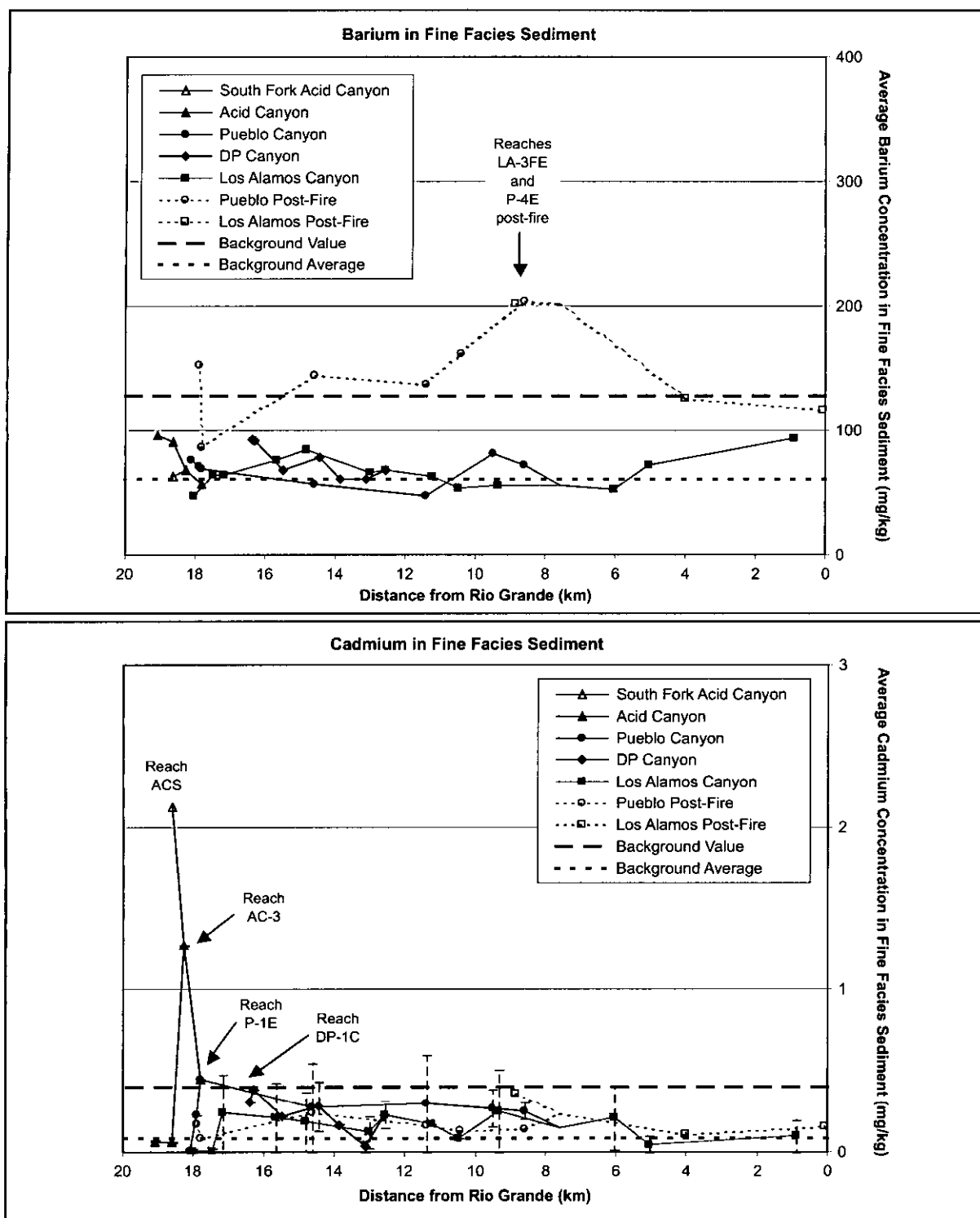
Source: Malmon et al. 2004, 85526, F6_Cartography by R.E. Kelley, 04/04
Rev. for F7.1-18, LAPCIR, 040904, cf

Figure 7.1-18. Modeled inventory of cesium-137 in four parts of upper Los Alamos Canyon between DP and Pueblo Canyons, shown for 1950, 1969, 1997, and 2050



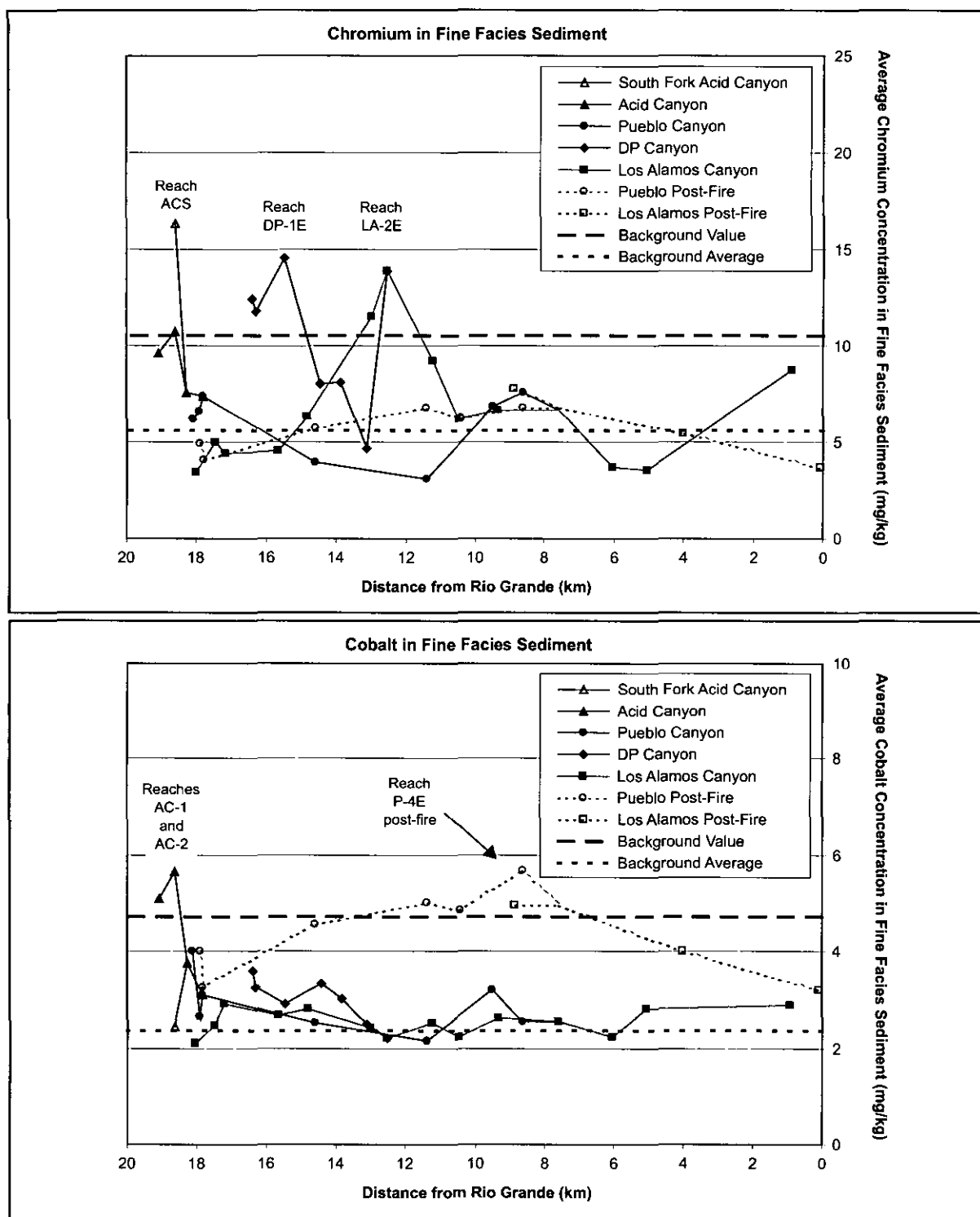
Note: Error bars indicated upper and lower bounds based on replacing nondetect values with either the detection limit or zero.

Figure 7.1-19. Estimated average concentrations of inorganic chemicals in fine facies sediment in the Los Alamos and Pueblo watershed



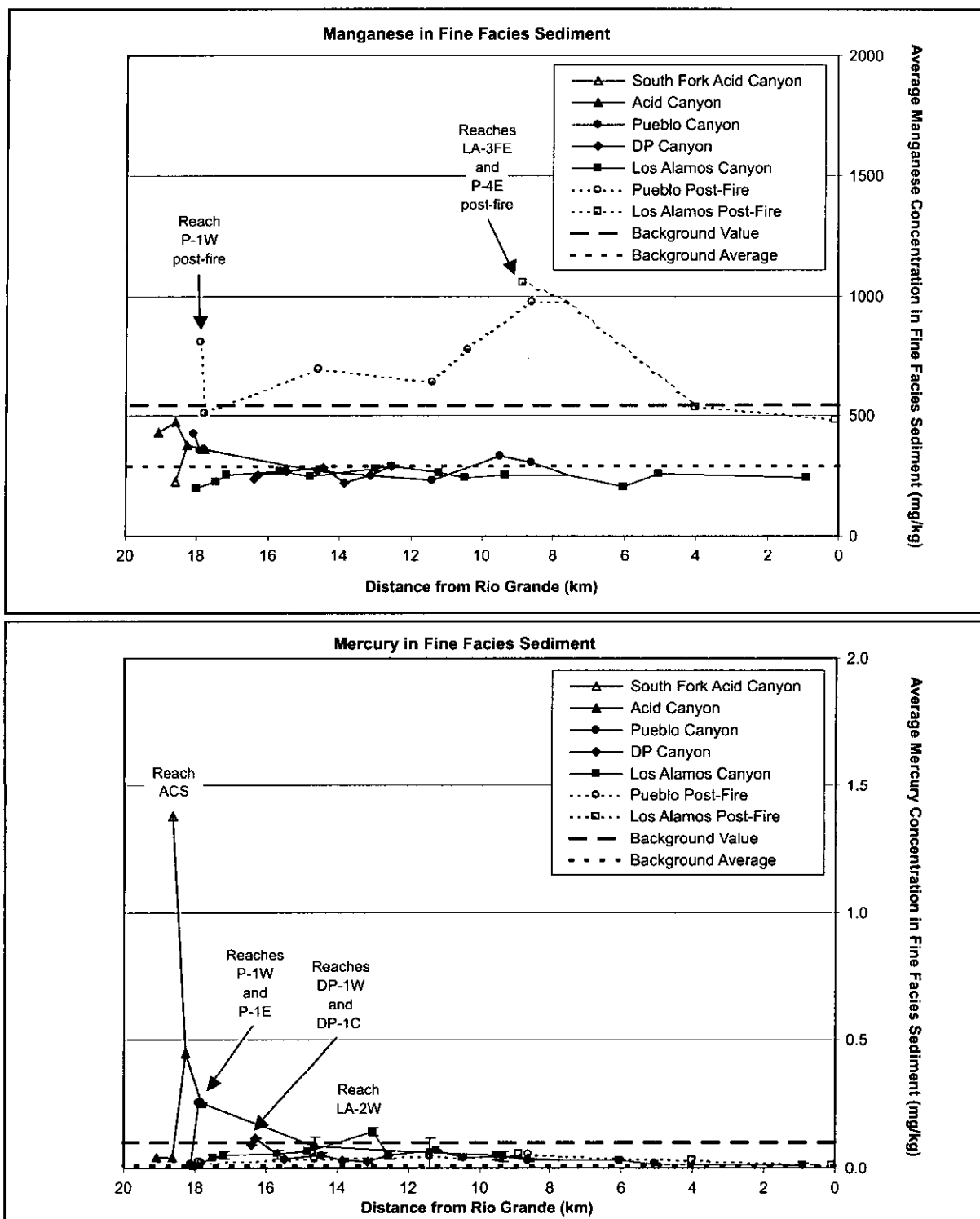
Note: Error bars indicated upper and lower bounds based on replacing nondetect values with either the detection limit or zero.

Figure 7.1-19 (continued). Estimated average concentrations of inorganic chemicals in fine facies sediment in the Los Alamos and Pueblo watershed



Note: Error bars indicated upper and lower bounds based on replacing nondetect values with either the detection limit or zero.

Figure 7.1-19 (continued). Estimated average concentrations of inorganic chemicals in fine facies sediment in the Los Alamos and Pueblo watershed



Note: Error bars indicated upper and lower bounds based on replacing nondetect values with either the detection limit or zero.

Figure 7.1-19 (continued). Estimated average concentrations of inorganic chemicals in fine facies sediment in the Los Alamos and Pueblo watershed

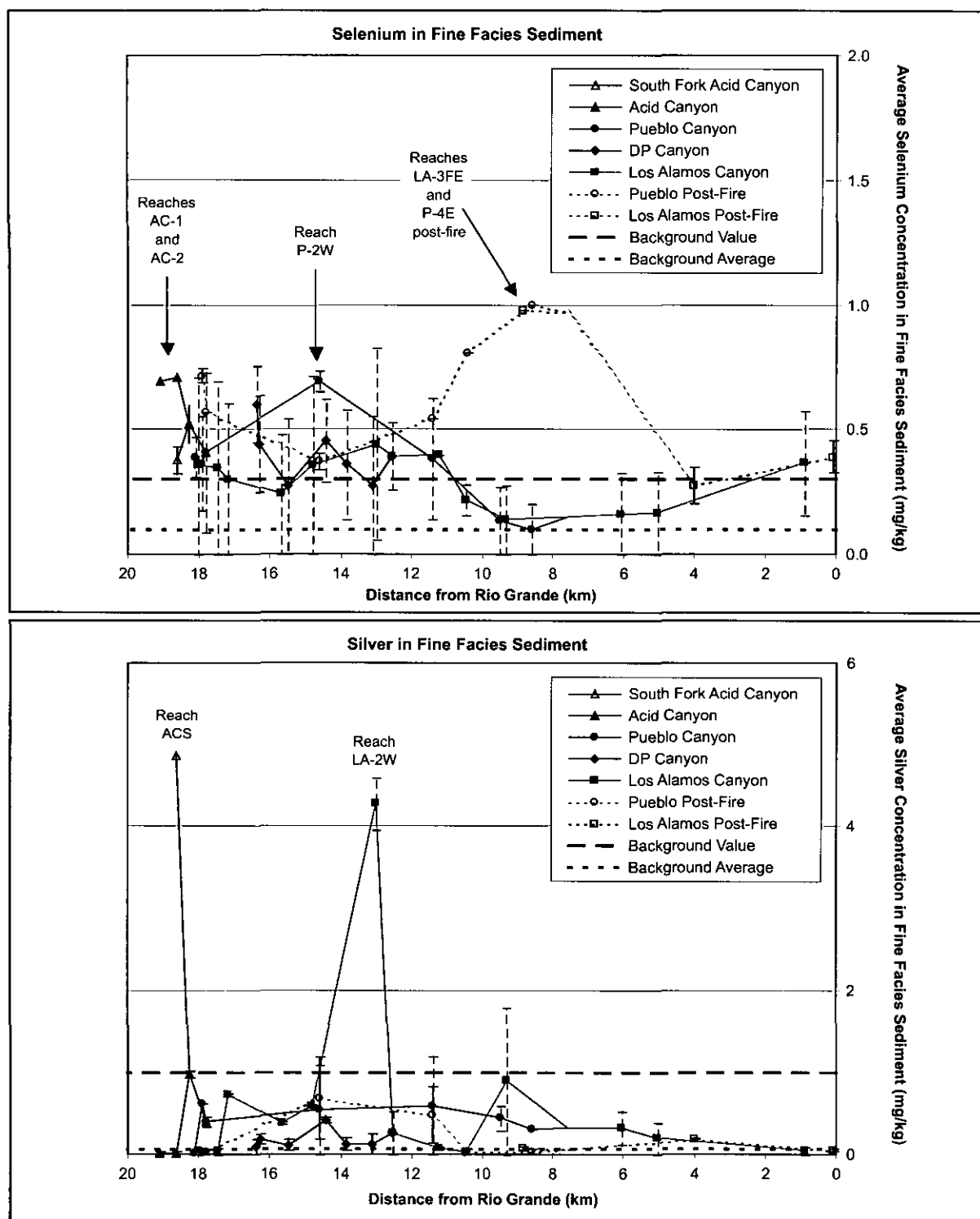
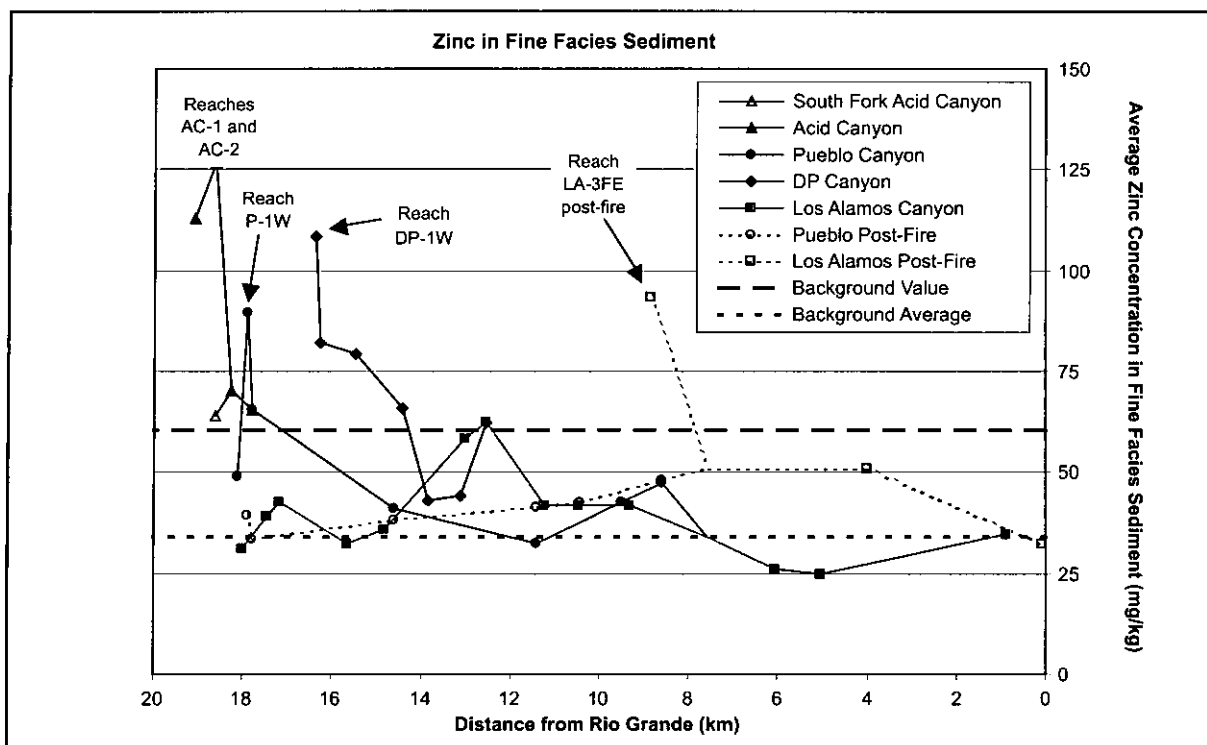


Figure 7.1-19 (continued). Estimated average concentrations of inorganic chemicals in fine facies sediment in the Los Alamos and Pueblo watershed



Note: Error bars indicated upper and lower bounds based on replacing nondetect values with either the detection limit or zero.

Figure 7.1-19 (continued). Estimated average concentrations of inorganic chemicals in fine facies sediment in the Los Alamos and Pueblo watershed

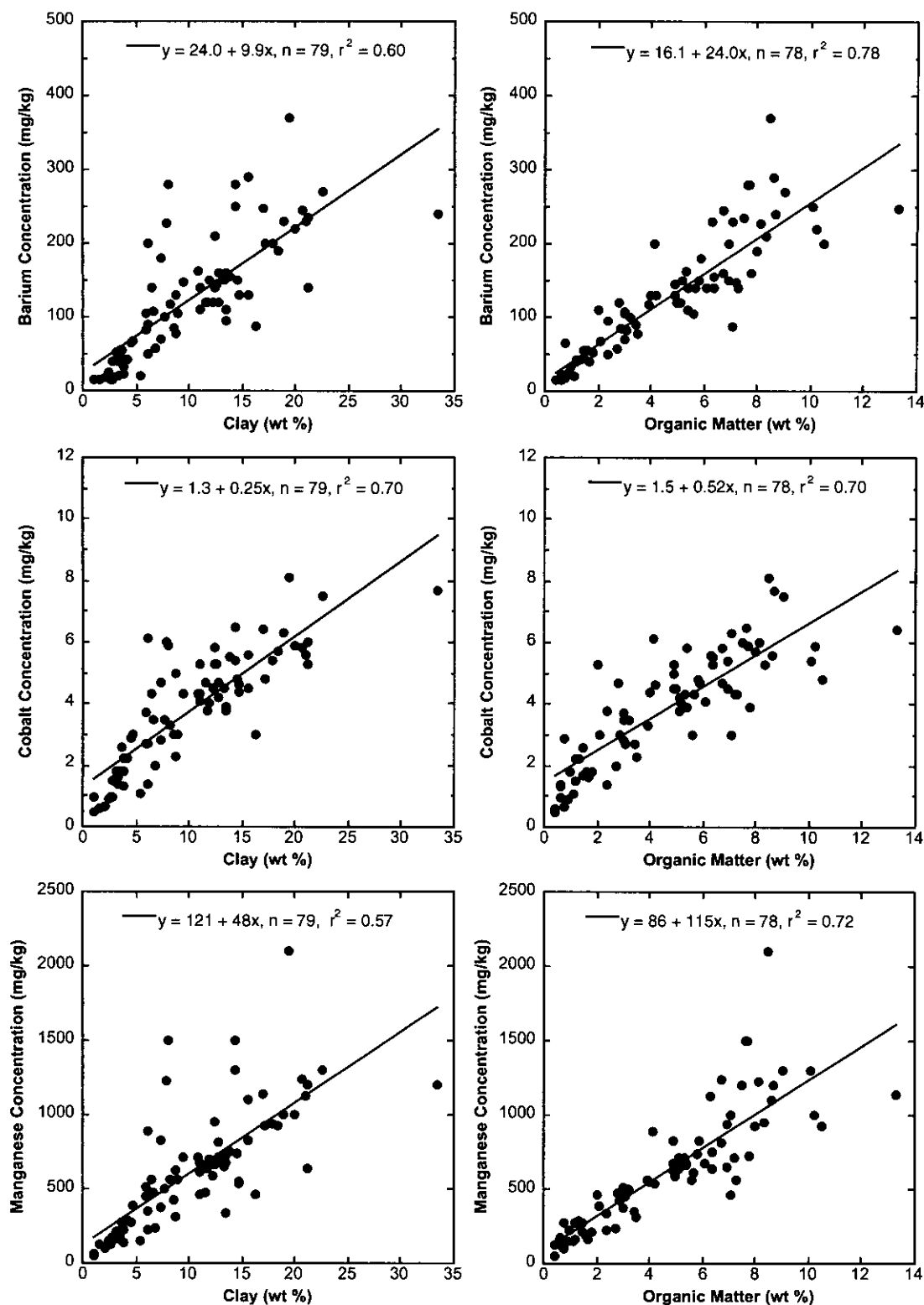
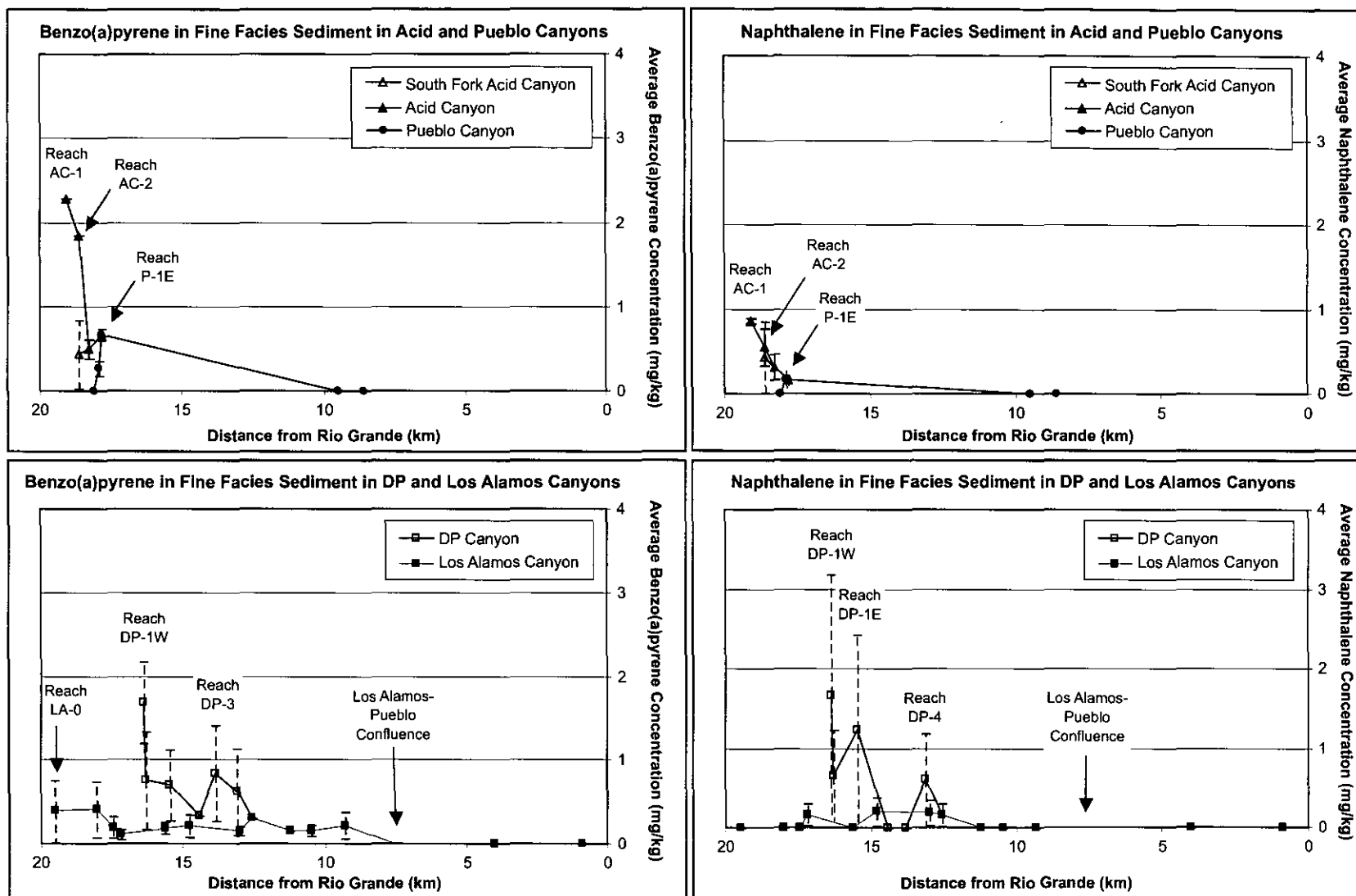
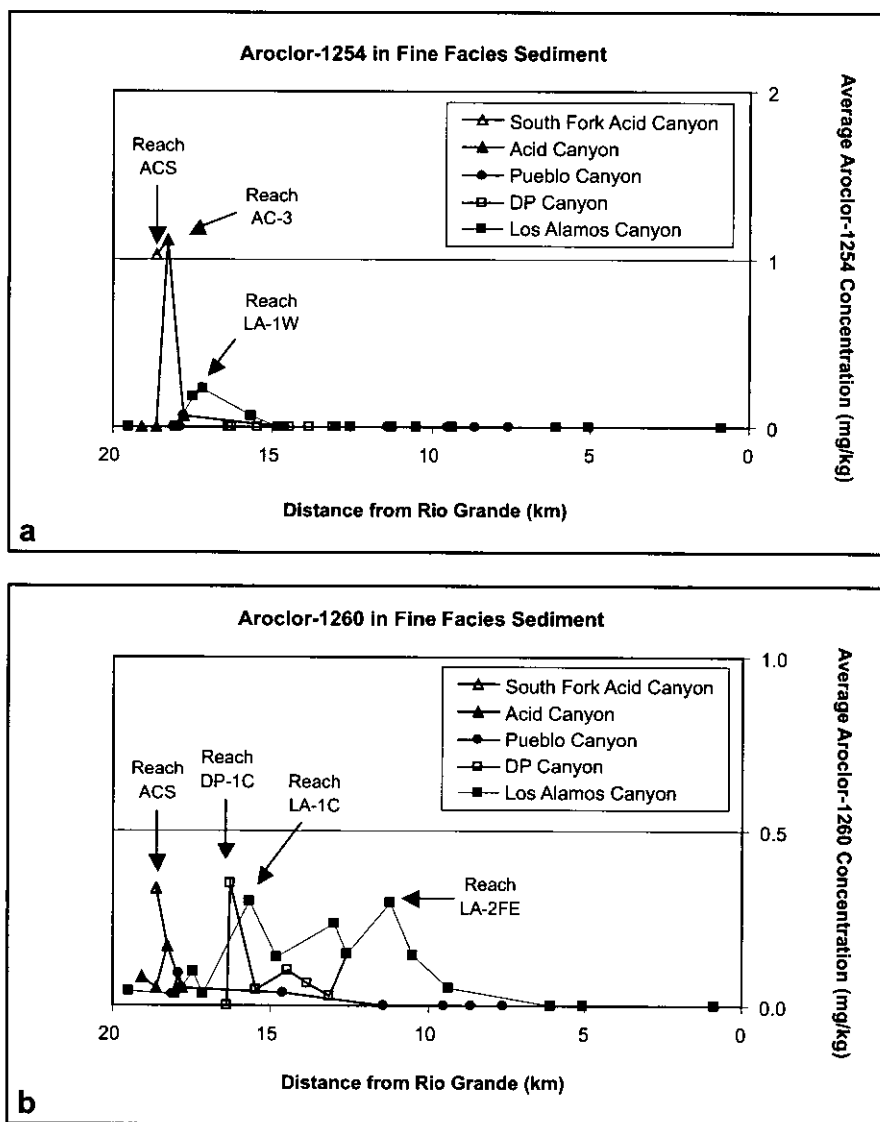


Figure 7.1-20. Plots of the concentrations of barium, cobalt, and manganese versus clay content and organic matter content in post-fire sediment deposits in Los Alamos and Pueblo Canyons



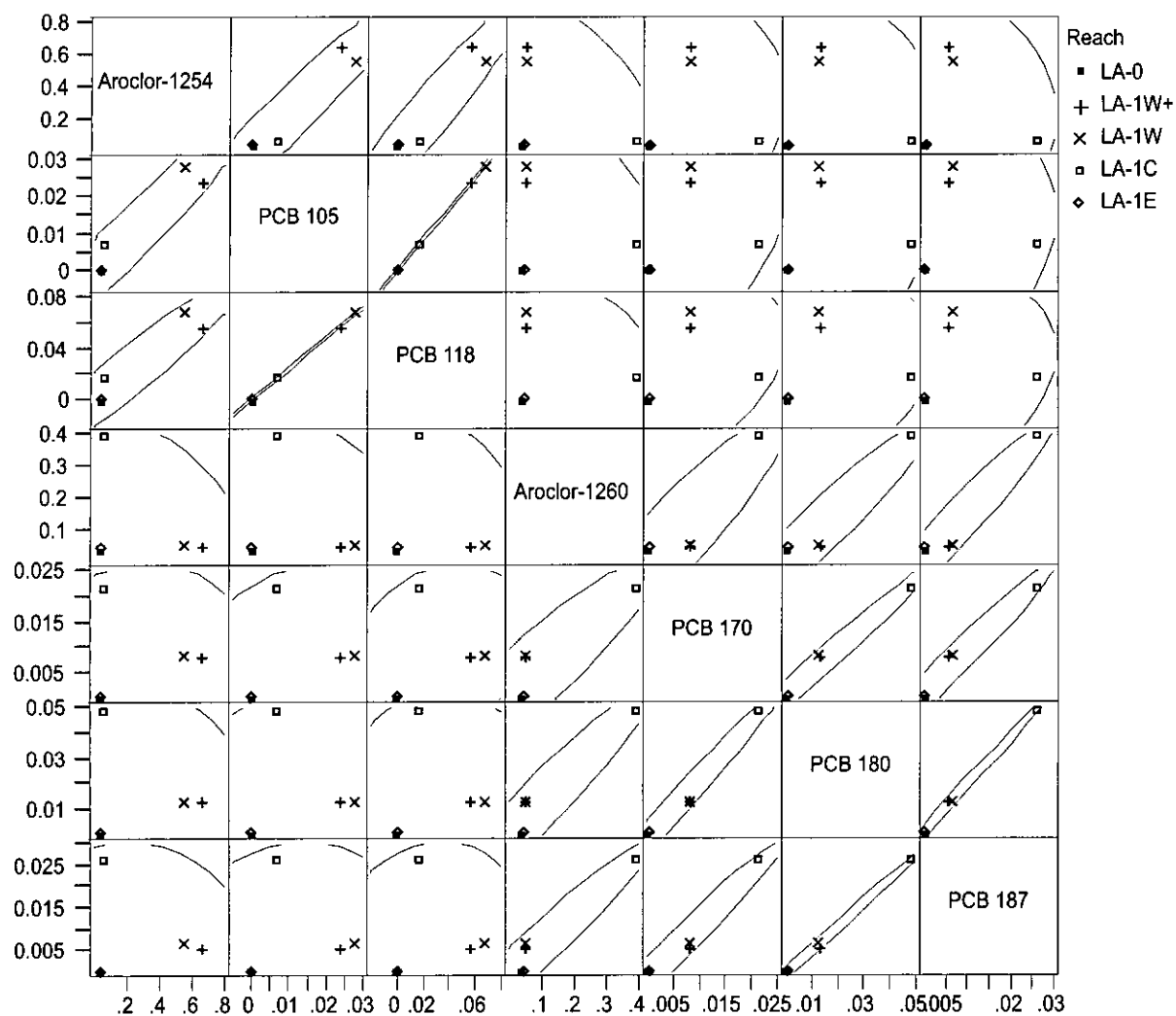
Notes: Error bars indicate upper and lower bounds based on replacing nondetect values with either the detection limit or zero. A value of zero is shown where there are no detected results.

Figure 7.1-21. Estimated average concentrations of benzo(a)pyrene and naphthalene in fine facies sediment in the Los Alamos and Pueblo watershed



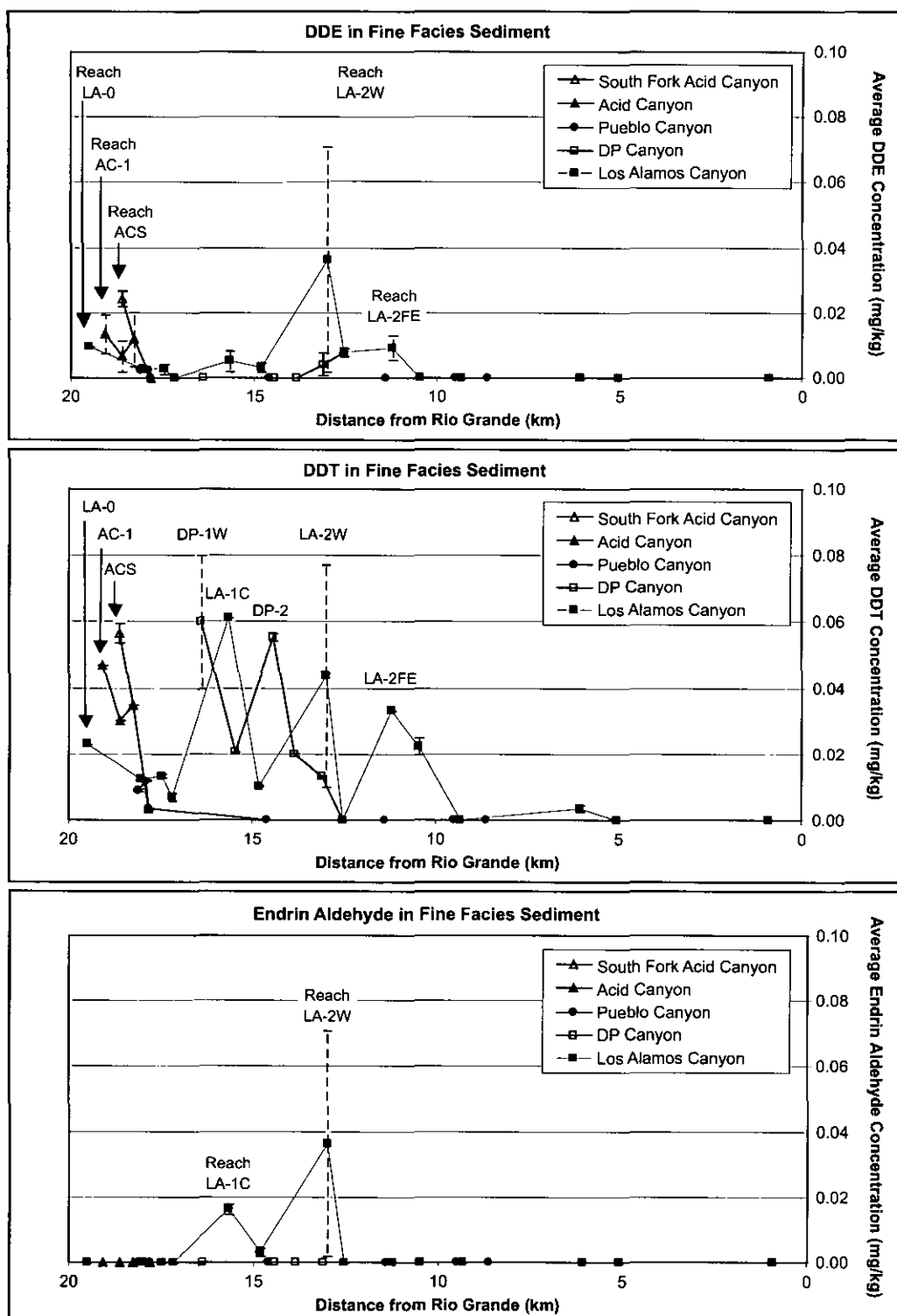
Notes: Error bars indicate upper and lower bounds based on replacing nondetect values with either the detection limit or zero. A value of zero is shown where there are no detected results.

Figure 7.1-22. Estimated average concentrations of Aroclor-1254 and Aroclor-1260 in fine facies sediment in the Los Alamos and Pueblo watershed



Notes: Red lines indicate 95% confidence limits on correlations between analytes. Axes are in units of mg/kg.

Figure 7.1-23. Scatterplot matrix showing results from select PCB congeners and Aroclor analyses in upper Los Alamos Canyon sediment samples



Notes: Error bars indicate upper and lower bounds based on replacing nondetect values with either the detection limit or zero. A value of zero is shown where there are no detected results.

Figure 7.1-24. Estimated average concentrations of DDE, DDT, and endrin aldehyde in fine facies sediment in the Los Alamos and Pueblo watersheds

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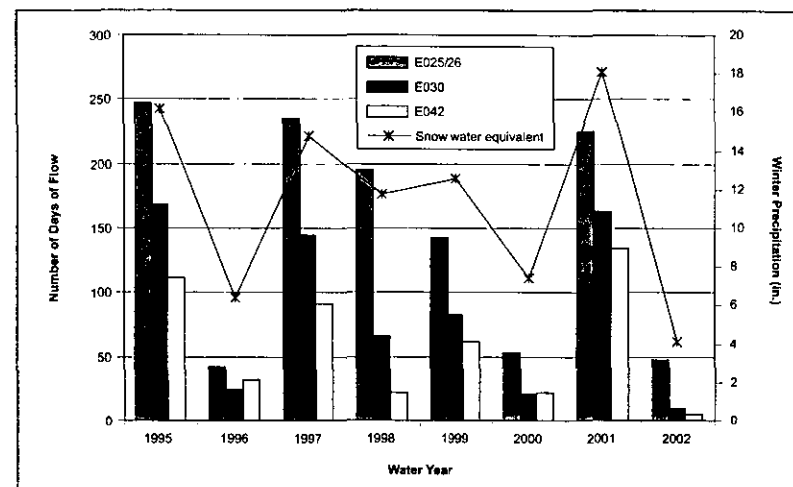


Figure 7.2-2. Number of days of flow at a series of stream gages in Los Alamos Canyon for water years 1995 through 2002

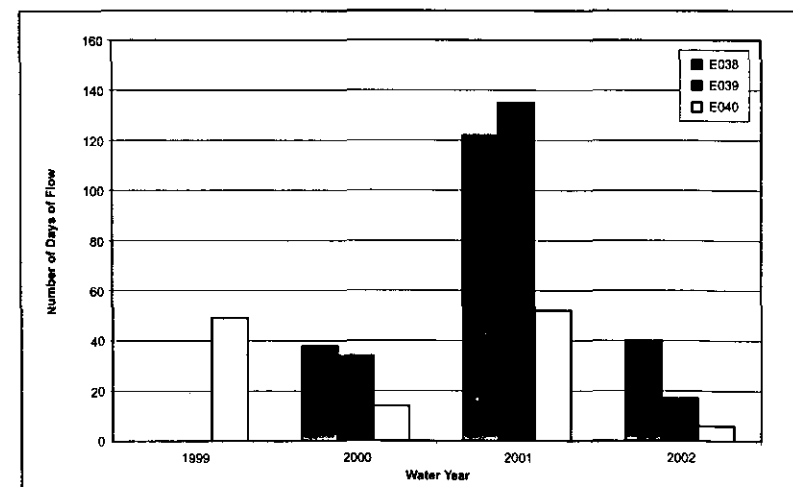


Figure 7.2-3. Number of days of flow at a series of stream gages in DP Canyon for water years 1999 through 2002

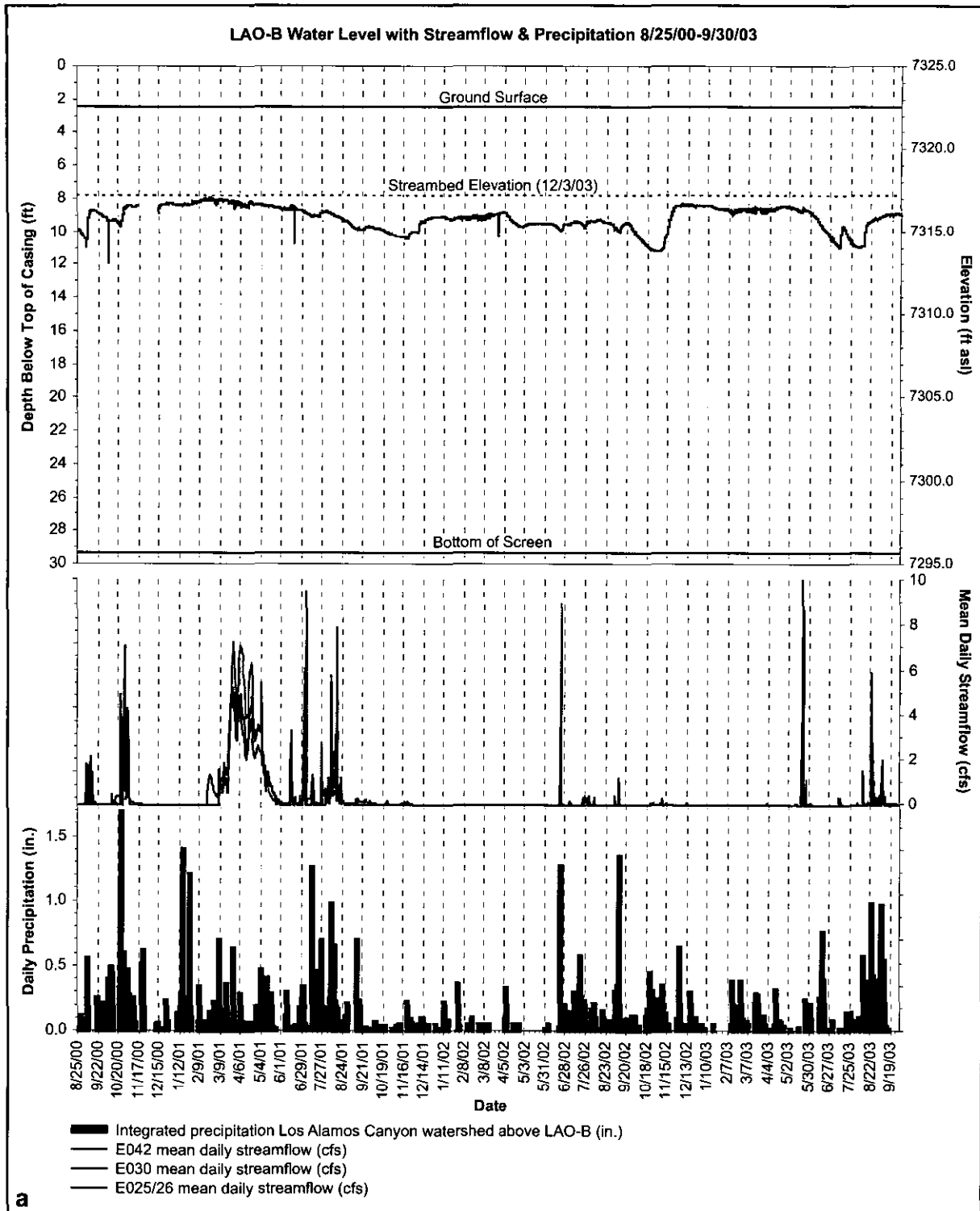


Figure 7.2-4. Integrated precipitation and streamflow data related to the groundwater-level data for a series of alluvial groundwater monitoring wells in upper Los Alamos Canyon

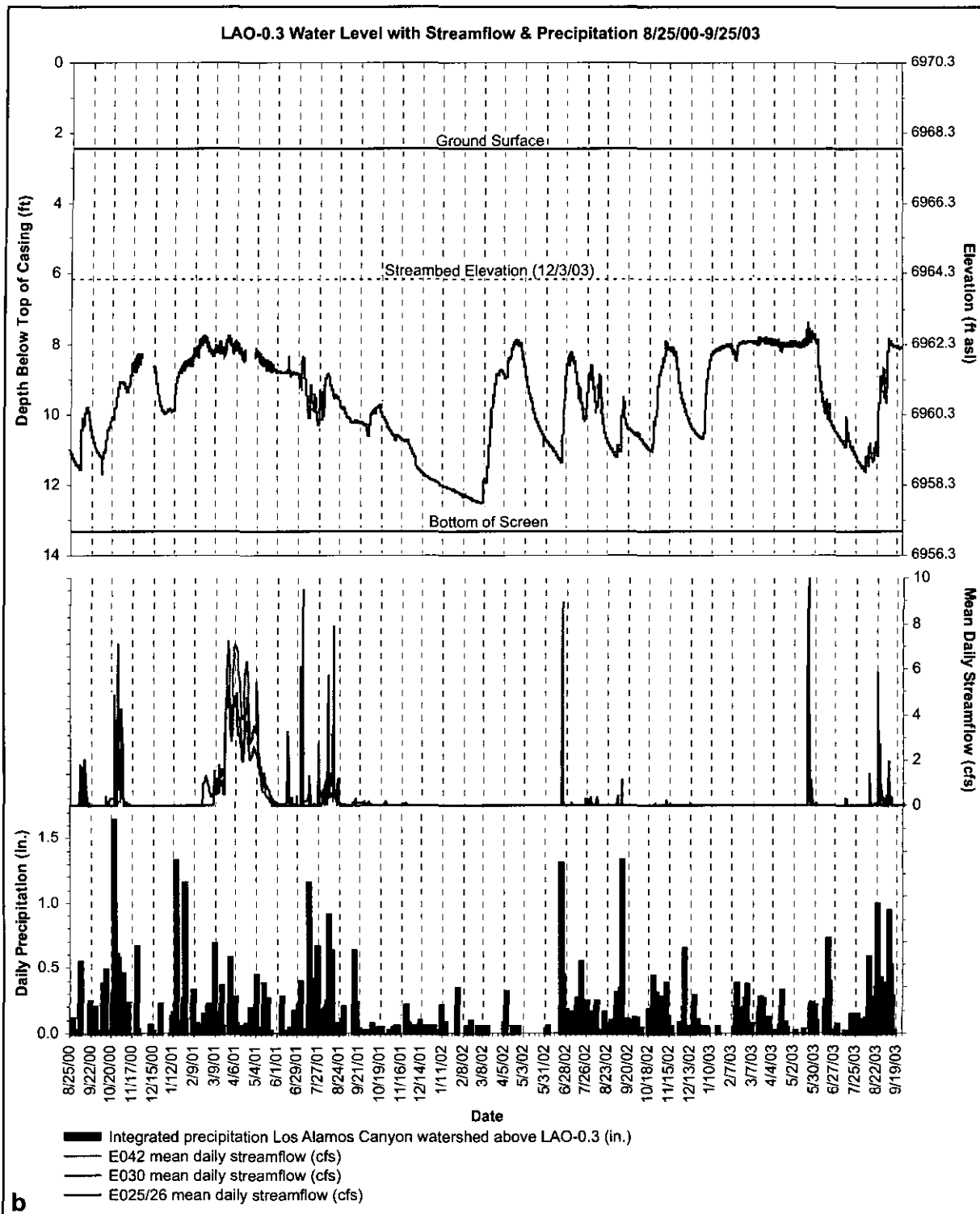


Figure 7.2-4 (continued). Integrated precipitation and streamflow data related to the groundwater-level data for a series of alluvial groundwater monitoring wells in upper Los Alamos Canyon

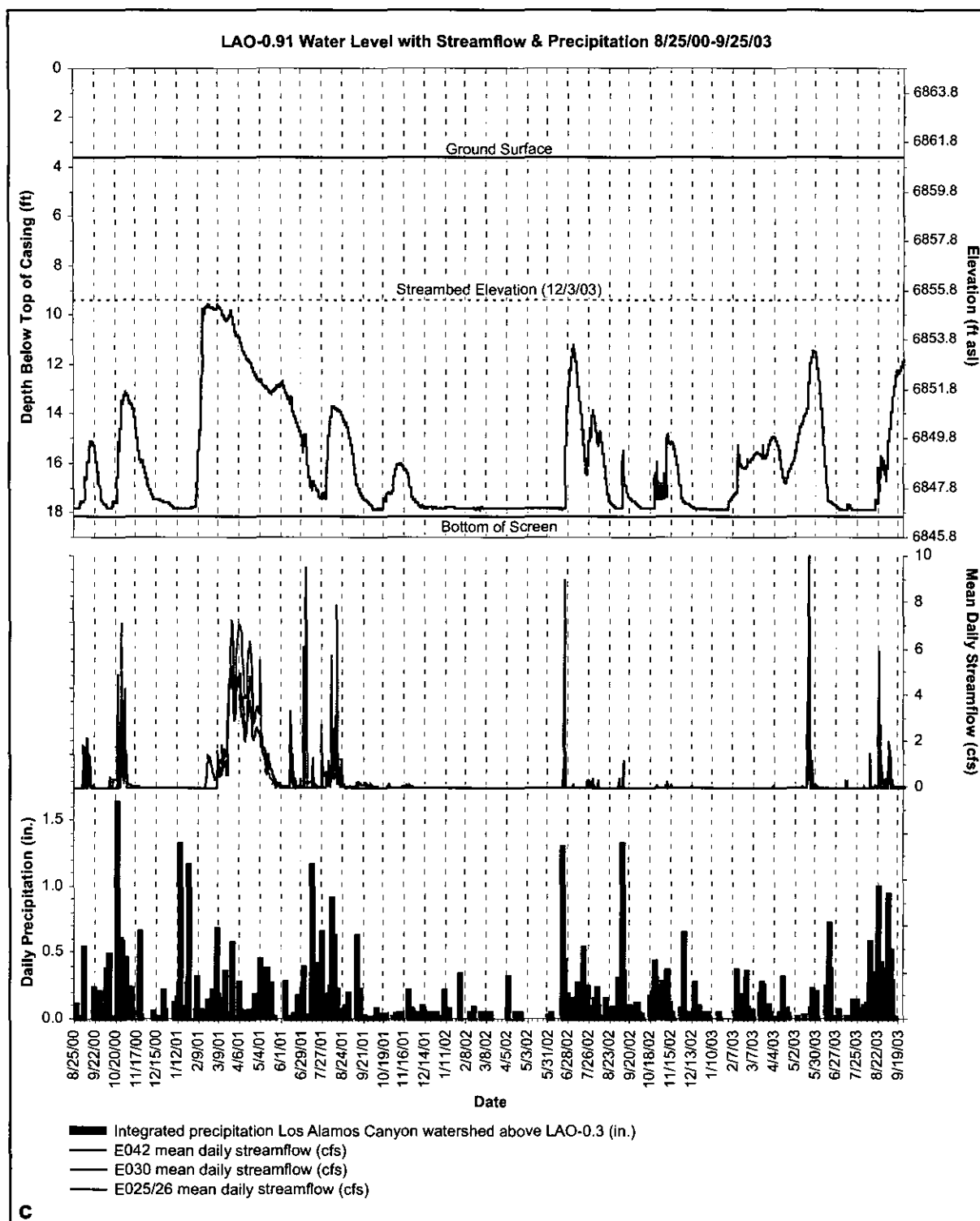


Figure 7.2-4 (continued). Integrated precipitation and streamflow data related to the groundwater-level data for a series of alluvial groundwater monitoring wells in upper Los Alamos Canyon

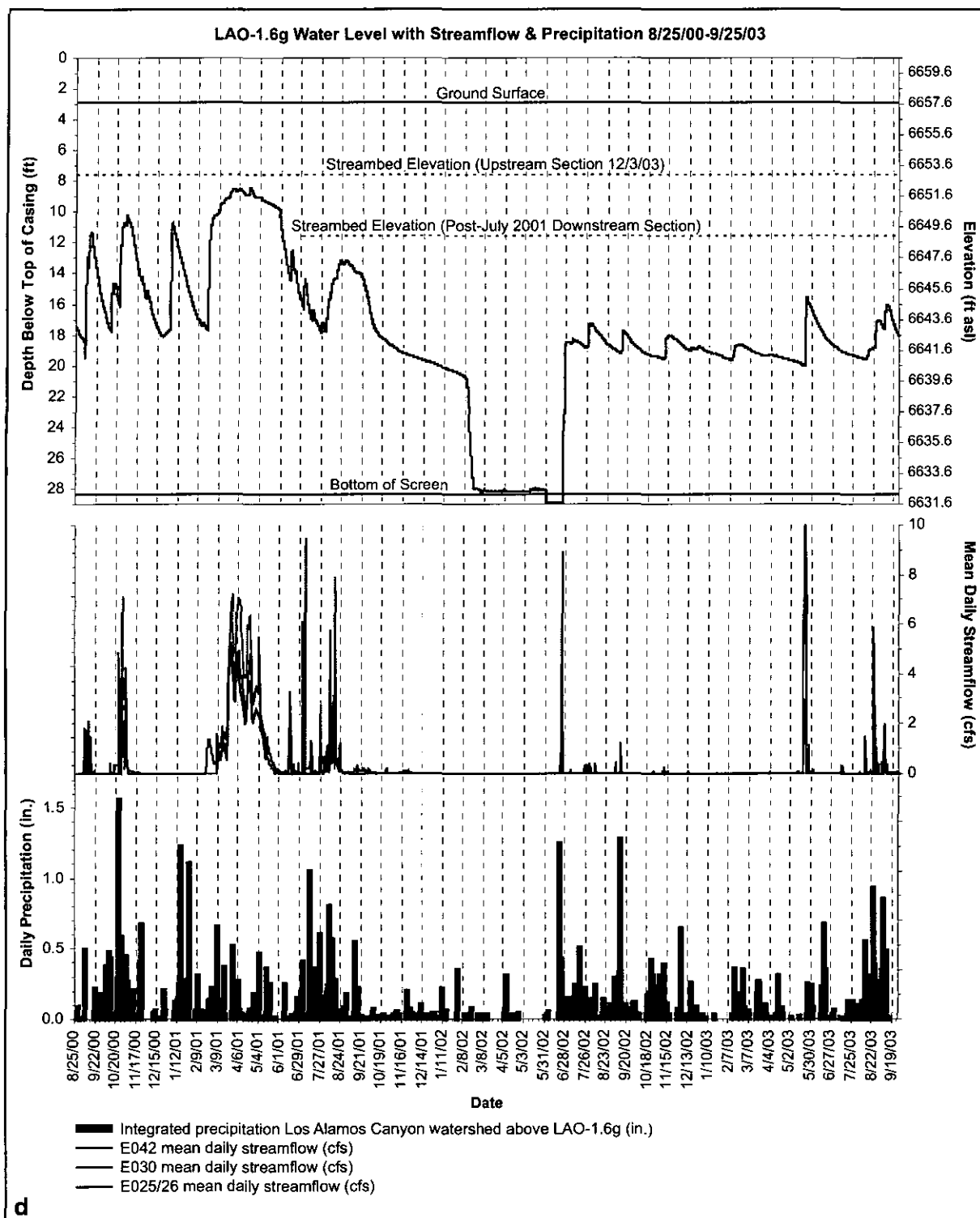


Figure 7.2-4 (continued). Integrated precipitation and streamflow data related to the groundwater-level data for a series of alluvial groundwater monitoring wells in upper Los Alamos Canyon

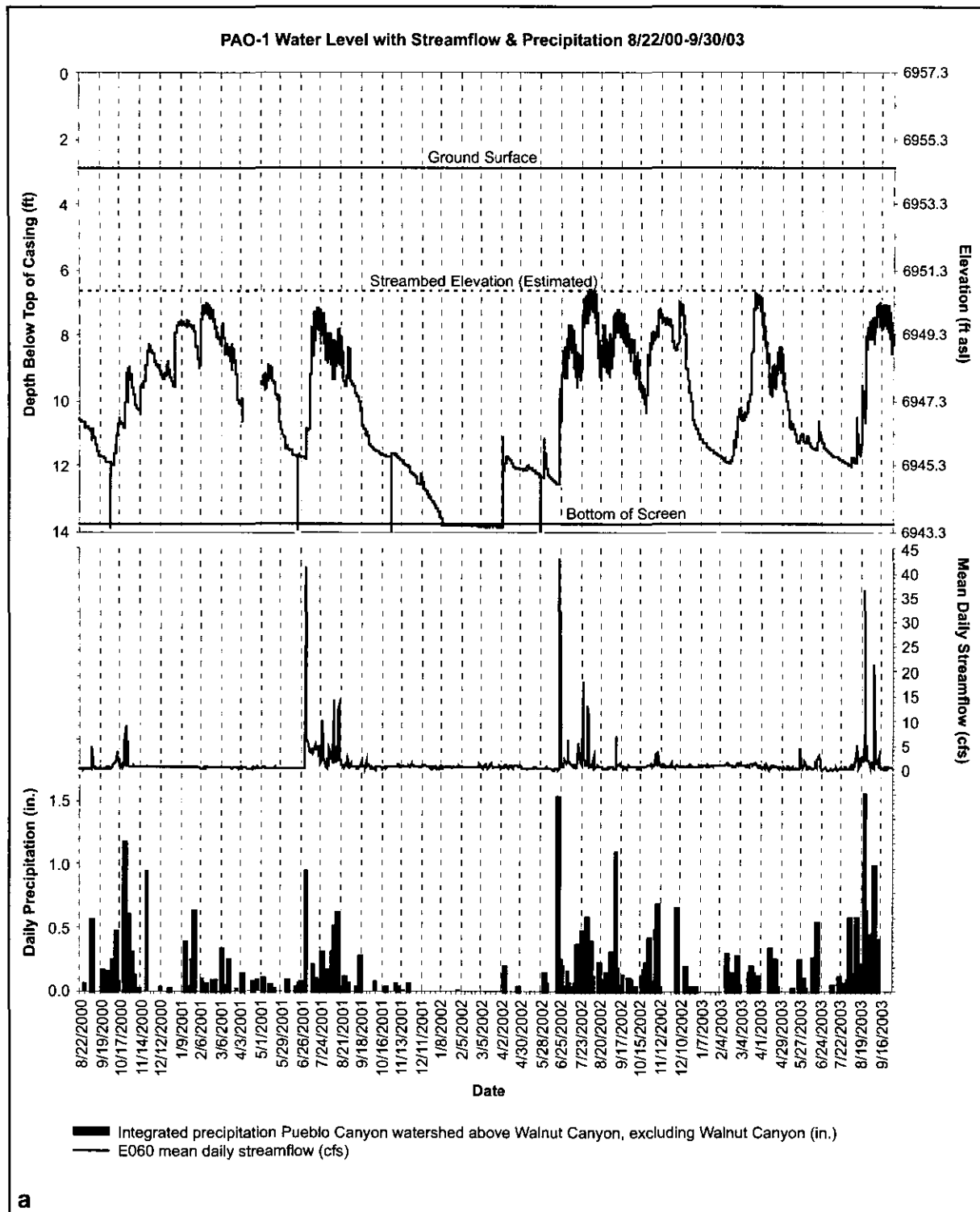


Figure 7.2-5. Integrated precipitation and streamflow data related to the groundwater-level record for a series of alluvial groundwater monitoring wells in Pueblo Canyon

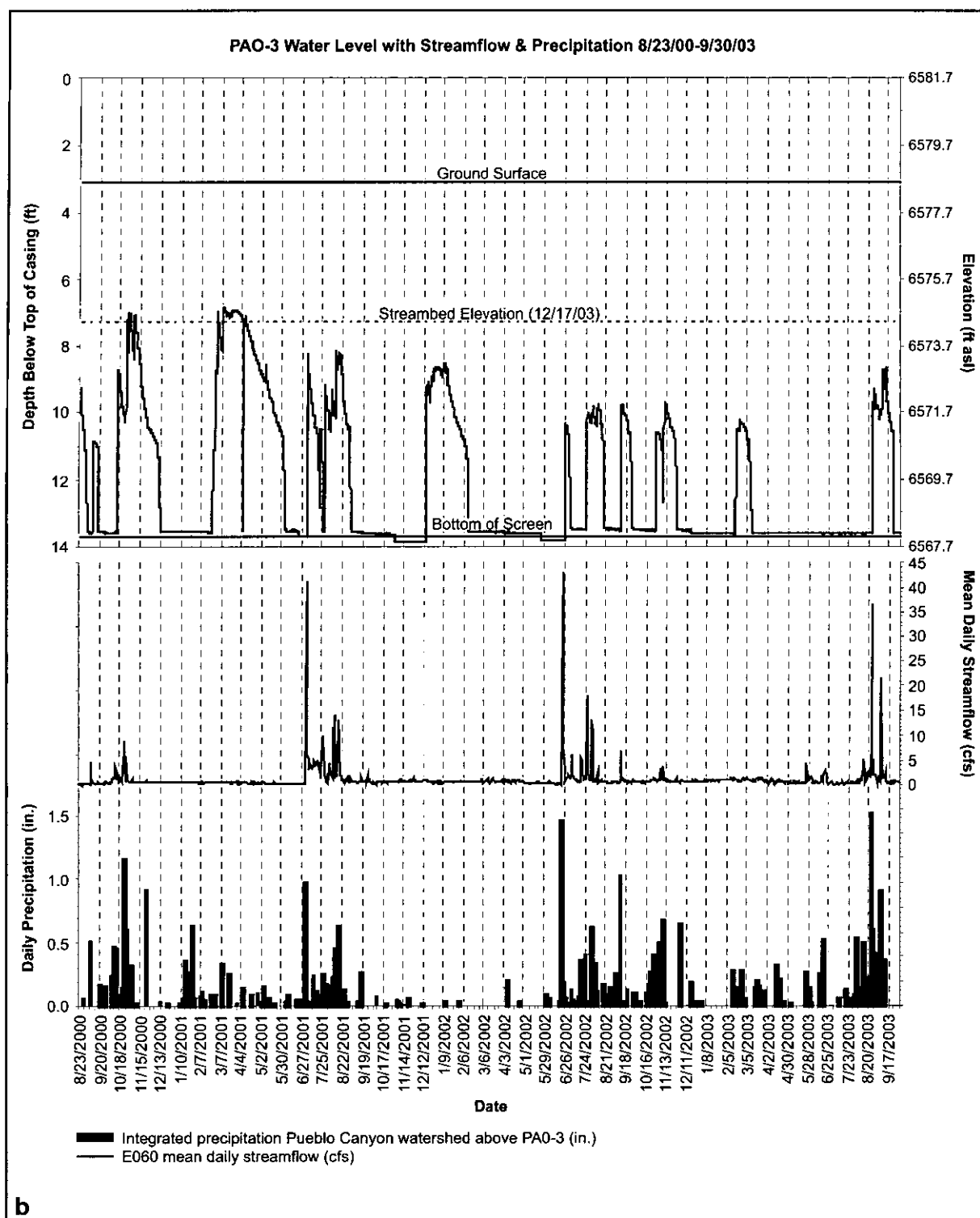


Figure 7.2-5 (continued). Integrated precipitation and streamflow data related to the groundwater-level record for a series of alluvial groundwater monitoring wells in Pueblo Canyon

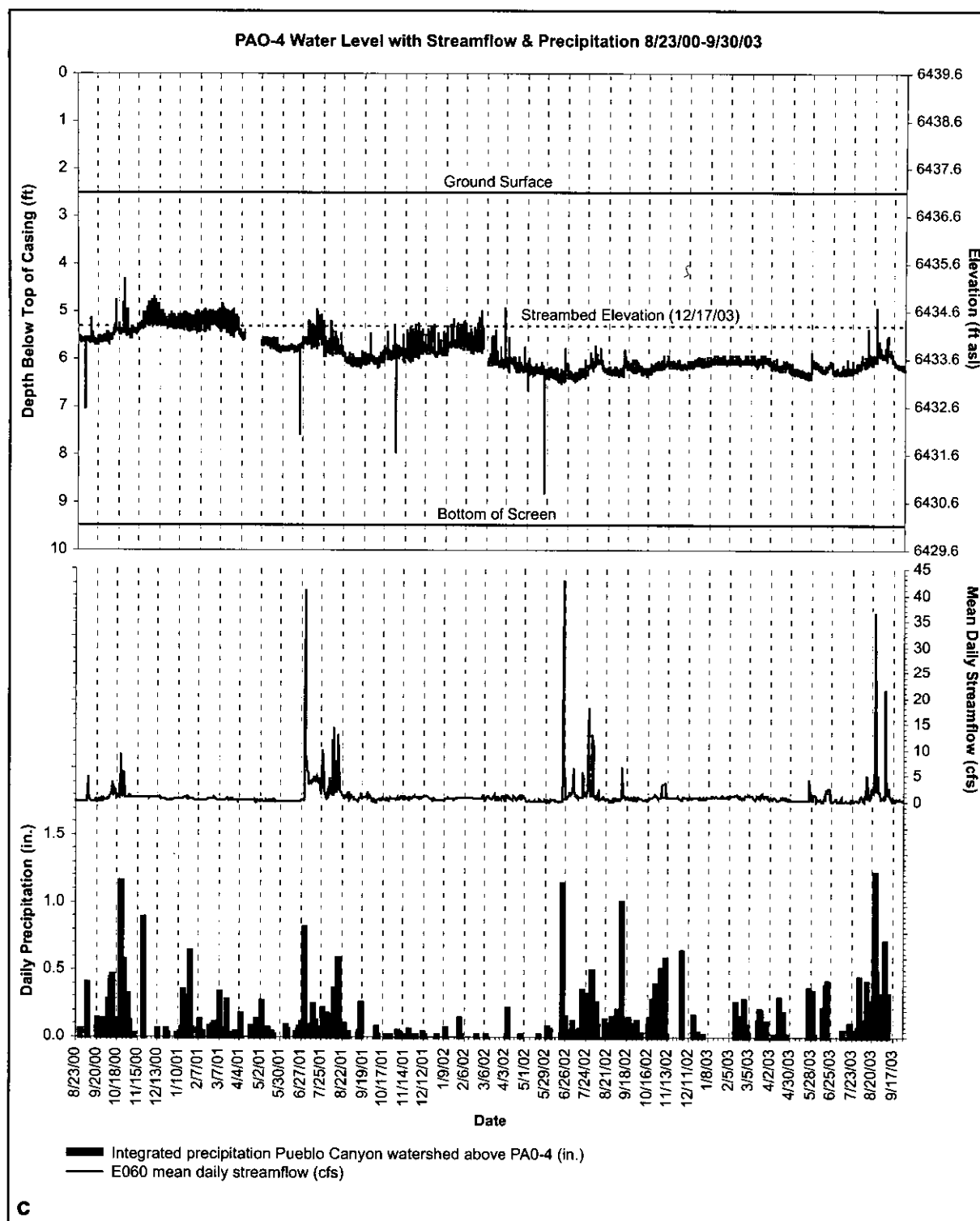


Figure 7.2-5 (continued). Integrated precipitation and streamflow data related to the groundwater-level record for a series of alluvial groundwater monitoring wells in Pueblo Canyon

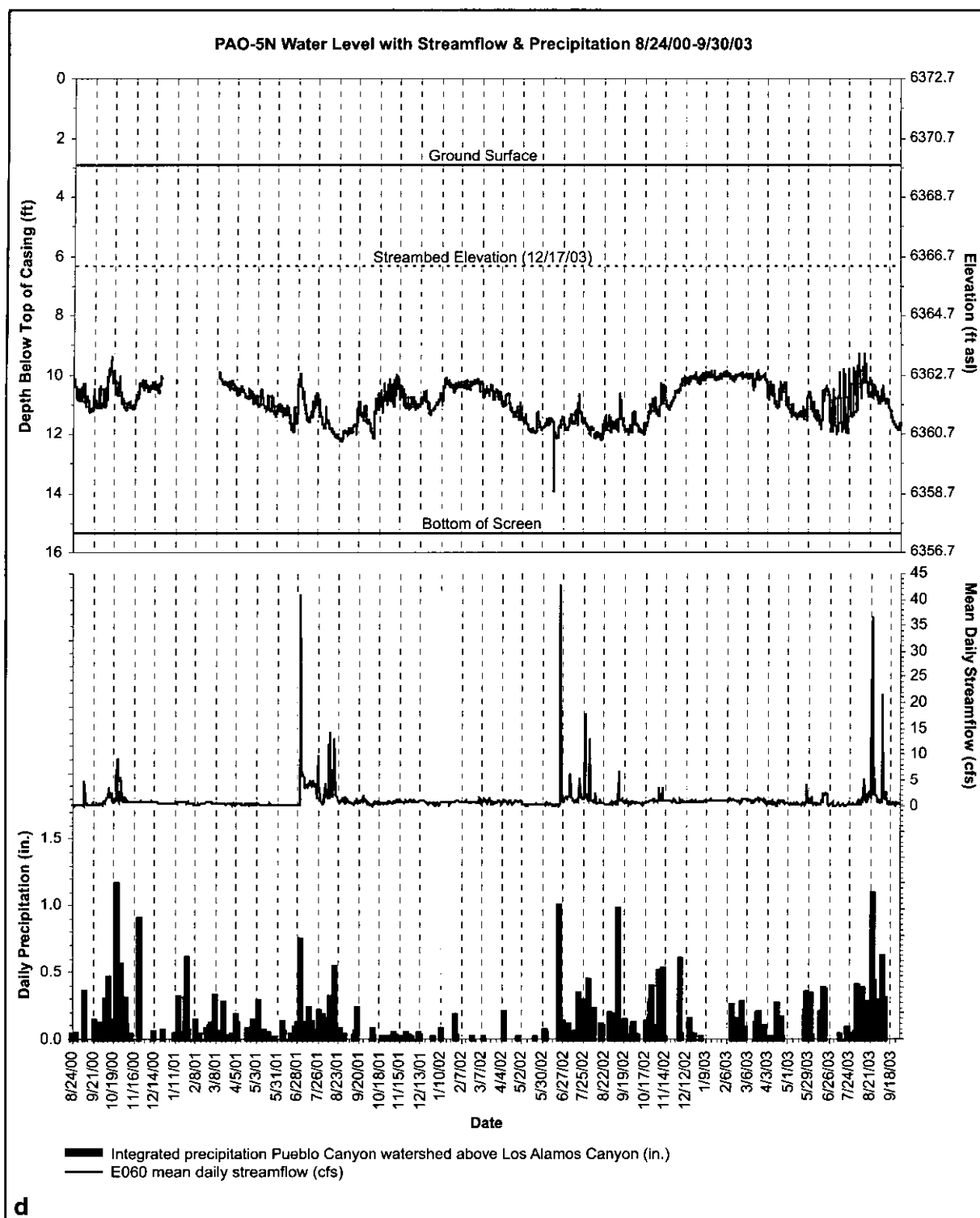


Figure 7.2-5 (continued). Integrated precipitation and streamflow data related to the groundwater-level record for a series of alluvial groundwater monitoring wells in Pueblo Canyon

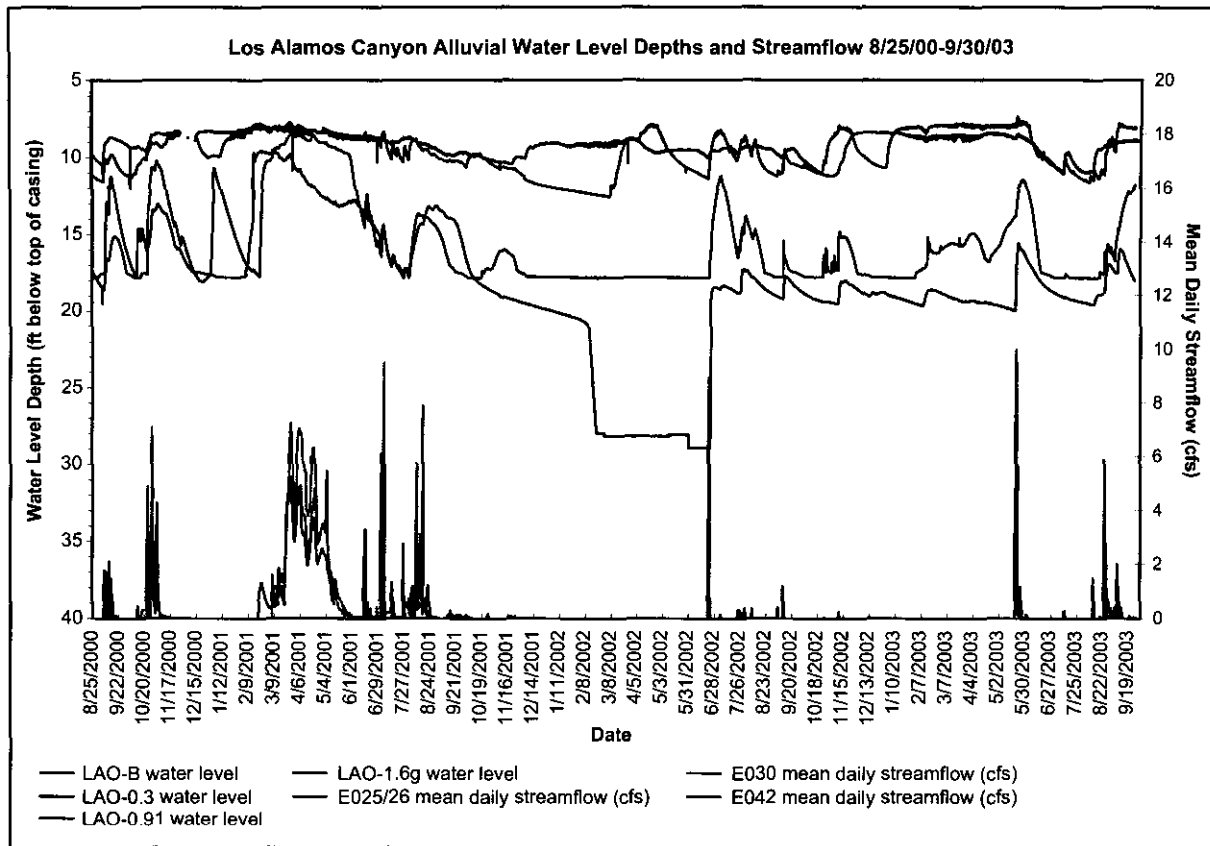


Figure 7.2-6. Combined water-level records for alluvial groundwater monitoring wells LAO(b), LAO-0.3, LAO 0.91, and LAO-1.6(g) shown with streamflow data from surface water gages in upper Los Alamos Canyon

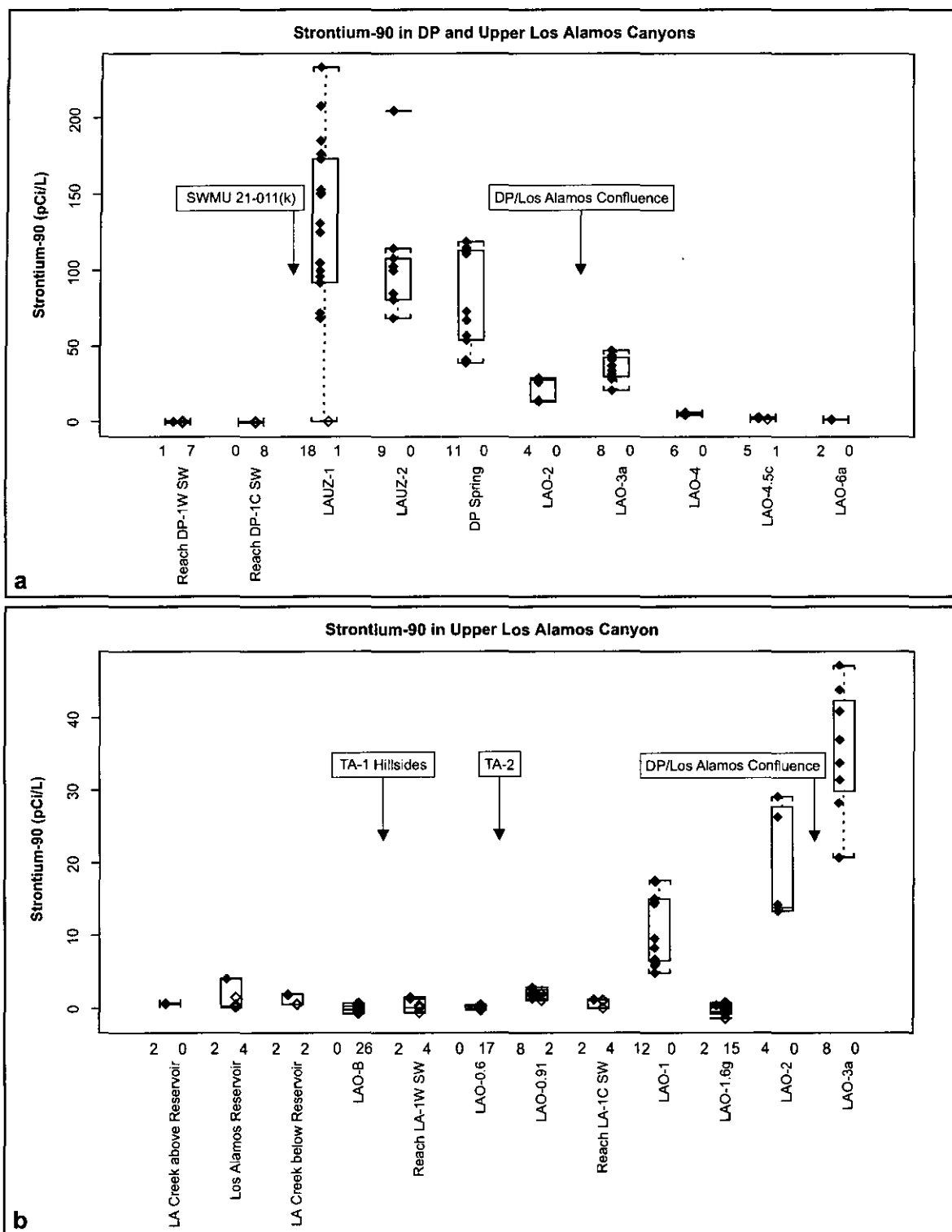


Figure 7.2-7. Box plots showing the spatial distribution of strontium-90 at surface water and alluvial groundwater locations in the Los Alamos and Pueblo watershed. Annotation shows the relative locations of key contaminant sources and other geographic features.

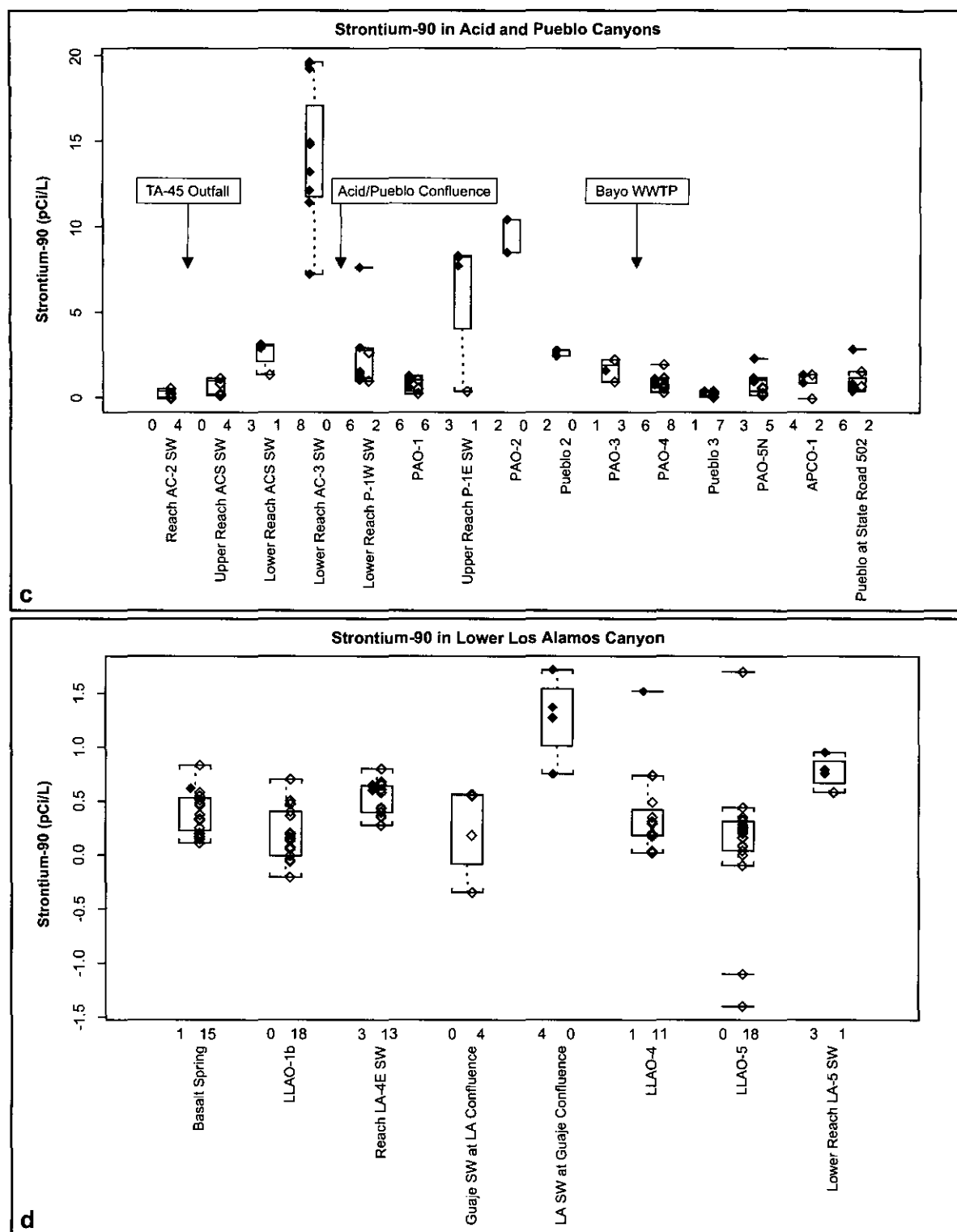


Figure 7.2-7 (continued). Box plots showing the spatial distribution of strontium-90 at surface water and alluvial groundwater locations in the Los Alamos and Pueblo watershed. Annotation shows the relative locations of key contaminant sources and other geographic features.

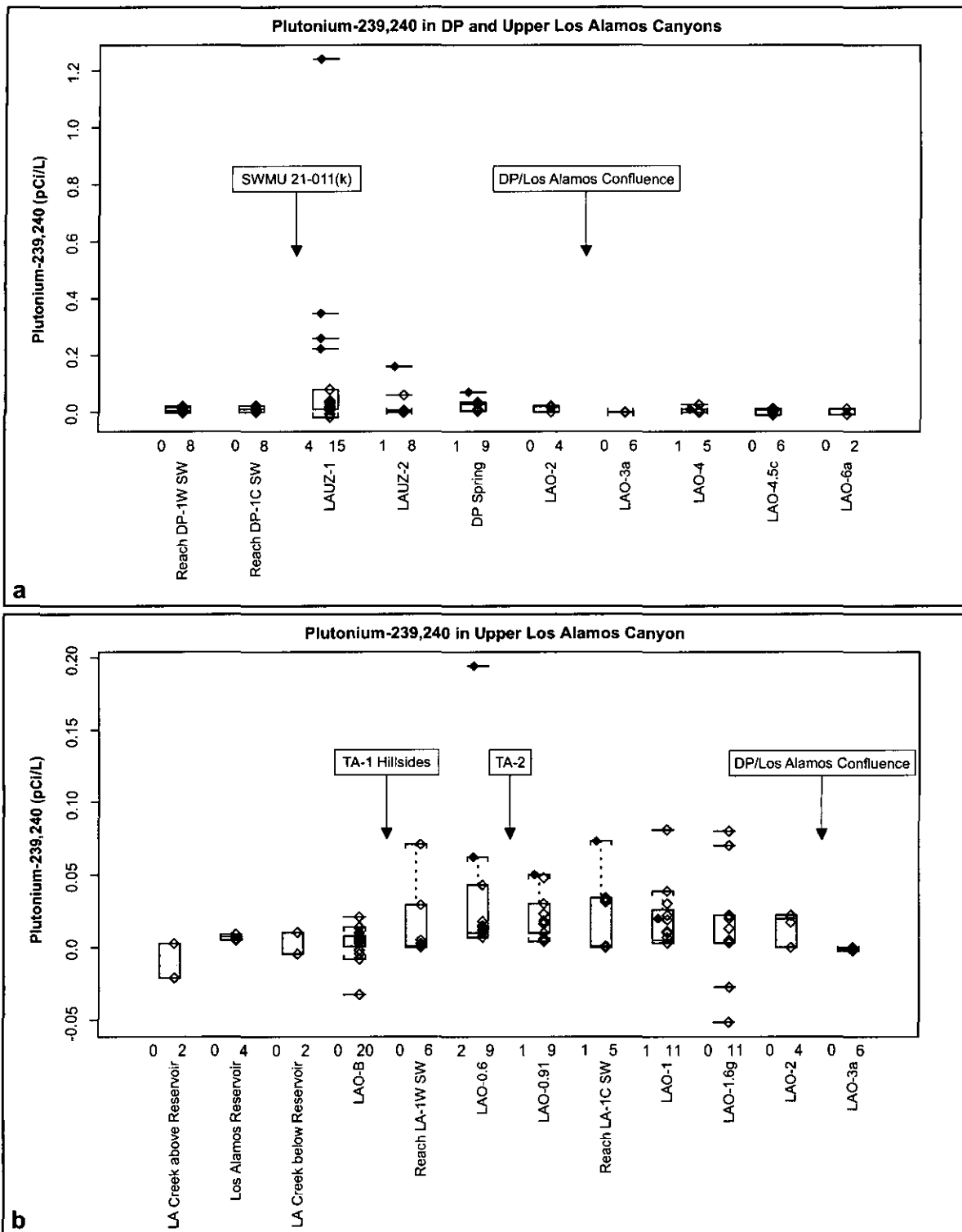
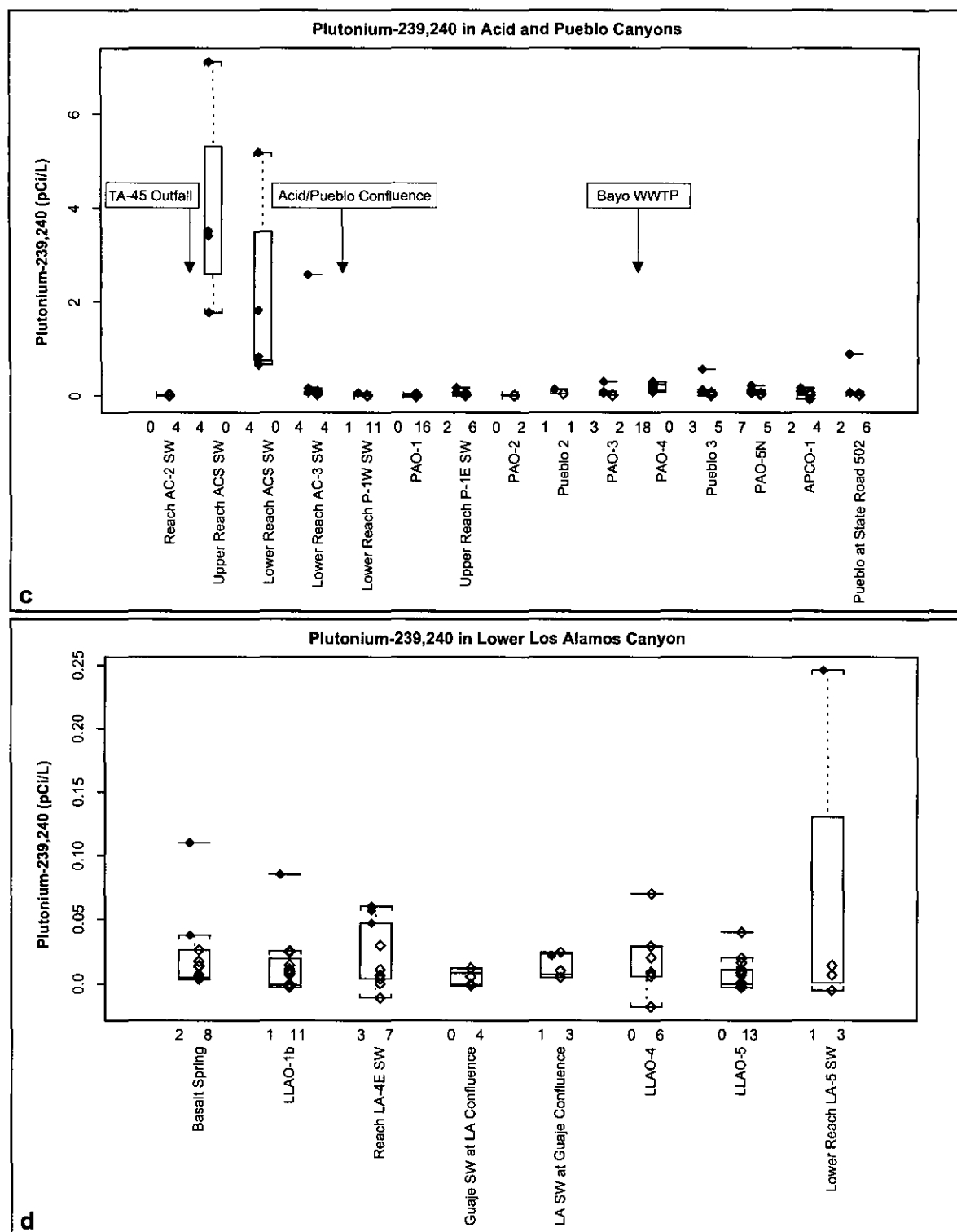


Figure 7.2-8. Box plots showing the spatial distribution of plutonium-239,240 at surface water and alluvial groundwater locations in the Los Alamos and Pueblo watershed. Annotation shows the relative locations of key contaminant sources and other geographic features.



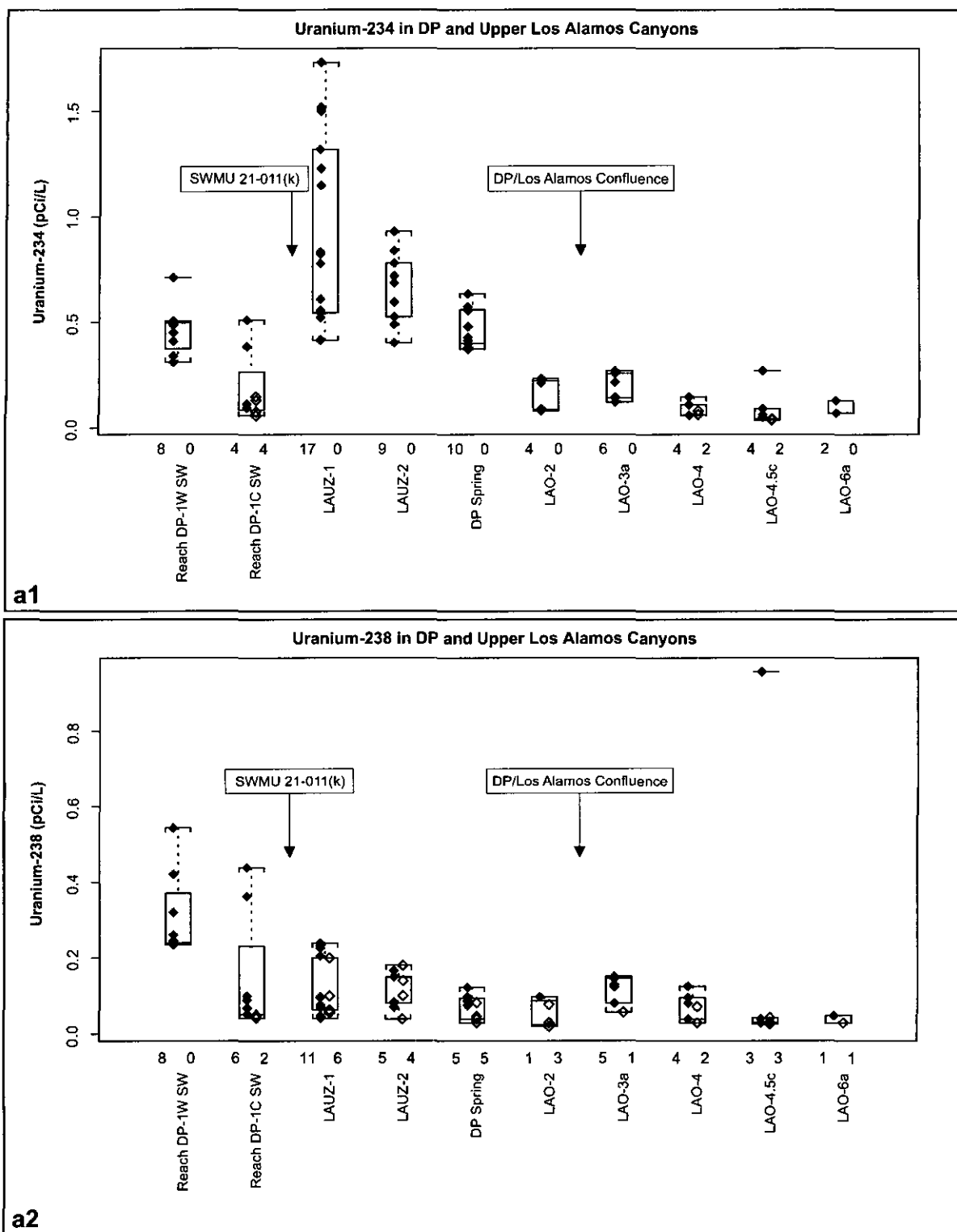


Figure 7.2-9. Box plots showing the spatial distribution of uranium-234 and uranium-238 at surface water and alluvial groundwater locations in the Los Alamos and Pueblo watershed. Annotation shows the relative locations of key contaminant sources and other geographic features.

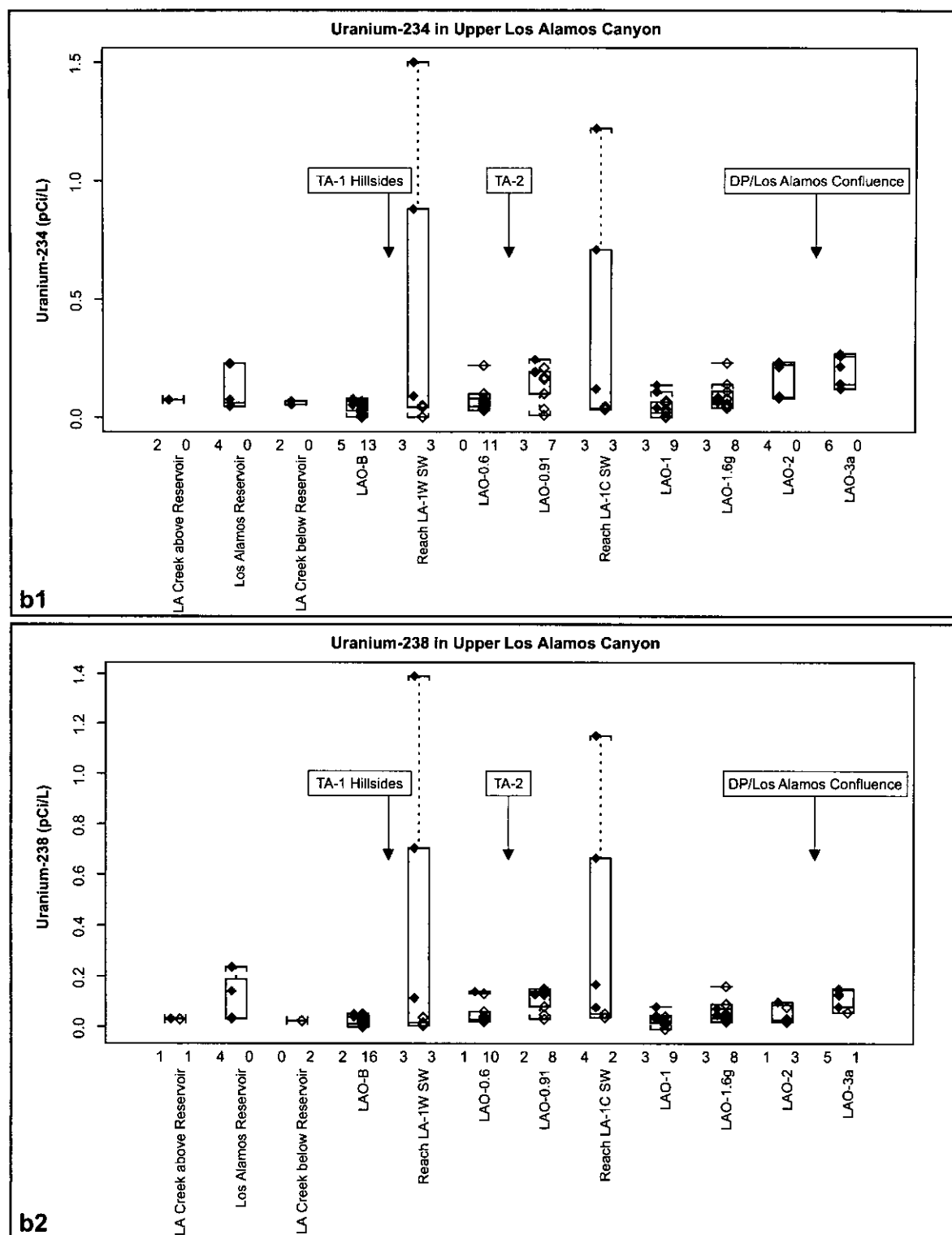


Figure 7.2-9 (continued). Box plots showing the spatial distribution of uranium-234 and uranium-238 at surface water and alluvial groundwater locations in the Los Alamos and Pueblo watershed. Annotation shows the relative locations of key contaminant sources and other geographic features.

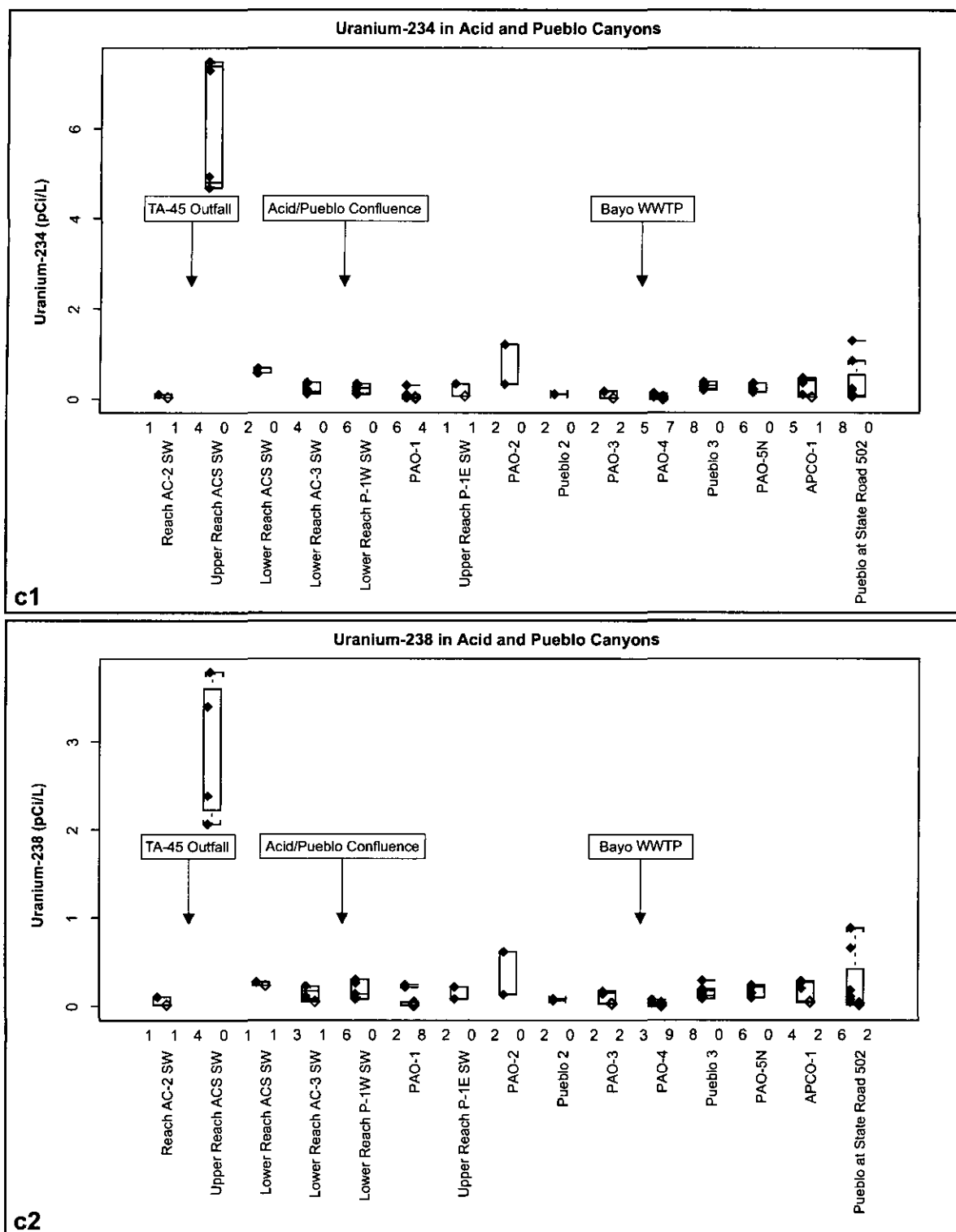


Figure 7.2-9 (continued). Box plots showing the spatial distribution of uranium-234 and uranium-238 at surface water and alluvial groundwater locations in the Los Alamos and Pueblo watershed. Annotation shows the relative locations of key contaminant sources and other geographic features.

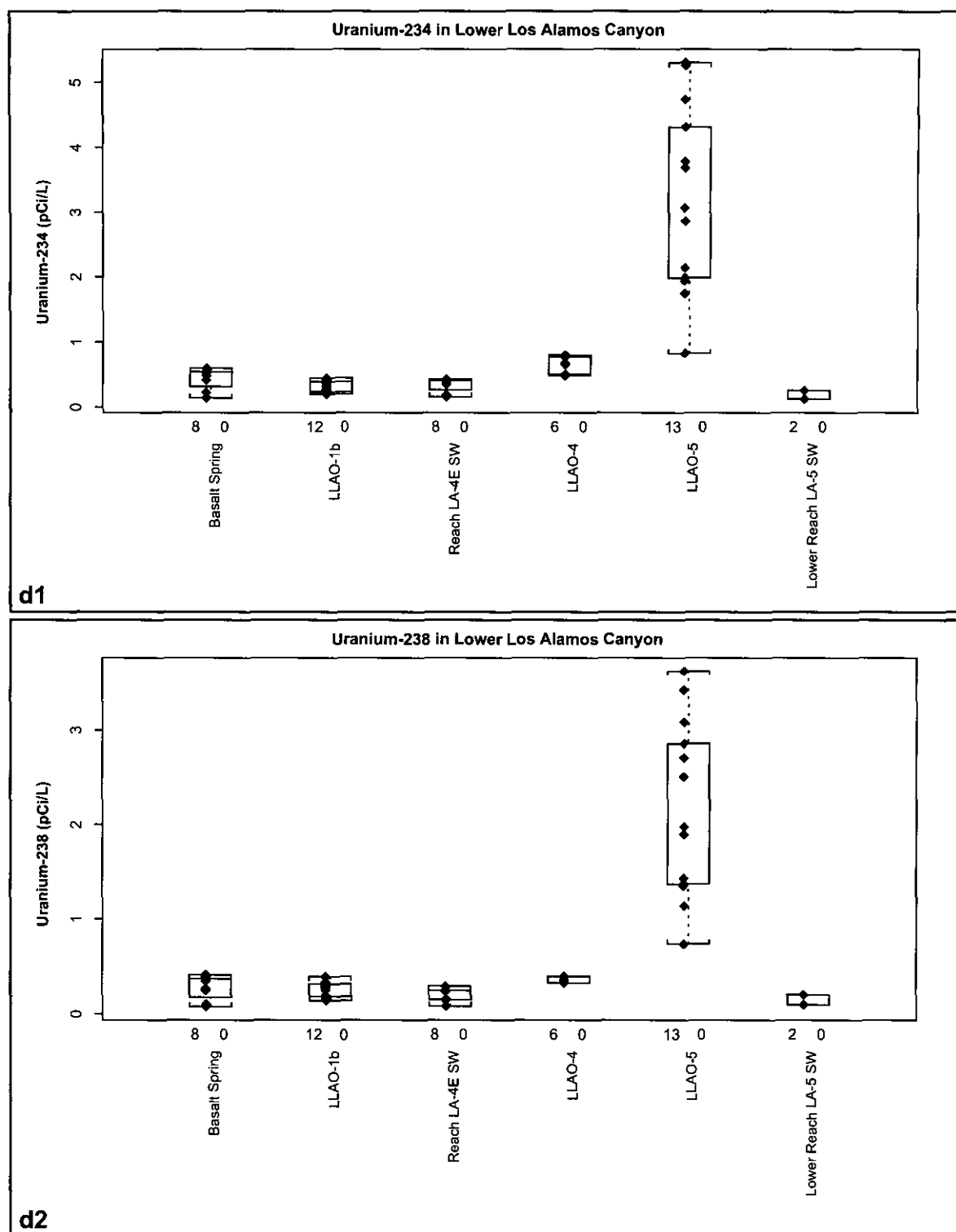


Figure 7.2-9 (continued). Box plots showing the spatial distribution of uranium-234 and uranium-238 at surface water and alluvial groundwater locations in the Los Alamos and Pueblo watershed. Annotation shows the relative locations of key contaminant sources and other geographic features.

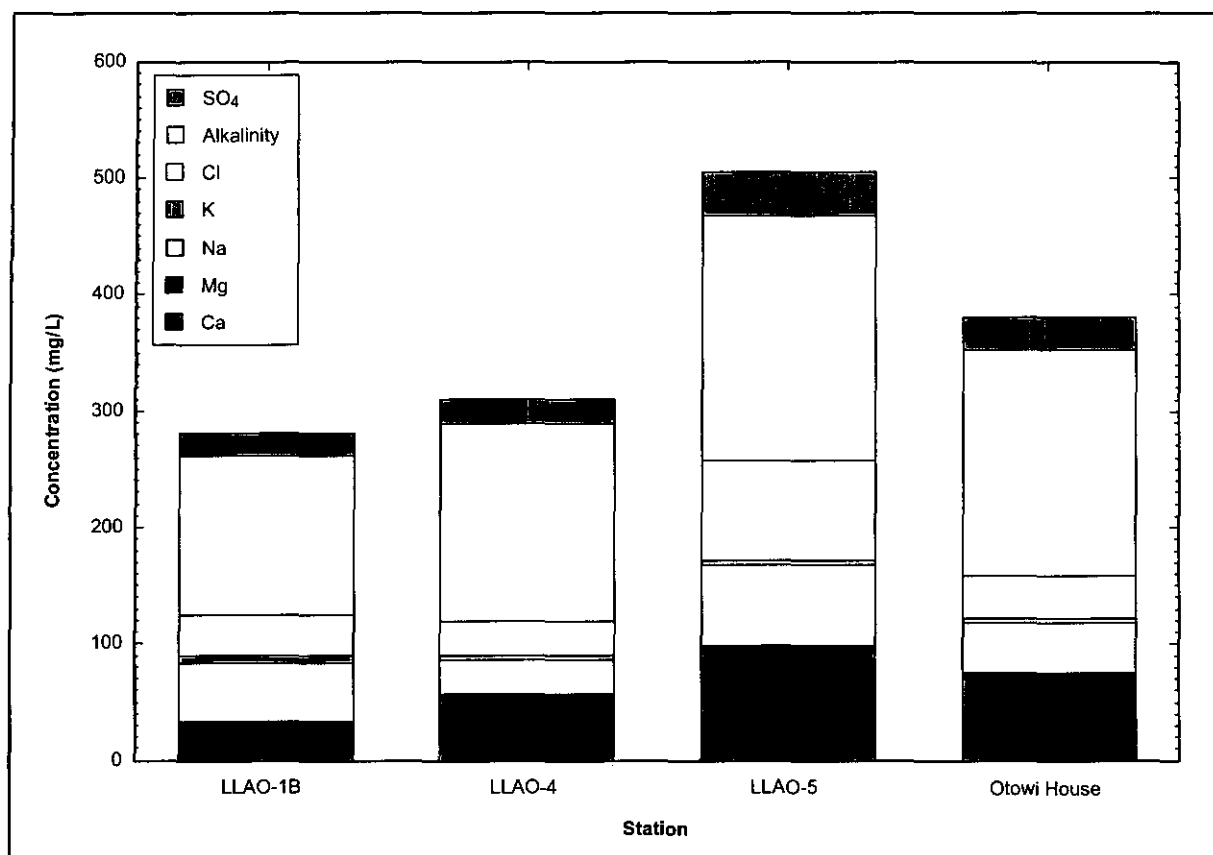


Figure 7.2-10. Major ion chemistry of select alluvial groundwater and regional groundwater monitoring wells in lower Los Alamos Canyon

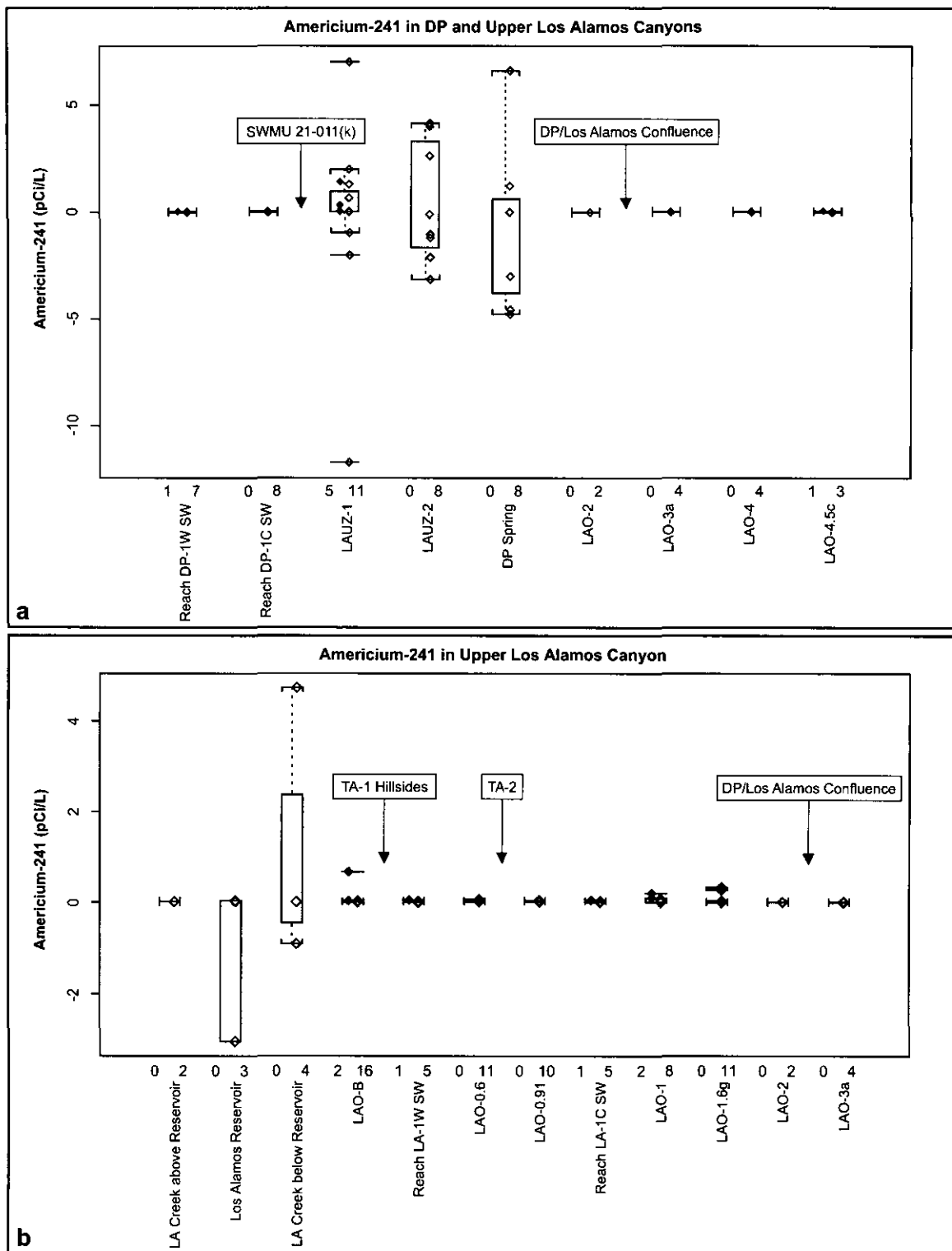


Figure 7.2-11. Box plots showing the spatial distribution of americium-241 at surface water and alluvial groundwater locations in the Los Alamos and Pueblo watershed. Annotation shows the relative locations of key contaminant sources and other geographic features.

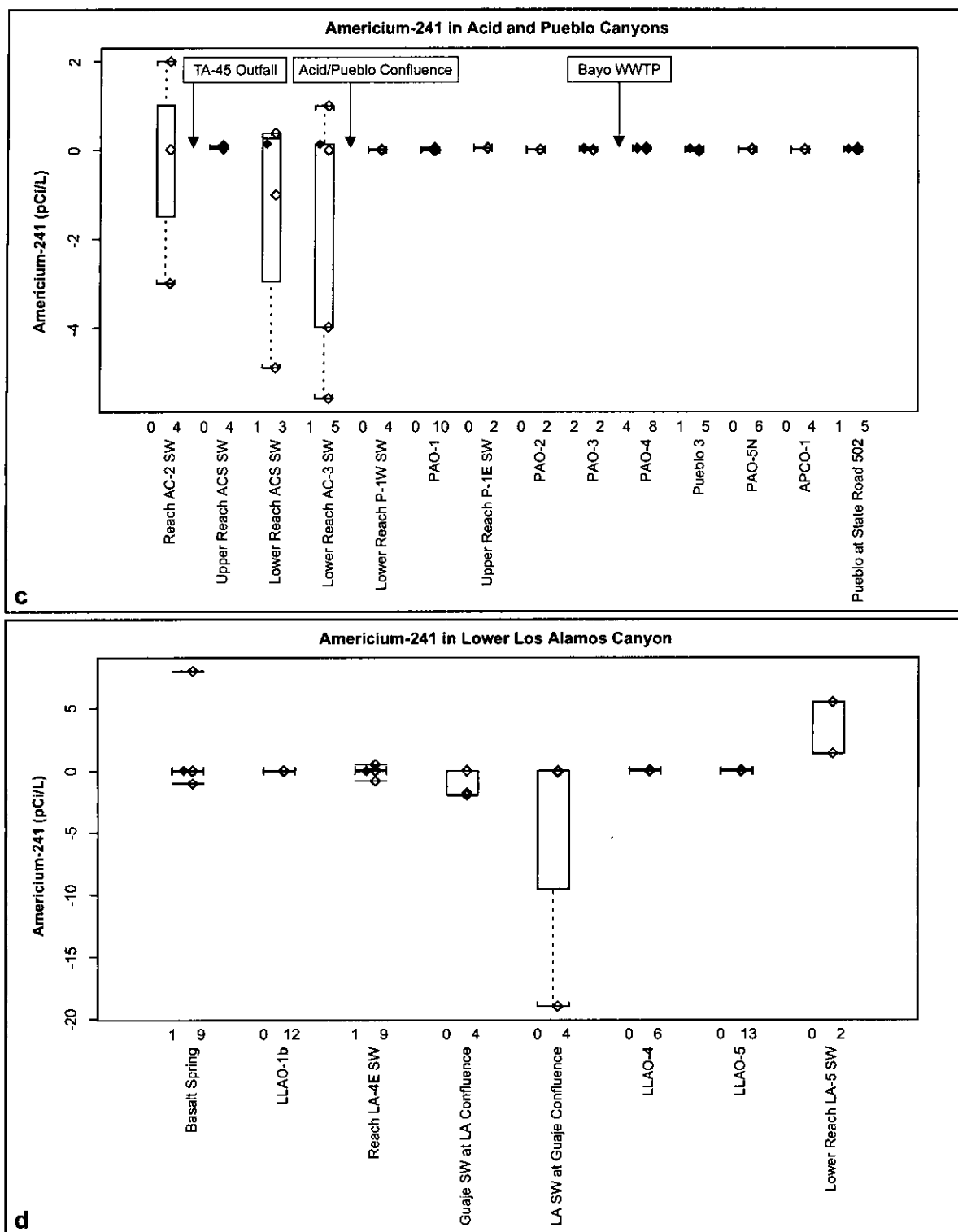


Figure 7.2-11 (continued). Box plots showing the spatial distribution of americium-241 at surface water and alluvial groundwater locations in the Los Alamos and Pueblo watershed. Annotation shows the relative locations of key contaminant sources and other geographic features.

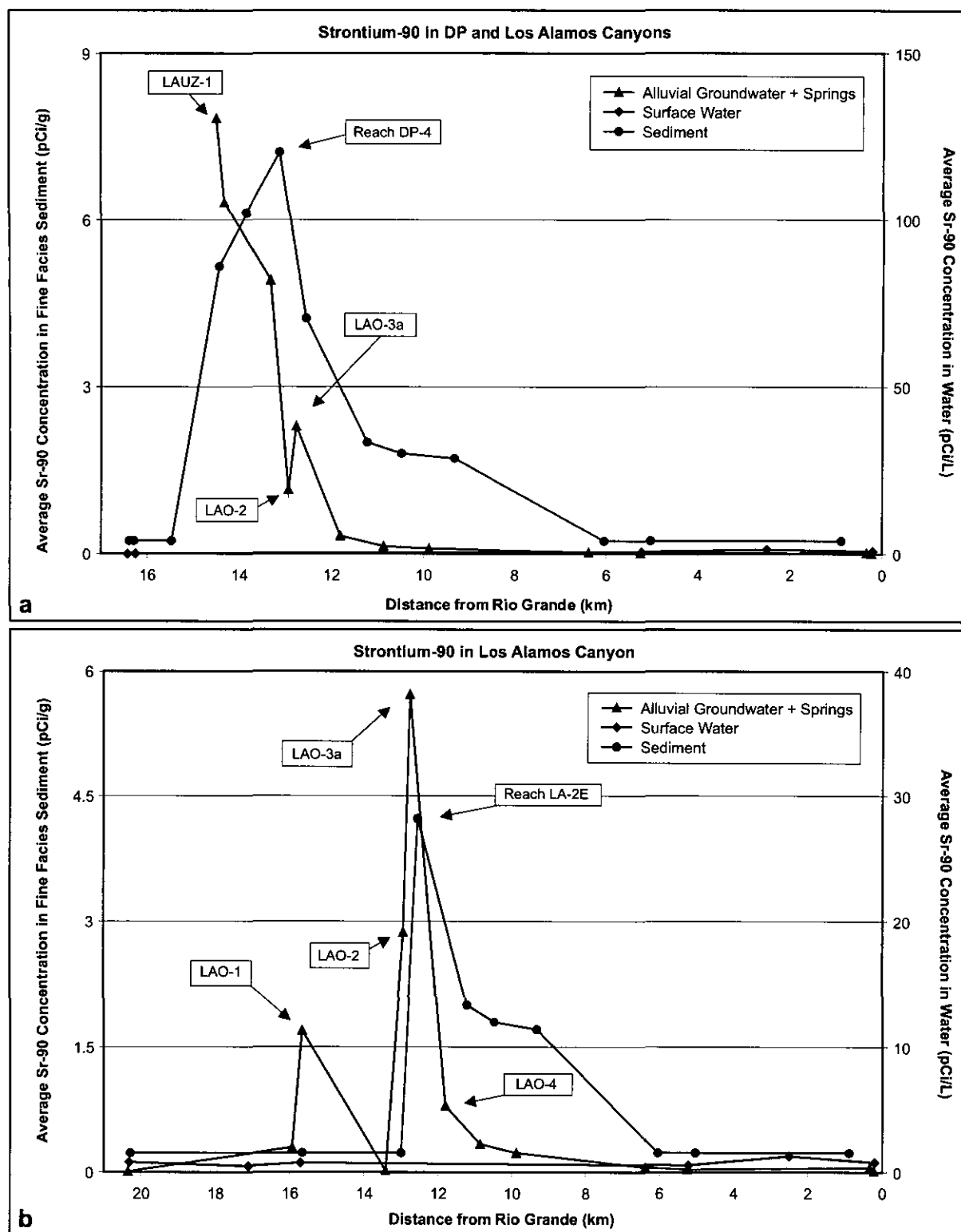


Figure 7.2-12. Spatial relation between estimated average concentrations of strontium-90 in fine facies sediment, surface water, and alluvial groundwater in different portions of the Los Alamos and Pueblo watershed

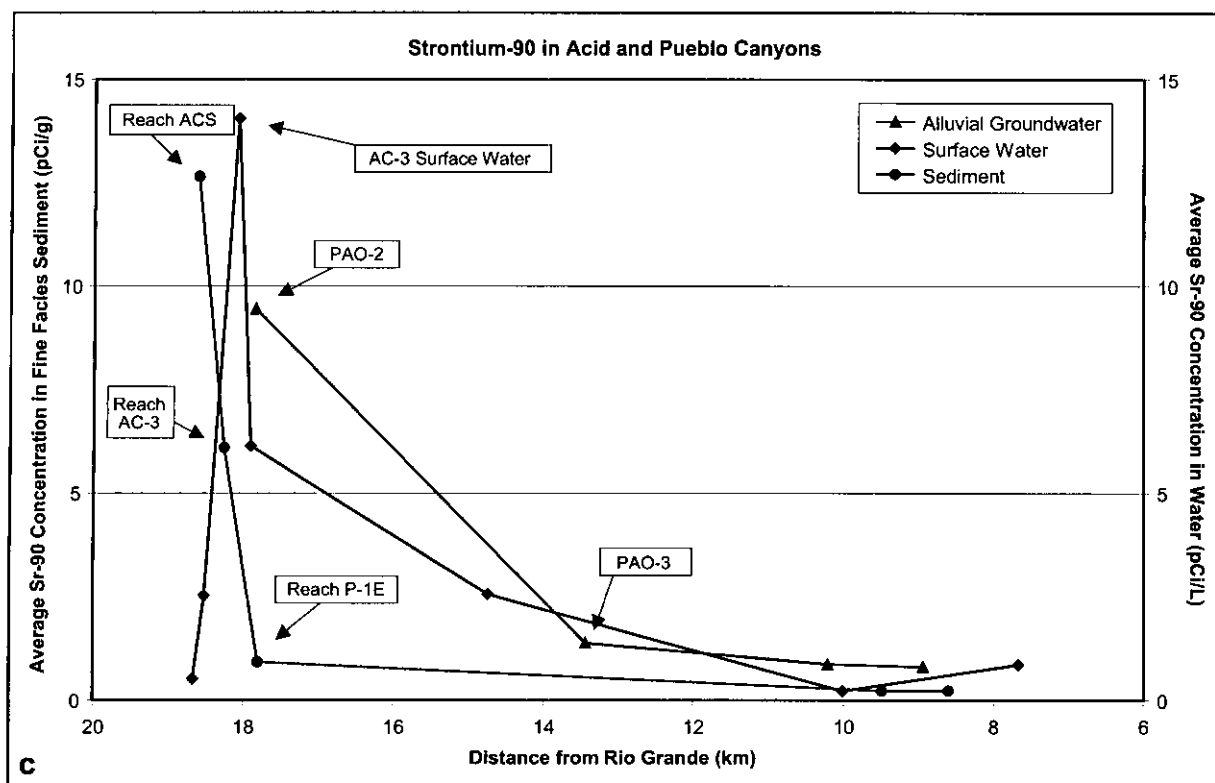


Figure 7.2-12 (continued). Spatial relation between estimated average concentrations of strontium-90 in fine facies sediment, surface water, and alluvial groundwater in different portions of the Los Alamos and Pueblo watershed

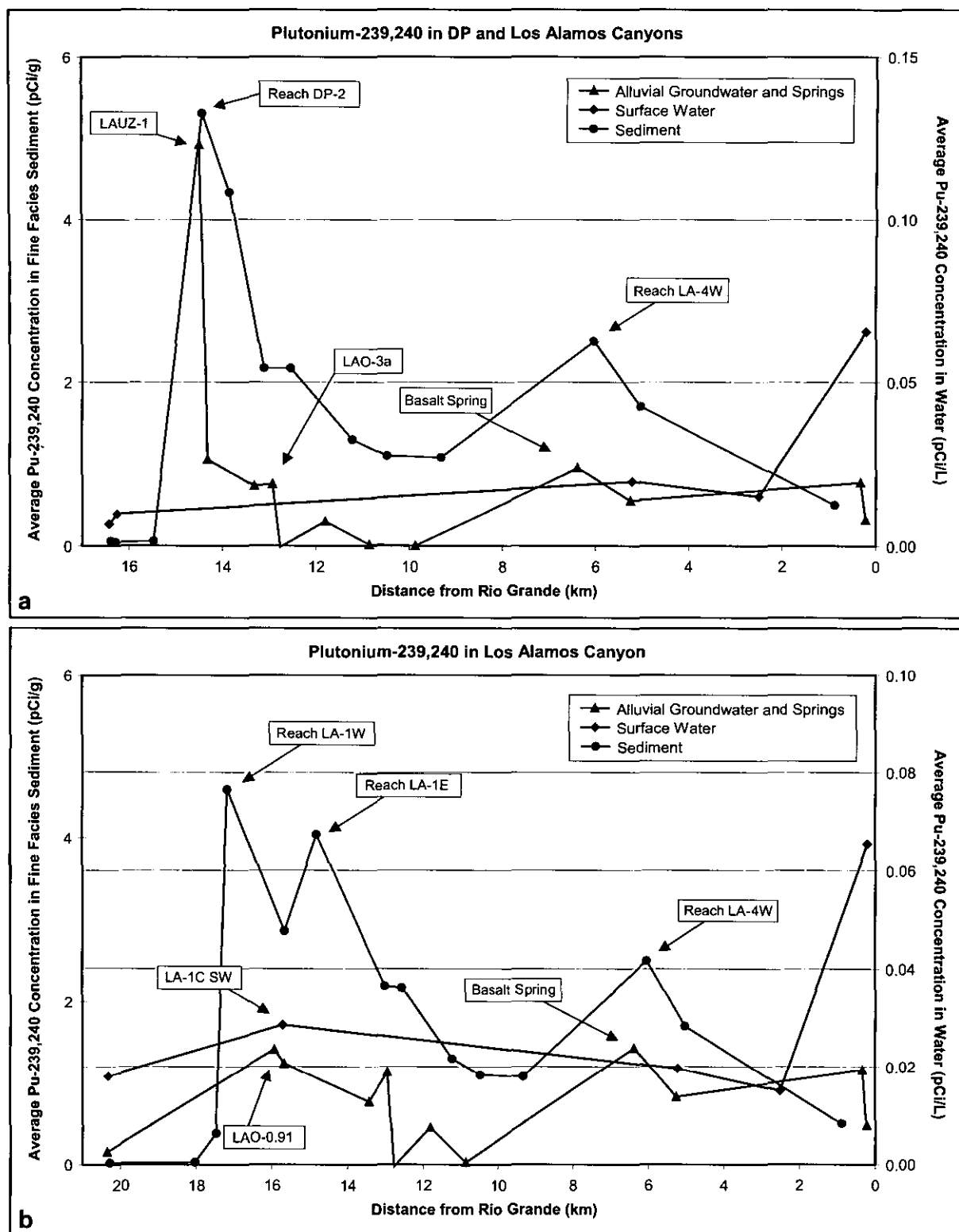


Figure 7.2-13. Spatial relation between estimated average concentrations of plutonium-239,240 in fine facies sediment, surface water, and alluvial groundwater in different portions of the Los Alamos and Pueblo watershed

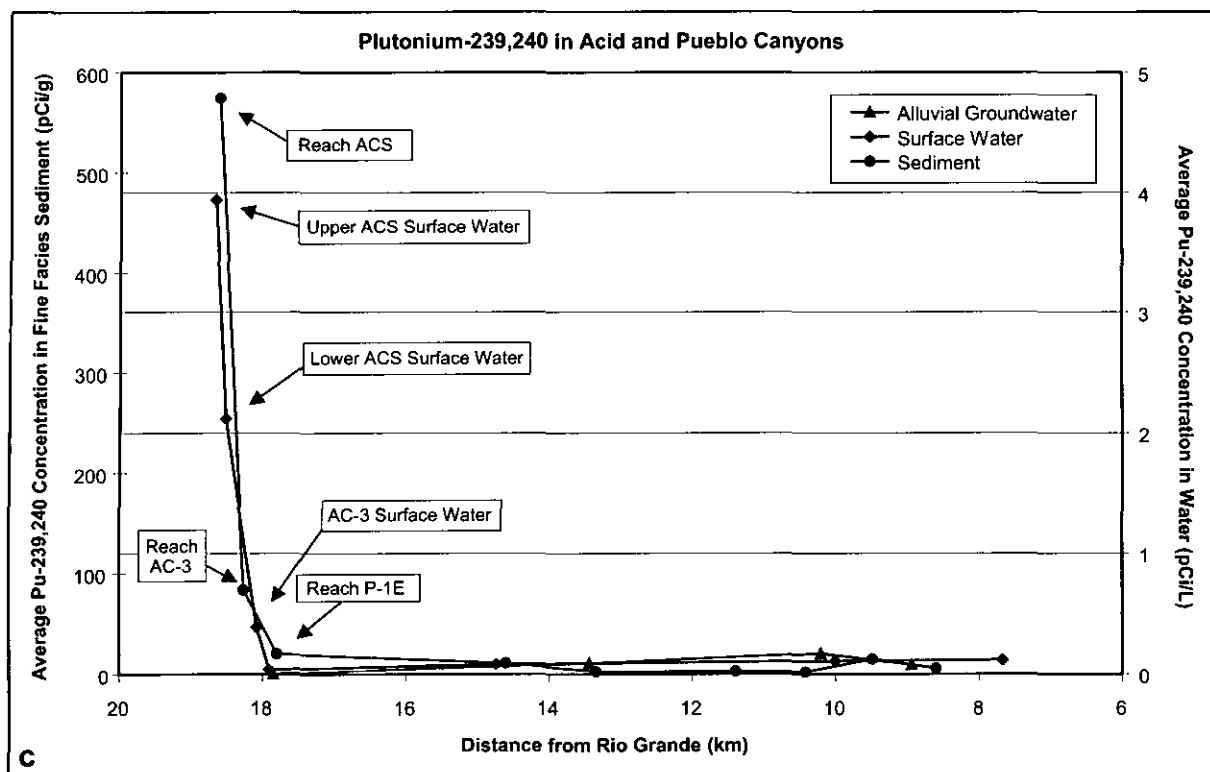


Figure 7.2-13 (continued). Spatial relation between estimated average concentrations of plutonium-239,240 in fine facies sediment, surface water, and alluvial groundwater in different portions of the Los Alamos and Pueblo watershed

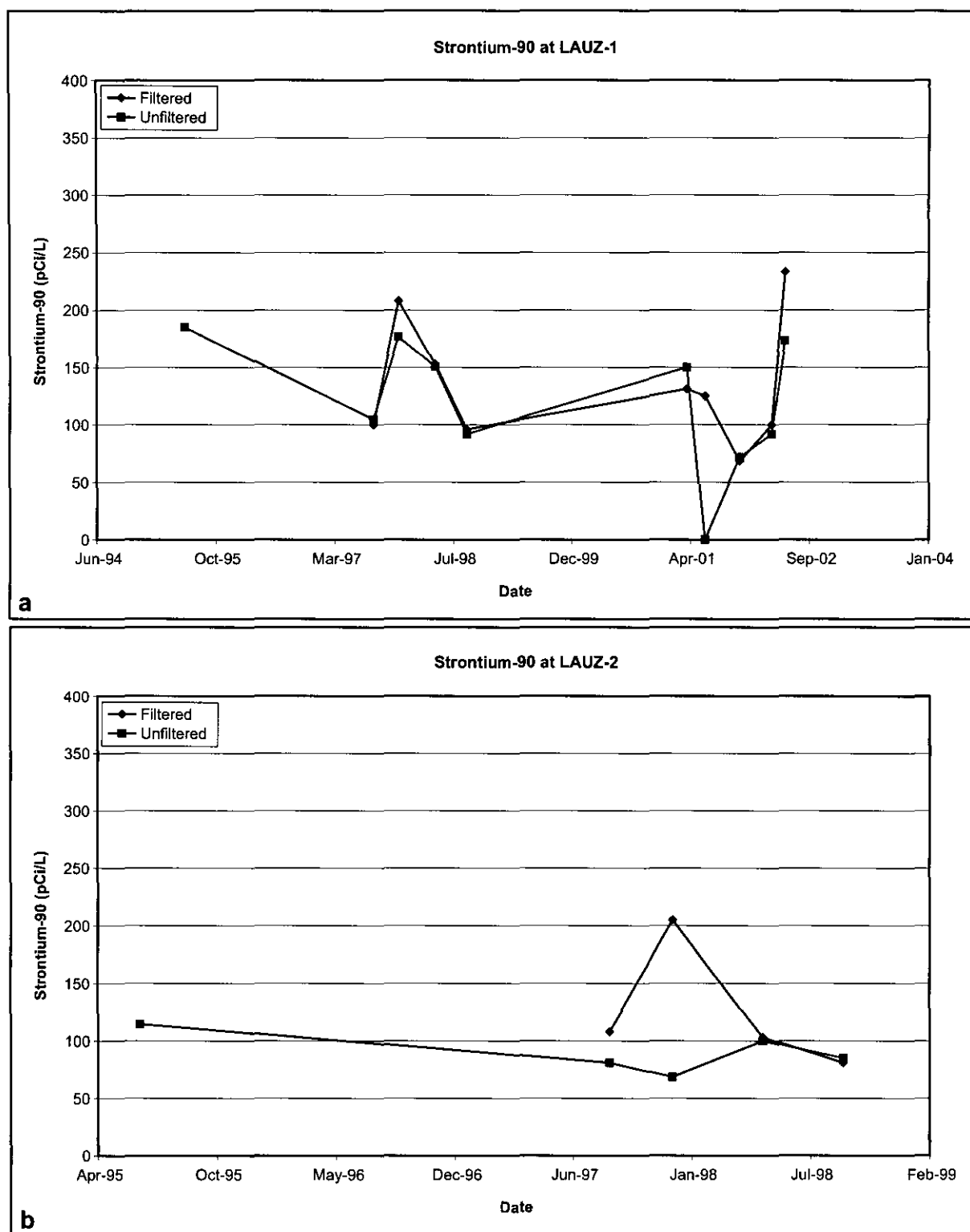


Figure 7.2-14. Time series plots for strontium-90 in surface water and alluvial groundwater in DP Canyon

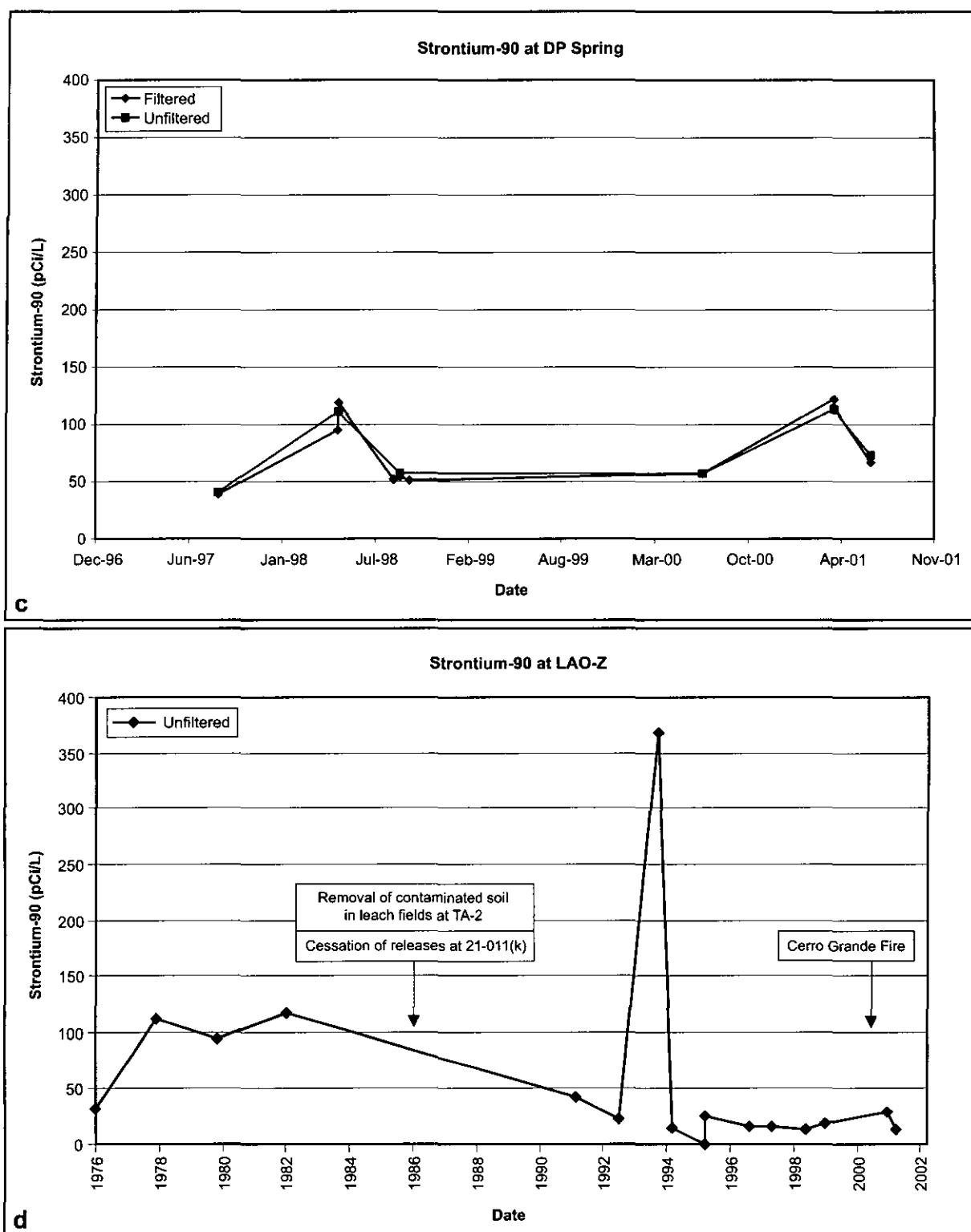


Figure 7.2-14 (continued). Time series plots for strontium-90 in surface water and alluvial groundwater in DP Canyon

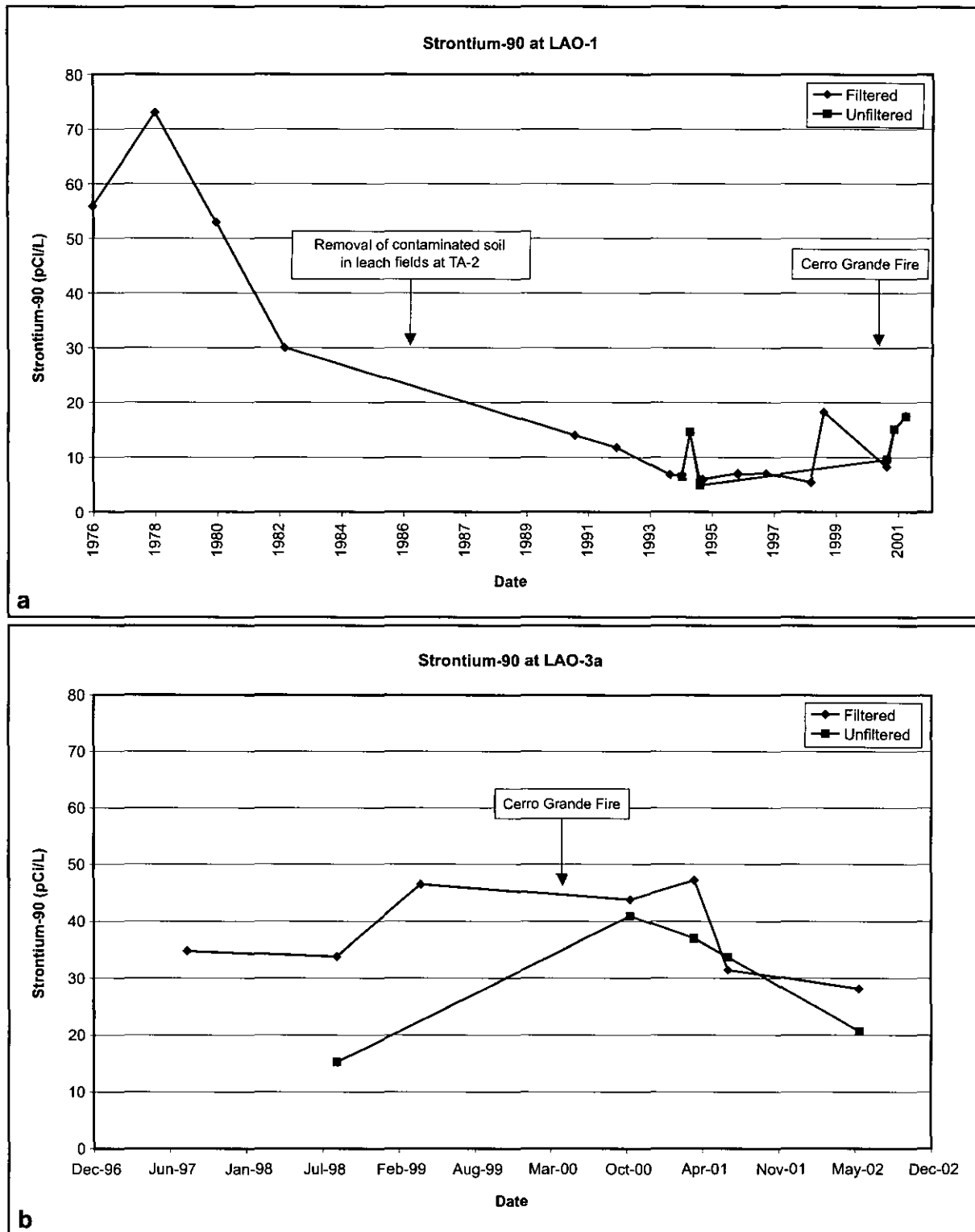


Figure 7.2-15. Time series for strontium-90 in alluvial groundwater in upper Los Alamos Canyon

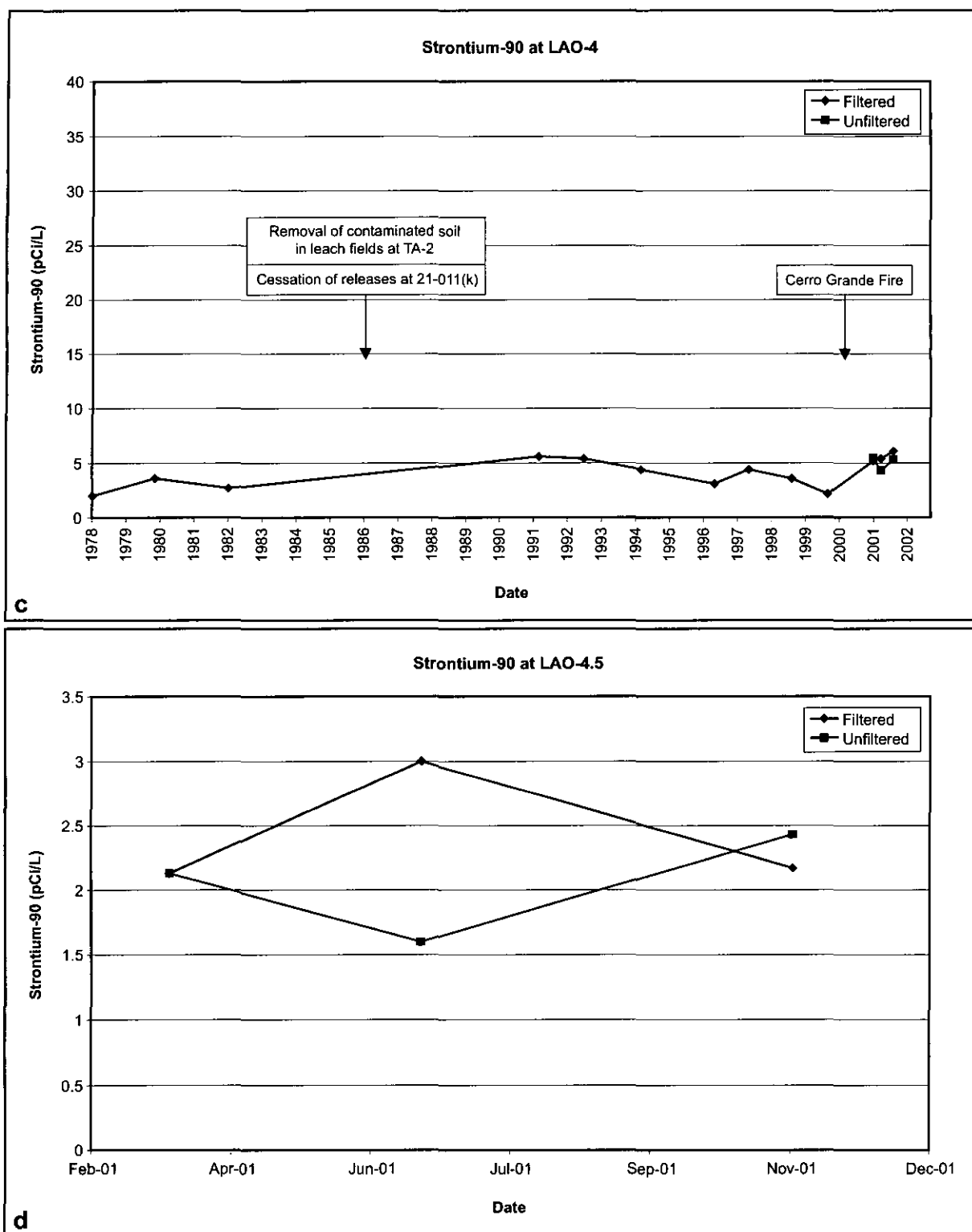


Figure 7.2-15 (continued). Time series for strontium-90 in alluvial groundwater in upper Los Alamos Canyon

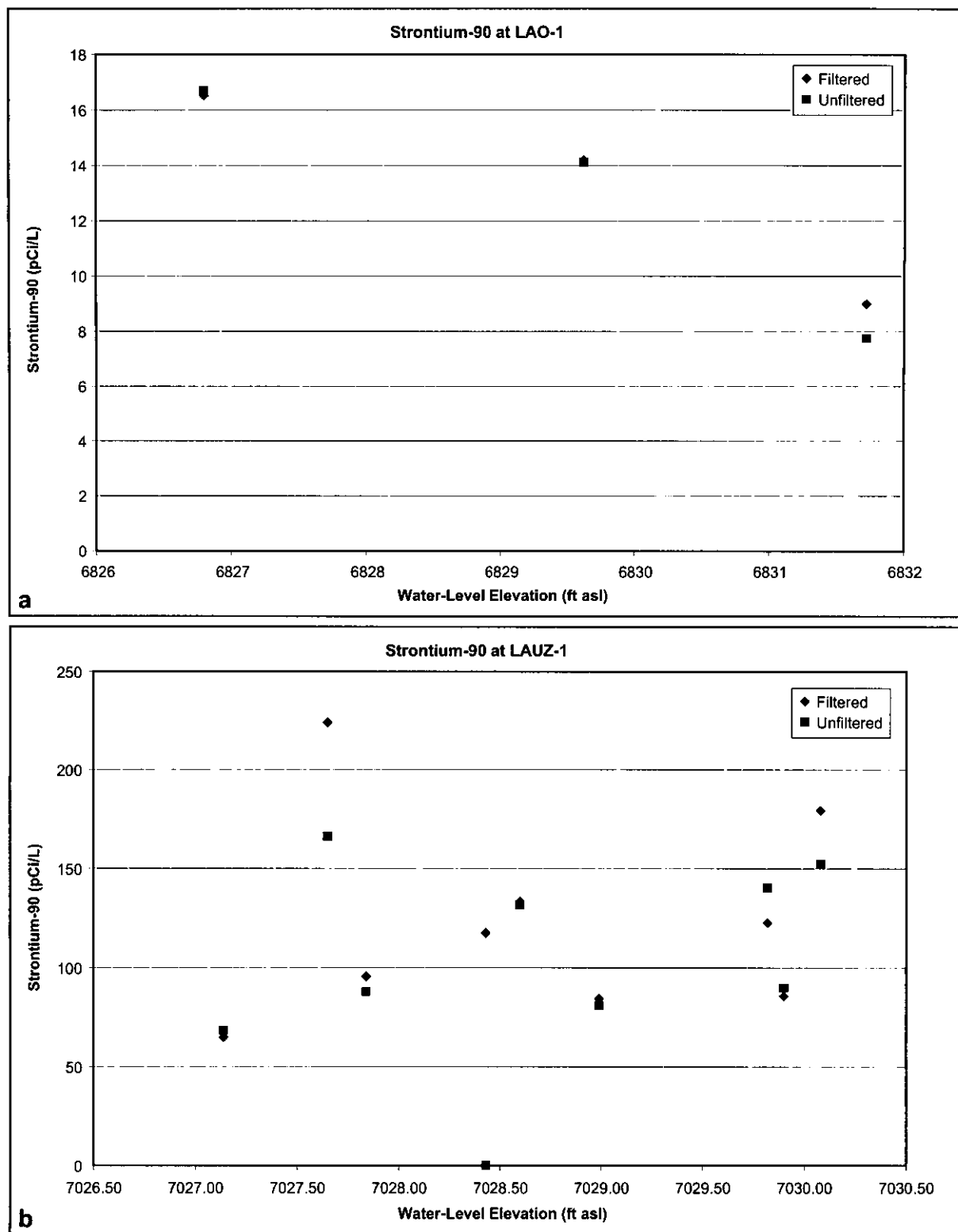


Figure 7.2-16. Decay-corrected strontium-90 concentrations plotted versus water level for select alluvial monitoring wells in DP and Los Alamos Canyons

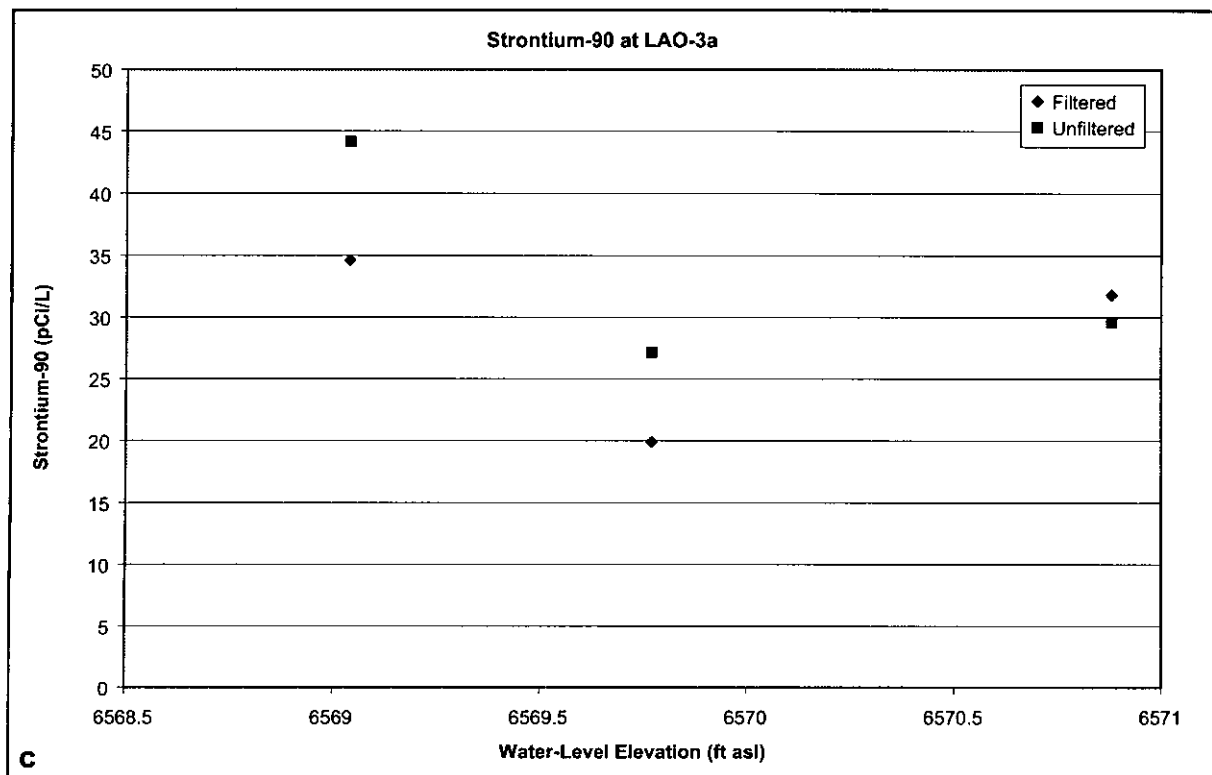


Figure 7.2-16 (continued). Decay-corrected strontium-90 concentrations plotted versus water level for select alluvial monitoring wells in DP and Los Alamos Canyons

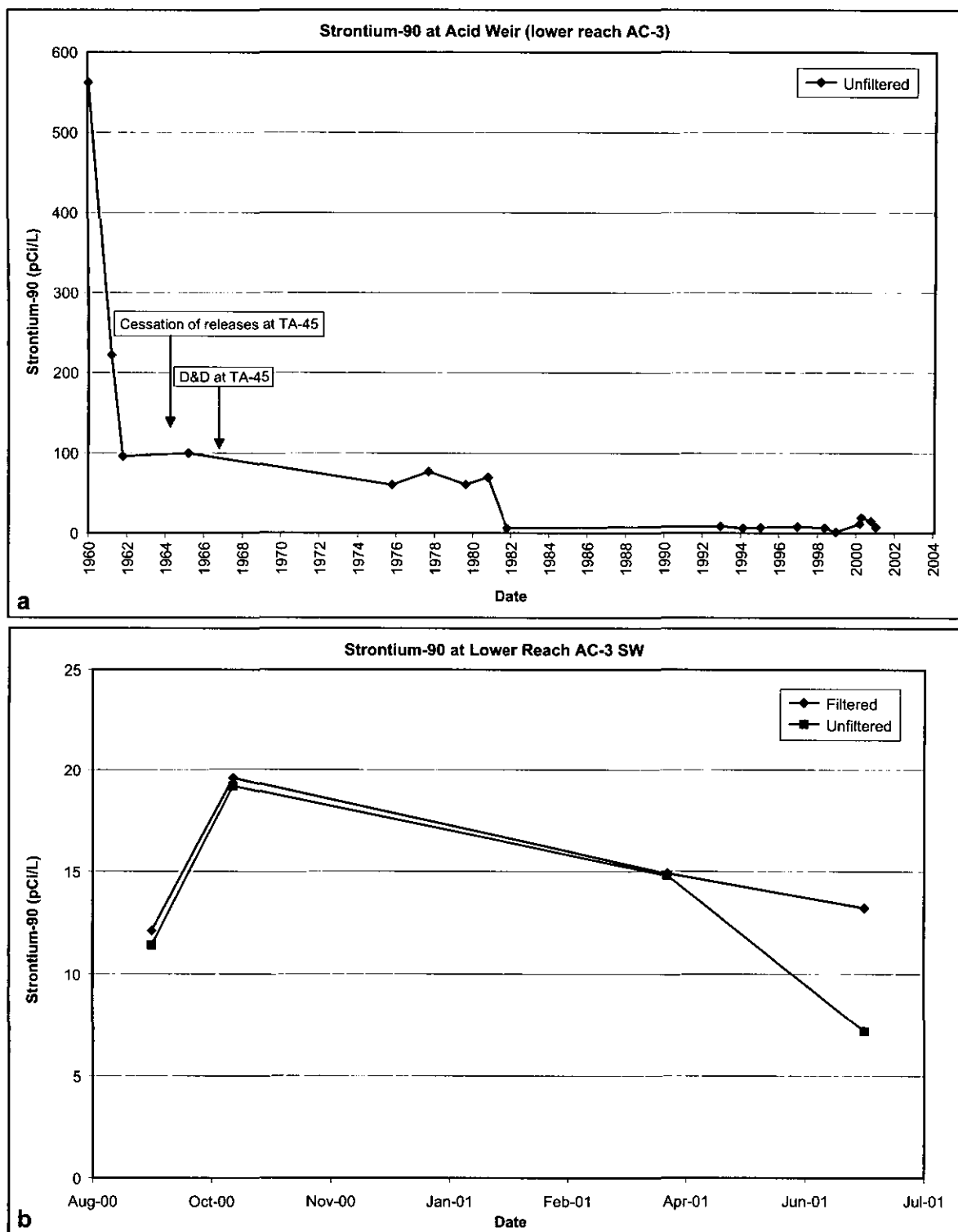


Figure 7.2-17. Time series for strontium-90 in Acid Canyon showing the long-term trend at Acid Weir from (a) Laboratory environmental surveillance data and this investigation and (b) a shorter-term trend from data collected at a surface water location in lower reach AC-3 during this investigation

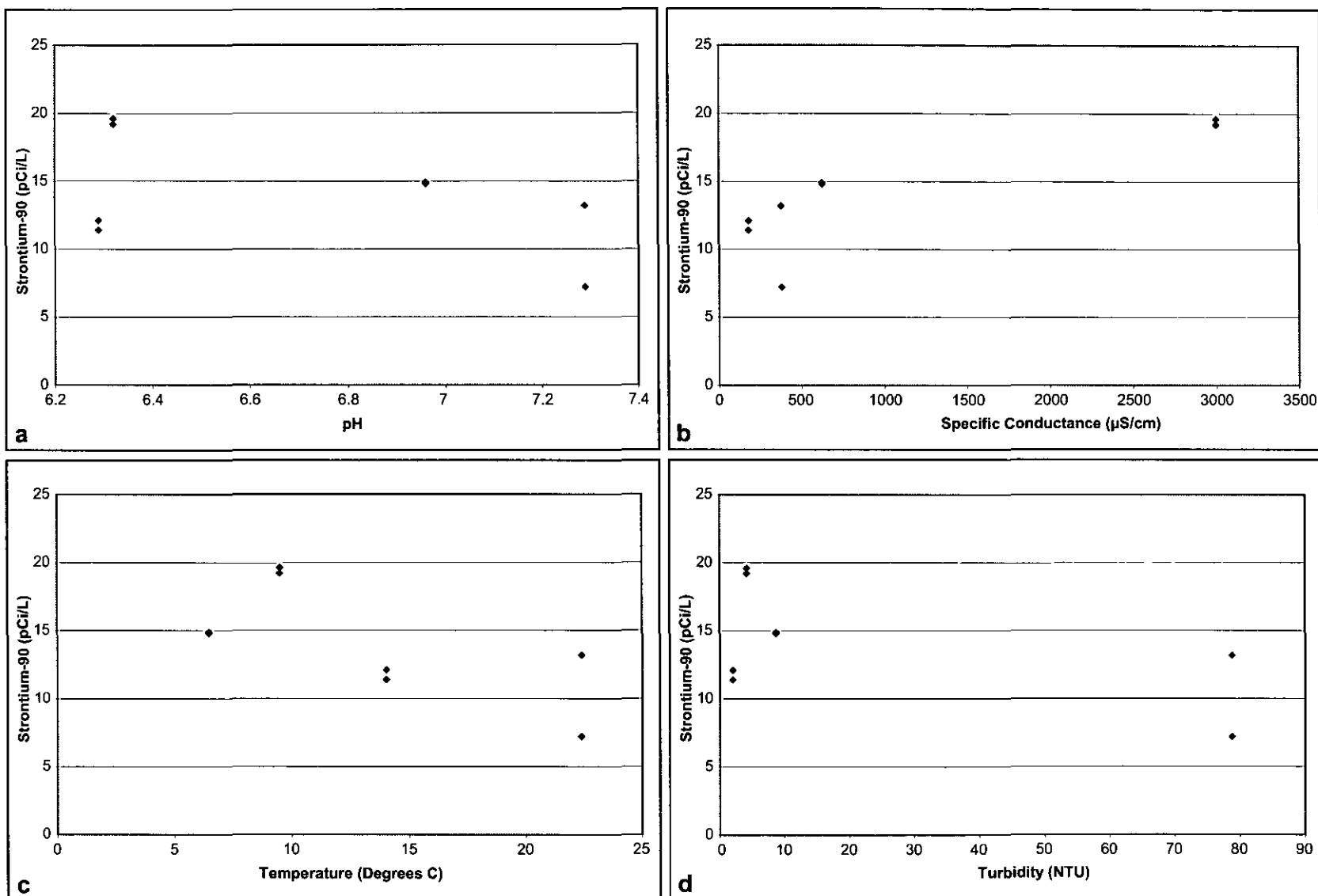


Figure 7.2-18. Strontium-90 concentrations from the surface water location in lower reach AC-3 plotted versus field parameters: (a) pH, (b) specific conductance, (c) temperature, and (d) turbidity

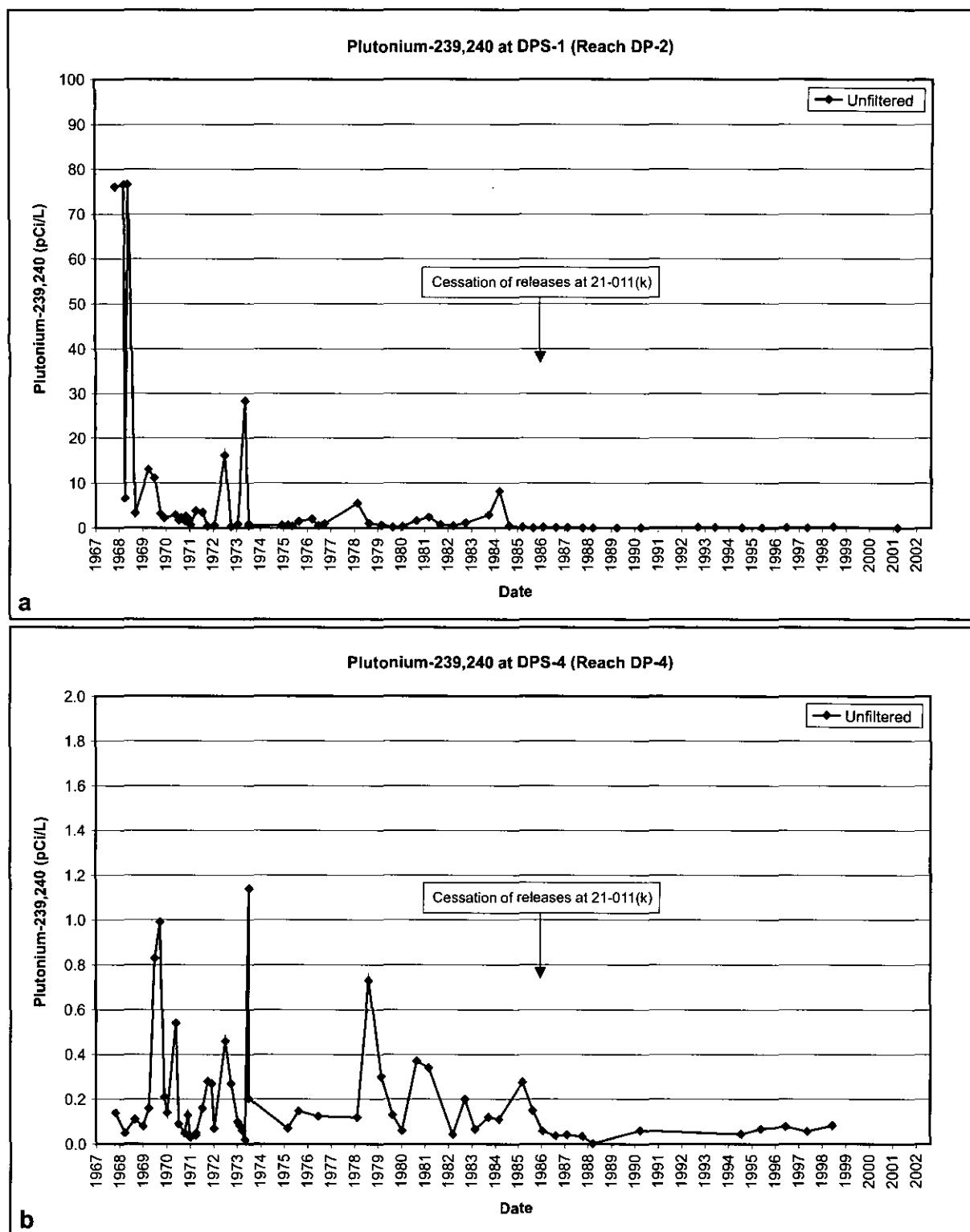


Figure 7.2-19. Long-term time series of plutonium-239,240 in surface water (a and b) and alluvial groundwater (c) in DP Canyon. The long-term record includes data primarily from the environmental surveillance record.

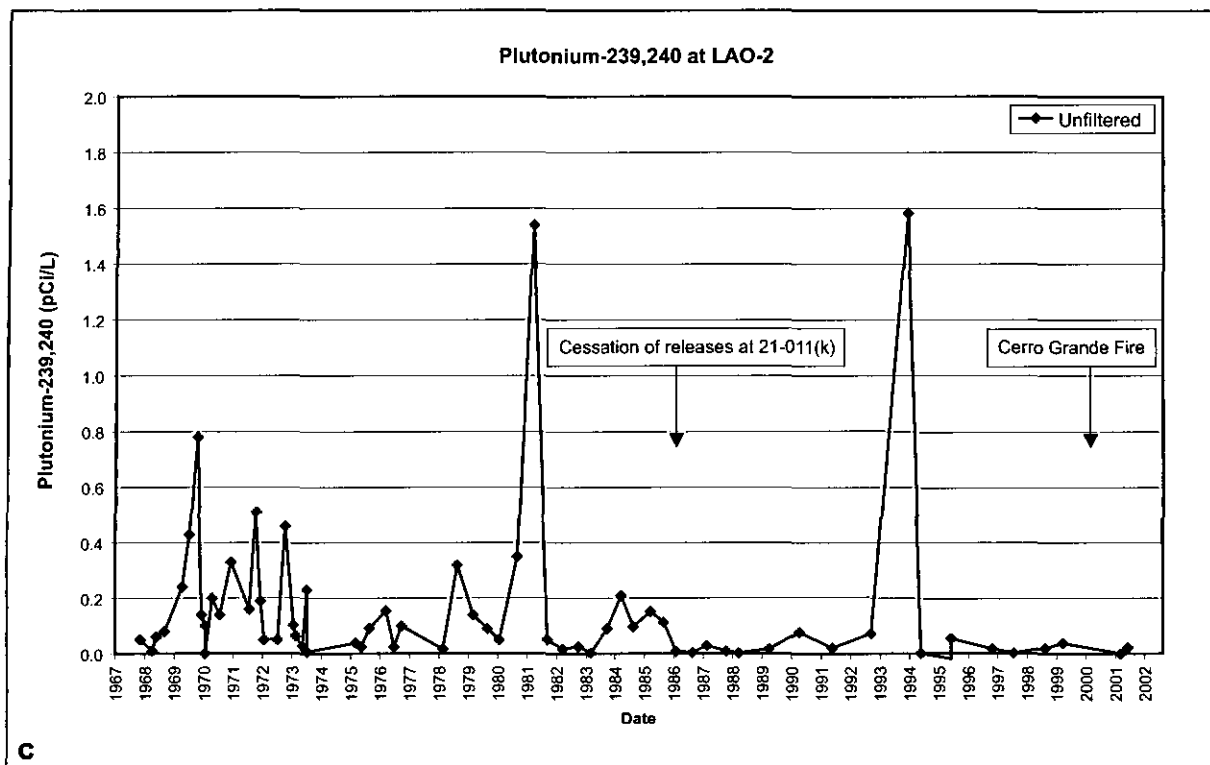


Figure 7.2-19 (continued). Long-term time series of plutonium-239,240 in surface water (a and b) and alluvial groundwater (c) in DP Canyon. The long-term record includes data primarily from the environmental surveillance record.

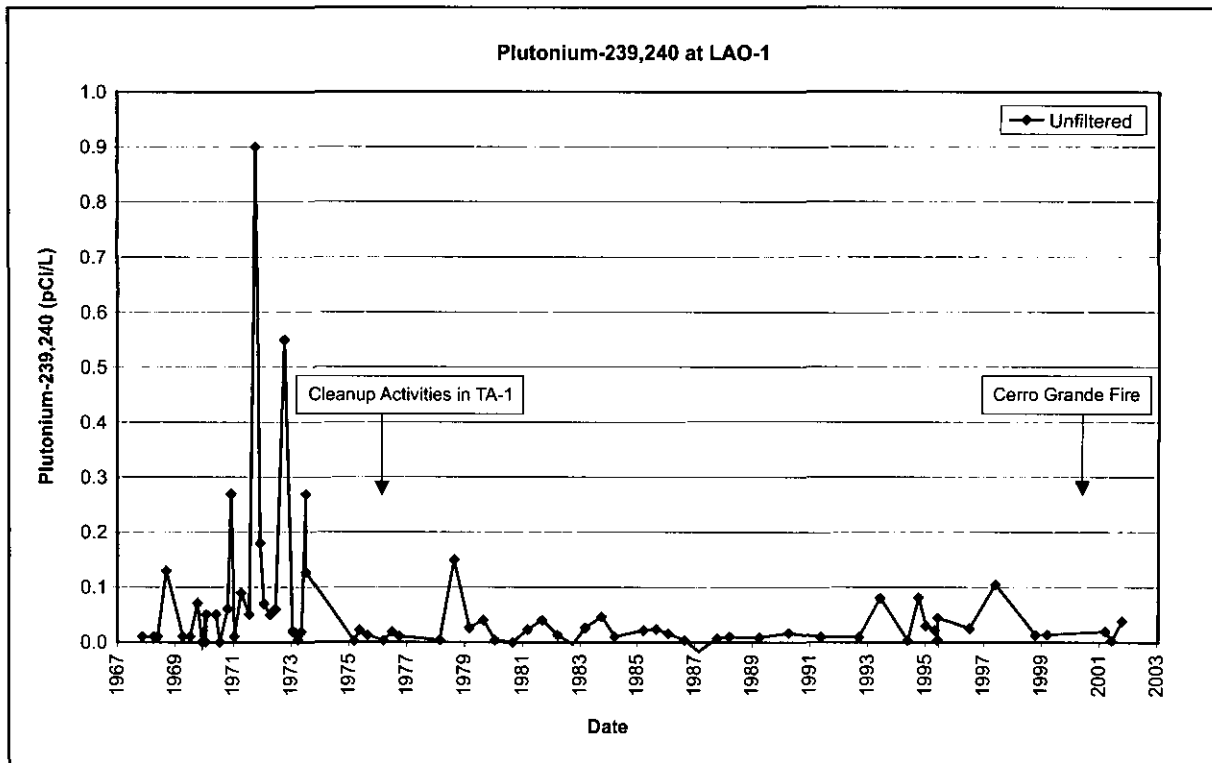


Figure 7.2-20. Long-term time series of plutonium-239,240 at alluvial monitoring well LAO-1 in upper Los Alamos Canyon. The long-term record includes data primarily from the environmental surveillance record.

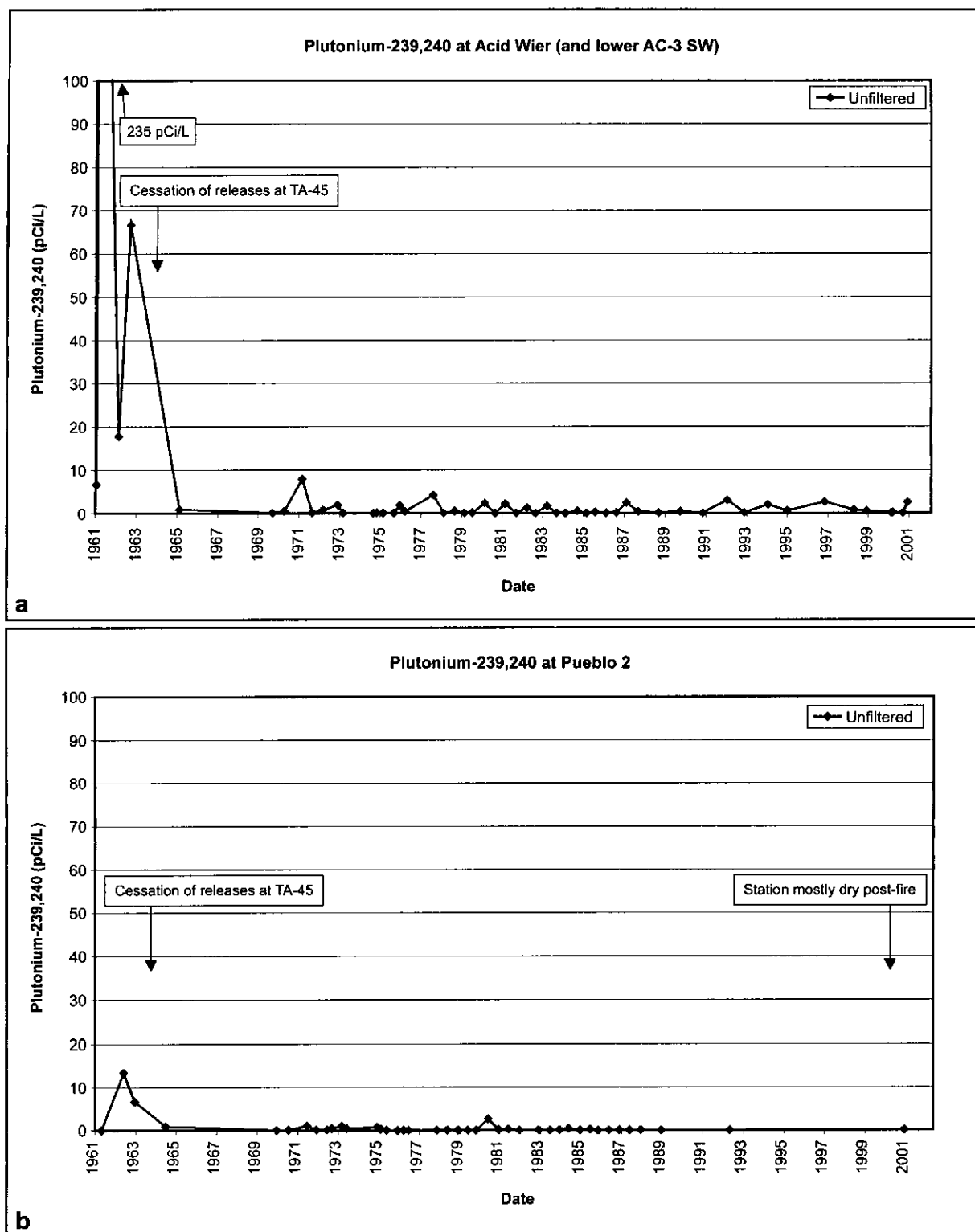


Figure 7.2-21. Time series of plutonium-239,240 in surface water (a–d) and alluvial groundwater (e and f) in Pueblo Canyon. Long-term record shown in (a–d) includes data primarily from the environmental surveillance record.

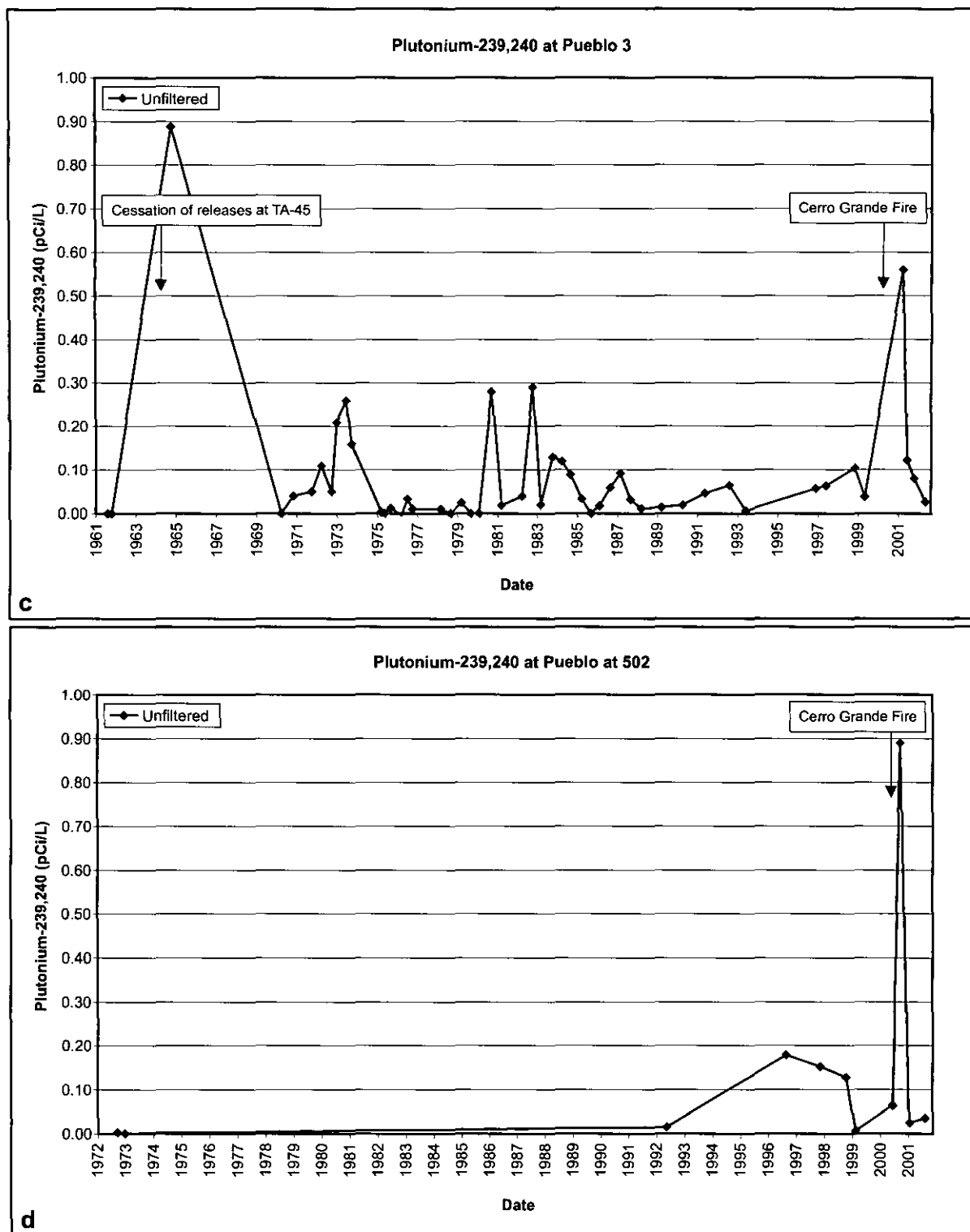


Figure 7.2-21 (continued). Time series of plutonium-239,240 in surface water (a–d) and alluvial groundwater (e and f) in Pueblo Canyon. Long-term record shown in (a–d) includes data primarily from the environmental surveillance record.

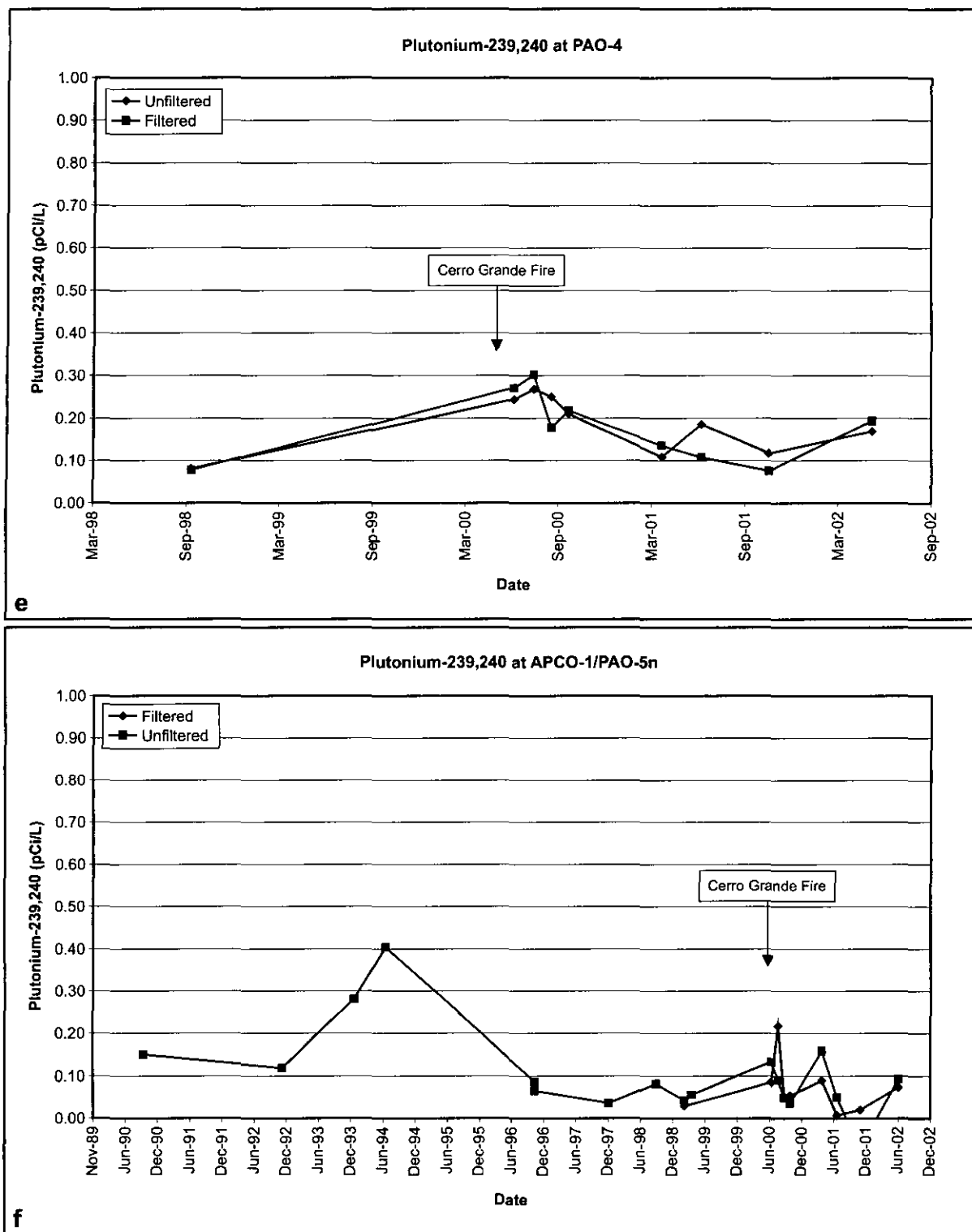


Figure 7.2-21 (continued). Time series of plutonium-239,240 in surface water (a–d) and alluvial groundwater (e and f) in Pueblo Canyon. Long-term record shown in (a–d) includes data primarily from the environmental surveillance record.

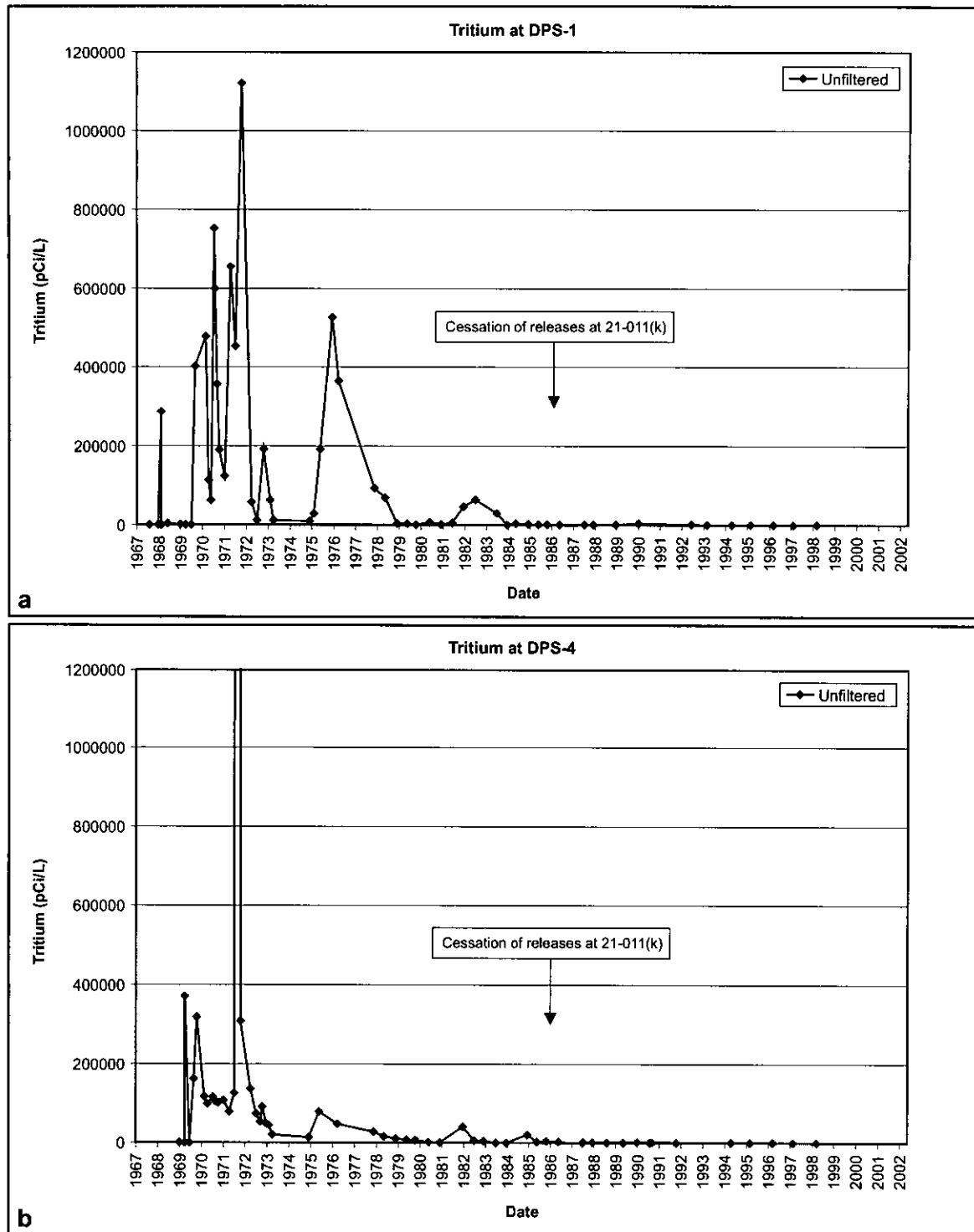


Figure 7.2-22. Long-term time series of tritium in DP and upper Los Alamos Canyons showing surface water data from DP Canyon (a and b), alluvial groundwater data from LAO-2 in DP Canyon at the confluence with upper Los Alamos Canyon (c), and alluvial groundwater data from monitoring wells located in upper Los Alamos Canyon below the DP confluence (d–g).

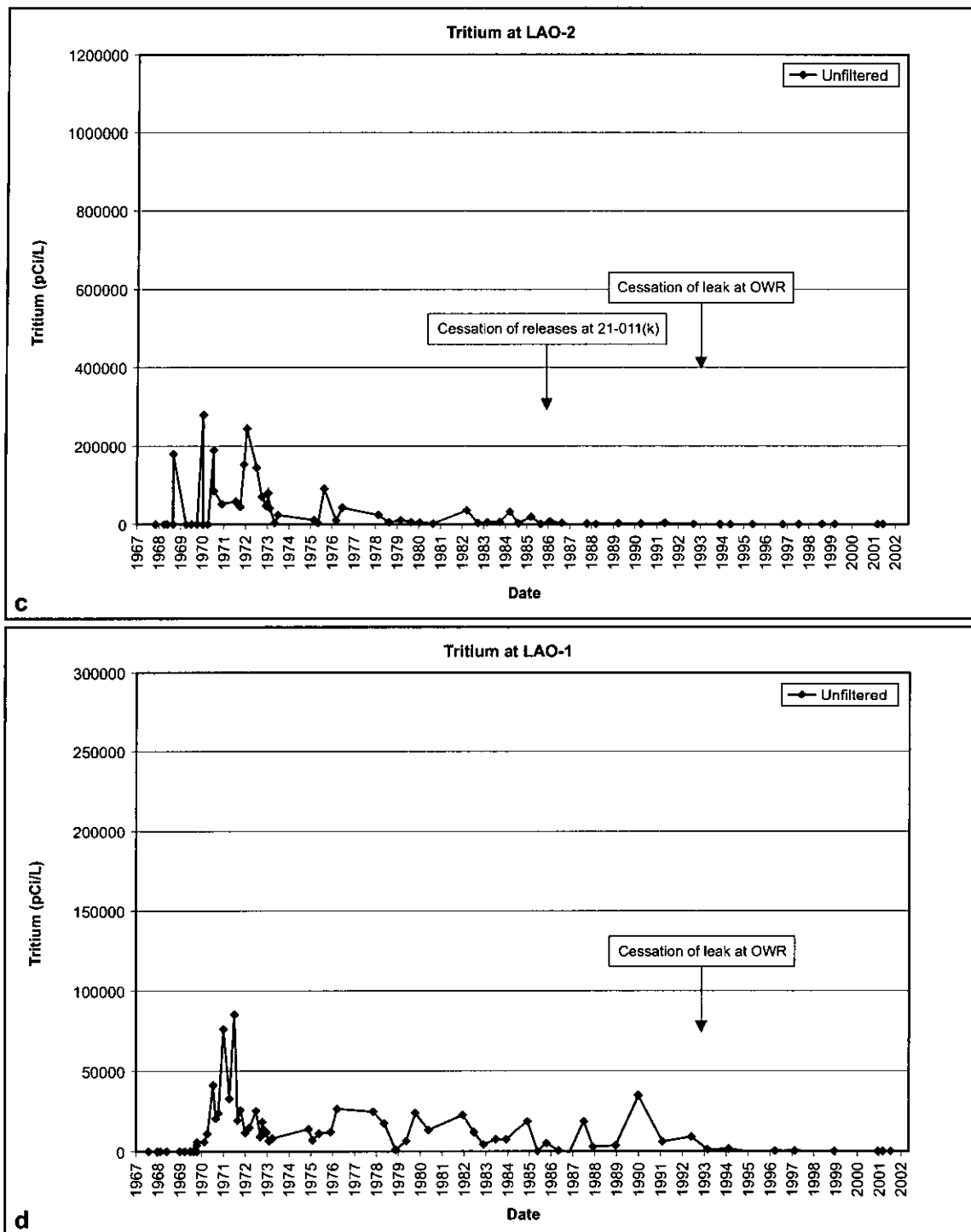


Figure 7.2-22 (continued). Long-term time series of tritium in DP and upper Los Alamos Canyons showing surface water data from DP Canyon (a and b), alluvial groundwater data from LAO-2 in DP Canyon at the confluence with upper Los Alamos Canyon (c), and alluvial groundwater data from monitoring wells located in upper Los Alamos Canyon below the DP confluence (d-g).

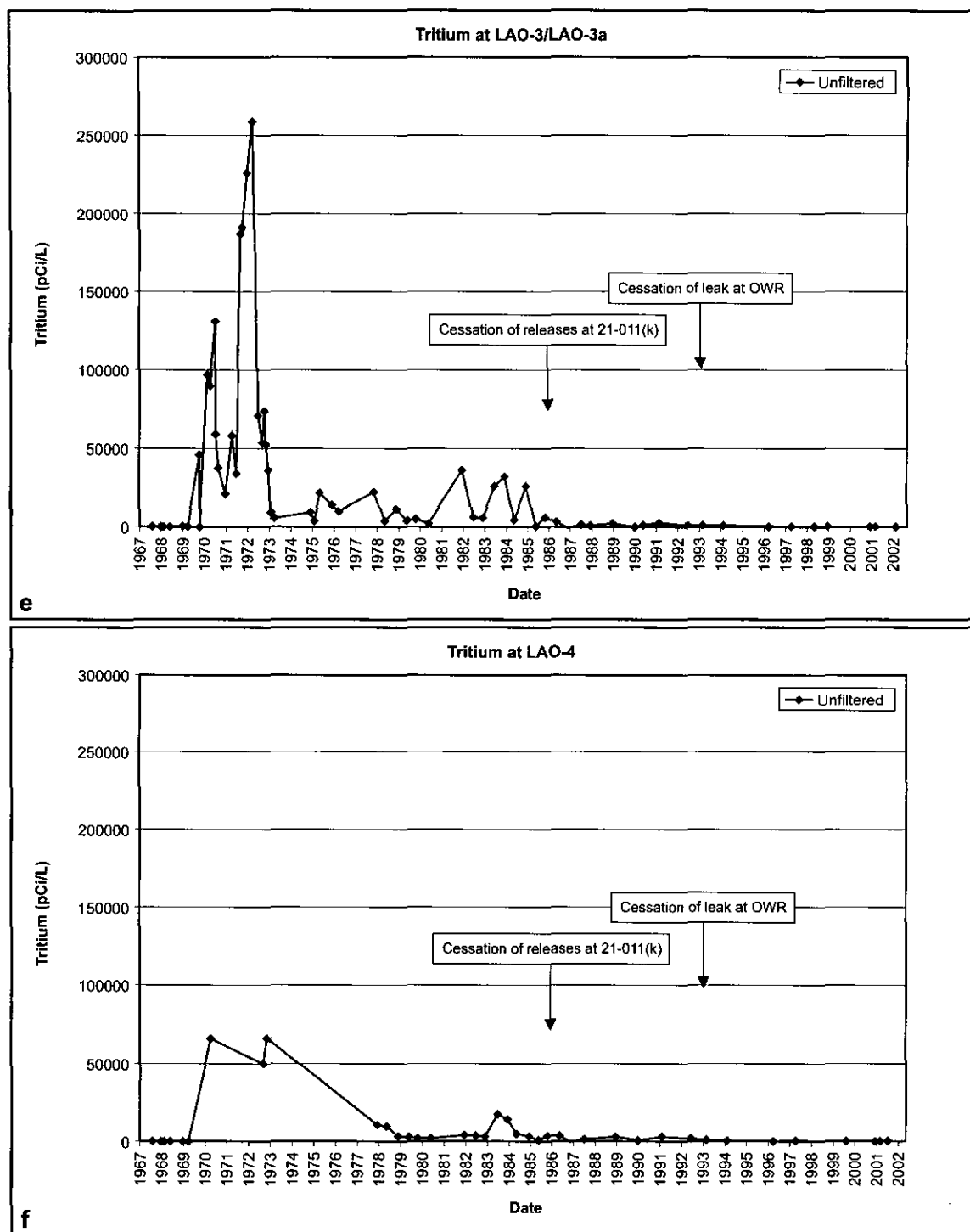


Figure 7.2-22 (continued). Long-term time series of tritium in DP and upper Los Alamos Canyons showing surface water data from DP Canyon (a and b), alluvial groundwater data from LAO-2 in DP Canyon at the confluence with upper Los Alamos Canyon (c), and alluvial groundwater data from monitoring wells located in upper Los Alamos Canyon below the DP confluence (d–g).

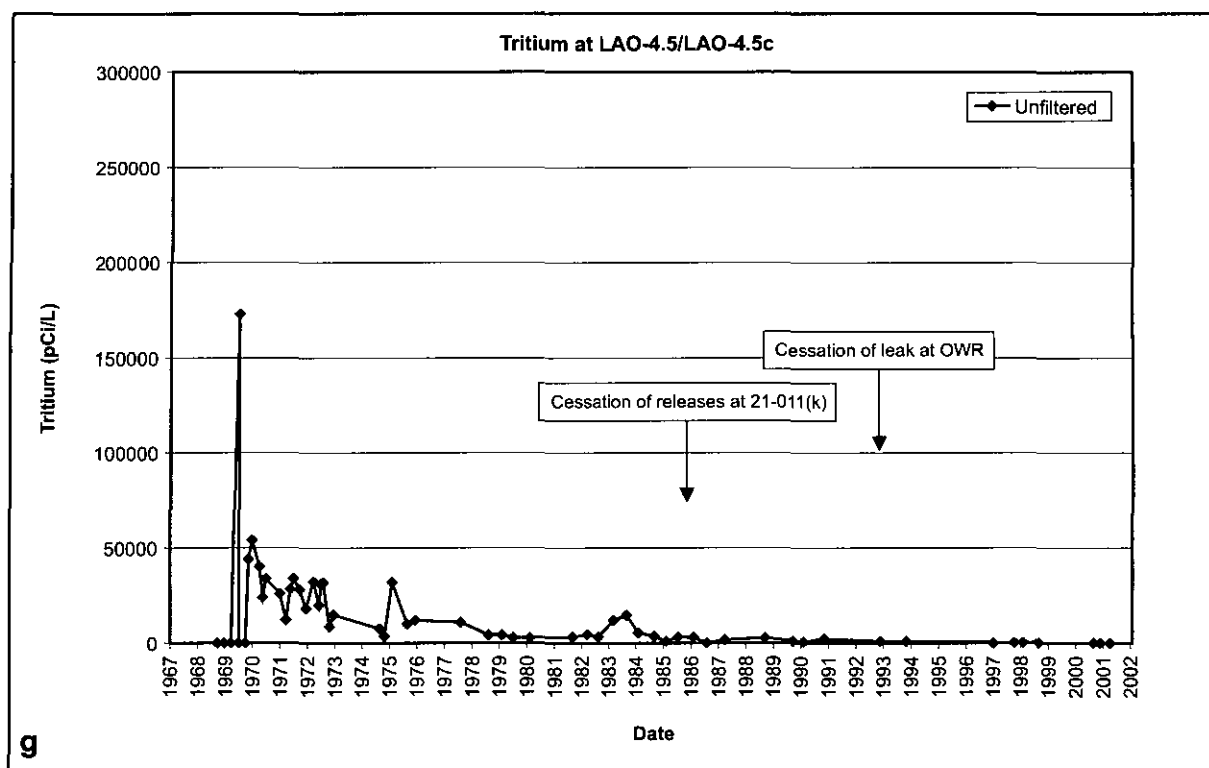


Figure 7.2-22 (continued). Long-term time series of tritium in DP and upper Los Alamos Canyons showing surface water data from DP Canyon (a and b), alluvial groundwater data from LAO-2 in DP Canyon at the confluence with upper Los Alamos Canyon (c), and alluvial groundwater data from monitoring wells located in upper Los Alamos Canyon below the DP confluence (d–g).

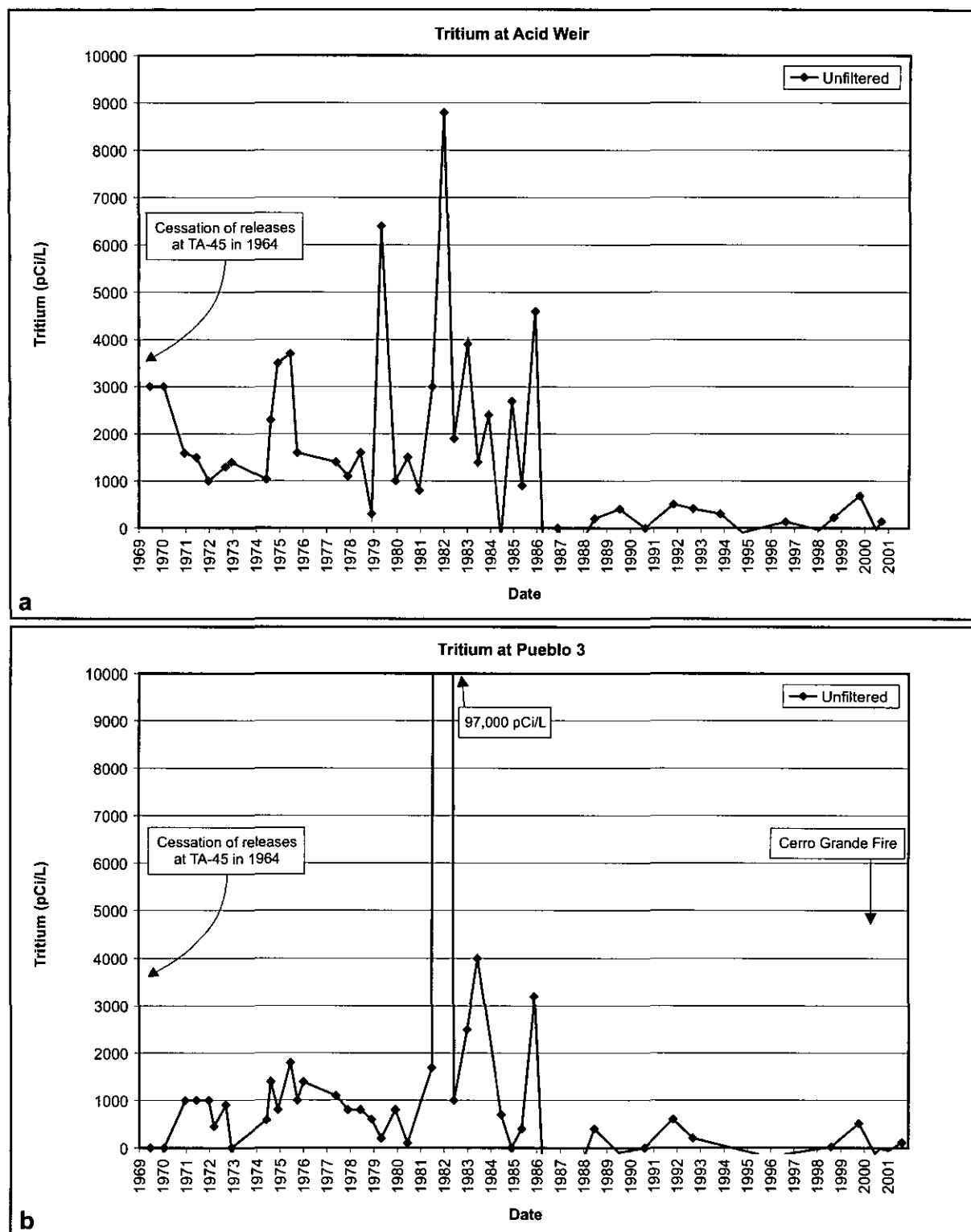


Figure 7.2-23. Long-term time series of tritium in Acid and Pueblo Canyon surface water (a–c), and at Basalt Spring (d). The long-term record includes data primarily from the Laboratory’s environmental surveillance record.

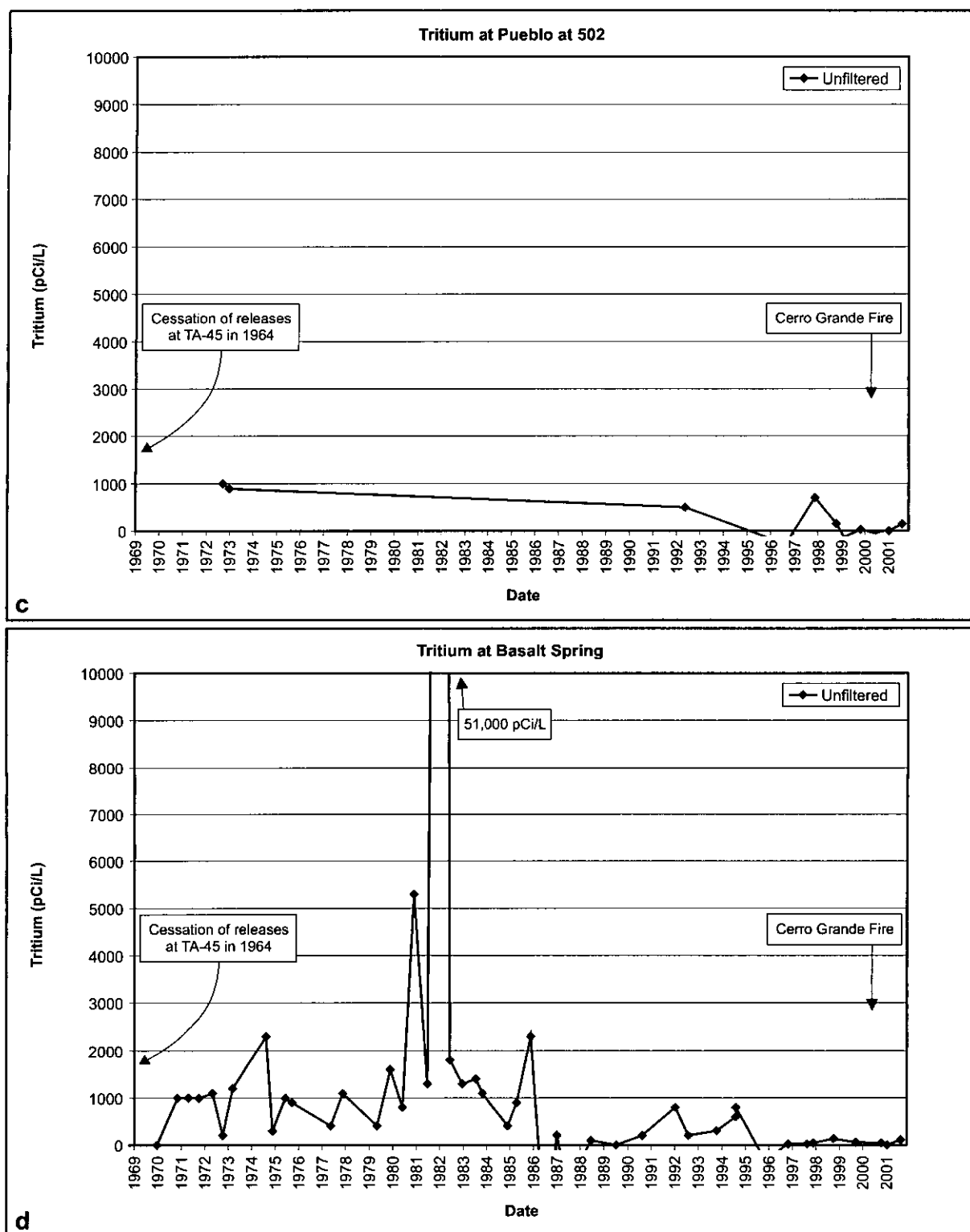


Figure 7.2-23 (continued). Long-term time series of tritium in Acid and Pueblo Canyon surface water (a–c) and at Basalt Spring (d). The long-term record includes data primarily from the Laboratory’s environmental surveillance record.

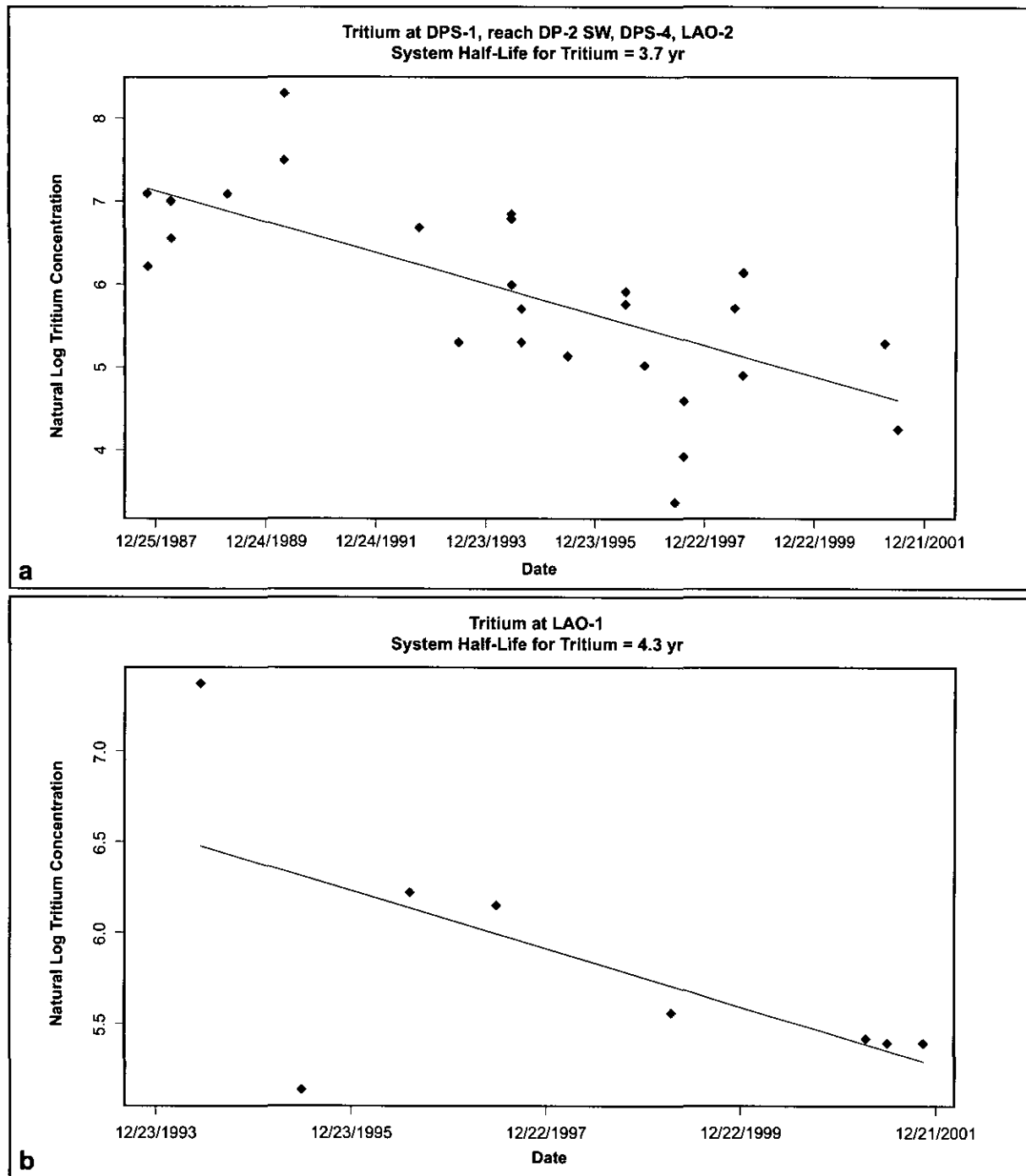


Figure 7.2-24. Natural log of tritium concentrations from combined water locations plotted versus time for monitoring locations in (a) DP Canyon, (b) monitoring well LAO-1 in upper Los Alamos Canyon above the DP Canyon confluence, (c) monitoring locations in the portion of upper Los Alamos Canyon below the DP Canyon confluence, and (d) a surface water monitoring location in Acid Canyon. The plots also show a regression line that has a slope used to calculate an estimated "system half-life" for tritium.

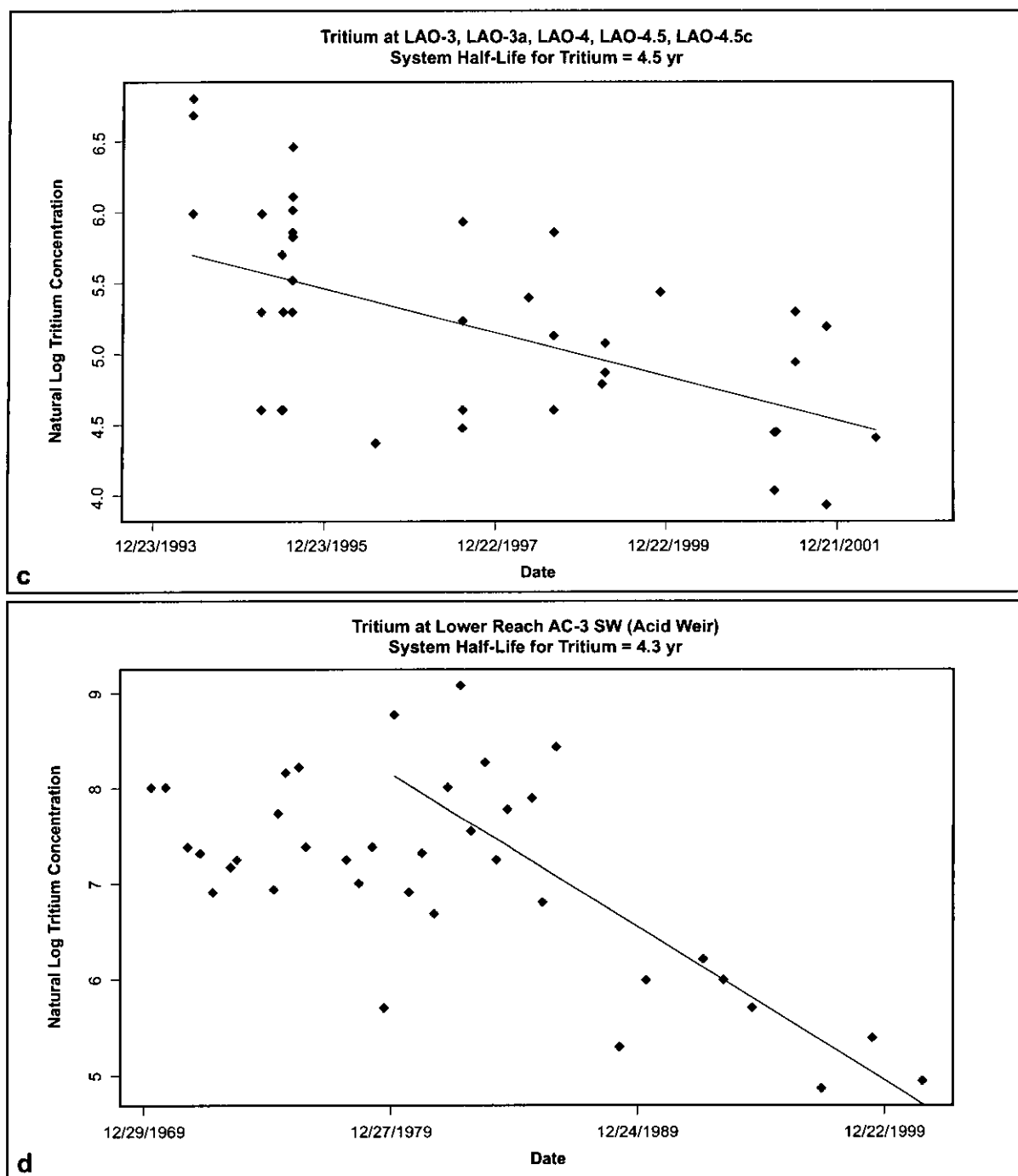


Figure 7.2-24 (continued). Natural log of tritium concentrations from combined water locations plotted versus time for monitoring locations in (a) DP Canyon, (b) monitoring well LAO-1 in upper Los Alamos Canyon above the DP Canyon confluence, (c) monitoring locations in the portion of upper Los Alamos Canyon below the DP Canyon confluence, and (d) a surface water monitoring location in Acid Canyon. The plots also show a regression line that has a slope used to calculate an estimated “system half-life” for tritium.

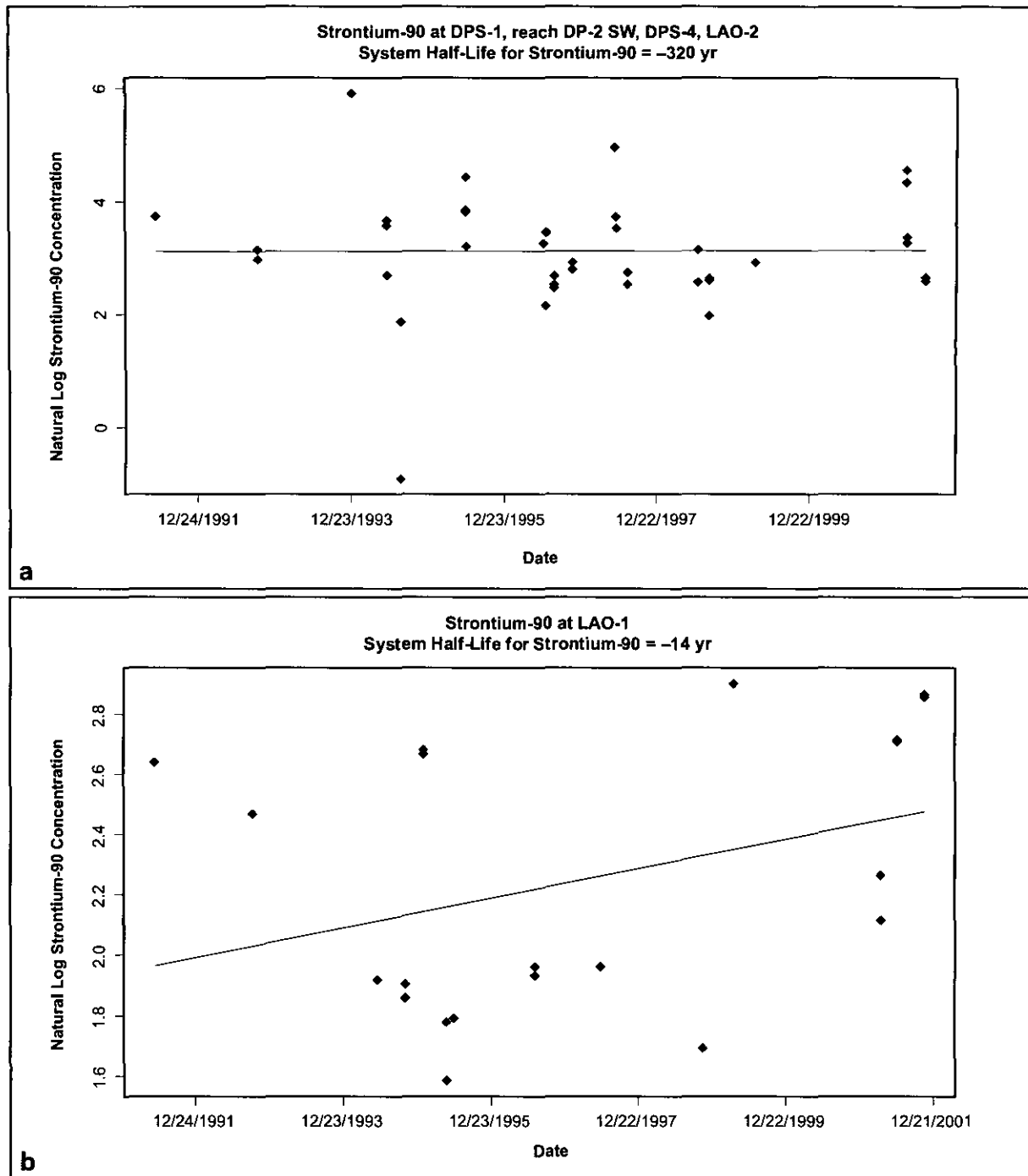


Figure 7.2-25. Natural log of strontium-90 concentrations from combined water locations plotted versus time for monitoring locations in (a) DP Canyon, (b) monitoring well LAO-1 in upper Los Alamos Canyon above the DP Canyon confluence, (c) monitoring locations in the portion of upper Los Alamos Canyon below the DP Canyon confluence, and (d) a surface water monitoring location in Acid Canyon. The plots also show a regression line that has a slope used to calculate an estimated "system half-life" for strontium-90.

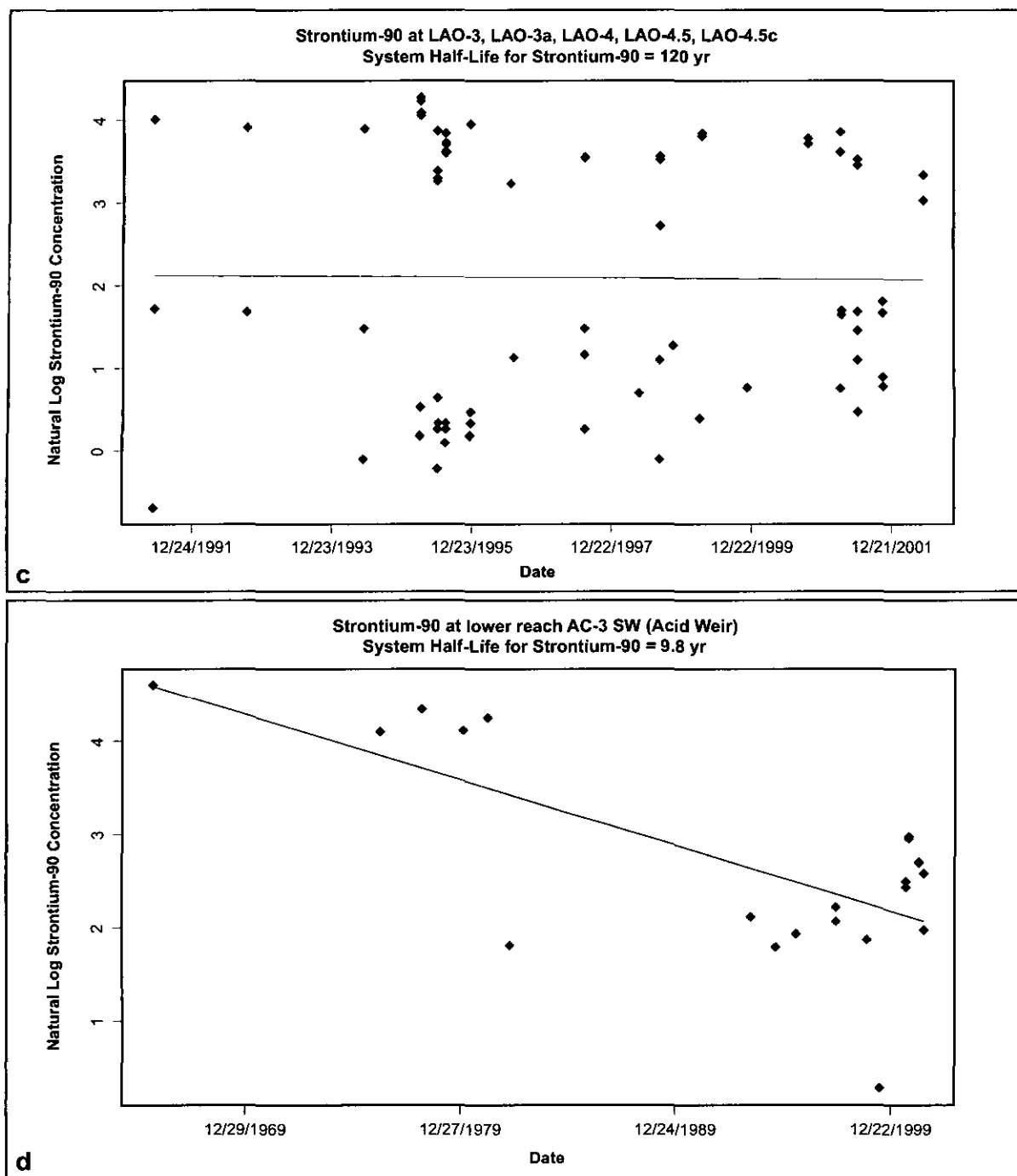


Figure 7.2-25 (continued). Natural log of strontium-90 concentrations from combined water locations plotted versus time for monitoring locations in (a) DP Canyon, (b) monitoring well LAO-1 in upper Los Alamos Canyon above the DP Canyon confluence, (c) monitoring locations in the portion of upper Los Alamos Canyon below the DP Canyon confluence, and (d) a surface water monitoring location in Acid Canyon. The plots also show a regression line that has a slope used to calculate an estimated “system half-life” for strontium-90.

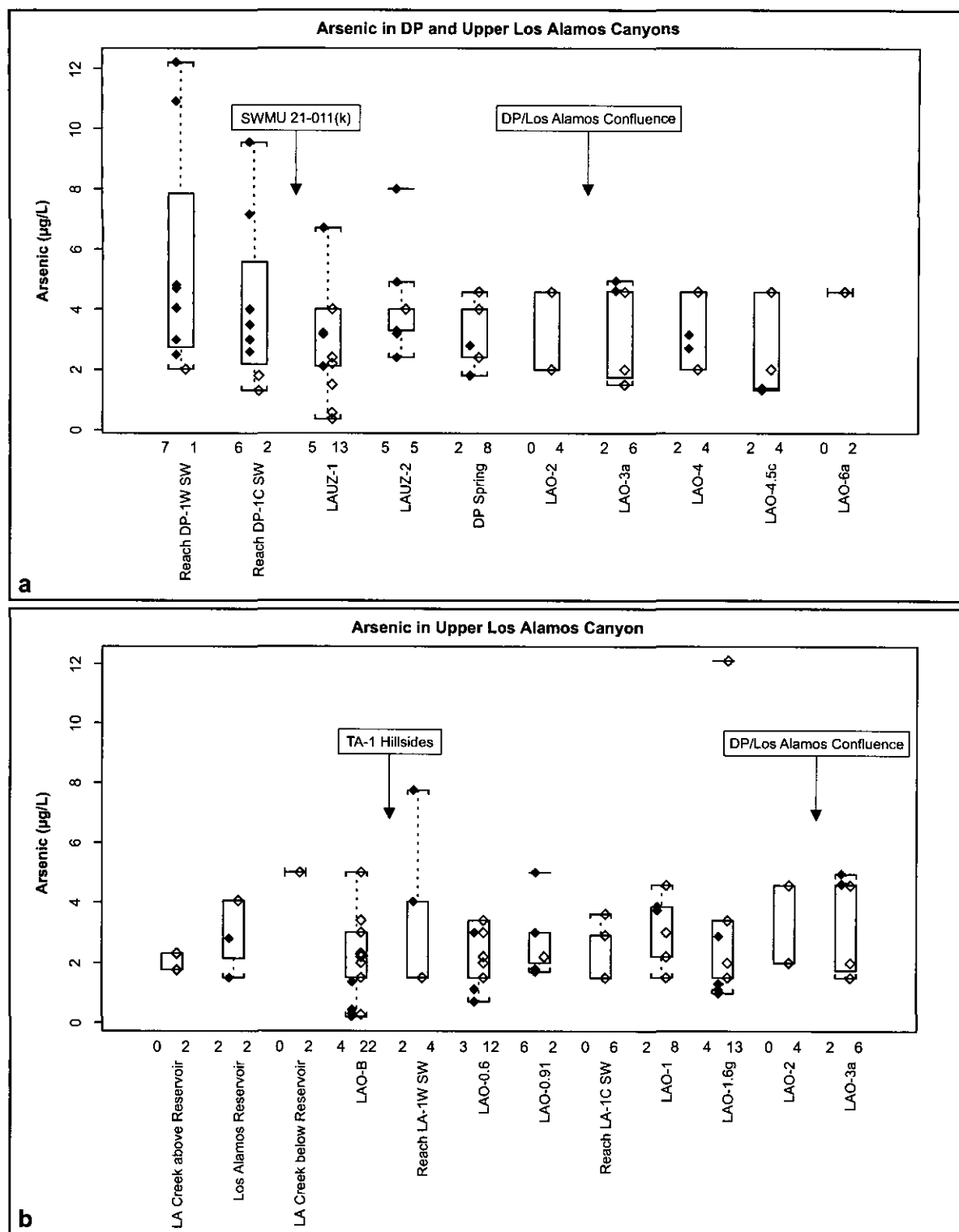


Figure 7.2-26. Box plots showing the spatial distribution of arsenic at surface water and alluvial groundwater locations in the Los Alamos and Pueblo watershed. Annotation shows the relative locations of key contaminant sources and other geographic features.

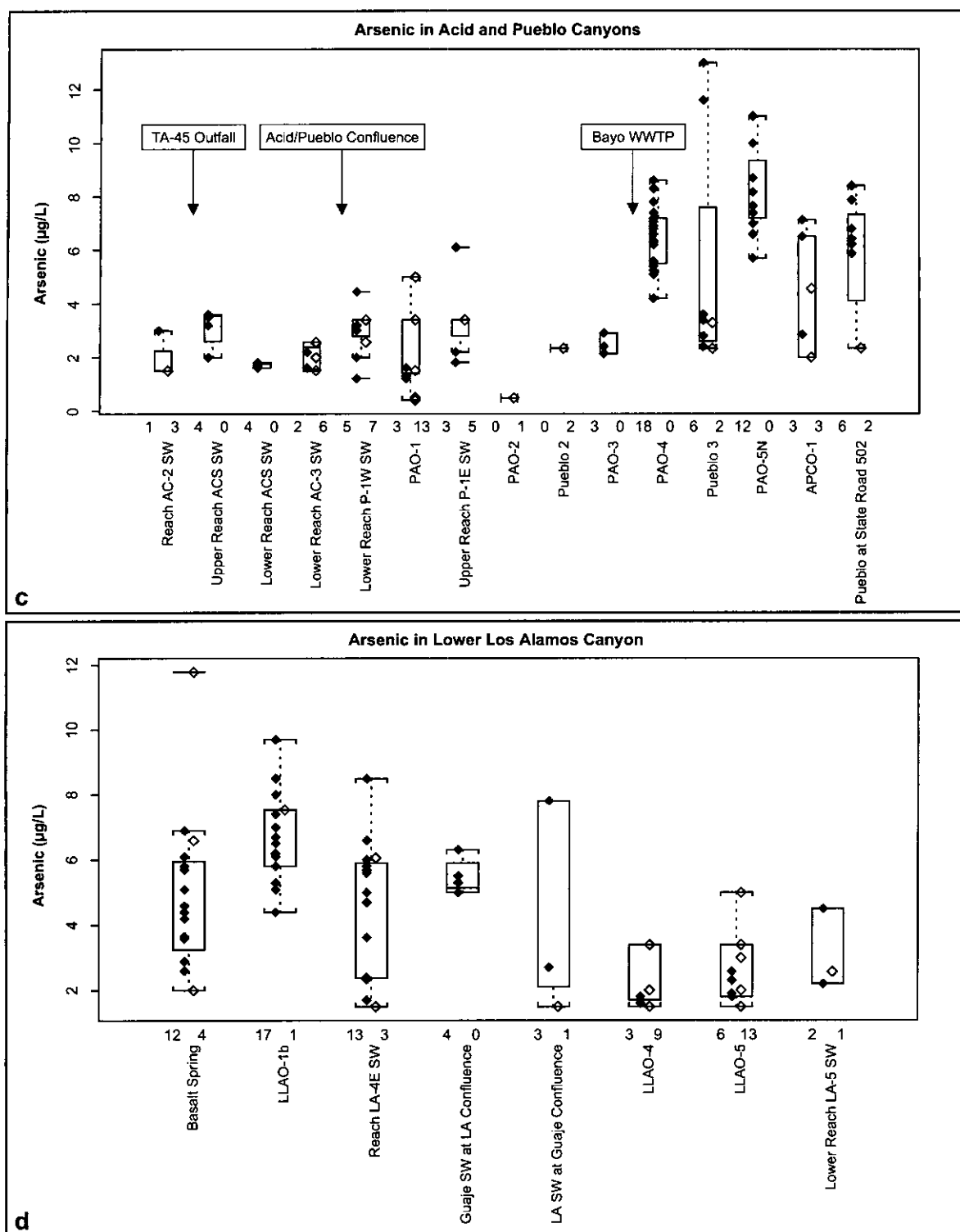


Figure 7.2-26 (continued). Box plots showing the spatial distribution of arsenic at surface water and alluvial groundwater locations in the Los Alamos and Pueblo watershed. Annotation shows the relative locations of key contaminant sources and other geographic features.

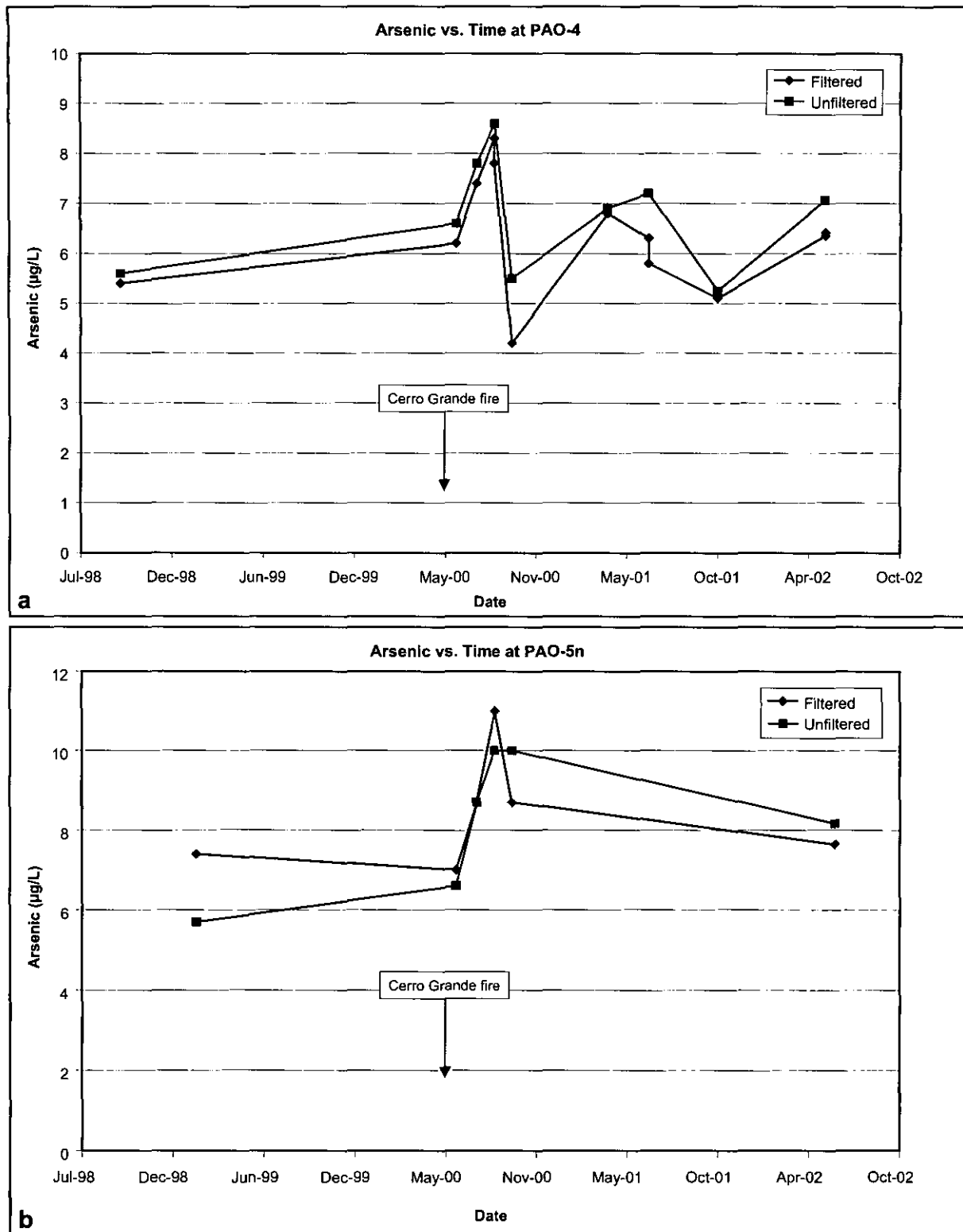


Figure 7.2-27. Time series for arsenic at select alluvial monitoring well locations in Pueblo Canyon

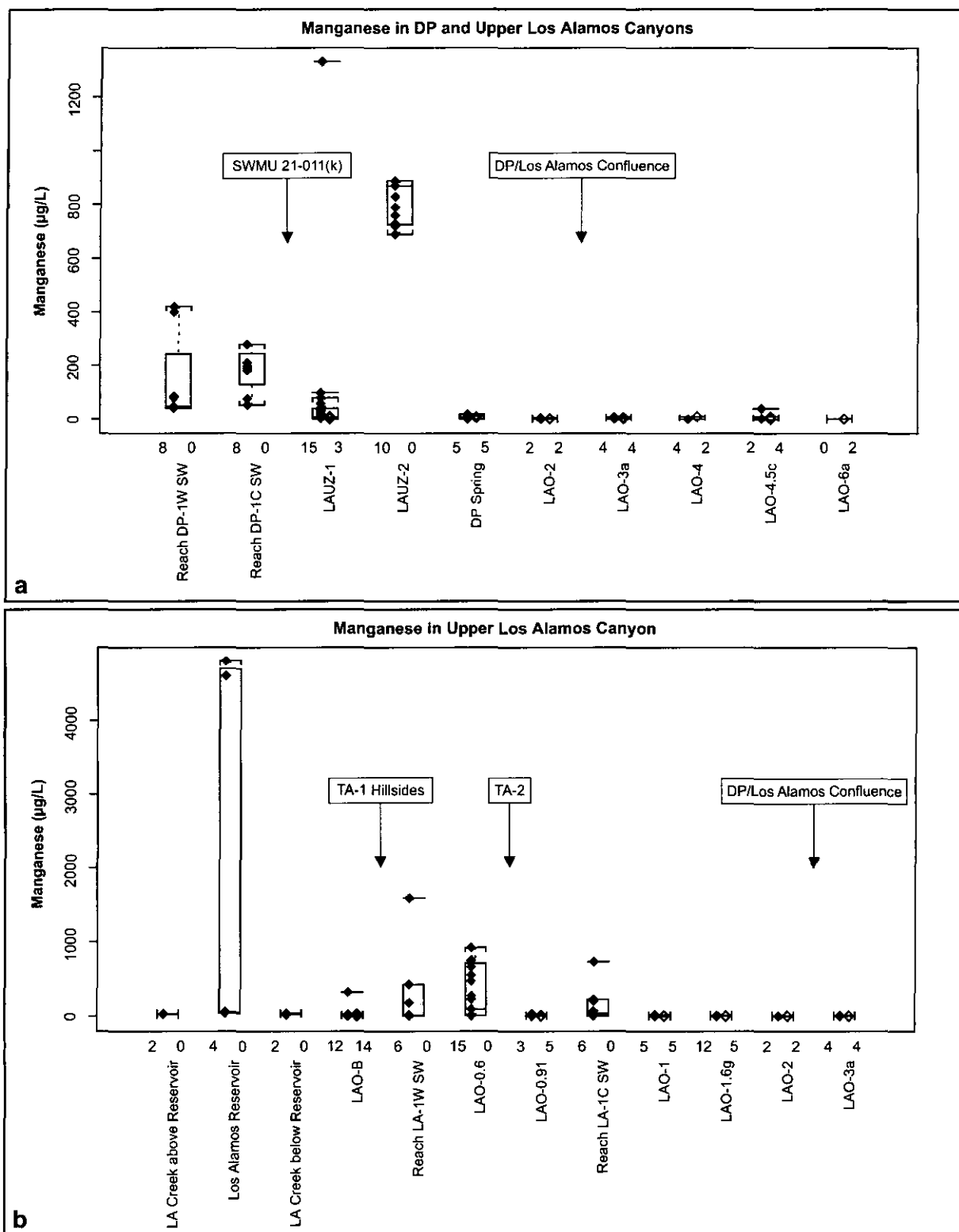


Figure 7.2-28. Box plots showing the spatial distribution of manganese at surface water and alluvial groundwater locations in the Los Alamos and Pueblo Watershed

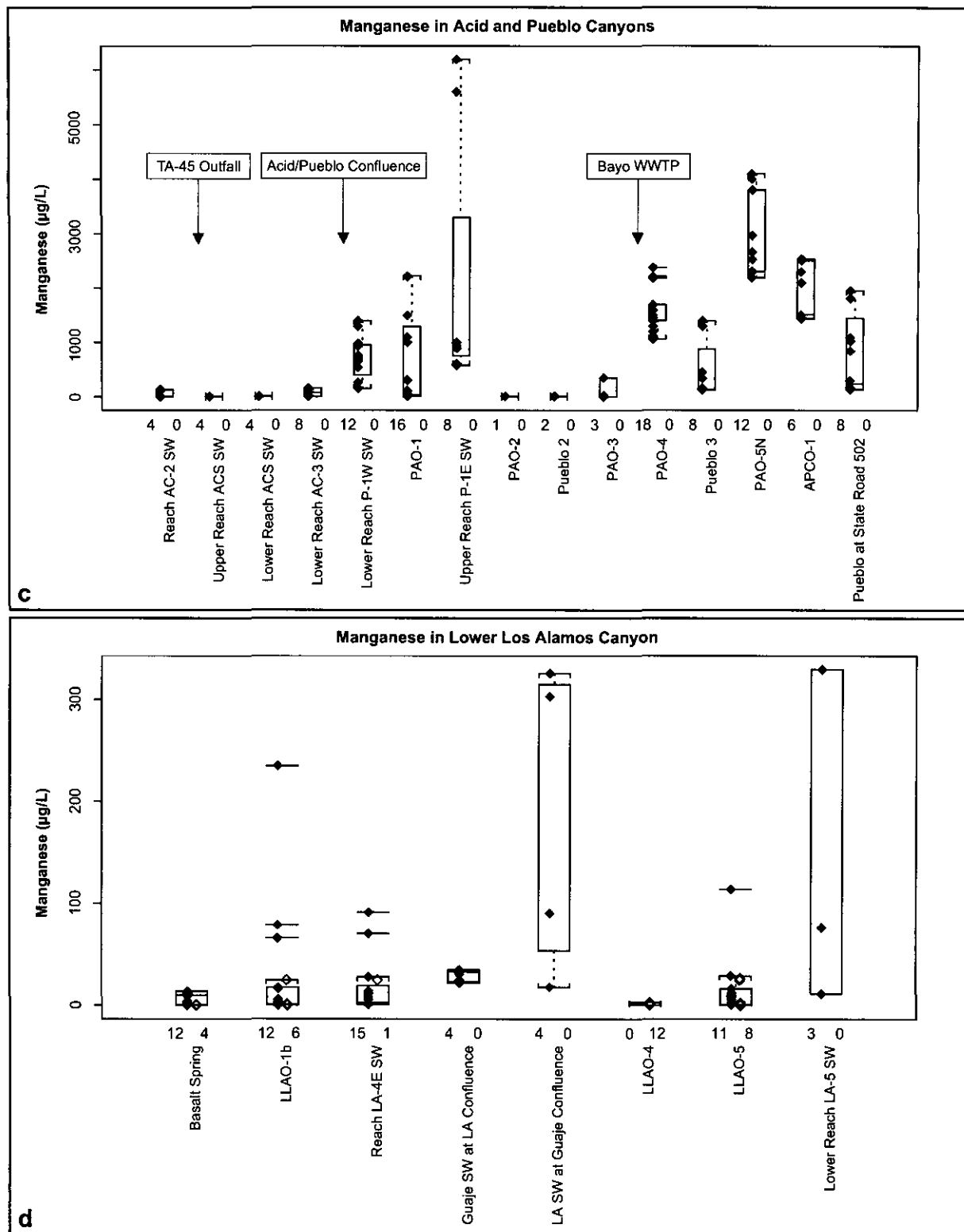


Figure 7.2-28 (continued). Box plots showing the spatial distribution of manganese at surface water and alluvial groundwater locations in the Los Alamos and Pueblo Watershed

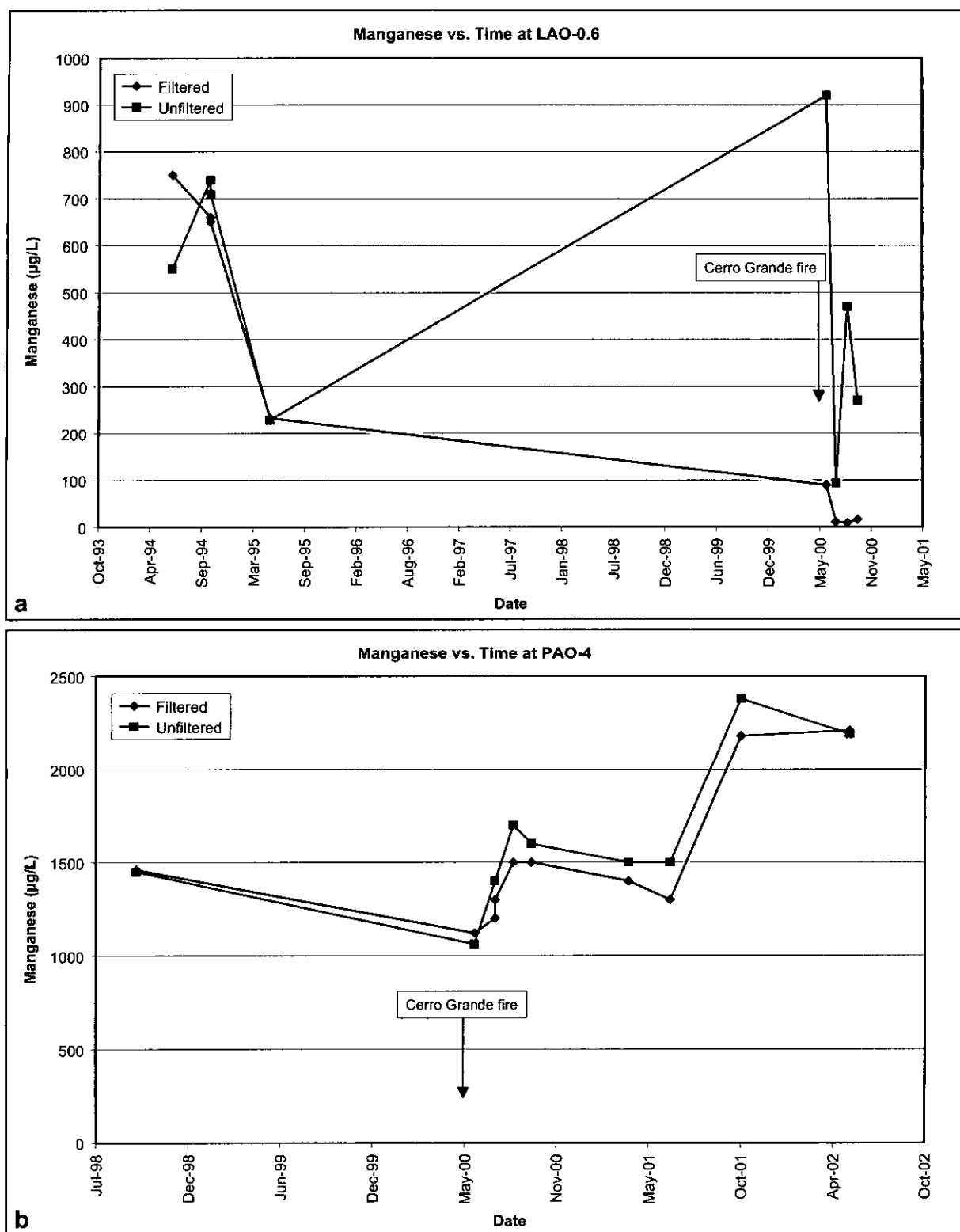


Figure 7.2-29. Time series for manganese at select alluvial monitoring well locations in upper Los Alamos and Pueblo Canyon

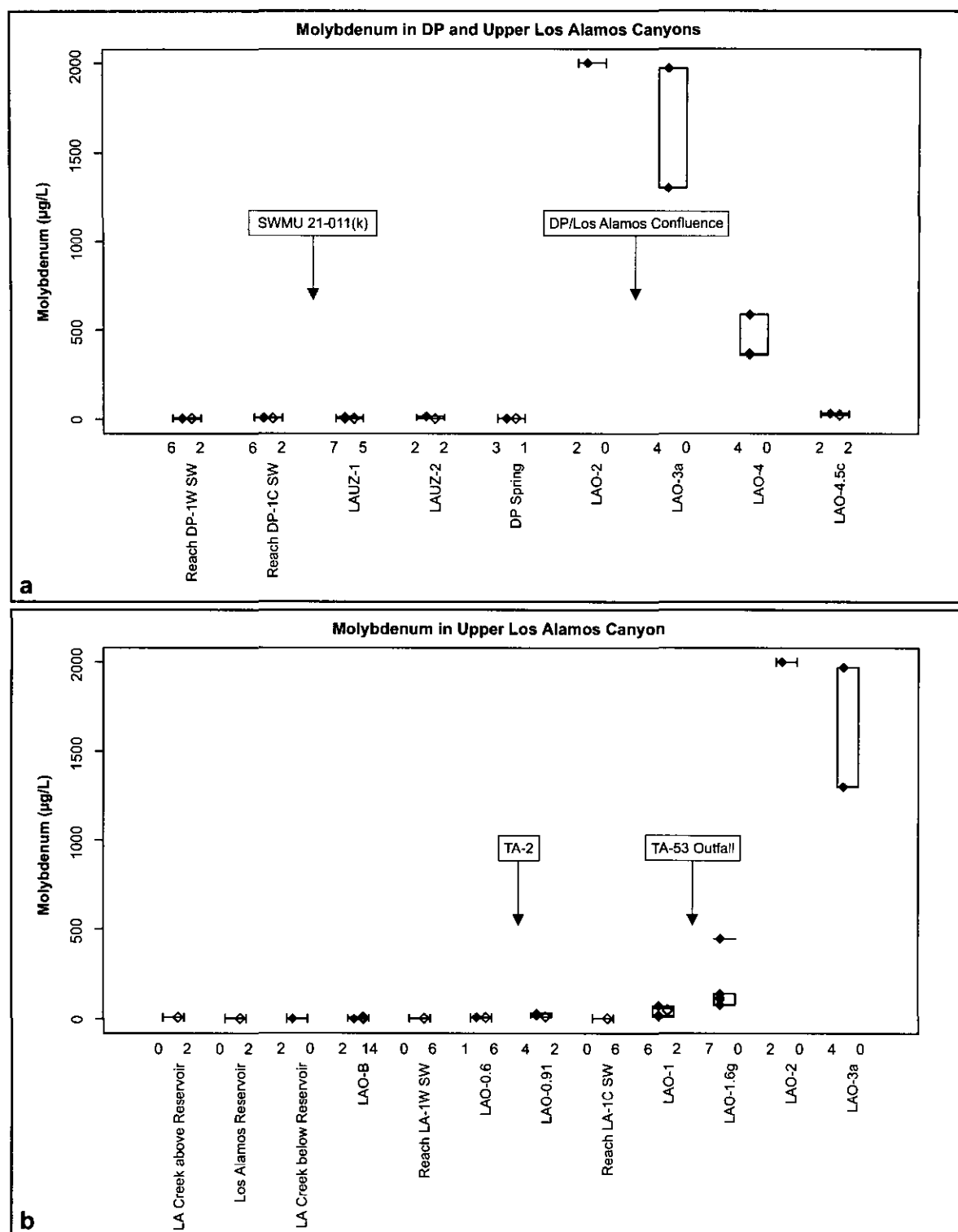


Figure 7.2-30. Box plots showing the spatial distribution of molybdenum at surface water and alluvial groundwater locations in the Los Alamos and Pueblo watershed. Annotation shows the relative locations of key contaminant sources and other geographic features.

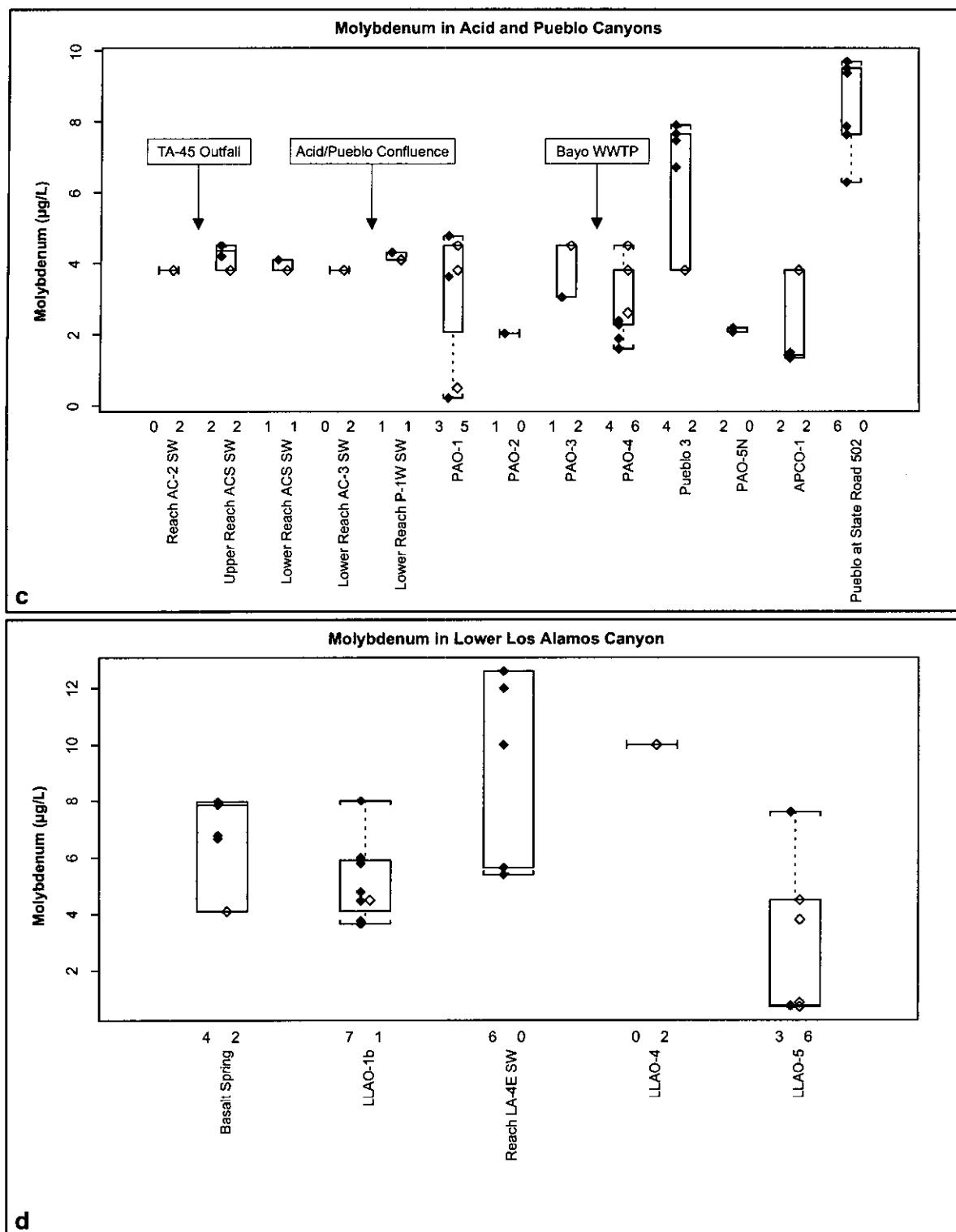


Figure 7.2-30 (continued). Box plots showing the spatial distribution of molybdenum at surface water and alluvial groundwater locations in the Los Alamos and Pueblo watershed. Annotation shows the relative locations of key contaminant sources and other geographic features.

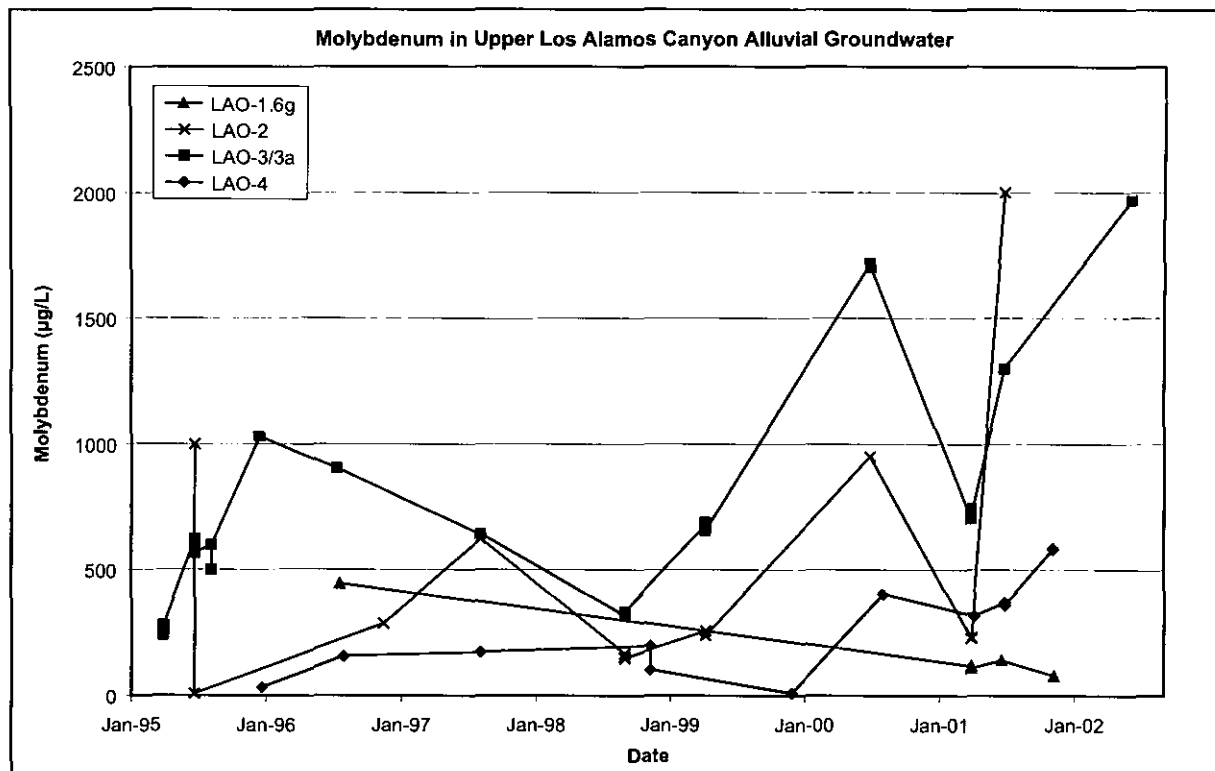


Figure 7.2-31. Composite time series for molybdenum at alluvial monitoring wells downcanyon of the location where molybdenum was historically discharged from outfalls at TA-53. Annotation shows the relative locations of key contaminant sources and other geographic features.

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Table 7.1-1
Summary of Estimated Inventory of Key Radionuclides
in Post-1942 Sediments in the Los Alamos and Pueblo Watershed

Area	Distance From Rio Grande (km)	Americium-241		Cesium-137		Plutonium-249,240		Strontium-90		Uranium-234	
		Inventory (mCi)	Percent of Total Inventory	Inventory (mCi)	Percent of Total Inventory	Inventory (mCi)	Percent of Total Inventory	Inventory (mCi)	Percent of Total Inventory	Inventory (mCi)	Percent of Total Inventory
Acid Canyon downcanyon from TA-45 and SWMU 0-030(g)	18.06–19.30	13	11%	6	1%	223	18%	7	8%	2.6	26%
Pueblo Canyon downcanyon from Acid Canyon	7.57–18.06	22	19%	3	1%	852	68%	5	6%	0	0%
Upper Los Alamos Canyon between Hillside 137 and DP Canyon	17.38–14.85	1	1%	9	2%	47	4%	0	0%	5.6	57%
DP Canyon downcanyon from SWMU 21-011(k)	12.89–14.85	24	21%	109	24%	14	1%	18	22%	1.7	17%
Upper Los Alamos Canyon between DP and Pueblo Canyons	7.57–12.89	50	43%	275	60%	29	2%	53	64%	0	0%
Lower Los Alamos Canyon	0–7.57	7	6%	58	13%	90	7%	0	0%	0	0%
Total, ca. 1997	—^b	117	100%	460	100%	1255	100%	83	100%	10	100%
Total removed in remediation activities, 2000-2003	—	8	7%	18	4%	150	12%	7	8%	0.5	5%
Total lost by radioactive decay, 1997–2004	—	0	0%	69	15%	0	0%	13	16%	0	0%

Note: Inventory applies to conditions at time of characterization, prior to remediation activities and prior to remobilization by post-fire floods; does not include estimates in reaches where these analytes are not COPCs; cesium-137 and strontium-90 adjusted to values in ca. 1997.

* — = Not applicable.

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8.0 RISK ASSESSMENTS

8.1 Baseline Ecological Risk Assessment

Biological data were collected in the Los Alamos and Pueblo watershed as lines of evidence to evaluate the potential for adverse ecological effects from contaminants in sediment and persistent surface water. Biological investigation plans were developed based on the application of the eight-step EPA ecological risk assessment guidance for Superfund (ERAGS) (EPA 1997, 59370) to COPECs in sediment and persistent surface water. Laboratory personnel, Laboratory subcontractors, and personnel from the NMED Hazardous Waste Bureau (HWB), NMED DOE Oversight Bureau (NMED DOE OB), and DOE applied ERAGS to affected canyons media in the Los Alamos and Pueblo watershed.

Steps 1 and 2 of ERAGS include the screening-level ecological risk assessment (LANL 1999, 64783), which identifies COPECs and ecological receptors potentially at risk. Screening-level ecological risk assessments have been presented previously in reports on the impacted media in DP, Los Alamos, and Pueblo Canyons (Reneau et al. 1998, 59159; Reneau et al. 1998, 59160; Reneau et al. 1998, 59667; Katzman et al. 1999, 63915). These screening-level assessments identified COPECs and formed the basis for proceeding to the baseline ecological risk assessment (ERAGS Steps 3 to 8). Ecological screening results based on the comparison of ESLs with available sediment and water data are provided in Katzman (2002, 73667) and in Section 6 and Appendix E, Section E-1, of this report.

Steps 3 and 4 of ERAGS comprise problem formulation and study design, which include refining the list of COPECs, developing a conceptual exposure model, selecting assessment endpoints, and selecting associated measures of effect and exposure. The study design required for these measures was included in a record of communication that documents agreements between Laboratory, NMED, and DOE personnel regarding the list of study design COPECs; assessment endpoints; measures of effect, exposure, and ecosystem/receptor characteristics; and risk characterization (Katzman 2002, 73667). Aspects of study design were modified based on field verification of the design (ERAGS Step 5), and deviations to the original plan are discussed in Section 8.1.2. ERAGS Steps 6 and 7 comprise the implementation of the study design, analysis of ecological exposure and effects, and risk characterization. ERAGS Step 8 is risk management and is documented in Section 10 of this report.

8.1.1 Problem Formulation

This section addresses the baseline ecological risk assessment problem formulation, or ERAGS Step 3, which includes refinement of the list of COPECs, a literature search on known ecological effects, the conceptual exposure model, and the selection of assessment endpoints. Problem formulation is documented in Katzman (2002, 73667), a record of communication used to document agreements and approaches between Laboratory, NMED, and DOE personnel.

8.1.1.1 Refinement of COPEC List

Concentrations of COPCs in sediment and water were compared with ESLs as part of the problem formulation (Katzman 2002, 73667). The ESLs were used to evaluate combined sediment and water exposures to wildlife. ESLs used were from the Ecorisk Database, Version 1.4, the current version at the time of this evaluation (LANL 2002, 72802); COPECs identified for terrestrial receptors included metals, SVOCs, PAHs, PCBs, pesticides, americium-241, and isotopic plutonium (Table 8.1-1). COPECs for study design were selected during meetings between Laboratory, NMED, and DOE personnel; selection criteria included the spatial distribution of COPECs and the magnitude of the HQ values (HQ >5). Analytes with HQ values less than 1 were not considered to be COPECs. COPECs with HQ values

between 1 and 5, based on the maximum watershed concentrations, did not warrant special biological studies because maxima are overly protective compared with central tendency values, which are more representative of actual exposure levels (Katzman 2002, 73667). The terrestrial study design was based on the list of COPECs presented in Table 8.1-1.

The Ecorisk database was revised between the time the study design was prepared and the time this report was written, and Table 8.1-2 provides a comparison of the COPECs from Sections 6 and E-1 (hereafter referred to as Section 6 COPECs) with the study design COPECs documented in Katzman (2002, 73667). The COPECs from Section 6 were obtained using ESLs from Ecorisk Database, Version 1.5 (LANL 2002, 73702; LANL 2003, 74012), the version of ecotoxicity and bioaccumulation information current at the time this report was written. COPECs identified in Section 6 are based on an HQ >0.3, which is a more stringent criterion than was used to select study design COPECs (HQ >5). In addition, ecotoxicity and bioaccumulation information from Ecorisk Database, Version 1.5, was used for calculations of exposure or effect (e.g., toxicity reference values [TRVs] were used in the ECORSK.7 model calculations in Gonzales et al. [2004, 85207] as one measure of effect for wildlife receptors). Thus, it is important to understand if the Section 6 COPECs differ markedly from the original study design COPECs (as listed in Table 8.1-1).

The Section 6 COPEC list includes analytes that were not selected as study design COPECs for terrestrial receptors or aquatic receptors and pathways (see Table 8.1-2 for a list of these analytes). Notes in Table 8.1-2 indicate the HQ for COPECs not included in the study design list; an HQ range of 0.3 to 3 is indicated for some COPECs. The upper-end HQ range of 3 was selected to represent the typical ratio between the NOAEL and lowest observed adverse effect level (LOAEL) (Dourson and Stara 1983, 73474) and is a slightly more inclusive selection criterion than the HQ >5 threshold originally used for the study design COPECs. Many of the additions are COPECs with HQ values between 0.3 and 3 or are analytes identified as COPECs because sample results represented removed samples or ash-rich post-fire baseline samples collected upstream of Laboratory SWMUs and AOCs (Table 8.1-2). These COPECs do not warrant assessment of ecological risks associated with existing Laboratory contamination. Some of the additional Section 6 COPECs meet the criteria for study design COPECs (HQ >5 and wide spatial distribution), although these did not expand the analytical suites identified by study design COPECs for either terrestrial receptors or aquatic receptors and pathways. Because analytical suites were not expanded by the Section 6 COPECs, relative to the study design COPECs, the suites used in this investigation are adequate for assessing potential adverse ecological effects.

Avian ground invertevovores (e.g., robins and bluebirds), mammalian invertevovores (e.g., shrews and deer mice), detritivores (earthworms and other soil organisms), and primary producers (plants) were the four feeding guilds with the highest HQs associated with the canyons investigation (Katzman 2002, 73667). An avian threatened and endangered (T&E) species, the Mexican spotted owl, was also evaluated, using the carnivorous kestrel as a surrogate receptor. The receptors potentially at risk from aquatic pathways from COPECs in water or sediment include wildlife receptors (mouse, shrew, cottontail, fox, bat, robin, kestrel, swallow) through the drinking water pathway; aerial insectivores (bat, swallow) through food chain exposure to COPECs in sediment; and representatives of the aquatic community (e.g., benthic macroinvertebrates, algae). However, screening of the water data showed that water HQs for terrestrial receptors were much less than 1 and therefore indicates that the drinking water pathway for terrestrial receptors is not a major wildlife exposure pathway (Katzman 2002, 73667).

8.1.1.2 Literature Search on Known Ecological Effects

Toxicity evaluations in addition to the reference set used to produce the ESLs in the Ecorisk database were not necessary. The Ecorisk database encompasses hundreds of primary and secondary references

and represents a comprehensive and up-to-date compilation of toxicity information on 134 chemicals, including inorganic and organic chemicals and radionuclides for soil, sediment, and water. Online literature databases (e.g., US EPA Ecotox, MEDLINE, PubMed) and bibliographies (e.g., Oak Ridge National Laboratory technical reports) were searched to find primary literature relevant for deriving TRVs, and 879 primary toxicity study evaluations were compiled for terrestrial receptors. Detailed information from each study was scored and ranked in a tiered-review system, and a primary toxicity value was calculated based on the published dose-response relationship. Thus, this literature review meets the intent of ERAGS problem formulation to obtain and review primary literature and also is consistent with EPA's approach for developing their ecological soil screening levels (Eco-SSLs) (EPA 2003, 76077). The following is a synopsis of the screening ecological receptors with the highest HQs (and the feeding guilds they represent), the study design COPECs for these receptors, and the potential adverse ecological effects from these COPECs.

1. The shrew as a representative for mammalian invertebrates had HQs greater than 5 (one criterion for study design COPEC selection) for Aroclor-1254, arsenic, barium, cobalt, silver, thallium, and titanium (Katzman 2002, 73667). The most important effects of increased concentrations of Aroclor-1254 on mammals are reproductive effects (decreased offspring survival). Cobalt was eliminated as a COPEC because concentrations in sediment in the Los Alamos and Pueblo watershed are less than EPA's Eco-SSLs (EPA 2003, 76077), thus indicating that further assessment of the potential toxic effects of cobalt on mammals is not warranted. Of the remaining five metals with HQs greater than 5, only silver has a spatial distribution that confirms notable releases from Laboratory sources, as discussed in Section 7.1.2.1. Toxicity studies of these metals are based on assuming bioavailable and typically more toxic forms of these COPECs; available data are insufficient to determine if these forms are present. Metals were included in the study design COPECs to test their bioavailability and toxicity (potential for adverse effects). Thus, potential reproductive effects of PCBs (primarily Aroclor-1254) are the most important ecological effects on the mammalian invertebrate community. Because mammalian invertebrates have not been found in these canyons, it is important to consider what COPECs had high HQs for mammalian omnivores, i.e., the deer mouse. All COPECs identified for the shrew also had HQs greater than 5 for the deer mouse (Katzman 2002, 73667). Thus, adverse effects on mammalian omnivores from these COPECs were investigated.
2. The robin (with an invertebrate diet) as a representative for avian invertebrates had HQs greater than 5 (one criterion for study design COPEC selection) for Aroclor-1254, DDE, DDT, endrin aldehyde, naphthalene, and cobalt (Katzman 2002, 73667). Reproductive effects are the more important effects of Aroclor-1254, DDE, DDT, and endrin aldehyde on birds. Naphthalene was also identified as a COPEC; however, adverse effects of naphthalene on birds are not well documented. The avian naphthalene TRV is based on a secondary study with unreported endpoints. An uncertainty factor of 100 was applied to adjust from an acute to chronic duration because study duration was not reported in the secondary source for this TRV. Cobalt is eliminated as a COPEC because concentrations in sediment in the Los Alamos and Pueblo watershed are less than EPA's Eco-SSLs, thus indicating that further assessment of the potential toxic effects of cobalt on birds is not warranted. Potential reproductive effects of PCBs (primarily Aroclor-1254) and pesticides (DDE, DDT, and endrin aldehyde) are the most important potential ecological effects on the avian invertebrate community. The same COPECs and ecological effects are important for the avian carnivore feeding guild. In addition, avian TRVs are lacking for several of the PAHs and some metals, so toxicity to birds from these COPECs cannot be evaluated from literature studies alone. Field and model measures were selected to complement literature toxicity information.

3. Invertebrates (i.e., earthworms) as representatives for detritivores had HQs greater than 5 (one criterion for study design COPEC selection) for chromium, mercury, and plutonium-239,240 (Katzman 2002, 73667). Effects from these COPECs include reproductive and survival endpoints. Toxicity studies of chromium and mercury are based on assuming a bioavailable and toxic form of these COPECs. However, available data indicate that the mercury and chromium in the watershed consist largely of nonbioavailable forms. Metals were included in the study design COPECs to test their bioavailability and toxicity (potential for adverse effects). Plutonium-239,240 is a COPEC for the earthworm because it is assumed to be highly bioavailable and invertebrates are assumed to be as sensitive to radiation as plants and wildlife. The literature lacks invertebrate toxicity information for many organic chemicals and some metals; therefore, toxicity to invertebrates from all COPECs cannot be evaluated from literature studies alone. Field and model measures were selected to complement literature toxicity information.
4. Plants as representatives for primary producers had HQs greater than 5 (one criterion for study design COPEC selection) for endrin aldehyde, antimony, chromium, manganese, selenium, silver, thallium, and zinc (Katzman 2002, 73667). Effects from these COPECs include growth and survival endpoints. Toxicity studies of these metals are based on assuming a more bioavailable and toxic form of these COPECs; however, available data are insufficient to determine if these forms are present. Metals were included in the study design COPECs to test their bioavailability and toxicity (potential for adverse effects). The literature lacks plant toxicity information for some organic chemicals (endrin aldehyde) and some metals, so toxicity to plants from these COPECs cannot be evaluated from literature studies alone. Field and model measures were selected to complement literature toxicity information.
5. Bats as representatives for mammalian aerial insectivores had HQs greater than 5 (one criterion for study design COPEC selection) for barium and cobalt (Katzman 2002, 73667). Neither of these COPECs have spatial distributions that indicate releases from Laboratory SWMUs or AOCs. Instead, the elevated concentrations in the watershed are primarily associated with post-fire sediment deposits that contain ash from the Cerro Grande burn area, as discussed in Section 7.1.2.3. Toxicity of these metals is based on assuming a bioavailable form is present; however, available data are insufficient to determine if these forms are present. Metals were included in the study design COPECs to test their bioavailability and toxicity (potential for adverse effects). Cobalt was eliminated as a COPEC because concentrations in sediment in the Los Alamos and Pueblo watershed are less than EPA's Eco-SSLs, thus indicating that further assessment of the potential toxic effects of cobalt on mammals is not warranted.
6. Swallows as representatives for avian aerial insectivores had HQs greater than 5 (one criterion for study design COPEC selection) for cobalt and cyanide (Katzman 2002, 73667). Cyanide was identified as a COPEC only because concentrations in post-fire deposits were greater than the BV. Cyanide was retained as a study design COPEC to collect additional information on its distribution and potential ecological effects. Cobalt was eliminated as a COPEC because concentrations in sediment in the Los Alamos and Pueblo watershed are less than EPA's Eco-SSLs, thus indicating that further assessment of the potential toxic effects of cobalt on mammals is not warranted.
7. The aquatic community that represents various functional and feeding guilds had HQs greater than 5 (one criterion for study design COPEC selection) for numerous inorganic, organic, and radionuclide COPECs (Katzman 2002, 73667). For sediments, the COPECs included cyanide, anthracene, benzo(a)anthracene, benzo(b)fluoranthene, indeno(1,2,3-cd)pyrene, pyrene, gamma-chlordane, benzoic acid, americium-241, cesium-137, plutonium-238, and

plutonium-239,240. For persistent surface water, the COPECs included anthracene, benzo(a)anthracene, benzo(a)pyrene, aluminum, barium, beryllium, cadmium, copper, lead, manganese, silver, and zinc. Potential ecological effects from these COPECs include decreased reproduction, survival, or growth of various aquatic macroinvertebrates.

Although aerial insectivores had a potential for adverse effects from COPECs in sediments, special investigations of this feeding guild were not warranted (Katzman 2002, 73667). The first and most important reason is that water resources in the Los Alamos and Pueblo watershed are limited in spatial extent and are more commonly ephemeral than perennial. This limited extent reduces the potential for maintaining either individuals or populations of aerial insectivores on these resources. Second, the invertebrate feeding guild was thoroughly assessed for the terrestrial receptors, and the terrestrial studies provide information on the relevance of the insect-eating pathways from aquatic environments.

8.1.1.3 Conceptual Exposure Model

The conceptual exposure model is based on the study design COPECs and the toxicity evaluation summarized in Section 8.1.1.2. This information is coupled with information compiled from ecological scoping site visits (the Acid Canyon ecological scoping checklist is provided in Section E-3 of Appendix E, and all other ecological scoping checklists have been included in previous reports [Reneau et al. 1998, 59159; Reneau et al. 1998, 59160; Reneau et al. 1998, 59667; Katzman et al. 1999, 63915]).

Terrestrial ecological receptors are abundant throughout these canyons, where the dominant plants include ponderosa pine, piñon pine, juniper, shrub oak, forbs, and grasses. Animals are also common and have been observed, or their sign (tracks or scat) has been noted, during ecological scoping visits. T&E species are potential receptors for contaminants in the Los Alamos and Pueblo watershed. Specifically, the Mexican spotted owl may forage in the watershed, and the habitat is suitable for nesting in parts of the watershed (Koch 1998, 59114; Koch 1998, 59115; Koch 1998, 59116; Koch 1999, 63519); however, the Mexican spotted owl currently does not nest anywhere in the watershed. Some areas of these canyons also have riparian habitats; however, areas of persistent surface water are limited in spatial and temporal extent and include areas in reaches DP-1W, DP-1C, LA-0, LA-1FW, LA-4W, P-3E, P-4W, and P-4E. Aquatic receptors have been found through collections of benthic macroinvertebrate samples at some of these locations of more persistent surface water flow (Foxy 1995, 50039, pp. 91-194). The quality of habitat for aquatic receptors is discussed in more detail in Section 8.1.3.6.

Historical contaminant releases to the soils, sediments, and persistent surface water in the Los Alamos and Pueblo watershed have occurred from multiple SWMUs and AOCs, as summarized in Section 2. For ecological receptors, the primary impacted media in the canyons are (1) post-1942 sediment deposits in the canyon bottoms; and (2) persistent surface water derived from seeps, springs, or snowmelt runoff. No direct exposure pathway for ecological receptors to alluvial groundwater exists, but alluvial groundwater is assessed where it emerges at springs or seeps. Effluent sources also exist, the primary effluent source being the Bayo WWTP, which discharges into Pueblo Canyon. Materials that are termed "sediments" in other parts of this report are subdivided in this section to account for the different ecological receptors in areas with and without persistent water. Active channel sediments (c1 geomorphic unit), potentially subject to persistent water, are referred to as "sediment" in this section to be consistent with ecological risk assessment literature. Post-1942 sediment in other geomorphic units (abandoned channels and floodplains) is referred to as "soil" in this section.

Persistent surface water exists only in limited sections of the active channel in the watershed. Even so, all active channel deposits are considered in this assessment potentially to be subject to persistent flow under different climatic conditions, and therefore potentially to harbor aquatic receptors (organisms

dependent on water, like algae or chironomids [LANL 1999, 64783, pp. 19–26]). Floodplains and abandoned channels generally have well-developed terrestrial plant and animal populations and do not support truly aquatic species. Thus, only active channel sediments and surface water potentially have complete exposure pathways to truly aquatic species, whereas terrestrial animals and plants are exposed to COPECs in surface water, soil, or sediment. It is important to recognize that the aquatic species in the watershed represent a fairly simple food web because surface water is limited both spatially and temporally.

Exposure pathways to terrestrial receptors can occur through air (respiration of vapors, inhalation or deposition of particulates); surface soil (root uptake and rain splash on plants, food web transport to plants and animals, incidental ingestion of soil, dermal contact with contaminated soil, and external irradiation); and persistent surface water and sediments (root uptake and rain splash on plants, food web transport to animals, incidental ingestion of water and sediment, dermal contact with contaminated water or sediment, and external irradiation from sediment). The major soil-related exposure pathways are plant uptake, food web transport, incidental ingestion of contaminated soil, and external gamma radiation exposure. Water and sediment pathways are of lesser importance to terrestrial receptors because of the limited temporal and/or spatial extent of persistent surface water in the watershed. Exposure to vapors is unlikely, because of the infrequent detection of VOCs in the watershed, the low VOC concentrations measured in sediment and water, and the rapid volatilization of VOCs in sediments near the ground surface. Exposure to airborne particulates is a minor pathway because of the limited amount of contamination at the ground surface and the dense plant cover in some reaches.

The remaining pathways related to exposure to surface soil (dermal contact) and surface water and sediment (food web transport, incidental ingestion of contaminated sediment and water, dermal contact, and external gamma radiation exposure) are also minor because of the limited amount of contamination at the ground surface or in surface water. In addition, soil exposure pathway analysis performed by EPA to support the development of their Eco-SSLs has shown that inhalation and dermal pathways contribute a small fraction of the dose obtained orally (EPA 2003, 76077). All complete exposure pathways are at least qualitatively evaluated in the assessment in this report. Because some of the measures considered in Section 8.1.3 are field measures of effect or exposure, all complete pathways are included. Measures based on models typically do not assess all exposure pathways.

8.1.1.4 Assessment Endpoints

Six assessment endpoints were selected based on the study design COPECs listed in Table 8.1-2 and the conceptual exposure model. These endpoints were selected to represent T&E species (the Mexican spotted owl) and species that are representative of the terrestrial food web in the Los Alamos and Pueblo watershed. The conceptual model indicates that ingestion exposure pathways and, in particular, food web transport, are important pathways for these COPECs. Assessment endpoints were developed for the four terrestrial feeding guilds that represented the receptors with the highest HQs. Because of the limited spatial extent of aquatic environments in the Los Alamos and Pueblo watershed, a single assessment endpoint for the aquatic study design was selected. In addition, the invertebrate feeding guild was evaluated for terrestrial receptors and provides relevant information on the importance of the insect-eating pathways from aquatic environments (as sediment and water COPECs are similar to soil COPECs). The six assessment endpoints (AE1 through AE6) are as follows:

1. Survival and reproduction of T&E species (i.e., Mexican spotted owl) (AE1)
2. Population abundance or persistence and species diversity of avian ground invertevore feeding guild species (e.g., robin, bluebird, ash-throated flycatcher) (AE2)

3. Population abundance or persistence and diversity of mammalian invertevore feeding guild species (e.g., deer mice) (AE3)
4. Nutrient cycling rates of detritivore species (e.g., earthworms) (AE4)
5. Native plant species presence and diversity (AE5)
6. Abundance and diversity of the aquatic community in the perennial stream segments of the Los Alamos and Pueblo watershed (AE6)

8.1.2 Study Design, Field Verification, and Site Investigation

This section discusses the baseline ecological risk assessment study design, field verification, and site investigation, or ERAGS Steps 4 and 5 and the first part of Step 6. Biological data were collected as lines of evidence (measures of exposure and effect) to evaluate the potential for adverse ecological effects from contaminants in soil, sediment, and persistent surface water. Field verification of the design occurred when locations were sited for data collection and included field trips with Laboratory personnel and a field trip with NMED personnel to confirm selection of some sites. The initial study design and deviations from the design are documented in Katzman (2002, 73667). Other deviations encountered during implementation and summaries of the results obtained are noted in this section.

8.1.2.1 Small-Mammal Trapping and Whole-Body Analysis (AE1, AE3)

Four areas for small-mammal trapping were selected to represent potential Mexican spotted owl nesting and foraging habitat and to represent a range of HQs for study design COPECs for the owl and mammal invertevres. Two reaches (AC-3 and LA-1C) were selected because they had the highest concentrations of Aroclor-1254, and one reach (P-3W) was selected because it had low concentrations of Aroclor-1254. Reach LA-1C was also selected because it had the highest concentrations of DDT. The fourth area was a small-mammal investigation reach in Guaje Canyon that represented a reference condition (low concentrations of COPECs). Two trapping events were completed as proposed in Katzman (2002, 73667) in the summer and fall of 2002. One deviation noted in Katzman (2002, 73667) is that one of the two arrays for reach P-3W mistakenly was located downstream of the Bayo WWTP outfall for the summer trapping. An upper array was sited upstream of the Bayo WWTP for the reach P-3W fall trapping event. Another deviation occurred at reach AC-3, where the canyon bottom was wide enough for only three trapping lines instead of five as in the other locations, and only a single array was trapped in the summer. A second array was added to the reach AC-3 fall trapping event to collect additional small mammals, but not to estimate density. Locations of the trapping arrays are shown on Figure 8.1-1.

The results of population abundance and reproductive status from the trapping events are presented in Robinson and Bennett (2003, 82663), and a summary of the results relevant to measures of exposure and effect is provided in Section 8.1.3. A total of 165 animals (mainly deer mice and brush mice) were collected, and 99 animals (plus 5 QC animals) were submitted for chemical analyses for study design COPECs for either the mammalian invertevore or avian carnivore feeding guilds (AE1, AE3) (Table B-3.0-6). Analytical suites included pesticides, PCBs, metals, isotopic plutonium, gamma spectroscopy radionuclides, and strontium-90. At the same time, the analytical laboratory analyzed four additional QC animals (for a total of nine QC animals) for metals for another project (LANL 2003, 77965), and metals results from these additional QC animals were considered in interpreting the metals results in this section.

Animals were selected for chemical analyses based on species, weight, and spatial coverage. The priority was to select animals of intermediate weight (between 18 and 22 g). Animals within the acceptable weight category were selected to provide spatial representatives across the trapping array, but animals caught

near the margins of the area of post-1942 flooding or outside of this area (uncontaminated locations) were excluded. Some of the selected animals did not have sufficient mass (around 15 g) to permit analysis for all desired analytical suites. Therefore, analyses were prioritized based on the study design COPEC HQ values for the avian carnivore feeding guild (Katzman 2002, 73667). Some samples were not analyzed for radionuclides, which were the lowest-priority COPECs (CAGU-03-50652, CAPU-02-49237, CAPU-02-49241, CAPU-02-49248, CALA-02-49217, CAPU-03-50588, and CAPU-03-50619), and other samples were not analyzed for metals, which were the next lowest priority COPECs (CAGU-03-50652, CAPU-02-49241, and CAPU-02-49248).

Total cyanide, which was a study design COPEC (Katzman 2002, 73667), was eliminated from the requested analyses because the analytical method used to analyze for cyanide is inappropriate for biological tissues. The analytical methods used for measuring cyanide concentrations follow EPA SW-846 Method 9010A or 9012A: Total and Amenable Cyanide. These methods were specifically developed and validated for solid samples, such as sediments, soils, wastes, and leachates. Biological samples have not been validated for these methods, and it is not reliable to use them for matrices other than those recommended in the method. Potential problems that may arise if these methods are used for biological samples include interference from thiocyanate, found in blood plasma. High levels of aldehydes and ketones can also pose interference problems. In addition, fatty acids (lipids) that are found in high concentrations in biological tissues interfere with the distillation step. This interference can result in difficulty in finding the titration endpoint, used for quantitative measurement, and makes quantitation difficult. Cyanide is evaluated in a qualitative manner in the uncertainty analysis (Section 8.1.4.2). Analytical results for the other COPECs are provided in Appendix C.

8.1.2.2 Soil Characterization (AE3, AE4, AE5)

Soil was characterized by collecting composite samples as a measure of exposure for wildlife receptors in the four areas trapped for small mammals (Katzman 2002, 73667). This information was needed because there was no soil characterization data for trapping arrays in Guaje Canyon and because the trapping arrays located in previously sampled reaches include areas outside the post-1942 geomorphic units that were not sampled previously. Composite samples were collected from 0- to 15-cm (0- to 6-in.) depth, because this depth represents the surface exposure concentrations for these animals under the assumption that most exposure occurs during foraging (Katzman 2002, 73667). A trapping array is roughly 200 by 50 m (656 by 164 ft), and samples for compositing were collected within one-third of the array length (approximately 65 by 50 m [213 by 164 ft] or about equal to a deer mouse's home range¹). Within each trap line of each array, three locations were selected at random from the 6 or 7 trap locations within the 65- by 50-m (213- by 164-ft) plot for compositing. The composite for each third of an array was based on 15 subsamples: 3 samples per trap line for 5 trap lines. When samples were collected, notes were made regarding the geomorphic setting and the presence of post-fire flood deposits at the trapping array locations. Table B-3.0-7 provides a list of the samples collected and submitted for laboratory analysis and the analytical suites requested. Tables B-3.0-1 through B-3.0-5 provide information on the geomorphic setting and post-fire sediment deposits sampled in each trapping array. Locations of the composite soil samples used to characterize the small-mammal trapping arrays are shown on Figure 8.1-1.

Soil was also characterized by collecting samples from depths of 0 to 30 cm (0 to 12 in.) at locations selected for plant and earthworm toxicity tests. Sample locations were selected on the basis of the

¹Deer mouse home range varies between 0.075 and 0.128 ha for habitats comparable to the Laboratory (ponderosa pine forest and sagebrush desert) (EPA 1993, 59384, p. 2-298).

existing geomorphic characterization and sediment characterization results, and the concentrations of COPECs represented a gradient of concentrations. An exception is that the Guaje Canyon (reference location) plant and earthworm tests were based on a portion of the composite sample collected in the mammal trapping array. The samples were analyzed for PCBs, pesticides, metals, and radionuclides (strontium-90, isotopic plutonium, and gamma spectroscopy radionuclides). Table B-3.0-7 provides a list of the samples collected and analytical suites requested, and analytical results are provided in Appendix C. Locations of the samples used for plant and earthworm toxicity tests are shown on Figure 8.1-1.

8.1.2.3 Nest Box Study (AE2)

In 1997, an avian monitoring network consisting of nest boxes was established at 18 locations at the Laboratory and in surrounding areas. The purpose of this network is to evaluate the health and condition of individuals and populations in areas near and far from contaminants (Fair 2002, 82654). A variety of cavity-nesting bird species use the nest boxes; however, the most common occupants are western bluebirds (*Sialia mexicana*) and ash-throated flycatchers (*Myiarchus cinerascens*). Some of these nest boxes were placed at locations in the Los Alamos and Pueblo watershed and include middle DP Canyon, Los Alamos Canyon downstream of the DP Canyon confluence, lower Pueblo Canyon, the Los Alamos golf course, and the Guaje Pines Cemetery (Fair 2002, 82654). Nest boxes were placed approximately 2 m (7 ft) off the ground in trees and spaced approximately 50 to 75 m (164 to 246 ft) apart. Boxes were placed in the open ponderosa pine forest and piñon-juniper woodland of the canyons and mesas. An average of 29 boxes were placed in each of the 18 locations. Information from the avian monitoring network provides measures of effect (occupancy, nest success, eggshell thickness, sex ratio) for the avian ground invertevore feeding guild, which was represented by the robin in the screening assessment. COPEC concentrations in eggs provide another measure of exposure and a measure of effect (by comparing egg concentrations with published safe levels for COPECs).

To further support the assessment of the avian invertevore feeding guild, more nest boxes were added to this existing cavity-nesting bird monitoring network in 2002 (Katzman 2002, 73667). Nest boxes were added to upper Los Alamos Canyon, Acid Canyon, and upper Pueblo Canyon near the Acid Canyon confluence because these areas encompassed a wider range of COPEC concentrations than was available in the original network. One deviation from the proposed plan was that boxes were placed mistakenly in Walnut Canyon instead of Acid Canyon as originally proposed. This error was corrected in April 2003. Nest box locations are shown on Figure 8.1-1. None of the new boxes was occupied during the investigation period, in part probably because of the drought conditions in 2002 and 2003 and also because of changes in regional habitat quality as a result of the Cerro Grande fire. Thus, nest box data from the Los Alamos and Pueblo Canyons part of the original network are assessed, and uncertainties related to nonoccupancy of the nest boxes added to the network in 2002 and 2003 are considered in the uncertainty analysis. To characterize effects of COPECs on nest occupancy, nest success, eggshell thickness, and sex ratios, spatial trends are evaluated within and between locations, as contaminant concentrations have trends longitudinally in the Los Alamos and Pueblo watershed (Section 7.1; Reneau et al. 1998, 59159; Reneau et al. 1998, 59160; Reneau et al. 1998, 59667; Katzman et al. 1999, 63915). In addition, data on occupancy and reproductive success for the birds are provided in Fair (2004, 85438) and are evaluated in Section 8.1.3.2. Results from the chemical analyses of eggs collected from the nest box network are documented in Fair et al. (2004, 85824), and results from the chemical analysis of eggs are summarized in Section 8.1.3.2.

8.1.2.4 Breeding Bird Survey (AE3)

Breeding bird surveys provide a measure of effect (abundance and diversity) for the avian ground invertevore feeding guild (Katzman 2002, 73667). Plots of bird abundance and diversity versus HQs for avian COPECs are the primary method used to characterize effects (Katzman 2002, 73667). In each survey area, the birds present were recorded by a point-count method, using standard methods that were previously used in baseline studies in Los Alamos and Guaje Canyons (Foxy 1993, 50039, pp. 241–242). Upon arrival to a survey area, surveyors walked through the area, stopping at 200-m (656-ft) intervals to record all birds seen or heard for a period of six minutes. Survey areas were selected in reaches having a gradient in COPEC concentrations for the avian feeding guild (Katzman 2002, 73667); survey areas included reaches AC-1, AC-2, AC-3, P-1FW, P-1W, P-1E, P-3W, LA-1C, LA-2E, DP-1W, DP-1C, DP-2, DP-3, and DP-4 and the Guaje Canyon small-mammal trapping arrays. Breeding bird surveys were completed in the summer of 2002 as proposed in Katzman (2002, 73667). Data were compiled from these surveys, with the exception of the Guaje Canyon (reference canyon) survey data that were lost. An additional set of point counts for all locations (including Guaje) was completed in the spring of 2003 to supplement the 2002 data. The 2002 and 2003 data and other recent data available for these canyons (from 2001) are summarized in Keller (2003, 82662), and a summary of the results relevant to measures of effect is provided in Section 8.1.3.2.

8.1.2.5 Earthworm Toxicity Tests (AE4)

Earthworm toxicity tests provide a measure of effect (mortality and growth) for detritivores. Although this measure of effect is not the same as the AE4 attribute (nutrient cycling), adverse effects on earthworms are an indirect indicator of impacts on nutrient cycling. Evidence for effects is based on statistically significant changes (using Dunnett's t-Test) in mortality and growth for the soils tested versus the reference site results (Katzman 2002, 73667). Effects are also evaluated by plotting the data to determine if there are trends in mortality and growth versus COPEC concentrations. Soils from 12 locations were selected to represent a gradient in COPECs, and one location (Guaje Canyon) also included fire-affected sediment deposits. Different samples from the same locations were evaluated using the seedling germination toxicity test. The reference location in Guaje Canyon was one of the small-mammal trapping arrays. Reaches were selected to represent the overall gradient in COPEC concentrations (Katzman 2002, 73667), and then specific sample locations within these reaches were selected to represent the higher HQ values for the plant or earthworm receptors. Locations selected for earthworm toxicity tests are shown on Figure 8.1-1. Earthworm mortality and growth tests were completed as proposed (Katzman 2002, 73667). The results are documented in ep&t (2002, 82658), and a summary of the results relevant to measures of exposure and effect is provided in Section 8.1.3. American Society for Testing and Materials [ASTM] procedure E1676-97 was used to conduct the tests.

Earthworm mortality was high (roughly 90%) for sediments from one location (reach LA-1W), while mortality for the other locations was low (0–3%) and not different from the negative control sample or reference location (Guaje Canyon) results. Concentrations of COPECs were unremarkable from the LA-1W location compared with the other locations and the reference sample collected in Guaje Canyon. The concentrations were similar to those measured previously at this location and reported by Reneau et al. (1998, 59160). Photographs and a narrative were sent to earthworm experts, who subsequently indicated that the most probable explanation for high mortality was a bacterial infection (ep&t 2003, 82659). The high mortality was evaluated by collecting and submitting two additional samples from the same geomorphic unit but from different sample locations 120 to 140 m (394 to 459 ft) upstream in reach LA-1W and reconducting the toxicity test on the sample with high mortality. Mortality or growth measured in these additional LA-1W samples was not different from the negative control samples or the reference location results (ep&t 2003, 82659). A test of the bacterial theory was devised by reusing replicates of the

LA-1W sample and retesting two replicates "as-is" and two replicates heated to 105 °C. The "as-is" replicates had 100% mortality after five days, and the heated replicates had no mortality, which indicates either a volatile COPEC or a microbe was responsible for the earthworm mortality. As VOCs are not COPECs in these settings (Section 8.1.1.1), the presence of pathogens is the most probable explanation for high mortality in the reach LA-1W sample.

Earthworms were sent to an analytical laboratory for chemical analyses (see Table B-3.0-8 for a crosswalk of earthworms, the bioassay, and the soil samples). Cyanide was eliminated from the requested analyses as described in Section 8.1.2.1. The earthworm laboratory soil was also analyzed to evaluate bioaccumulation. Analytical results for the earthworms and soil are provided in Appendix C.

8.1.2.6 Seedling Germination Tests (AE5)

Seedling germination tests are a measure of effect for plants. Evidence for effects is based on statistically significant changes (using Dunnett's t-Test) in germination measures for the soils tested versus the reference site results (Katzman 2002, 73667). Effects are also evaluated by plotting the data to determine if there are trends in germination measures versus COPEC concentrations. The species selected for the test was western yarrow (*Achillea millefolium*). This species was recommended by the toxicity testing laboratory (ecological planning & toxicology,) because it is representative of native species and because it previously yielded acceptable germination rates in laboratory control samples. Toxicity tests were conducted according to ASTM procedure E1963-98, and the results are presented in Kapustka (2002, 82657). Soils from 12 locations, including one area (Guaje Canyon) with post-Cerro Grande fire sediment deposits, were selected for testing to represent a gradient in COPEC concentrations. Different samples from the same locations were evaluated using the earthworm toxicity test. The reference location was in Guaje Canyon in one of the small-mammal trapping arrays. Reaches were selected to represent the overall gradient in COPEC concentrations (Katzman 2002, 73667), and then specific sample locations within these reaches were selected to represent the higher HQ values for the plant or earthworm receptors. Locations selected for seedling germination tests are shown on Figure 8.1-1. Seedling germination tests were completed as planned (Katzman 2002, 73667). The results are documented in Kapustka (2002, 82657), and a summary of the results relevant to measures of effect is provided in Section 8.1.3.5. Concentrations of COPECs in soil were measured in a sample from the same location, and Table B-3.0-8 provides a crosswalk between the toxicity tests and the soil samples.

8.1.2.7 Plant Survey (AE1, AE2, AE3, AE4, AE5)

Plant surveys to determine species composition and abundance provide a measure of effect (abundance and diversity) for plants and a measure of receptor characteristics for other assessment endpoints. For example, vegetation is an indicator for the presence of bird species, including the Mexican spotted owl. Reaches were selected to represent the overall gradient in COPEC concentrations (Katzman 2002, 73667), and these reaches overlapped most of the locations selected for plant surveys, invertebrate toxicity testing, the cavity-nesting bird monitoring network, the breeding bird survey, and the small-mammal trapping arrays. The survey areas included reaches AC-3, P-3W, DP-2, LA-0, LA-1FW, LA-1W, LA-1C, LA-1E, LA-2E, and LA-3 and the Guaje Canyon small-mammal trapping arrays. Plant surveys were completed in summer 2002 as planned (Katzman 2002, 73667). Data were analyzed using standard plant transect methods, which were supplemented with the quantitative habitat analysis (QHA) procedure. QHA is a tool for assessing and ranking habitat within a user-friendly ArcView application, and it provides information on ecosystem "health" through US National Vegetation Classification Element Occurrence scoring and other metrics. Descriptions of all methods and detailed results are provided in Marsh (2003, 82661), and a summary of the results relevant to measures of effect and ecosystem/receptor characteristics is provided in Section 8.1.3.

8.1.2.8 *Chironomus tentans* Toxicity Tests (AE6)

Toxicity testing using an aquatic midge, *Chironomus tentans*, provides a measure of effect (survival and growth) for the aquatic community that can be related to the impacts on abundance and diversity of the aquatic community in the perennial stream segments of the Los Alamos and Pueblo watershed. Toxicity testing in this assessment was based on the approach and test organisms applied previously in Cañon de Valle (LANL 2003, 77965), using Test Method 100.2 (EPA 2000, 73776).

As indicated in the Cañon de Valle report (LANL 2003, 77965, Appendix L), two general approaches are available for conducting toxicity tests: the use of water-column test organisms or sediment-dwelling test organisms. Given the nature of the aquatic system in the Los Alamos and Pueblo watershed, organisms that live in sediment are more representative of contaminant exposures to endemic biota than are water-column organisms (such as the cladoceran *Ceriodaphnia dubia*, an organism commonly used to test the sensitivity of aquatic organisms to metals in water). The midge, *Chironomus tentans*, is a toxicity test organism that is well documented for its toxic responses to contaminants, is widely used in toxicity testing, and is reared from laboratory populations. Additionally, the genus *Chironomus* is present in the Los Alamos and Pueblo watershed (Foxy 1995, 50039, pp. 163–164). A cursory literature review provided by ASTM (1995, 73729) indicates that *Chironomus tentans* was among the most sensitive of 24 species evaluated with Great Lakes sediment. In various studies, the midge tended to be less sensitive than the amphipod *Hyalella azteca* for some metals and equivalent to or more sensitive than *Hyalella azteca* for pesticides.

Locations in the Los Alamos and Pueblo watershed were selected for testing, based on the presence of persistent or intermittent surface water and a gradient of COPEC concentrations. Locations selected for *Chironomus tentans* growth and mortality tests are shown on Figure 8.1-1. Dunnett's t-Test was used to compare the results of the tests with results from reference locations where either persistent water or drier conditions exist. Two reference (or upstream) locations were selected; one was a persistent surface water location in upper Los Alamos Canyon (reach LA-0), and the second was an intermittent surface water location in upper Pueblo Canyon (reach P-1FW). At each location, the water and sediment were collected for chemical analysis for the following analytical suites: metals, cyanide, PAHs, PCBs, pesticides, americium-241, strontium-90, isotopic plutonium, and gamma spectroscopy radionuclides. Information from the toxicity tests was compared with COPEC concentrations in the water and sediment. Fieldwork and laboratory analyses were completed as planned (Katzman 2002, 73667). The *Chironomus tentans* toxicity tests are documented in Pacific Ecorisk (2002, 82656), and a summary of the results relevant to measures of effect is provided in Section 8.1.3.6. Sediment and water samples collected and analytical suites requested are summarized in Table B-3.0-9, and analytical results are provided in Appendix C. Table B-3.0-10 provides a crosswalk of the sediment and water samples and the *Chironomus tentans* growth and mortality tests.

8.1.2.9 Rapid Bioassessment Characterization (AE6)

Near the end of the 2002 rainy season (September and October), a rapid bioassessment characterization (EPA 1999, 73728) was conducted at locations with sufficient water to potentially support an aquatic community. The rapid bioassessment provides information about the physical habitat quality and aquatic macroinvertebrate community structure present at these locations. Habitat was assessed, and aquatic macroinvertebrates were sampled at six sites where flow volume potentially could support the development of aquatic invertebrate communities. The study sites included four locations in Los Alamos Canyon (reaches LA-0, LA-1FW, LA-4W, and LA-5), one in DP Canyon (reach DP-1C), and one in Pueblo Canyon (reach P-3E). The rapid bioassessment characterization included habitat ratings for

locations based on watershed features, riparian vegetation, in-stream features, aquatic vegetation, and benthic substrate (Henne 2004, 84601).

Aquatic invertebrate samples were collected under standardized effort (i.e., to cover the same length of reach and to sample for a consistent amount of time) using a dip net to sample the major habitat types present in the reach (riffles, runs, pools, submerged vegetation). The invertebrate specimens were identified by an expert, and the resulting data were analyzed using a set of six metrics that have been shown to be robust across wide geographic areas, including measures of richness (number of Ephemeroptera taxa, number of Plecoptera taxa, and number of Trichoptera taxa), diversity (Shannon-Weiner index), feeding groups, tolerance to perturbation (number of intolerant taxa), and habitat (number of clinger taxa) (Henne 2004, 84601). These metrics are used in a semiquantitative manner to support characterization of these locations. Fieldwork was completed as planned (Katzman 2002, 73667). The results are documented in Henne (2004, 84601), and a summary of the results is provided in Section 8.1.3.6.

8.1.2.10 *Chironomus tentans* Deformities (AE6)

Chironomid mouthpart deformities have been used as a measure of exposure for aquatic organisms (Henne and Ryti 2004, 85533). An experimental tank of sediment and water (see Section 8.1.2.8), in addition to the replicates needed for the toxicity tests, was treated in the same manner as the replicates evaluated for toxicity. Morphology (mouthparts and antennae) of these animals was evaluated to quantify malformations, and the rates of deformities were compared with contaminant concentrations or contaminant loading (Henne and Ryti 2004, 85533). Changes in morphology are not used as a measure of effects in this report, but instead, this deformity assessment evaluation is a pilot investigation of bioindicators of exposure under controlled conditions for future environmental monitoring (Katzman 2002, 73667). *Chironomus tentans* mouthparts and antennae were examined for deformities as proposed in Katzman (2002, 73667). The results are documented in Henne and Ryti (2004, 85533), and a summary of the results is provided in Section 8.1.3.6.

8.1.2.11 Spatial Modeling using ECORSK.7 (AE1, AE2, AE3)

ECORSK.7 provides a measure of effect using the HQ methodology for wildlife receptors (EPA 1997, 59370). ECORSK.7 integrates biological, ecological, and toxicological information using Geographic Information System (GIS) interfaces so that all model input and output are spatially explicit (Gonzales et al. 2004, 85207). ECORSK.7 was used to model risk to three receptors: *Peromyscus maniculatus* (deer mouse), *Strix occidentalis* (Mexican spotted owl), and *Sialia mexicana* (western bluebird). Effects are characterized by evaluating impacts on individual Mexican spotted owls using a measure of population effects on invertebrate species as the proportion of the population with an HI greater than 1 (Katzman 2002, 73667). Exposure pathways considered in ECORSK.7 are incidental soil ingestion and food ingestion. The model assigns nest sites or focal locations (the center of the animals' home range) within GIS land cover types that incorporate measurements on the distribution of these animals. An animal then can either forage across its home range in a uniform manner or forage based on the central-place foraging theory with greater amounts of food and greater COPEC exposure near the nest or focal point. The model calculates unadjusted, adjusted, and background HI values for each nest site or focal point. The unadjusted HI is equivalent to the total exposure from COPECs, including background sources. The adjusted HI removed the contribution of background sediment concentrations. The adjusted scenario was identified as the most reasonable case on which to base conclusions because the adjusted HI provides information on the COPECs that may originate from Laboratory releases and does not reflect background risks.

8.1.3 Characterization of Exposure and Effects

This section discusses the baseline ecological risk assessment characterization of exposure and effects, or the second part of ERAGS Step 6. Figures that support this assessment include scatter plots and box plots. Scatter plots show the data for one variable (e.g., analyte concentration in biota samples on the y-axis) plotted against data from a second variable (e.g., analyte concentration in soil samples on the x-axis). Box plots are used to show differences between two or more categories of data and summarize information about the shape and spread of the distribution of results. The box plots consist of a box and a line (the median value) across the box. The y-axis displays the observed values in the reported units. The area enclosed by the box shows the range containing the middle half of the data; that is, the lower box edge is at the 25th percentile, and the upper box edge is at the 75th percentile. The horizontal line above each box represents the 90th percentile, and the line beneath the box represents the 10th percentile of the sample results. The height of the box is a measure of the spread of the results. The horizontal line across the box represents the median (50th percentile) of the data, a measure of the center of the distribution. If the median line divides the box into two approximately equal parts, the shape of the distribution of results could be symmetric; if not, the distribution is skewed or asymmetric. Thus, each box indicates values for the central half of the data, and comparing the location of boxes can readily assess shifts in the results.

8.1.3.1 Threatened and Endangered Species: Mexican Spotted Owl

The weight of evidence for the Mexican spotted owl consists of two lines of evidence: the ECORSK.7 model and body burdens of prey species. These measures were evaluated in addition to the line of evidence provided by the screening-level ecological risk assessment for the carnivorous avian T&E species guild.

1. ECORSK.7 Modeling

ECORSK.7 modeling assesses potential ecological risks to terrestrial animals over large spatial areas. Estimates of animal exposure over a gridded area are compared with assumed effects levels to generate HIs. ECORSK.7 integrates biological, ecological, and toxicological information using GIS interfaces so all model input and output are spatially explicit. The ECORSK.7 model used the most current information available on COPEC concentrations, toxicity, and bioaccumulation (Gonzales et al. 2004, 85207). The model provides information on the average HI or HQ for ecological receptors and the spatial distribution of HI values.

Key exposure parameters for the Mexican spotted owl include a body weight of 600 g, home range of 412 ha, food intake of 59 g fresh weight per day, and an 88%-carnivore and 12%-insectivore diet (Gonzales et al. 2004, 85207). The owl was also assumed to be a central-place forager with exponentially decreasing foraging intensity with increasing distance from the nest site. Central-place foraging birds have a nest or roost to which they return after each foraging event. Most birds are central-place foragers, especially during the breeding season. Based on these inputs, the unadjusted average HI for the owl is 0.67 across the watershed (Gonzales et al. 2004, 85207, p. 35), and this HI was dominated by anthropogenic sources (average background HI was 0.22). The unadjusted average HI was less than 1, indicating no potential for adverse ecological effects for an average nest site, because exposure doses do not exceed the NOAEL.

These results are generally comparable to those obtained from ECORSK.4, which was also used to model potential risks to the Mexican spotted owl (Gallegos et al. 1996, 57915). However, one difference is that a greater frequency of model results was greater than an HI of 1 based on

ECORSK.7 model structure and inputs. None of the owl nest sites modeled using ECORSK.4 had an HI greater than 1, whereas 13 of the 100 ECORSK.7 modeled nest sites (or 13%) had HIs greater than 1 (ECORSK.7 model results are provided in Gonzales et al. [2004, 85207], including a map showing HIs [Gonzales et al. 2004, 85207, p. 38]). One of these nest sites with an HI greater than 1 (HI was 3.5) was in upper Los Alamos Canyon (maximum HI for a canyon location), and the dominant contributor to the potential hazard to the modeled Mexican spotted owl nest site was Aroclor-1254. The Aroclor-1254 HQ was 1.1, indicating an exposure only slightly greater than the NOAEL. HQ values for other COPECs at this nest site were less than 1. Thus, effects on the population are unlikely, based on the low HIs and low frequency of HIs greater than 1.

2. Concentrations of COPECs in Prey

Small mammals, which are prey for Mexican spotted owls, were analyzed for metals, PCBs, and pesticides. Four small-mammal species were analyzed, including deer mouse (*Peromyscus maniculatus*) and brush mouse (*Peromyscus boylii*), which are more common and omnivorous, and western harvest mouse (*Reithrodontomys megalotis*) and piñon mouse (*Peromyscus truei*), which are less common and more granivorous (seed eating). Maximum concentrations of COPECs measured in small mammals are listed in Table 8.1-3, which includes the maximum detection limit for some COPECs (if not detected). Table 8.1-3 also provides the owl ESL calculated for each COPEC based on the Ecorisk Database, Version 1.5, avian TRV (LANL 2002, 73702; LANL 2003, 74012) and exposure parameters for the Mexican spotted owl (see below). The owl ESL is calculated based on the general HQ equation (LANL 1999, 64783), which is derived as follows:

$$HQ = \frac{\text{Exposure}}{\text{Effect}}; \quad HQ_{owl,j} = \frac{I_{owl} \cdot C_{mammal,j}}{NOAEL_{owl,j}}; \quad \text{Let } HQ_{owl} = 1, \text{ solve for } C_{mammal,j}$$

$$ESL_{owl,j} = C_{mammal,j} = \frac{NOAEL_{owl,j}}{I_{owl}}$$

where $C_{mammal,j}$ is the concentration in small mammals of COPEC j (mg of COPEC/kg animal fresh weight) [note this concentration includes soil in the pelt and therefore includes incidental soil ingestion for the owl];

$ESL_{owl,j}$ is the owl ESL for COPEC j (mg of COPEC/kg animal fresh weight);

$NOAEL_{owl,j}$ is the avian NOAEL for COPEC j (mg/kg/day); and

I_{owl} is the normalized daily dietary ingestion rate for the owl (kg food fresh weight/kg owl/day).

The normalized food intake of 0.102 kg food fresh weight/kg owl/day for the Mexican spotted owl is based on the average intake of one wood rat per day (or 0.059 kg fresh weight per day) and the average body weight of 0.58 kg (Weathers et al. 2001, 73476). This calculation assumes an area use factor of 1, which is consistent with the way other ESLs are derived (LANL 1999, 64783). Comparison of the maximum biota concentrations with owl ESLs is used as a screening tool to determine if the concentrations of any COPEC in small mammals might exceed an HQ of 1. Only the lead HQ is greater than 1, and all other HQs are less than 0.16 (Table 8.1-3). The maximum lead concentration was from an animal collected in the reference location (Guaje Canyon), but the lead HQ for the maximum small-mammal concentration in the Los Alamos and

Pueblo watershed was also greater than 1. The HI (sum of HQs) based on owl ESLs and using maximum results from all animals is greater than 1 for the data from the Los Alamos and Pueblo watershed (2.23) and Guaje Canyon (2.32), and the majority of the HI is from the lead HQ. Because HIs exceed 1, some further assessment of small-mammal concentrations, and in particular the lead concentrations that yield HQ and HI greater than 1, is warranted.

The HQ based on the upper confidence limit (UCL) of average lead concentrations in mammals is much less than the HQ based on the maximum lead concentrations (the 95th UCL of average small-mammal lead concentrations for Guaje Canyon was 68.7 mg/kg, for a lead HQ of 0.45; the 95th UCL of average small-mammal lead concentrations for the Los Alamos and Pueblo watershed was 22.5 mg/kg, for a lead HQ of 0.17). Thus, chronic exposures to Mexican spotted owl based on the UCL of the average concentrations indicate no potential for adverse ecological effects. In addition, the lead HQ based on the maximum or average of the reference site samples is larger than the HQ based on the same statistics for lead concentrations in small-mammals from the Los Alamos and Pueblo watershed. Because HQs based on maximum results from individual animals are all less than 1 except for lead and the HQ for lead based on average concentrations is less than 1, there is no potential for adverse ecological effects on Mexican spotted owls by consuming small mammals with these whole-body concentrations.

The relationship between contaminant concentrations in small mammals and COPC concentrations in soil is provided in scatter plots in Section E-4.1 of Appendix E. There is no statistical relationship between whole-body concentrations of lead and concentrations of lead in soil, and Figure 8.1-2 shows that the higher whole-body concentrations of lead (>100 mg/kg dry weight) were measured across the range of lead concentrations from the Los Alamos and Pueblo watershed (9 to 59 mg/kg). Figure 8.1-2 also shows whole-body concentrations of lead versus soil results from a literature compilation (Sample et al. 1998, 72726).

One difference between the literature and Los Alamos and Pueblo lead concentrations in mammals is the frequency of sample results where the concentration in mammals is greater than the concentration in soil. Twenty-four of 96 samples collected from Acid, Los Alamos, Pueblo, and Guaje Canyons had higher lead concentrations in mammals than in soil, but only 2 of 136 of the mammal concentrations from the literature compilation had lead concentrations in mammals greater than concentrations in soil. Thus, concentrations are greater in the mammal samples from this investigation than reported in the literature compilation. One possible explanation could be a bias introduced during sample preparation, but this possibility is not consistent with the lack of high lead concentrations in the nine QC animals (average lead concentration in the QC animals was 0.035 mg/kg fresh wt [Tardiff et al. 2003, 85525]).

Regardless of whether these lead measurements reflect animals with high lead or not, there are two important results. First, sample results for lead were elevated in a fraction of animals across all trapping arrays, and the maximum concentration was for an animal collected in the reference arrays (Guaje Canyon). Second, HQ values for all COPECs (except lead) based on the maximum concentrations are less than 1. Lead HQs for the Los Alamos and Pueblo watershed are less than those obtained in the reference location (Guaje Canyon). Thus, concentrations of COPECs in measured samples of Mexican spotted owl prey are less than levels associated with adverse ecological effects or are similar to concentrations measured in a reference area.

8.1.3.2 Avian Invertevore Feeding Guild

The weight of evidence for the avian invertevore consists of seven lines of evidence. Nest occupancy rates, nesting success, eggshell thickness, COPEC concentrations in eggs, COPEC concentrations in food, ECORSK.7 modeling, and field surveys were evaluated in addition to the screening-level ecological risk assessment for the avian invertevore feeding guild.

1. Occupancy Rate by Bluebirds

Nest occupancy by cavity-nesting birds across the nest box monitoring network is documented in a series of annual reports (e.g., Fair 2002, 82654; Fair and Sommer 2002, 84602; Fair and Colestock 2003, 84603). The overall occupancy frequency for the monitoring network ranges between 9 and 28% from 1997 to 2003, and, excluding the first year of the network, occupancy ranges between 16 and 28%; occupancy was lowest in the first year, possibly because it took time for the birds to locate the boxes (Fair and Colestock 2003, 84603, p. 10). Occupancy for various locations across the network and locations within the Los Alamos and Pueblo watershed is variable. For example, in 2003 none of the nest boxes in 2003 in Acid Canyon (31 boxes) or in 2002 in Guaje Canyon (11 boxes) was occupied. Occupancy in 2003 at other locations in the Los Alamos and Pueblo watershed ranged from 3% to 80% (DP Canyon, 25% of 12 boxes; golf course, 80% of 10 boxes; cemetery, 38% of 16 boxes; Los Alamos Canyon, 4% of 112 boxes; and Pueblo Canyon, 52% of 61 boxes [Fair and Colestock 2003, 84603 p. 8]). Boxes in these other locations in the Los Alamos and Pueblo watershed have been in place since 1997.

Explanations for variability in nest occupancy range from regional trends to more location-specific problems. One of the major regional trends has been a greater occupancy in locations that were burned during the Cerro Grande fire. Nest occupancy in 2003 illustrates a clear preference for burned locations outside of the Los Alamos and Pueblo watershed; 69 of 98 boxes in burned locations (70%) were occupied, and 101 of 534 boxes in unburned locations (19%) were occupied (Fair and Colestock 2003, 84603, p. 8). These numbers suggest that nest occupancy is unrelated to concentrations of these COPECs because burned locations in Mortandad Canyon, with relatively high contaminant levels, have a very high occupancy rate (98% occupancy in 2003 [Fair and Colestock 2003, 84603, p. 8]). Although none of the locations in the Los Alamos and Pueblo watershed was burned, greater occupancy in burned locations probably means fewer birds in unburned locations, assuming that the western bluebird population has not greatly expanded. One location-specific problem is that two locations added in 2002 and 2003 (Acid and Guaje Canyons) have suffered from vandalism, which has not occurred in other parts of the network. Vandalism is relevant to measures of occupancy, because a nest box demolished or lying on the ground is not suitable for nesting bluebirds.

2. Nest Success for Bluebirds

Seven years of data from the Los Alamos and Pueblo watershed portion of the cavity-nesting bird monitoring network (Fair 2004, 85438) were reviewed to assess nest success. Results for western bluebirds are most relevant for evaluating potential COPEC effects because of their short foraging distances (Fair et al. 2003, 82660). Western bluebirds are year-round residents, so potential confounding effects of contaminant exposures during winter migration are avoided (Kunisue et al. 2003, 82667).

Because contaminant concentrations generally decrease downstream from sources in the upper parts of the canyons (Section 7.1), trends in nest success versus the easting coordinate of each nest box can be evaluated as a surrogate for COPEC trends. For example, scatter plots showing

the number of young fledged per nest were evaluated to determine if fledgling numbers are lower in the upper part of the watershed (locations farther west). Differences between nests can also be evaluated as a function of their location in the watershed. Nest boxes in the cemetery or golf course locations are upstream of key SWMUs or AOCs in the Los Alamos and Pueblo watershed, and locations in DP, Los Alamos, or Pueblo Canyons are located downstream of key SWMUs or AOCs (Fair 2002, 82654, Figure 1). Figure 8.1-3 shows that there are no differences in the number of birds fledged per nest between locations in the Los Alamos and Pueblo watershed or along a gradient (versus easting). The percent of females fledged per nest is evaluated as another measure of effects. Figure 8.1-4 shows that there are no differences between locations and across the easting gradient. Additional plots are provided in Section E-4.2 of Appendix E for western bluebird nests in the Los Alamos and Pueblo watershed. No differences were noted in western bluebird nest success from 1997 to 1999 for the entire monitoring network (including but not exclusive of locations in the Los Alamos and Pueblo watershed) (Fair and Myers 2002, 82655). One uncertainty is that the nest boxes added to the monitoring network in 2002 and 2003 to evaluate portions of the Los Alamos and Pueblo watershed were not occupied; the implications are considered in the uncertainty analysis.

3. Eggshell Thickness for Bluebirds

Seven years of data from the Los Alamos and Pueblo watershed portion of cavity-nesting bird monitoring network (Fair 2004, 85438) were reviewed to assess differences in eggshell thickness. Spatial trends are evaluated as an indication of changes in eggshell thickness as related to COPECs. Figure 8.1-5 shows that there are no differences in eggshell thickness between locations in the Los Alamos and Pueblo watershed or along a gradient (versus easting). Additional plots are provided in Section E-4.3 for western bluebird nests in the Los Alamos and Pueblo watershed. These findings are similar to those reported from the analysis of 1997 to 1999 eggshell thickness data, except for eggs collected from nests in Sandia Canyon that had a lower eggshell thickness index (Fair and Myers 2002, 82655) and serve to confirm the utility of eggshell thickness as a measure of effect.

4. COPEC Concentrations in Eggs

COPEC concentrations in eggs provide a measure of exposure and, combined with a comparison with safe levels in biota, can also be a measure of effect. Eggs collected across the monitoring network were analyzed for metals, PAHs, PCB congeners, and pesticides (Fair et al. 2004, 85824). These data provide a general indication of exposure and effects from Laboratory sources and are not specific to releases in the Los Alamos and Pueblo watershed. However, radionuclides were measured in eggs collected in the Los Alamos and Pueblo watershed only, and therefore reflect exposures for the specific watershed of interest in this report. Several metals, PCB congeners, DDE, and DDT were detected in multiple eggs. Concentrations of metals generally did not vary among eggs. Radionuclides were not detected in eggs, and PAHs either were not detected or the results not quantified (reported as "<" values).

Concentrations of metals, DDE, and the sum of measured PCB congeners were compared for western bluebird and ash-throated flycatcher eggs as estimates of exposure and bioaccumulation. Ash-throated flycatchers are winter migrants and therefore may be exposed to these COPECs from non-Laboratory sources. Western bluebirds are year-round residents, so overall levels of PCBs and DDE in bluebird eggs are indications of local or Laboratory sources for these COPECs. Figure 8.1-6 shows that concentrations of PCB congeners are somewhat greater in bluebird eggs than in flycatcher eggs (although statistically not different [Fair et al. 2004, 85824, p. 13]), and the concentrations of DDE are similar between the two species (and

statistically not different [Fair et al. 2004, 85824, page 13]). PCB concentrations in western bluebird eggs are plotted by watershed in Figure 8.1-7, and DDE concentrations in western bluebird eggs are plotted by watershed in Figure 8.1-8. PCB concentrations are less than 2 mg/kg (fresh weight) in all analyzed eggs.

Bennett et al. (1999, 82652) developed a summary of PCB concentrations in birds that may be associated with adverse effects, and the most definitive threshold from that survey is that adverse effects may be associated with concentrations in brain tissue when greater than 300 mg/kg (fresh weight). Given available ratios between muscle tissue and brain tissue concentration (a multiplier between 2 and 8.7), 2 mg/kg in an egg translates to far less than 300 mg/kg in brain tissue (maximum estimated brain concentration would be 17 mg/kg or 8.7 times 2). Thus, these PCB egg concentrations are less than levels reported to be associated adverse effects in birds. The maximum egg concentration reported for DDE (0.3 mg/kg fresh weight) is consistent with values reported for killdeer eggs (0.5 mg/kg reported by Fair et al. [1994, 82650]), which indicates that the bluebird DDE exposure concentrations in the Los Alamos and Pueblo watershed are similar to those reported for birds elsewhere.

PCBs and DDE have also been detected in adult birds collected in the watershed (Podolsky 2000, 73477; p. 37). The only western bluebird in the Podolsky (2000, 73477; p. 37) study had 0.7 mg/kg Aroclor-1260 fresh weight and 0.03 mg/kg DDE fresh weight (value reported by Podolsky was converted to fresh weight by assuming 68% moisture). The maximum concentrations for any birds in the Podolsky (2000, 73477; p. 37) study were 1.7 mg/kg Aroclor-1260 fresh weight and 0.8 mg/kg DDE fresh weight (assuming 68% moisture). The DDE concentrations reported in birds or eggs from the Los Alamos and Pueblo watershed and vicinity fall in the lower range of DDE concentrations measured in adults and reported for a variety of bird species (0.02 to 22 mg/kg reported by Kennedy et al. [1995, 82651]). Thus, DDE concentrations measured in western bluebird and ash-throated flycatcher eggs are similar to those reported in other studies and indicate there is no greater exposure to DDE for birds in the Los Alamos and Pueblo watershed than birds elsewhere. Therefore, DDE is ubiquitous in the environment (see discussion in Section 7.1.3.3 about the sources of DDT and its metabolites), and concentrations of DDE in eggs or birds in the investigation area are at the low end of values reported in the literature. In conclusion, there is no evidence for increased concentrations or any associated increase in adverse ecological effects associated with pesticides in the Los Alamos and Pueblo Canyon watershed or, more generally, at the Laboratory.

Some metals were also detected in eggs, and four metals (barium, copper, mercury, and zinc) were detected in many eggs. Copper, mercury, and zinc were measured at similar concentrations in western bluebird and ash-throated flycatcher eggs, but concentrations of barium were greater in the western bluebird eggs (Figure 8.1-9). Metals concentrations in western bluebird eggs were similar across the various watersheds (Figure 8.1-10). This observation indicates that metals are equally bioavailable in these watersheds, possibly because the source of these metals is primarily from background sources. In summary, concentrations of PCBs, DDE, and metals in bird eggs in the Los Alamos and Pueblo watershed are indicative of exposure, but these concentrations are either less than thresholds of concern or are similar to levels of exposure obtained elsewhere. Concentrations of PCBs and DDE measured in the eggs are less than levels associated with adverse effects.

5. Concentrations of COPECs in Food

Concentrations of COPECs in earthworms provide a measure of concentrations of COPECs in food for the avian invertevore feeding guild. The earthworm toxicity test was conducted for

28 days to estimate bioaccumulation. Scatter plots that show the relationship between the concentrations of metals in earthworms and the concentrations of metals in soil are provided in Section E-4.4. Significant statistical relationships exist between concentrations in earthworms and soil for some of the metals, indicating that metals can accumulate in earthworms and potentially be transferred to birds. The potential ecological effects of metals in earthworms are further discussed below using the results of an earlier Laboratory-specific study (Podolsky 2000, 73477, pp. 39–40).

The three metals with the most significant relationships are cadmium, lead, and mercury, and earthworm and soil concentrations for these metals are plotted in Figure 8.1-11, showing data from this study and from Podolsky (2000, 73477). The bioaccumulation rates indicated by the two studies are not consistent for cadmium and mercury (i.e., the data plotted in Figures 8.1-11[a] and 8.1-11[c] are not linear for cadmium and mercury), although they appear to be consistent for lead (Figure 8.1-11[b]). These inconsistencies indicate uncertainties in these relations that affect conclusions about potential ecological risk. These plots also show that in each set of earthworm bioaccumulation data one location has higher concentrations of cadmium, lead, and mercury than other locations. Because a bioaccumulation model developed using these data would potentially be biased by statistical outliers, additional uncertainties would be introduced in calculations of empirical bioaccumulation factors such as for use in ECORSK.7 modeling.

Another important observation is that samples of other ground-dwelling invertebrates were also collected in the Podolsky study, and concentrations of cadmium, lead, and mercury in these invertebrates were 3 to 50 times lower than those reported for the earthworms (Podolsky 2000, 73477, p. 40). This observation indicates that bioaccumulation information for earthworms may lead to highly protective estimates of ecological risk unless invertebrates can truly specialize on earthworms.

In summary, the metals data from the earthworm bioaccumulation test and from Podolsky (2000, 73477) indicate potential exposure of invertebrates to metals, and hence potential transfer to birds. However, significant relationships were obtained for only a few metals, and the data are not consistent and not amenable to developing reliable bioaccumulation models. In addition, bioaccumulation provides only a measure of exposure, and an evaluation of the measures of effect is based on data from the nest box network, ECORSK.7 modeling, and field surveys of bird abundance and diversity. Therefore, the evidence for bioaccumulation in earthworms does not by itself indicate adverse ecological effects on birds in the watershed.

6. ECORSK.7 Modeling

ECORSK.7 assesses potential ecological risks to terrestrial animals over large spatial areas. Key exposure parameters for the western bluebird include a body weight of 31 g, home range of 0.43 ha, food intake of 15.5 g fresh weight per day, and an 88%-insectivore and 12%-herbivore diet (Gonzales et al. 2004, 85207). The bluebird was assumed to forage uniformly over its home range. Based on these inputs, the unadjusted average HI for the watershed for the bluebird, 5.6, was dominated by background concentrations of metals (average background HI = 5.1). Thus, the adjusted average HI for the bluebird is 0.5 across the watershed, and because the adjusted average HI was less than 1, this indicates no potential for adverse ecological effects for an average nest site from Laboratory-derived COPCs (Gonzales et al. 2004, 85207, p. 35). ECORSK.7 also provides information on the spatial patterns in the HI values and the frequency of HI values greater than 1. About 11% (106 of 1000) of the model nest sites in the watershed had adjusted (total minus background) HIs greater than 1, and 7% (65 of 1000) had adjusted (total minus background) HIs greater than 3 (Gonzales et al. 2004, 85207, p. 40, provides a map

showing these locations). Thus, across the entire watershed, relatively few model bluebird nest sites have the potential for adverse ecological effects ($HI > 1$), and the probability of population effects is small.

7. Field Surveys of Bird Abundance and Diversity

Field surveys were completed to provide information on the number of birds, number of species, and species diversity (Keller 2003, 82662). Species diversity is calculated on the basis of the frequency of species noted during the survey and provides an index of the evenness or relative abundance of species. For example, a site with 2 species observed in equal number has a calculated diversity of 2, but a site with 2 species where 1 species is 99 times more abundant has a diversity calculated of about 1. The locations surveyed were cross-referenced to reaches and the average concentrations of two key avian COPECs (PCBs [sum of Aroclor-1254 and Aroclor-1260] and DDX [sum of DDE and DDT]). Based on the average concentrations of these COPECs, HQs were calculated for the reaches with bird surveys using the robin-invertevore ESL. HQ values were calculated using the robin-invertevore ESL because the robin-invertevore reflects how the AE2 assessment endpoint was defined, and HQ values provide information on spatial trends for the COPECs included in the sum and also provide an indication of where effects may be possible (areas with $HQ > 1$) or not expected ($HQ < 1$). There were no trends between bird abundance, the number of bird species, or bird species diversity and PCB or DDX HQ values (Figures 8.1-12 and 8.1-13). Similar bird densities have been reported for these locations in surveys conducted in 1993 and 1994 (Fox 1995, 50039, pp. 243-249). Thus, there is no evidence for effects on bird abundance or diversity with increasing concentrations of COPECs in soil. However, landscape changes caused by drought and subsequent large-scale tree-thinning operations at the Laboratory may be a confounding factor for bird density and diversity (Fair and Keller 2003, 82664), and the impacts of drought are considered in the uncertainty analysis.

8.1.3.3 Mammalian Invertevore Feeding Guild

The weight of evidence for the mammalian invertevore consists of four lines of evidence. Field surveys of small-mammal abundance and diversity, field surveys to determine small-mammal reproductive status, concentrations in food and organisms, and the ECORSK.7 model were evaluated in addition to the screening-level ecological risk assessment for the mammalian invertevore feeding guild.

1. Field Surveys of Small-Mammal Abundance and Diversity

Trapping arrays to measure small-mammal abundance and diversity were established at four locations in Acid, Los Alamos, Pueblo, and Guaje Canyons. These locations were selected to represent a range of concentrations of study design COPECs for the mammalian invertevore or mammalian omnivore feeding guilds. Study design COPECs for the mammalian invertevore feeding guild are Aroclor-1254, antimony, barium, manganese, and silver. HQ values for these COPECs are calculated on the basis of the reach characterization data (maximum and average soil concentrations) and the average of the composite soil samples collected at the trapping arrays (Table 8.1-4).

Because there are no reach characterization data for the mammal trapping arrays in Guaje Canyon, BV and average background concentrations are used as a surrogate measure for the Guaje Canyon maximum and average concentrations. Because there is no background concentration for Aroclor-1254, concentrations of Aroclor-1254 in reaches upstream of Laboratory SWMUs and AOCs (reaches LA-0 and P-1FW) were used as an estimate of baseline concentrations of Aroclor-1254. HQ values for the metals were similar among the locations

selected for small-mammal trapping, but the Aroclor-1254 HQ varies over approximately two orders of magnitude for reaches AC-3 and LA-1C (Table 8.1-4). Concentrations of Aroclor-1254, and therefore HQ values, are lower in the composite samples than in the reach average data (Table 8.1-4). Concentrations of metal COPECs are generally more similar between composite samples and the reach average, which is consistent with concentrations generally similar to background levels.

This comparison emphasizes that the reach investigations represent a biased assessment of the terrestrial habitat in these canyons, and concentrations from the investigation reaches are overestimates of the exposure concentrations for wildlife. HQ values based on the average of the composite samples are essentially the same as the HQs for background average concentrations of antimony, barium, and manganese (Table 8.1-4). The HQ for silver in reach AC-3 is about five times the HQ based on background average concentration but is about one-third of the HQ based on the silver BV (Table 8.1-4). The Aroclor-1254 HQ based on the average of the composite samples varies over approximately a factor of 20 from the low values in reach P-3W and the Guaje mammal trapping area compared with the highest Aroclor-1254 HQ based on the reach AC-3 composite averages. This analysis indicates that differences in Aroclor-1254 concentrations between the mammal trapping arrays provide a gradient in COPEC concentrations.

Figure 8.1-14 shows the relationship between small-mammal density estimated from the mark-recapture study in the trapping arrays (Robinson and Bennett 2003, 82663) and the Aroclor-1254 HQ from the trapping array. The upper and lower arrays provided independent estimates of mammal density. Two trapping events occurred (summer and fall 2002), providing 14 density estimates (Acid Canyon had one trapping array, the other three sites had two arrays, and there were two trapping events). In some cases, an insufficient number of recaptures prevented a valid density estimate, and one trapping array was incorrectly located for the summer trapping event (lower array for reach P-3W).

For the 10 estimates of small-mammal density, there is no evidence for a decreasing trend with increasing Aroclor-1254 HQ (Figure 8.1-14). In fact, the highest density estimate (about 50 animals/ha) was for the summer 2002 trapping event in reach AC-3, which has the highest COPEC concentrations. These density estimates are comparable to those obtained in 1993 and 1994 at other locations in Los Alamos and Guaje Canyons (density between 8 and 39 animals/ha [Fox 1995, 50039, p. 263]). Species diversity was similar across the mammal trapping arrays, except the fall trapping event in reach LA-1C, which had lower diversity than the other arrays and events (Robinson and Bennett 2003, 82663, p 19). It is unknown why diversity was lower in this one event at this one location, but it was not a repeatable difference, and this lower diversity is associated with trapping arrays with intermediate Aroclor-1254 concentrations (HQ of 1.4). Two species represented most of the captures: deer mice and brush mice (Robinson and Bennett 2003, 82663, pp. 14–18). Thus, there is no evidence for COPECs causing decreased density or diversity of small-mammal species.

2. Field Surveys to Determine Small-Mammal Reproductive Status

Animals were visually inspected to assess reproductive status of small mammals captured during mark-recapture events (Robinson and Bennett 2003, 82663). The visual cues for reproductive status are based on pelage color or gross morphological observations. The numbers of animals in reproductive classes by species, trapping event, and location are provided in Robinson and Bennett (2003, 82663). One result is that the numbers of animals per species, location, and reproductive class are small (typically between 0 and 5 individuals). Figure 8.1-15 illustrates the numbers of animals for male and female reproductive classes for deer mice in both trapping

events, and Figure 8.1-16 presents the same information for brush mice. The only notable difference in reproductive status is that Pueblo Canyon (reach P-3W) had a large number of nonscrotal deer mouse males (Figure 8.1-15), which may indicate that reach P-3W is an area of active recruitment of males, although the specific reasons for this observation are unknown. Because of the small numbers of animals when split by species and the finer resolution of reproductive classes, data on reproductive status were sorted by reproductive males (scrotal) and nonreproductive males (juvenile and nonscrotal) and reproductive females (pregnant and lactating) and nonreproductive females (juvenile and nonreproductive). Figure 8.1-17 shows no decreases in the fraction of reproductive females or males status versus the Aroclor-1254 HQ for the trapping array. Some differences were noted in the sex ratios (different from 50:50) for specific events in specific arrays (Robinson and Bennett 2003, 82663), but sex ratios do not differ between the pooled event and array data for each reach. Thus, there is no evidence for COPECs causing adverse impacts to the reproductive status of small-mammal species.

3. Concentrations of COPECs in Food and Organisms

Concentrations of COPECs in food (earthworms) and small mammals have been presented as lines of evidence for the Mexican spotted owl (Section 8.1.3.1) and the avian invertivore feeding guild (Section 8.1.3.2). In summary, the analysis of metals in earthworms shows evidence for bioaccumulation of some metals, but the metals with the best evidence for bioaccumulation (cadmium, lead, and mercury) are not study design COPECs for the mammalian invertivore (or omnivore) feeding guild. Concentrations of COPECs measured in small mammals do not indicate bioaccumulation (Section 8.1.3.1). Because Aroclor-1254 is a study design COPEC for the mammalian invertivore (or omnivore) feeding guild, bioaccumulation of PCBs in small mammals is a measure of exposure.

Figure 8.1-18 presents the comparison of concentrations of PCBs in small mammals (converted to dry weight) with the concentrations of PCBs in soil. The first observation is that Aroclor-1254 was not detected in small mammals, and Figure 8.1-18(a) presents the range of nondetected sample results for Aroclor-1254 to show that detection limits are similar among the mammals analyzed. Figure 8.1-18 also provides two reference lines that represent the predicted bioaccumulation of PCBs based on the Ecorisk Database, Version 1.5, transfer factors (LANL 2002, 73702; LANL 2003, 74012). Detectable small-mammal concentrations of Aroclor-1254 are predicted on the basis of Aroclor-1254 transfer factors and soil concentrations in most of the trapping arrays (Figure 8.1-18[a]).

Aroclor-1260 was detected in small-mammal tissue, and the concentrations of Aroclor-1260 are plotted versus the concentration of total Aroclor (Aroclor-1254 plus Aroclor-1260) in soil in the trapping arrays (Figure 8.1-18[b]). Total Aroclor in soil is plotted on the x-axis because Aroclor mixtures are often difficult to quantify in weathered environmental media, and Aroclor mixtures are difficult to quantify in biological tissues where the various congeners have different bioaccumulation rates. These uncertainties in the correct identification of Aroclor mixtures are addressed by evaluating the relationship between total Aroclors and small-mammal Aroclor concentrations. Relatively few Aroclor-1260 results were detects (20 out of 98 animals), and most of these detects are greater than 0.1 mg/kg dry weight. In Figure 8.1-18(b), seven results are reported as greater than 0.1 mg/kg dry weight, including four results for females and three results for males.

Gender differences in contaminant concentrations are worth noting because of physiological and behavioral differences between the genders. These detected concentrations of Aroclor-1260 are generally associated with low or medium PCB concentrations in soil, and with one exception,

these concentrations are consistent with the bioaccumulation models from the Ecorisk Database, Version 1.5. The highest Aroclor-1260 concentration is for a male trapped in reach P-3W, which is a reach with low and typically nondetected concentrations of PCB in soil. One explanation may be that this animal was trapped in reach P-3W but obtained its body burden of PCBs elsewhere. The maximum Aroclor-1260 small-mammal concentrations are less than concentrations associated with adverse effects on small mammals (Bennett et al. 1999, 82652). Thus, the available evidence indicates that adverse effects on small mammals from COPECs in food are unlikely.

4. ECORSK.7 Modeling

ECORSK.7 modeling assesses potential ecological risks to terrestrial animals over large spatial areas. Key exposure parameters for the deer mouse include a body weight of 20 g, home range of 0.064 ha, food intake of 1.4 g fresh weight per day, and an omnivore diet (50% insectivore and 50% herbivore) (Gonzales et al 2004, 85207). Although the home range of the deer mouse is less than the area of one grid cell in the model (900 m² [10,000 ft²]), the model requires that the deer mouse forage uniformly within a grid cell (or the smallest spatial scale evaluated in the ECORSK.7 model).

Based on these inputs, the unadjusted average HI for the deer mouse, 9.8, was dominated by background concentrations (HI = 9.5). Thus, the adjusted average HI for the deer mouse is 0.3 across the watershed, and because the adjusted average HI was less than 1, this indicates no potential for adverse ecological effects for an average nest site (Gonzales et al. 2004, 85207, p. 35). The ECORSK.7 model also provides information on the spatial patterns in the HI values and the frequency of HI values greater than 1. About 6% (58 of 1000 model focal points) had adjusted (total minus background) HIs greater than 1, and about 5% (46 of 1000 model nest sites) had adjusted (total minus background) HIs greater than 3 (see Gonzales et al. [2004, 85207, p. 42] for a map showing these locations). Thus, across the entire watershed, relatively few model deer mouse focal points have the potential for adverse ecological effects (HI >1), and therefore the likelihood of population effects is small.

8.1.3.4 Detritivores

The weight of evidence for detritivores consists of two lines of evidence. Toxicity tests of earthworm survival and growth and concentrations of COPECs in organisms were evaluated in addition to the screening-level ecological risk assessment for detritivores.

1. Toxicity Tests (Earthworm Survival and Growth)

The earthworm toxicity test provides information on survival and growth of earthworms at various sites in the Los Alamos and Pueblo watershed across a gradient of COPEC concentrations and in comparison with a reference location (Guaje Canyon) (ep&t 2002, 82658; ep&t 2003, 82659). Results are summarized with box plots comparing survival and growth test results, and these plots also include comparison circles (Figures 8.1-19 and 8.1-20). These plots indicate which samples had higher or lower survival and growth compared with the reference sample (Guaje Canyon). The boxes indicate the interquartile range of the sample results, with the upper and lower ends defined by the 75th and 25th percentiles, respectively. Lines above and below the boxes represent the 5th and 95th percentiles of the data. Dunnett's t-Test results are presented in the right-hand section of the figure. The comparison circles indicate statistical differences between the tests and the reference sample (also known as the control sample. The control sample for the Dunnett's t-Test is displayed as a heavy red circle, and the text for the reference

location (Guaje Canyon) is printed in bold red text on the x-axis. Thin red circles represent samples that are not statistically different ($p > 0.05$), and the reach identifiers (IDs) are printed in red on the x-axis. Heavy gray circles represent samples that are statistically different, and the reach IDs are printed in black on the x-axis. The diameter of the circle is proportional to the variance of the test results.

Other than the sample from reach LA-1W with high mortality discussed in Section 8.1.2, no significant differences in survival and only one statistically significant difference in growth was noted (ep&t 2002, 82658; ep&t 2003, 82659). Also, all of the treatments, including the laboratory negative control sample, showed weight loss, which is typical in these tests (ep&t 2002, 82658; ep&t 2003, 82659). Figure 8.1-19 shows variations in survival between the laboratory replicates for a reach and laboratory or test control samples. The only significant decrease in survival is for the sample collected in reach LA-1W, and as discussed in Section 8.1.2.5, the decreased earthworm survival for this sample is probably related to soil pathogens. Figure 8.1-20 shows variation in growth between the laboratory replicates for a reach and laboratory or test control samples. The only significant decreases in growth are for the samples collected in reaches LA-1W and P-3E. Samples from reach LA-3E show less weight loss than the reference site (Guaje Canyon). Differences in survival and weight loss are not related to COPEC concentrations (based on scatter plots of survival and growth versus invertebrate COPEC HQs in Section E-4.5 of Appendix E). Specifically, the HQ and HI values based on the invertebrate ESL are low for the sample with high mortality, and samples with high HQ and HI values have low mortality and no increase or decrease in growth. Thus, there is no statistically significant difference in survival of earthworms among the soils tested and no relationship of survival or growth with COPEC concentrations.

2. Concentrations of COPECs in Organisms

Earthworms were analyzed for metals after the toxicity tests were completed. Three metals had evidence for bioaccumulation. The highest concentrations of these three metals (cadmium, lead, and mercury) were from a sample collected in reach AC-3. However, reach AC-3 did not exhibit any difference in survival or growth compared with the reference site or laboratory control samples (Figures 8.1-19, 8.1-20). Thus, there is no evidence for adverse effects on earthworm survival or growth because of COPECs in soil.

8.1.3.5 Plant (Primary Producers)

The weight of evidence for plants consists of two lines of evidence. Toxicity tests of seedling germination and growth and abundance and diversity of plants were evaluated in addition to the screening-level ecological risk assessment for detritivores.

1. Toxicity Test (Seedling Germination and Growth)

Seedling germination tests using western yarrow provide 10 measures for evaluating possible adverse ecological effects of COPECs on plants and include mortality, average shoot height, average root length, shoot wet weight, root wet weight, total wet weight, shoot dry weight, root dry weight, total dry weight (replicate [pot] or plant). Details on these tests are available in Kapustka (2002, 82657), and box plots with comparison circles of the plant test measures versus soil samples are provided as Figures 8.1-21 to 8.1-30. These plots indicate which samples had higher or lower germination and growth measures compared with the reference location (Guaje Canyon). The boxes indicate the interquartile range of the sample results, with the upper and

lower ends defined by the 75th and 25th percentiles, respectively. Lines above and below the boxes represent the 5th and 95th percentiles of the data. Dunnett's t-Test results are presented in the righthand section of the figure. The comparison circles indicate statistical differences between the tests and the reference sample based on Dunnett's t-Test, and the text for the reference location (Guaje Canyon) is printed in bold red text on the x-axis. The control sample for the Dunnett's t-Test is displayed as a heavy red circle, and a thin red circle represents samples that are not statistically different ($p > 0.05$), and the reach IDs are printed in red on the x-axis. Heavy gray circles represent samples that are statistically different, and the reach IDs are printed in black on the x-axis. The diameter of the circle is proportional to the variance of the test results.

Four of these 10 measures (shoot height for all reaches, Figure 8.1-22; root length for reaches P-3E, P-3W, LA-1C, and LA-2W, Figure 8.1-23; shoot wet weight for reaches P-3W, DP-1W, DP-2, LA-2W, and LA-3E, Figure 8.1-24; and total wet weight for LA-2W, Figure 8.1-26) exhibited significant decreases relative to Guaje Canyon soil (the reference site) (Kapustka 2002, 82657). Data indicate that the differences in these 10 measures are not related to a gradient in COPEC concentrations (see scatter plots of the plant test measures versus plant COPEC HQs in Section E-4.6). Specifically, the HQ and HI values based on the plant ESL are relatively low for the sample with shorter shoots or roots, and samples with high HQ and HI values have germination measures similar to samples with low HQ/HI values (Section E-4.6). Plants were not analyzed for COPECs after harvest, and therefore no information exists on the bioavailability of COPECs. Thus, the lack of toxicity could be caused by limited bioavailability of COPECs or tolerance of the plants to the COPECs. Some Laboratory-specific data do indicate that plants take up some radionuclides and metals (Fresquez et al. 1998, 58972), but regional sampling of vegetation for radionuclides did not find different concentrations between locations for most radionuclides (an exception is tritium near Material Disposal Area G [Gonzales et al. 2000, 69697]). Thus, there are no differences in seedling germination between the soils tested and no relationship of differences in growth measures to COPEC concentrations.

2. Abundance and Diversity of Plants

Surveys to quantify the number of plant species (trees, shrubs, forbs, grasses, total) at reaches in the Los Alamos and Pueblo watershed were documented in Marsh (2003, 82661). Because elevation may have a confounding effect on species diversity, the residuals of a linear regression of species diversity versus elevation were also evaluated. There are no trends between the number of plant species and the HQ for key plant COPECs (based on scatter plots of the number of plant species versus COPEC HQs in Section E-4.7). Specifically, the species diversity is similar across a range of HQ and HI values. These plots show that reach LA-0 has greater plant diversity probably because of its higher elevation relative to other reaches and/or to the presence of more persistent surface water.

8.1.3.6 Aquatic Community

The weight of evidence for the aquatic community consists of two lines of evidence. Toxicity bioassay of *Chironomus tentans* survival and growth and rapid bioassessment characterization of habitat and invertebrate abundance and diversity were evaluated in addition to the screening-level ecological risk assessment for the aquatic community. The results of the pilot investigation of *Chironomus tentans* deformities also provide a possible measure of exposure.

1. Toxicity Bioassay (*Chironomus tentans* Survival and Growth) Along a COPEC Gradient

Toxicity to *Chironomus tentans* was tested using Method 100.2 (Pacific Ecorisk 2002, 82656). The laboratory control sample survival and growth parameters were within the limits required to make the test valid (Pacific Ecorisk 2002, 82656), and impacts on survival and growth are inferred by comparing results with reference site results. Two reference (or upstream) locations were selected for the Los Alamos and Pueblo watershed: reach LA-0 and reach P-1FW.

Box plots with comparison circles of the survival and growth test measures versus sediment and water samples are provided as Figures 8.1-31 to 8.1-34. These plots indicate which samples had higher or lower test results compared with the reference locations (LA-0 and P-1FW). The boxes indicate the interquartile range of the sample results, with the upper and lower ends defined by the 75th and 25th percentiles, respectively. Lines above and below the boxes represent the 5th and 95th percentiles of the data. Dunnett's t-Test results are presented in the right-hand section of the figure. The comparison circles indicate statistical differences between the tests and the reference sample. The control sample for the Dunnett's t-Test is displayed as a heavy red circle, and the text for the reference location (Guaje Canyon) is printed in bold red text on the x-axis. Thin red circles represent samples that are not statistically different ($p > 0.05$), and the reach IDs are printed in red on the x-axis. Heavy gray circles represent samples that are statistically different, and the reach IDs are printed in black on the x-axis. The diameter of the circle is proportional to the variance of the test results.

Growth and mortality measures for the downstream reaches were compared with reach P-1FW results in Figures 8.1-31 and 8.1-32, and the comparison of the test results and the reach LA-0 reference sample results are provided in Figures 8.1-33 and 8.1-34. No differences were noted in survival, and three reaches (AC-3, P-3E, and LA-1FW) had slightly more biomass than reach P-1FW (Figures 8.1-31 and 8.1-32). Growth and mortality measures for the downstream reaches were compared with reach LA-0 results in Figures 8.1-33 and 8.1-34. No differences were noted in survival, and four reaches (AC-3, P-3E, LA-1FW, and LA-5) had slightly more biomass than reach LA-0. Differences in these *Chironomus tentans* survival and growth are not related to COPEC concentrations (see plots of survival and growth versus aquatic community COPEC HQs in Section E-4.8). Thus, there are no statistical decreases in survival and growth between the sediments and waters tested and no relationship of variability in survival and growth to COPEC concentrations.

2. Rapid Bioassessment Characterization of Habitat and Invertebrate Abundance and Diversity

Henne (2004, 84601) employed the rapid bioassessment method at five reaches characterized by fairly persistent surface water flow. The aquatic community in these reaches is somewhat to grossly impoverished of aquatic invertebrates. The major reason for having aquatic communities of lesser diversity and abundance is adverse physical factors, including the common lack of persistence and low volume of surface water flow. In some reaches (LA-4W and LA-5W), flow varies to such a degree that substrate and organisms do not persist and organisms must recolonize the reach; these conditions are in part related to the increased magnitude and frequency of floods following the Cerro Grande fire. Another reach with persistent surface water flow, P-3E, is supplied with treated wastewater from the Bayo WWTP, and organisms typical of WWTPs (sewage worms) are found in this reach.

In 1993 and 1994, sampling of aquatic invertebrates was conducted at three locations in Los Alamos Canyon and three locations in Guaje Canyon as part of baseline ecological studies in

these canyons (Foxy 1995, 50039; p. 97). Two of the three Los Alamos Canyon locations were upstream of reach LA-0 or the most upstream reach sampled for invertebrates by Henne (2004, 84601). One of the major conclusions from the 1993 and 1994 investigation was that invertebrates were impoverished in the two locations downstream of the reservoir, and the scarcity of flowing water was identified as one key factor (Foxy 1995, 50039, p. 144). In summary, habitat factors, including the persistence and volume of surface water flow, are important limiting factors for the diversity and abundance of aquatic invertebrates in the Los Alamos and Pueblo watershed.

3. *Chironomus tentans* Deformities

Henne and Rytty (2004, 85533) describes a pilot study to evaluate whether the frequency or severity of *Chironomus tentans* deformities can be related to contaminant concentrations, sediment HQ values, or contaminant loading. Although the rate and severity of mouthpart deformities varied (e.g., the frequency of deformities varied from 7 to 32%), there was only one statistically significant correlation between greater deformities and the concentration of COPECs in sediment (Henne and Rytty 2004, 85533). The linear regression between the toxic score for DDX (sum of DDE and DDT) and the deformity index was significant ($r^2 = 0.434$, $p = 0.02$, Henne and Rytty 2004, 85533). However, a statistical outlier influenced this result. Excluding outlier data did not change the results for any of the nonsignificant regressions, but excluding the sample with the largest deformity index did make the relationship between the DDX toxic score and the deformity index nonsignificant ($r^2 = 0.095$, $p = 0.36$, Henne and Rytty 2004, 85533). It was hypothesized that variation in deformities could be related to genetic variation in laboratory chironomid stocks or be related to water and sediment chemistry changes as a result of the Cerro Grande fire (Henne and Rytty 2004, 85533). As deformities may be a measure of contaminant exposure, these results indicate that contaminant levels in Los Alamos and Pueblo sediment and persistent surface water are not high enough to yield any difference in this measure.

8.1.4 Risk Characterization

ERAGS Step 7 is risk characterization, which includes risk estimation and the uncertainty analysis. Risk estimation includes a synopsis of the measures used to evaluate the potential for adverse ecological effects. A weight of evidence criterion (e.g., low, medium, or high) is provided for each measure, and it reflects agreements between the Laboratory, NMED, and DOE on the relative weight (or credibility) of the line of evidence for evaluating adverse ecological effects (Katzman 2002, 73667). Thus, if measures indicate different outcomes, meaning one measure indicates a potential for adverse effects and one does not, then the overall conclusion would be weighted toward the measure with the greater weight (i.e., high is greater than medium).

8.1.4.1 Risk Estimation

Mexican Spotted Owl. ECORSK.7 model results and evaluation of COPECs in Mexican spotted owl food (small mammals) indicate no potential for adverse effects, which contradicts the screening level ecological risk assessment result indicating the potential for adverse ecological effects (Table 8.1-5). The ECORSK.7 model and the small-mammal body burden analysis indicated different COPECs might be of concern. Organic chemicals had higher HQs in the ECORSK.7 model and lead had the highest HQ based on the owl ESL, which indicates the COPECs predicted to have higher risks based on the models (ECORSK.7 or screening models) were not being taken into the food web at the rate predicted. The observation of lead as a more important COPEC for the Mexican spotted owl is an unexpected result, and as discussed in Section 8.1.3.1 could be caused by anomalous lead small-mammal body burden data or

some unknown ubiquitous source of lead (the reference location animals had higher lead concentrations). Thus, the weight of evidence from the concentrations of COPECs in prey and the ECORSK.7 model indicates no potential for adverse effects on survival and reproduction of the Mexican spotted owl (Table 8.1-5).

Avian Invertevore Feeding Guild. Results from the nest box monitoring network (occupancy, nest success, and eggshell thickness), concentrations in eggs, ECORSK.7 model results, and field surveys of abundance and diversity indicate no potential for adverse effects, which contradicts the screening-level ecological risk assessment result indicating the potential for adverse ecological effects (Table 8.1-6). The only uncertainty associated with the nest box monitoring network is the lack of occupancy for the nest boxes in certain parts of the watershed in 2002 and 2003. Data collected in this study indicate the bioaccumulation of metals in food (earthworms), but these data could not be used to develop bioaccumulation models as a measure of exposure. In addition, the field measures of effect indicated no adverse effects, and the ECORSK.7 model results indicated that a small fraction of the assessment population in the Los Alamos and Pueblo watershed would have HIs greater than 1. Thus, despite some uncertainties associated with the nest box network and bioaccumulation models for COPECs, the weight of evidence from the seven measures of effect and exposure indicates no adverse effects of COPECs on species diversity, population abundance, and/or persistence for the avian invertevore feeding guild (Table 8.1-6).

Mammalian Invertevore Feeding Guild. Results from field surveys of small-mammal abundance, diversity, and reproductive status; concentrations of COPECs in mammals; and ECORSK.7 modeling indicate no potential for adverse effects, which contradicts the screening-level ecological risk assessment result indicating the potential for adverse ecological effects (Table 8.1-7). The only field data that indicated any adverse effects were the concentrations of some metals in food (earthworms), and there was uncertainty associated with these potential adverse effects. Most of the field data indicated no adverse effects, and the ECORSK.7 model results indicated that a small fraction of the assessment population in the Los Alamos and Pueblo watershed would have HIs greater than 1. Thus, despite some uncertainties associated with COPEC concentrations in food, the weight of evidence from the four measures of effect and exposure indicates no adverse effects of COPECs on species diversity, population abundance, and/or persistence for the mammalian invertevore feeding guild (Table 8.1-7).

Detritivores. Results from toxicity tests on earthworms indicate no potential for adverse effects, which contradicts the screening-level ecological risk assessment result indicating the potential for adverse ecological effects (Table 8.1-8). In contrast, evidence for bioaccumulation in earthworms indicates the potential for exposure. Specifically, several metals had evidence for bioaccumulation, but primarily for a sample from reach AC-3. Because the sample for reach AC-3 did not have greater mortality or lesser growth than the reference location, there is no evidence of adverse effects of metal bioaccumulation on earthworms. The only toxicity test sample with any decrease in mortality or growth was retested after heat treatment and the sediment deposit was resampled, and in both cases there was no toxicity. This information supports the hypothesis that the toxicity was from a pathogen and not COPECs. Thus, the weight of evidence from the two measures of effect and exposure indicates no adverse effects of COPECs on earthworms and therefore no impact on rates of nutrient cycling for detritivores (Table 8.1-8).

Plants (Primary Producers). Results from toxicity tests and field surveys of plant abundance and diversity indicate no potential for adverse effects, which contradicts the screening level ecological risk assessment result indicating the potential for adverse ecological effects (Table 8.1-9). There were no differences in seedling germination but some differences in measures of growth. However, none of this variability in the toxicity test results was related to increased concentrations of COPECs. There was no decrease in plant abundance or diversity with increasing COPEC concentrations. Thus, the weight of

evidence from the two measures of effect and exposure indicates no adverse effects of COPECs on native plant species diversity and/or the absence of native plant species (Table 8.1-9).

Aquatic Community. Results from toxicity tests and field surveys of macroinvertebrate abundance and diversity indicate no potential for adverse effects, which contradicts the screening level ecological risk assessment result indicating the potential for adverse ecological effects (Table 8.1-10). There were no decreases in chironomid growth or survival compared with reference locations. Field surveys of macroinvertebrate abundance and diversity documented an impoverished fauna, which was related to the quality of the aquatic habitat in these canyons. Measures of chironomid deformity could not be correlated to contaminant concentrations with the exception of the DDX toxic score (concentration normalized to organic matter), which indicates that contaminant levels are not high enough to yield a statistical predictor of exposure. Thus, the weight of evidence from the two measures of effect and the measure of exposure indicates no adverse effects of COPECs on abundance or diversity of aquatic organisms in the more persistently wet segments of the Los Alamos and Pueblo watershed (Table 8.1-10).

8.1.4.2 Uncertainty Analysis

Uncertainties in the ecological risk assessment are potentially associated with the nature of sediment characterization data obtained in this investigation. The composite samples, which provide important characterization data for wildlife receptors, allow an informative comparison with the reach characterization data based on the geomorphic approach described in Section B-1 of Appendix B.

Averages calculated from samples collected in a reach, using a geomorphic approach, provide biased values that tend to overestimate COPC concentrations relative to composite samples, which are more appropriate for estimating exposures for wildlife. One reason is that most reaches (and all of the reaches investigated with mammal trapping arrays) cover a narrow portion of the canyon compared with the home range of small mammals or other wildlife. Thus, the fraction of the canyon that is outside the extent of post-1942 sediment deposits contribute to decreased exposure to COPECs that are confined to sediment deposits. The active channel (c1 geomorphic unit), which has relatively low concentrations of COPECs, also occupies a large portion of the canyon bottom in some reaches. An important reason why arithmetic averages are overestimates of concentrations within reaches is that samples collected using a geomorphic approach are biased toward fine-grained deposits, which have higher average COPEC concentrations than coarse-grained deposits, and toward sediment deposits with small areas but high concentrations. Thus, a less biased estimate of the average is based on a weighted average, which is more appropriate for geomorphic (stratified) sampling (see Ryti et al. [2004, 85206] and Section B-1.0). Calculation of weighted averages is also discussed in Section D-1.3 of Appendix D and Section E-2.2 of Appendix E.

Cyanide was eliminated from the analysis of biological material, which is a deviation from the original study design and therefore introduces uncertainty into conclusions of this investigation. However, cyanide was identified as a COPC largely in post-fire sediments within or downstream from the Cerro Grande burn area and therefore does not appear to be related to Laboratory SWMUs or AOCs. Thus, because cyanide is generally related to post-fire sediment deposits, any adverse effect would be greater in burned watersheds. Because cyanide concentrations are greater in burned areas, data from burned and unburned locations in the nest box monitoring network can be compared to evaluate the potential effects of cyanide and other fire-related analytes. No differences were noted in nest success or eggshell thickness information between burned and unburned locations, indicating that cyanide and other fire-related COPECs have not adversely affected this component of the ecosystem (see Sections E-4.2 and E-4.3).

Another uncertainty is the adequacy of the toxicity and bioaccumulation data used to develop the assessment endpoints and associated measures and study design. As discussed in Section 8.1.1, the Ecorisk database contains a wealth of information on ecotoxicity and bioaccumulation, but this literature does have its limitations. Gaps exist mainly for toxicity of COPECs on invertebrates and the ecological effects of PAHs on birds. Because literature studies can provide only a partial answer, the study design included field, laboratory, and model components to provide complementary information on ecological risks. These combined aspects of the study design act to reduce uncertainties related to toxicity and bioaccumulation data.

Field Measures

Empirical ecological effects data are the most relevant data for determining if there are adverse effects on ecological receptors. However, these data are inherently more variable and difficult to quantify than literature studies or laboratory measures. Uncertainty associated with a limited number of locations, a limited number of trapping events, and a limited trapping effort for small mammals is mitigated by collecting information across a variety of relevant measures of exposure and effect. Understanding broader temporal and spatial variation in small-mammal density and other related measures is also helpful in interpreting and assessing the uncertainty of these data. This broader site-specific understanding is partly available from previous Laboratory field studies.

Repeating some field measures over time, like the cavity-nesting bird monitoring network and small-mammal trapping, can reduce uncertainty. This assessment benefited from seven years of nest box data, and it is clear that future nest box monitoring in reaches of the upper canyons could further reduce uncertainty. However, one of the key uncertainties for the nest box network relates to the greater occupancy of nest boxes in the burned areas and no occupancy in areas where additional nest boxes were placed. The sites with no occupancy include AC-3, one of the more contaminated reaches in the watershed, and the absence of nest box data from this reach prevents a direct evaluation of the effects of contaminants here on nesting success.

Continuing the nest box monitoring network would also address some of the issues related to regional or watershed-scale changes over time, such as effects of droughts and other aspects of climate variability, the die-off of pine trees from bark beetles, and fire. Not all changes are negative as is clear from the greater occupancy of nest boxes in areas that were burned in the Cerro Grande fire. Nest boxes in areas of the canyons downstream of sources provide the opportunity for detecting adverse effects if they occur.

Field measures can also provide some information on adverse effects that cannot be obtained with other methods. For example, eggs were analyzed for PAHs as a direct measure of bioaccumulation to provide some information on exposure that can be combined with information on effects, and this can address the lack of literature ecotoxicity data on the adverse effects of PAHs on birds. The egg data are useful in understanding if PAHs are present at detectable concentrations in eggs, which they are not, and provide some indication of the bioavailability or biological retention of PAHs in birds.

Laboratory Measures

Laboratory toxicity tests benefit from being conducted under controlled environmental conditions but are subject to uncertainties associated with sample collection and representativeness. Confounding factors are also possible as demonstrated by the extremely low survival and growth in one set of the earthworm bioaccumulation tests. Other confounding factors may include variability in the test species selected relative to more typically tested, but less ecologically relevant, agricultural species. For example, western yarrow had greater variability in germination success or growth measures compared with an agricultural

species, lettuce (Kapustka 2002, 82657). Another confounding factor is that some of the sampled soils may be nutrient-poor, and variation in test responses could be caused by variation in nutrients between soil samples. Overall representativeness of the laboratory toxicity tests was addressed by collecting and homogenizing a large sediment sample for toxicity testing. Sample sites were also selected to represent a gradient of COPEC concentrations to improve the representativeness of the toxicity tests to potential COPEC impacts.

Model Measures

ECORSK.7 represents a modified exposure model with many of the limitations of the simple exposure models used for screening-level ecological risk assessments. ECORSK.7 blends more realistic information on spatial use of the watershed with simple models of contaminant bioaccumulation and toxicity. This is why ECORSK.7 is considered a Tier 2 ecological risk assessment model (Gonzales et al. 2004, 85207). Conservatism is present for key parameters like TRVs and bioaccumulation factors even in the most realistic or baseline model scenario. For example, the TRVs are based on NOAELs, and risks are assessed assuming additivity of response or summing of exposure across COPECs (HI). ECORSK.7 is also based on conservative estimates of COPEC concentrations in soil, as it assumes that the average of the sample data for a model grid cell is representative of the true average concentration. However, the composite samples collected for the small-mammal trapping arrays show that averages obtained using a biased sediment sampling approach can be an order of magnitude greater than more representative exposure concentrations (composite samples) for terrestrial ecological communities in these canyons. Thus, risks calculated by the ECORSK.7 model are overestimated.

8.1.5 Summary

Screening of affected media in the Los Alamos and Pueblo watershed identified many COPECs, which led to developing a plan to characterize ecological risk based on the ERAGS process (EPA 1997, 59370). The weight of evidence demonstrated by the various lines of evidence gathered in this effects assessment indicates there are no adverse effects of COPECs on terrestrial and aquatic receptors. The field studies, model calculations, and laboratory toxicity tests all provide a complementary set of results that support this interpretation and indicate that the assessment endpoints are not adversely affected. Thus, no COPECs are retained for any further assessment or mitigation and the lack of effects for various measures used in the baseline ecological risk assessment confirm the protective nature of ESLs (i.e., the overestimation of potential effects using ESLs).

8.2 Site-Specific Human Health Risk Assessment

The human health risk assessment in this investigation report is divided into two sections. Section 6 documents the screening assessment for identification of COPCs. The human health screening assessment includes data evaluation, comparison of site data to background concentrations, and screening of maximum values and 95% UCLs against SALs. The current section documents the site-specific human health risk assessment that employs specific exposure scenarios for evaluation of potential exposure in canyon bottoms. This approach to organizing the risk assessment was taken to help identify the COPCs discussed in the physical system conceptual model in Section 7.

The transport of ash from the Cerro Grande burn area has influenced the concentrations of chemicals in sediments and waters of the Los Alamos and Pueblo watershed, as discussed in Section 7. The data used to conduct this risk assessment consist of sediment data that are not affected by the fire (sample results from pre-fire sediment deposits and post-fire deposits in areas not affected by the fire) and both pre- and post-fire water data. The effects of post-fire floods on COPC concentrations are discussed in

Section 7. Risk characterizations that focus on post-fire sediment deposits and water are presented in Kraig et al. (2002, 85536), IFRAT (2002, 85429), and RAC (2002, 85431).

The risk assessment approach used in this report follows guidance from EPA (1989, 8021), LANL (2000, 66801), and NMED (2000, 68554) and is organized in seven major subsections. Section 8.2.1 provides the basis for selection of exposure scenarios for the human health risk assessment. In Section 8.2.2, the data collection and evaluation processes described in previous sections of the report are summarized, focusing on aspects of data analysis that are pertinent to the risk assessment. The exposure assessment (Section 8.2.3) provides information used in quantifying human exposure to chemicals in sediments and water. Qualitative aspects of exposure are also discussed to provide a context for interpreting chemical intake. The toxicity assessment (Section 8.2.4) provides information on potential human health effects for chemicals and radionuclides evaluated in the risk assessment. The information pertaining to exposure and toxicity is used in Section 8.2.5 to characterize potential human health risks. These effects include radiation dose, cancer risk, and systemic toxicity. Uncertainty related to the various assumptions and inputs used in the risk assessment is evaluated in Section 8.2.6 to support interpretation of the risk characterization. A summary of the risk assessment is provided in Section 8.2.7.

8.2.1 Problem Formulation

The purpose of this risk assessment is to evaluate potential human health risks related to the COPCs identified in sediments and water in the Los Alamos and Pueblo watershed and to determine whether a management decision to mitigate potential human-health risks is warranted. This risk assessment uses information pertaining to current and reasonably foreseeable future land use to assess potential impacts under reasonable maximum exposure (RME) conditions. The canyon bottoms in the Los Alamos and Pueblo watershed include a mixture of Laboratory property and land owned by Los Alamos County or the San Ildefonso Pueblo, potentially supporting a variety of land use alternatives.

The assessment in this report primarily employs trail user and extended backyard exposure scenarios to represent the current and reasonably foreseeable future exposure activities for contaminated sediments and surface waters in the watershed. The trail user scenario describes an adult individual who contacts contaminated sediments and surface water while hiking or jogging in the canyons. The extended backyard scenario describes an older child living in a home sufficiently close to a canyon that he or she may use the canyon as an extension of play areas immediately surrounding the home. The extended backyard scenario was originally developed through collaboration among Laboratory, DOE, and NMED personnel for intensive recreational use by older children (ages 6 through 11) for the interim report for reach ACS (Reneau et al. 2000, 66867). These uses are considered to be inclusive of realistic present-day potential exposure activities in canyon bottoms in most areas of the watershed.

Three additional exposure scenarios are evaluated in the human health risk assessment. They are residential, resource user (incorporating aspects of ranching/hunting and gathering of wild plant foods), and construction worker. A description of these supplemental exposure scenarios is provided in Section 8.2.3.3. Unlike trail user and extended backyard scenarios, these additional scenarios are not generally applicable across the watershed. Residential and resource user scenarios do not represent current or reasonably foreseeable land uses in most parts of the canyon bottoms, and residential development in particular is not a feasible land use within the parts of the canyons subject to flooding. Although residences on the mesas are in relatively close proximity to contaminated sediment deposits in some locations, the trail user and extended backyard scenarios address increased potential exposures to adults and children residing near such sediment deposits. With respect to the resource user scenario, ranching and hunting of game animals do not occur in the canyon areas within Laboratory boundaries and on Los Alamos County-owned lands where concentrations of COPCs in sediment are highest. Construction

activities within a canyon are generally of limited scope and duration and are unlikely to be focused on areas of contaminated sediments, as these are often prone to flooding. The construction worker risk calculations included in this report do not replace the need for health and safety planning for any job site in a canyon bottom in accordance with the federal and state requirements at the time of the activity.

Although not universally applicable across the watershed, the residential, resource user, and construction worker scenarios represent present-day land uses at some specific locations. Residential and resource user scenarios are active in lower Los Alamos Canyon on San Ildefonso Pueblo land, and construction of a new wastewater treatment plant is planned for part of Pueblo Canyon. Therefore, these scenarios are used in conjunction with the trail user and extended backyard scenarios in the risk assessment for these locations. Assessment results for these three exposure scenarios at these locations, and for the trail user and extended backyard scenarios in all areas of the canyons are provided in Section 8.2.5. The results of risk calculations for the residential, resource user, and construction worker scenarios in other parts of the watershed where these scenarios are incomplete are provided in Section E-5 of Appendix E. The results of these calculations are not intended to directly support risk-based decisions in these areas but may assist in comparing theoretical impacts across the watershed.

The exposure scenarios employed in this human health risk assessment differ from those presented in Chapter 6 of the canyons core document (LANL 1997, 55622; LANL 1998, 57666) by incorporating more realistic land use assumptions, which in part have been developed since the completion of the core document. The core document proposed risk assessments of sediments, surface water, groundwater, and air particulates for nine exposure scenarios over three categories of land use. In the core document, continued Laboratory land use included a construction worker scenario and an on-site Laboratory worker scenario. The recreational land use alternative included both a trail user scenario and a camper scenario. The Native American land use alternative consisted of exposure scenarios for residential use, ranching, hunting, traditional uses, and use of the Rio Grande and Cochiti Lake.

The current approach of using the trail user and extended backyard scenarios to support decisions throughout the watershed, with additional information for residential, resource use, and construction worker scenarios where those activities occur, simplifies the amount of information that goes into decisions and emphasizes potential exposures under current and reasonably foreseeable future land uses. Development of a Native American land use scenario with various exposure pathways was proposed in the core document (LANL 1997, 55622; LANL 1998, 57666). The intent of that scenario was to define and quantify the exposure pathways that reflect the unique activities of the local pueblo populations in areas where such activities may occur. However, the exposure pathways related to the traditional and cultural uses of natural resources described in the core document have not been developed and therefore are not assessed in this report. The pathways associated with the residential, trail user, and resource user scenarios may approximate exposure for some of the activities associated with a Native American land use scenario but are not intended to define or describe actual contact by Native American individuals or populations with contaminants in the Los Alamos and Pueblo watershed.

8.2.2 Data Collection and Evaluation

The approach to sampling design, data collection, and characterization is described in Sections 3 and 4. Sample locations, sample results, and data quality for data employed in the human health risk assessment are presented in Appendix C. Additionally, Section 6 and Appendix B describe how sediment data were separated into reaches and status and how sediment data within reaches were combined for the comparison of contaminant data maxima and 95% UCLs with BVs and/or screening criteria. Acquisition and evaluation of water data are also addressed in Sections 3 and 4. The initial screen used

water data assembled into hydrosegments. Subsequent data screens were performed at the scale of each water sampling location.

Area- and Volume-Weighted Averages for Sediments

The investigation approach for sediments resulted in samples associated with discrete geomorphic units and sediment facies within each reach. These data are combined to estimate weighted averages and weighted 95% UCLs for COPCs in each reach. The approach to estimating weighted averages and weighted 95% UCLs is well established in the statistical methods for stratified sampling, (e.g., Gilbert 1987, 56179; Cochran 1977, 84462). A description of these methods is provided in Section E-2 of Appendix E. Many of the data sets for combinations of COPCs and reaches or COPCs and water sampling locations include nondetect values. The approach to estimating averages and UCLs with data that include nondetects is also described in Section E-2.

The trail user and extended backyard exposure scenarios use sediment exposure point concentrations (EPCs) calculated from surface-area weighted averages and surface area weighted UCLs for sediment facies that typically occur in the uppermost parts of geomorphic units, because exposure associated with these exposure scenarios occurs predominantly with near-surface sediment. In addition, the uppermost sediment facies is usually finer grained and contains higher contaminant concentrations than deeper sediment, thus providing a more protective assessment. The calculation approach for the averages and UCLs uses the relative areas of the different geomorphic units in a reach to derive the weights. The resource user, construction worker, and residential exposure scenarios include activities that penetrate the ground surface, resulting in direct exposure to buried sediments, or activities that include the consumption of plants that have the potential to take up contaminants from deeper sediment layers, resulting in indirect exposure to these sediments. Therefore, these exposure scenarios use the volumes of sediment deposits within geomorphic units to derive weights rather than the surface areas.

Water COPC concentrations are evaluated for each sampling location, unlike sediments, where multiple sample locations are combined to generate an EPC for a reach. As a result, methods to estimate weighted averages and weighted 95% UCLs are not used to calculate water EPCs. The approach to calculating averages and 95% UCLs for the water data follows the approach described in Section E-2 for calculating UCLs to support the screening assessments described in Section 6.

8.2.3 Exposure Assessment

The trail user and extended backyard scenarios are the two exposure scenarios that apply across the whole watershed in this risk assessment. Additionally, risk estimates associated with residential, resource user, and construction worker scenarios are provided as points of reference and because they include present or potential land uses in parts of the canyons. The five exposure scenarios employed in the human health risk assessment have been generally described in other documents, although some modifications to pathways, equations, and parameter values have been made. The trail user scenario is based on the adult receptor in the recreational scenario (LANL 2000, 66801). An extended backyard scenario is described in Reneau et al. (2000, 66867), and aspects of this scenario are equivalent to the child receptor in the recreational scenario in LANL (2000, 66801). The residential and resource user scenarios are developed in LANL (2000, 66801). The construction worker scenario corresponds to the "industrial scenario, construction worker" in LANL (2000, 66801).

8.2.3.1 Calculation of COPC Intake

The basic structure of the exposure equations used in this assessment was obtained from EPA's risk assessment guidance for Superfund (EPA 1989, 8021). The general intake equation for a chemical is

$$Intake = \frac{C_i \times CR \times EF \times ED}{BW \times AT}$$

where Intake = rate of chemical available for uptake at an exchange boundary (mg/kg body weight /day);

C_i = concentration of contaminant i at exposure point (e.g., mg/kg sediment);

CR = contact rate with the environmental medium (e.g., mg sediment/day);

EF = exposure frequency (days/yr);

ED = exposure duration (yr);

BW = body weight (kg); and

AT = averaging time for toxicological effects (days).

The equation for a radionuclide is simpler because the exposure duration is defined within the context of annual dose, and because body weight and averaging time are not applicable to dose calculations. The general intake equation for a radionuclide is

$$Intake = C_i \times CR \times EF$$

where Intake = rate of radionuclide available for uptake at an exchange boundary (pCi/yr);

C_i = concentration of contaminant i at exposure point (e.g., pCi/g sediment);

CR = contact rate with the environmental medium (e.g., mg sediment/day); and

EF = exposure frequency (days/yr).

Generally, COPC intake is calculated as an intermediate step in the risk assessment and is then combined with toxicity criteria to yield estimates of systemic toxicity, cancer risk, or radiation dose (EPA 1989, 8021). In this human health risk assessment, the relatively low concentrations of COPCs measured in sediments and water and the large number of sediment reaches and hydrosegments indicated that the use of site-specific RBCs provides a more efficient assessment tool. The RBCs are provided in Tables E-5.3-6 and E-5.3-7. In addition to the exposure parameters used to calculate intake, the RBCs incorporate toxicity and health effects criteria directly and yield media-specific COPC values that may be used to screen site data to identify potential risk-drivers. Therefore, their derivation and use is similar to that of the SALs described in Section 6.2.3. The exposure parameter values that were applied in this assessment are documented in Table E-5.3-1, with additional values pertaining to RESRAD inputs in Table E-5.3-2. Equations for the calculation of RBCs for each exposure pathway and medium, except for pathways associated with exposure to radionuclides in soil, are provided in Section E-5. Risk-based concentrations for radionuclides in soil were calculated using Version 6.21 of the RESRAD computer code.

8.2.3.2 Exposure Scenario Descriptions

The human health risk assessment focuses on potential risks resulting from direct exposure to contaminants in sediments via ingestion, inhalation, external irradiation (radionuclides only), and dermal

contact (chemicals only). The water pathways consist of ingestion and dermal contact (chemicals only) using alluvial groundwater (residential scenario only) and persistent surface water data. Exposure to stormwater is not assessed because stormwater is transient and does not occur frequently enough to sustain chronic exposures. A summary of potentially complete exposure pathways, by scenario, is provided in Table 8.2-1.

Exposure scenario parameters were selected to provide an RME estimate of potential exposures. As discussed in EPA (1989, 8021), the RME estimate is generally the principal basis for evaluating potential health impacts. In general, an RME estimate of risk is at the high end of a risk distribution, i.e., 90th–99.9th percentiles (EPA 2001, 85534). An RME scenario assesses risk to individuals whose behavioral characteristics may result in much higher potential exposure than seen in the average individual.

Trail User

The trail user scenario addresses limited site use for outdoor activities such as hiking and jogging. The receptor for this scenario may be either a Laboratory employee or a local resident using the canyon over an extended period of time. Although an older child might also reasonably be evaluated as a trail user, this potential receptor is evaluated under a child-specific extended backyard scenario. Therefore, receptors under the trail user scenario are defined as adults (age 12 years or greater). A summary of trail user exposure parameters is provided below; a complete description of the parameter values and associated rationale is provided in Table E-5.3-1.

The potentially complete exposure pathways for the trail user scenario are incidental soil ingestion, inhalation, dermal absorption of organic chemicals from soil, external irradiation, surface water ingestion, and dermal absorption of organic chemicals from water. Exposure intensity in an investigation reach under the trail user scenario is defined as 1 hour/day, 200 days/yr, corresponding to 4 weekly visits for 50 weeks/yr. The exposure duration, an important parameter in the calculation of incremental cancer risk, is defined as 30 years.

Major exposure parameters related to contact with exposure media include

- soil ingestion of 100 mg/day, of which 12.5% (12.5 mg) comes from the contaminated site;
- water ingestion of 0.2 L/event for 20 events/yr, or 10% of the total trail user events/yr;
- inhalation of air at 1.6 m³/hour, corresponding to moderately strenuous activity;
- dermal exposure to organic chemicals in soil over 3200 cm² of skin area, corresponding to head, hands and arms; and
- dermal exposure to organic chemicals in water for 20 events/yr over 2130 cm² of skin area, corresponding to immersion of hands and feet.

The exposure frequency of 20 events per year for water-related pathways is intended to reflect the likelihood of trail users bringing their own drinking water, the semi-arid nature of the canyons with infrequent occurrences of water, and that water, to the extent that it is present, is unavailable for drinking for part of the year because of freezing.

Extended Backyard

Residential areas occur near some of the investigation reaches, and it is possible that older children could use the canyons as an extension of play areas surrounding their homes. Therefore, an extended

backyard scenario for children was developed to supplement the adult trail user scenario. For this scenario, a child is defined as encompassing 6 years, from age 6 through 11. The potentially complete exposure pathways and exposure intensity (1 hour/day for 200 days/yr) are identical to those described for the adult trail user. A summary of extended backyard exposure parameters is provided below; a complete description of the parameter values and associated rationale is provided in Table E-5.3-1.

Major exposure parameters related to contact with exposure media include

- soil ingestion of 400 mg/day of which 18% (71.4 mg) comes from the contaminated site;
- water ingestion of 0.35 L/event for 20 events/yr, or 10% of the total extended backyard events/yr;
- inhalation of air at 1.6 m³/hour, corresponding to moderately strenuous activity for children;
- dermal exposure to organic chemicals in soil over 3360 cm² of skin area, corresponding to face, forearms, hands, lower legs, and feet; and
- dermal exposure to organic chemicals in water for 20 events/yr over 3140 cm² of skin area, corresponding to immersion of forearms, hands, lower legs, and feet.

As with the trail user scenario, the water exposure component of the extended backyard scenario is adjusted to reflect the availability of water and climatic constraints on water use.

8.2.3.3 Supplemental Exposure Scenarios

Supplemental exposure scenarios for which risk estimates are provided include residential, construction worker, and resource user scenarios. A brief description of these scenarios is provided here; a more detailed discussion of the basis and parameterization of these scenarios is provided in LANL (2000, 66801) and Table E-5.3-1 of this report.

Under residential land use, exposure may be expected to result from frequent, repeated contact with contaminated media. The exposure pathways evaluated in this scenario include incidental ingestion of soil, alluvial groundwater ingestion, inhalation of ambient air and dust, dermal contact with organic chemicals in soil and alluvial groundwater, external irradiation from soil, and consumption of home-grown fruits and vegetables. Because of the large amount of time spent on-site and the evaluation of exposure via plant ingestion and use of alluvial groundwater, the residential scenario is considered to reflect maximum exposure conditions.

The construction worker scenario encompasses potential receptors including construction personnel, road crews, drillers, and anyone excavating in a contaminated area in the canyon. The exposure pathways evaluated in this scenario include incidental ingestion of soil, inhalation of ambient air and dust, dermal contact with organic chemicals in soil, and external irradiation from soil. Although the construction worker scenario reflects potentially high incidental soil ingestion rates and soil loading on exposed skin, the exposure duration is defined as only one year. Therefore, this scenario may generate relatively low RBCs for certain chemicals.

The resource user scenario pertains to individuals that may be exposed to contaminated environmental media as a result of outdoor activities that include the use of natural resources in a canyon. Under this exposure scenario, foraging for wild plants and berries as well as hunting or ranching are addressed. With the exception of the plant and meat ingestion pathways, the resource user scenario is similar to the trail user with respect to the exposure intensity and potentially complete exposure pathways for contaminated soil and water (Table 8.2-1).

8.2.3.4 Spatial Scales of Application for the Exposure Scenarios

Each exposure scenario is evaluated at the scale of a reach for sediments and at the scale of individual sampling locations for water. All of the canyons included in this report have multiple investigation reaches and water sampling locations. The risk assessment does not attempt to integrate exposure across multiple reaches for sediment or across water sampling locations for surface water or groundwater. By assessing each reach and water sampling location separately, the impacts of local variability in COPC concentrations upon the risk assessment results are preserved. Multimedia assessments were also performed by combining the risk results for sediment and water where investigation reaches and water sampling locations were in close proximity. When risk criteria were exceeded for one media but not the other media, multimedia sums (MMSs) were not calculated.

The canyons core document (LANL 1997, 55622; LANL 1998, 57666) proposed using different spatial scales for each exposure scenario. The extended backyard scenario represents activities that match up well with the reach scale of data integration. The trail user scenario would in practice occur at a larger scale than a reach and include uncontaminated as well as contaminated areas, possibly with multiple reaches being visited on a single day. The approach presented here overestimates exposure to the trail user. The resource user scenario would also occur at a larger scale than a reach in order for the plant and meat pathways to be realistic. The application of the resource user scenario to a reach assumes that all plant materials are gathered within the contaminated area of the canyon bottom and that the animals used for meat range completely within the same contaminated area of the reach. This approach also over estimates exposure to the resource user via these pathways. The residential and construction worker scenarios typically are considered at smaller scales than the investigation reaches. The geomorphic approach to reach investigation focused the sample collection on the part of the canyon bottom that contains contaminated sediments. This was accomplished through field-screening methods to identify higher contaminant concentration areas and by conducting the fieldwork over multiple phases to address the data requirements. These data provide a protective estimate of COPC EPCs for the residential and construction worker scenarios applied to the canyon bottom.

8.2.4 Toxicity Assessment

This section of the human health risk assessment provides information related to the basis for distinguishing among the three classes of chemicals that are evaluated in this assessment; systemic toxicants (noncarcinogens), chemical carcinogens, and radionuclides. This information provides a context for interpreting the results of the risk assessment, which employs COPC-specific values of toxicity and radiation dose to evaluate potential health impacts. The protocol used for identifying the specific values used in the calculation of the RBCs is also described. Table E-5.3-3 of Appendix E provides a summary of those toxicity and dose values.

8.2.4.1 Noncarcinogen Effects

Chemical-induced adverse effects on the function of various organ systems, other than cancer and gene mutations, are referred to as systemic or noncancer effects. Based on current understanding of homeostatic and adaptive mechanisms, systemic or noncancer toxicity is assumed to have an identifiable threshold, which means the receptors can tolerate a range of lesser exposures without adverse effects. The benchmark value for this threshold is the reference dose (RfD), expressed in mg/kg-day, or the reference concentration (RfC), expressed in units of mg/m³ of air (EPA 1989, 8021). In general, the RfD is the estimated daily dose considered to pose no appreciable deleterious effects to humans, including sensitive subgroups. The RfC is the estimated daily air concentration considered to pose no appreciable risk of deleterious effects to humans, including sensitive subgroups. For the human health risk

assessment, RfC values were converted to inhalation RfD values (expressed in units of mg/kg-day) by assuming an inhalation rate of 20 m³/day and a body weight of 70 kg.

The toxicity values used to evaluate noncarcinogenic health effects in this risk assessment are chronic RfDs. The chronic RfD is an estimate of daily exposure without appreciable risk of adverse effects for long-term exposure of several years or longer (EPA 1989, 8021). An RfD is derived by EPA using human dose-response data from adequate studies, if available. If data from studies involving humans are unavailable, dose-response information from animal studies may be employed. EPA preferentially bases an RfD on the highest dose level not associated with adverse effects (the NOAEL). If such a value was not identified in the literature, the LOAEL is generally used as the basis of the RfD. In practice, EPA generally first identifies the critical study and adverse effect for a chemical from a review of available toxicological data. Once these are specified, the NOAEL or LOAEL is identified. The RfD is then calculated from the NOAEL or LOAEL using uncertainty factors to account for uncertainty in extrapolating from the NOAEL or LOAEL to a chronic RfD. Uncertainty factors may relate to potential variability in sensitivity in the human population, to interspecies variability between humans and test animals, to inadequate dosing periods in a critical study, or to use of a LOAEL instead of a NOAEL. A modifying factor is sometimes also employed to account for additional uncertainties in the derivation of a chronic RfD. The uncertainty associated with an RfD or RfC may span as high as three orders of magnitude (EPA 1989, 8021).

8.2.4.2 Carcinogenic Effects

The toxicity value used to evaluate carcinogenic health effects in the human health risk assessment is the cancer slope factor (SF). A SF is a quantitative relationship between dose and carcinogenic response and is usually representative of a plausible upper-bound estimate of the lifetime probability of developing cancer associated with exposure to a specific quantity of a potential carcinogen (EPA 1989, 8021). Unlike noncarcinogenic effects, the model of chemical carcinogenesis assumes that there is no "safe" threshold of exposure below which effects are not observed. There is a question whether the assumption of no threshold dose for carcinogenic effects upon which the cancer SFs are based is valid, or whether there may be little or no carcinogenicity at low exposure rates such as those encountered in most environmental exposures. The EPA has stated the true risk is probably less than what is predicted by a SF or may even be zero (EPA 1989, 8021).

Oral SFs are published in units of (mg/kg-day)⁻¹. Inhalation cancer toxicity values are generally expressed as unit risk values, with units of µg/m³. These unit risk values were converted to SFs for use in the human health risk assessment in a manner analogous to that described for RfC values in Section 8.2.4.1. The conversion was accomplished by assuming an inhalation rate of 20 m³/day and a body weight of 70 kg.

To be protective of health regarding exposures to carcinogens, EPA guidance (EPA 1989, 8021) assumes a relatively small number of molecular events can elicit changes in a cell, ultimately resulting in uncontrolled cell proliferation and tumor formation. Based on this nonthreshold theory of chemical carcinogenesis, the EPA uses a two-part process to evaluate the potential carcinogenic effects of contaminants: (1) assign a weight-of-evidence classification, and (2) calculate a cancer SF.

Evidence of carcinogenicity is not uniform across all chemicals for which EPA publishes a SF. The EPA weight-of-evidence classification system for carcinogenicity is as follows:

- A human carcinogen,
- B1 or B2 probable human carcinogen (limited human data available indicating carcinogenicity),
- C possible human carcinogen (inadequate or no human data available),

- D not classifiable as to human carcinogenicity, and
- E evidence of noncarcinogenicity in humans.

The weight-of-evidence classification is based on the source of the data (human epidemiology study or animal bioassay) and whether carcinogenic effects have been observed in more than one animal species. In general, SFs are available for potential carcinogens in Groups A, B1, and B2, but are calculated only on a case-by-case basis for Group C and are not calculated for Groups D and E (EPA 1989, 8021). The great majority of SFs are based on carcinogenic effects observed at relatively high dose rates that have been extrapolated to lower doses. Multiple mathematical models used for this extrapolation relate both to the goodness-of-fit with the dose-response data, as well as theoretical models of carcinogenesis. The SF is commonly calculated as the 95% UCL on the slope of the dose-response curve, although in some cases where the data are more robust, a "best estimate" is used instead.

8.2.4.3 Radiation Dose

Health effects related to radionuclides were evaluated in terms of radiation dose, specifically the 50-yr whole-body effective dose equivalent. The effective dose equivalent uses a weighted sum of radiation doses to several organs and body tissues to account for differences in sensitivity to cancer or genetic disorders. The basis of radiation dose assessment is similar to that for chemical carcinogenesis in that both are ultimately based on a no-threshold model of the probability of developing cancer. Dose conversion factors (DCFs) for internal exposure (ingestion or inhalation) are expressed as dose per activity ingested (mrem/pCi). Internal dose of some long-lived radionuclides may accrue long after exposure. The internal DCFs are therefore calculated to reflect a "committed" dose over a 50-yr period following intake (EPA 1988, 50123). DCFs for external exposure to soil are expressed as dose rate per soil concentration (mrem/yr per pCi/cm³). The soil source is assumed to be an effectively infinite slab source. External DCFs used in the human health risk assessment were converted to units of mrem/yr per pCi/cm³, assuming a bulk soil density of 1.25 g/cm³.

The DCFs published by EPA were derived for an adult in an occupational setting and therefore are not directly applicable to a general population that includes infants and children. It is probable that infants and children are more susceptible to certain malignancies associated with radiation exposure than adults (ICRP 1997, 68750). This may be because of a greater proportional dose equivalent for children and/or a greater biological effectiveness per unit dose in children. It is important to note, however, that empirical dose-response models for the biological effects of ionizing radiation do not exist at the very low dose levels associated with most environmental exposures. The DCFs are based on dose-response data for populations exposed to very high doses over a short time period (for example, Japanese A-bomb survivors), and opinions differ regarding their applicability for low dose/long duration exposure.

Although adverse health effects related to radionuclides are evaluated using radiation DCFs in the calculation of the RBCs, radiological cancer risk estimates are also provided in the risk assessment summary. Radionuclide cancer risk is calculated in a different manner than radiation dose; exposure is integrated over the scenario-specific exposure duration rather than on a per-year basis. Additionally, radionuclide slope factors were derived to pertain to the general United States population rather than adults in an occupational setting. For these reasons, the relationship of calculated radionuclide dose to cancer risk will vary depending on the specific scenario, exposure pathways, and radionuclides in question.

8.2.4.4 Identification of Toxicity Values and Dose Conversion Factors

The toxicity values and dose factors used in this risk assessment are documented in Table E-5.3-3 in Appendix E. These values and factors are extracted from the most recently available information developed by regulatory agencies and other sources.

The primary source of chemical toxicity values used in the risk assessment was EPA's Integrated Risk Information System (IRIS) (EPA 2003, 76870). A secondary source of information used was EPA's Health Effects Assessment Summary Tables (HEAST) (EPA 1997, 58968). Additional EPA sources of toxicological information were used for a limited number of chemicals when values were unavailable in the primary references, as described in Table E-5.3-3. The sources of the radionuclide DCFs incorporated in RESRAD and used in the human health risk assessment are EPA's Federal Guidance Report 11 (EPA 1988, 50123) and Federal Guidance Report 12 (EPA 1993, 62798). Radiogenic cancer risks described in Section 8.2.7 were calculated in RESRAD using cancer morbidity slope factors from Federal Guidance Report 13 (EPA 2002, 75934).

EPA provides RfD and SF values associated with the oral ingestion exposure route. These values may be directly applied to the ingestion exposure pathways. However, EPA does not provide toxicity criteria specific to the dermal absorption route of exposure. Because oral RfD and SF values are generally based on the amount of a chemical administered by means of food or water, they incorporate the gastrointestinal absorption efficiency of that chemical. If the oral absorption efficiency is low, the absorbed dose associated with the observed effect may be much lower than the administered dose captured in the RfD or SF. Therefore, oral RfD and SF values are commonly adjusted when used for the dermal route of exposure by a chemical-specific oral absorption factor reflecting an assumption that, once the chemical is in the bloodstream, the observed health effects will be similar regardless of the route of intake. For noncarcinogenic effects, the oral RfD was adjusted according to the following equations (EPA 1989, 8021):

$$RfD_{dermal} = RfD_{oral} \times ABS_{oral}$$

where ABS_{oral} is the chemical-specific oral absorption factor. For carcinogenic effects, the oral SF was adjusted according to

$$SF_{dermal} = SF_{oral} / ABS_{oral}$$

Route-to-route extrapolation of toxicity values was employed to develop inhalation toxicity values for certain organic chemicals (Tables E-5.3-3 and E-5.3-5). Route-to-route extrapolation was used only if neither RfC nor unit risk values were available for a specific organic chemical.

8.2.5 Risk Characterization

In this section of the human health risk assessment, information provided in the exposure and toxicity assessments (Sections 8.2.3 and 8.2.4, respectively) is integrated to characterize potential adverse effects. The risk characterization is conducted on the basis of the general principles described in Section 8.0 of the risk assessment guidance for Superfund (EPA 1989, 8021). Potential adverse effects related to noncarcinogens, chemical carcinogens, and radionuclides are discussed in Sections 8.2.5.1, 8.2.5.2, and 8.2.5.3, respectively. The presentation of potential adverse effects focuses on the quantitative expressions of potential impacts. In the uncertainty analysis (Section 8.2.6), the confidence

associated with the quantitative risk estimates is discussed through an evaluation of the uncertainties pertaining to each step of the risk assessment process.

As described in Section 8.2.3.1, this risk assessment employs RBCs to screen for potentially adverse health effects. COPC intake and toxicity are combined within the RBC calculations; therefore, separate calculations of intake and health effects (cancer risk, hazard, and dose) were not generated. Human health effects were assessed using the ratios of EPCs to RBCs for each of the five exposure scenarios. These ratios were then summed for an investigation reach and (when applicable) a water sampling location within the COPC classes of chemical carcinogens, noncarcinogens, and radionuclides. A sum of less than one indicates that exposure is unlikely to result in an unacceptable cancer risk, hazard, or radiation dose. The RBCs for COPCs in sediment and water are presented in Tables E-5.3-6 and E-5.3-7, respectively.

The RBCs were calculated using the following target adverse-effects levels: an HQ of 1 for noncarcinogenic chemicals, a cancer risk of 1×10^{-5} for chemical carcinogens, and a radiation dose of 15 mrem/yr for radionuclides in sediments and 4 mrem/yr for radionuclides in water. These adverse-effects levels may be employed to assess the hazard, risk, or dose associated with the ratios of EPCs to RBCs by multiplying an EPC:RBC ratio by the corresponding adverse effects level used in the RBC calculation. For example, to derive cancer risk for a chemical having a ratio of 0.5, 1×10^{-5} is multiplied by 0.5 to express the cancer risk as 5×10^{-6} .

With the exception of the construction worker scenario, the risk assessment scenarios include exposure to contaminants in both sediment and water. Although site-specific risk criteria have been generated separately for sediments and water, it is necessary to integrate exposure to both media. This is accomplished by summing the ratios of EPCs and RBCs for each medium, where the resulting value has been defined as an MMS. The equation for the calculation of an MMS is provided as Equation 4 in Section E-4.

Tables 8.2-2 and 8.2-3 present the summed results of the sediment EPC-to-RBC ratios for the trail user and extended backyard scenarios. Table 8.2-4 provides these ratios for each of the COPCs contributing to the sums in Tables 8.2-2 and 8.2-3. Table 8.2-4 also provides the weighted averages and UCLs for each sediment COPC in investigation reaches. Tables 8.2-5 through 8.2-7 provide analogous information for COPCs in surface water. MMSs, evaluating combined exposure to COPCs in sediment and surface water under trail user and extended backyard scenarios, are provided in Tables 8.2-8 and 8.2-9, respectively. The tables contain multiple sediment reaches for each water sampling location to evaluate multimedia exposures for a water sampling location and all of the sediment reaches in the vicinity. Results for the supplemental exposure scenarios (residential, construction worker, and resource user) are provided in Tables E-5.3-8 through E-5.3-22.

8.2.5.1 Noncarcinogenic Effects

Chemical hazard for an individual chemical is commonly defined by the HQ, which is calculated as the ratio of the chemical intake to the RfD for that chemical. An HQ value greater than 1 is indicative of the potential for adverse effects; therefore, an HQ of 1 was used in the calculation of RBCs for noncarcinogenic effects. When the potentially additive effects of two or more chemicals are considered, HQs may be summed to generate a HI. However, summing of chemical HQs to create an HI assumes that the target organs and mechanisms of toxicity are similar. Summing of the ratios of EPC and RBC values in this human health risk assessment is functionally equivalent to generating an HI. The protective approach of summing these ratios does not warrant refinement because the summed ratios of EPC and RBC values are in all cases well below 1.0.

Separate RBC calculations were performed for adult and child receptors for incidental soil ingestion, water ingestion, dust inhalation, and dermal absorption exposure pathways in the residential exposure scenario (the only scenario combining child and adult receptors). The more protective value (that is, the smaller RBC) was used in the risk assessment. In almost all cases, the smaller RBC was associated with the child receptor because of their smaller body size and higher soil ingestion rate. Calculations for the biota ingestion pathways pertain to a general population of both adults and children because the ingestion rate information is based on survey data across all ages.

Trail User and Extended Backyard Scenarios

None of the investigation reaches had an HI exceeding 1 after data evaluation methods and screening processes were performed (Section 6). The largest ratio of sediment EPC to RBC for the adult receptor in the trail user scenario was less than 0.04 and related mostly to dermal absorption of Aroclor-1254 in reach AC-3. For the child receptor in the extended backyard scenario, the maximum ratio was 0.33, also associated primarily with dermal absorption of Aroclor-1254 in reach AC-3. Both of these RBC ratios also include a secondary component for soil ingestion. Noncarcinogenic surface water COPCs were identified at 20 surface water sampling locations. The highest ratio of surface water EPC to RBC for the adult receptor in the trail user scenario was approximately 0.03 at location LA-10040 near reach LA-0, a baseline location upcanyon from Laboratory SWMUs and AOCs. The highest ratio of surface water EPC to RBC for the child receptor in the extended backyard scenario was approximately 0.12, also at location LA-10040. In both cases, iron via water ingestion was the primary contributor to chemical hazard. The MMSs for trail user and extended backyard exposure scenarios are provided in Tables 8.2-8 and 8.2-9.

Residential and Resource User Scenarios in Lower Los Alamos Canyon

Lower Los Alamos Canyon is the one location in the watershed where residential and resource user scenarios are present-day land uses. These activities occur on land owned by San Ildefonso Pueblo. Noncarcinogen COPC concentrations in sediments for reaches LA-4W, LA-4E, and LA-5 in lower Los Alamos Canyon were below the screening criterion (HQ of 1) in Section 6 and were not evaluated further. The residential and resource user scenarios also include water exposures via ingestion and dermal absorption. The residential scenario water exposure comes from alluvial groundwater. The HIs associated with noncarcinogens in alluvial groundwater sampled from wells LLAO-1 (LA-00215), LLAO-2 (LA-00045), LLAO-4 (LA-00046), and LLAO-5 (LA-00002) range from 5 to 8, as a result of fluoride, nitrite, nitrate, and thallium concentrations. The resource user water exposure is from surface water. The HIs associated with surface water collected at Basalt Spring (LA-00219), reach LA-4 SW (LA-00218), upper reach LA-5 SW (LA-10057) and lower reach LA-5 SW (LA10058) in the lower canyon ranges from 0.003 to 0.01. Results for the residential and resource user scenarios for other parts of the watershed are provided in Section E-5.

Construction Worker Scenario in Pueblo Canyon

A construction project to build a new wastewater treatment plant is planned for part of Pueblo Canyon. Noncarcinogen COPCs in sediments for reaches P-2W, P-2E, and P-3W, in the vicinity of the construction work, were below the screening criterion (HQ of 1) in Section 6 and were not evaluated further. Exposure to water is not a complete pathway for the construction worker scenario. Results for the construction worker scenario for other parts of the watershed are provided in Section E-5.

8.2.5.2 Carcinogenic Effects

Cancer risk for an individual chemical is defined by the ICR, which is calculated as the product of exposure to a single chemical and the cancer SF for that chemical. ICRs for each exposure route and chemical are then summed to calculate the total ICR to an individual. The acceptability of any calculated excess cancer risk is generally evaluated relative to a target risk range of 10^{-6} to 10^{-4} , in accordance with 55 FR 46, "National Oil and Hazardous Substances Pollution Contingency Plan." A target risk level of 1×10^{-5} was used in this human health risk assessment to calculate RBCs for carcinogenic effects based on the adoption of this value by the NMED (NMED 2000, 68554).

Lifetime cancer risk is considered to be additive over time; therefore, residential exposures integrating childhood and adulthood are summed to calculate the ICR. As with the HQ, calculations for the produce ingestion pathway pertain to a general population of both adults and children because the ingestion rate information is based on survey data across all ages.

Trail User and Extended Backyard Scenarios

Carcinogenic sediment COPCs were identified in 12 of the 17 reaches that were carried forward to the risk assessment from the human health screening assessment in Section 6. Ratios of sediment EPCs to RBCs for the adult receptor in the trail user scenario ranged from 0.02 to 0.5, with the highest ratios occurring in reaches AC-1 (0.52; 5×10^{-6} ICR), AC-2 (0.32; 3×10^{-6} ICR), AC-3 (0.16; 2×10^{-6} ICR) and DP-1W (0.29; 3×10^{-6} ICR). Ratios of sediment EPC to RBC in the extended backyard scenario ranged from 0.026 (3×10^{-7} ICR) to 0.91 (9×10^{-6} ICR), with the highest ratios occurring in reach AC-1 (0.91; 9×10^{-6} ICR), AC-2 (0.57; 6×10^{-6} ICR), and AC-3 (0.28; 3×10^{-6} ICR).

The PAH benzo(a)pyrene was the primary contributor to cancer risk from sediment exposure. Approximately two thirds of the benzo(a)pyrene risk for the trail user is associated with dermal contact with sediment, with the remainder resulting from the incidental soil ingestion exposure pathway. Benzo(a)pyrene was also the primary COPC related to cancer risk for the child receptor in the extended backyard scenario, although in this scenario incidental soil ingestion and dermal absorption are equal contributors to exposure. The exception to benzo(a)pyrene as the primary COPC is in reach AC-3, where exposure to the PCB Aroclor-1254 via incidental soil ingestion and dermal absorption was determined to be a contributor equal to benzo(a)pyrene in the total carcinogen ratio for the extended backyard scenario.

Carcinogenic surface water COPCs were identified at 30 of the 33 surface water sampling locations. The ratio of surface water EPC to RBC for the adult receptor in the trail user scenario exceeded 1.0 at location PU-10155 in reach AC-3 (2.4; 2×10^{-5} ICR) and location PU-10231 in reach P-2W, which is 3 km (2 miles) downgradient from Acid Canyon (1.2; 1×10^{-5} ICR). The ratio of surface water EPC to RBC for the child receptor in the extended backyard scenario exceeded 1.0 at location PU-10155 (1.7; 2×10^{-5} ICR). In both cases, exposure to carcinogenic PAHs via dermal contact with surface water was the primary contributor to chemical hazard.

The MMS in reaches AC-3, P-1E, and P-1W, associated with water sampling location PU-10155, ranged from 1.7 (2×10^{-5} ICR) to 2.6 (3×10^{-5} ICR) across both scenarios. No carcinogen data were collected for reach P-2W in the vicinity of PU-10231. The nearest upcanyon reach with carcinogen data is reach P-1E. Those data can be used to approximate an MMS of 1.3 (1×10^{-5} ICR) for water and sediment in reach P-2W.

Residential and Resource User Scenarios in Lower Los Alamos Canyon

Analysis for SVOCs in lower Los Alamos Canyon was performed only for sediments collected from reach LA-5. Therefore, data for carcinogenic organic chemicals from sediments in reaches LA-3W and LA-5 were used to protectively bound the exposure to these chemicals for residential and resource users in lower Los Alamos Canyon. The values for carcinogenic organic chemicals from both reaches were below screening criterion (10^{-5}) and were not evaluated further in Section 6. Residential water exposures to alluvial groundwater as represented by EPC-to-RBC ratios in Table E-5.3-13 range from 4.3 (4×10^{-5} ICR) to 23 (2×10^{-4} ICR) for alluvial groundwater from wells LLAO-1 (LA-00215), LLAO-2 (LA-00045), LLAO-4 (LA-00046), and LLAO-5 (LA-00002). All of the carcinogenic risk associated with exposure to alluvial groundwater is caused by arsenic. Resource user water exposures to carcinogens in surface water presented in Table E-5.3-12 for Basalt Spring (LA-00219), reach LA-4 SW (LA-00218), upper reach LA-5 SW (LA-10057) and lower reach LA-5 SW (LA-10058) range from 0.022 (2×10^{-7} ICR) to 0.079 (8×10^{-7} ICR). Results for the residential and resource user scenarios for other parts of the watershed are provided in Section E-5.

Construction Worker Scenario in Pueblo Canyon

Sediment data for carcinogenic organic chemicals were not collected for reaches P-2W, P-2E, and P-3W, in the vicinity of planned construction work for a new wastewater treatment plant. The nearest upcanyon reach with organic carcinogen data is P-1E. The EPC-to-RBC ratio sum for P-1E is 0.014, equivalent to an ICR of 1×10^{-7} . Results for the construction worker scenario for other parts of the watershed are provided in Section E-5.

8.2.5.3 Radiation Dose

The radiation dose associated with the EPA DCFs used in the human health risk assessment is the annual committed effective dose equivalent (internal) or annual effective dose equivalent (external), expressed in units of millirem per year (mrem/yr). The target dose limit used for calculating RBCs related to soil pathways is 15 mrem/yr, which is consistent with guidance from the DOE (DOE-AL 2000, 67153) and EPA (1997, 58693). For water-based exposure pathways, RBC values were calculated using a target dose limit of 4 mrem/yr. Use of this more protective dose limit for water pathways is based on the radiation dose limit for a public drinking water supply in DOE Order 5400.5, "Radiation Protection of the Public and the Environment."

Although DCFs were derived to apply to adults, not children, exposure parameters for children were used in the residential RBC calculations if a higher rate of exposure resulted. This is analogous to the use of the smaller of the RBC values for child or adult for the calculation of the HQ, discussed above in Section 8.2.5.1. As with the HQ and ICR, calculations for the biota ingestion pathways pertain to a general population of both adults and children because the ingestion rate information is based on survey data across all ages. Consistent with EPA guidance (EPA 1989, 8021), dose via dermal absorption is not quantified, as it is probably negligible compared with the other exposure pathways.

Trail User and Extended Backyard Scenarios

Radionuclide sediment COPCs were identified in 10 of the 17 reaches that were carried forward to the human health risk assessment from the human health screening assessment described in Section 6. Ratios of sediment EPCs to RBCs for the adult receptor in the trail user scenario exceeded 0.1 in reaches DP-2, DP-3, and LA-2FE. The highest ratio (0.14; 2 mrem/yr) was calculated for DP-2. External irradiation from cesium-137 was the primary contributor to radionuclide dose from sediment exposure in the trail

user scenario. Ratios of sediment EPCs to RBCs for the child receptor in the extended backyard scenario were highest in reaches ACS (0.50; 8 mrem/yr) and AC-3 (0.39; 6 mrem/yr). In both reaches, exposure to plutonium-239,240 via incidental soil ingestion was the primary contributor to radiation dose. The differences between COPCs and pathways for the trail user and extended backyard scenarios reflect the influence of the higher soil ingestion rate value for children compared with adults.

Radionuclide surface water COPCs were identified at five surface water sampling locations. The highest ratio of surface water EPC to RBC for the adult receptor in the trail user scenario was 0.028 at location PU-10175 in reach ACS (0.12 mrem/yr). The highest ratio of surface water EPC to RBC for the child receptor in the extended backyard scenario was 0.049 at location PU-10175 (0.2 mrem/yr). In both cases, radiation dose was primarily associated with exposure to plutonium-239,240 via surface water ingestion. The highest MMSs for the extended backyard scenario were in reaches ACS (0.55, PU-10175, corresponding to 8 mrem/yr) and AC-3 (0.41, PU-10155, corresponding to 6 mrem/yr). For the trail user, the highest MMS was calculated for reach DP-2 (0.15, 21-01854, corresponding to 2 mrem/yr).

Residential and Resource User Scenarios in Lower Los Alamos Canyon

Radionuclide COPC concentrations in sediments for reaches LA-4W, LA-4E, and LA-5 in lower Los Alamos Canyon were below the screening criterion of 15 mrem/yr (Section 6) and were eliminated from further consideration. Similarly, radionuclide COPC concentrations in groundwater from wells LLAO-1 (LA-00215), LLAO-2 (LA-00045), LLAO-4 (LA-00046), and LLAO-5 (LA-00002) and surface water from Basalt Spring (LA-00219), reach LA-4 SW (LA-00218), upper reach LA-5 SW (LA-10057) and lower reach LA-5 SW (LA10058) were below the screening criterion of 4 mrem/yr (Section 6) and were not evaluated further. Results for the residential and resource user scenarios for other parts of the watershed are provided in Section E-5.

Radionuclide COPC concentrations were above the screening criterion of 15 mrem/yr (Section 6) for post-fire sediment deposits in reach LA-5E containing ash from the Cerro Grande burn area. Potential doses from radionuclide COPCs in post-fire sediment deposits and water are evaluated elsewhere (IFRAT 2002, 85429; Kraig et al. 2002, 85536; RAC 2002, 85431).

Construction Worker Scenario in Pueblo Canyon

Radionuclide COPC concentrations in sediments for reaches P-2W, P-2E, and P-3W, in the vicinity of planned construction work for a new wastewater treatment plant, were below the screening criterion of 15 mrem/yr (Section 6) and were not evaluated further. Results for the construction worker scenario for other parts of the watershed are provided in Section E-5.

8.2.6 Uncertainty Analysis

The uncertainty analysis uses qualitative and semi-quantitative information to evaluate the uncertainty associated with the risk, hazard, and dose estimates described in Section 8.2.5. This uncertainty analysis primarily pertains to the results of the trail user and extended backyard scenarios and to the results of the supplemental exposure scenarios in locations where these scenarios are occurring. The uncertainty analysis is organized according to the major aspects of the human health risk assessment: data collection and evaluation (Section 8.2.6.1), exposure assessment (Section 8.2.6.1), and toxicity assessment (Section 8.2.6.3). A summary of the results of the residential, construction worker, and resource user scenarios where these scenarios are incomplete is provided in Section 8.2.6.4.

8.2.6.1 Data Collection and Evaluation

Some uncertainty in the selection of sediment COPCs is introduced by using a minimum 5% detection frequency to identify organic COPCs and by using BV comparisons to identify inorganic and radionuclide COPCs. However, it is unlikely that such uncertainty excluded important risk-drivers from the assessment. The 5% rule was used to eliminate COPCs that occur sporadically and at low concentrations and are not representative of broader areas. The BVs were developed specifically for the Laboratory and represent the background concentrations for metals and radionuclides (Ryti et al. 1998, 59730).

There are no BVs available for surface water and alluvial groundwater. The inability to distinguish COPCs in water media based on comparisons with background concentrations is a substantial source of uncertainty in the results of the human health risk assessment for these media. For example, concentrations of arsenic in groundwater, which are responsible for calculated ICR values above the decision criterion are apparently consistent with variations in local background. Tables E-5.3-13 and E-5.3-14 present ratios for alluvial groundwater EPCs to RBCs with and without the arsenic data to show the effects of other COPCs on these ratios. No ratios are greater than 1.0 when arsenic is removed, whereas 22 of 24 water sampling locations, including background or baseline locations, exceed the risk criterion for carcinogens when arsenic is included. These results indicate that the potentially unacceptable cancer risk calculated for the residential scenario in lower Los Alamos Canyon probably results from natural arsenic concentrations in alluvial groundwater. Additional information indicating that measured arsenic concentrations are consistent with naturally occurring groundwater concentrations is provided in Section 7.2.

Additional uncertainty exists in identifying COPCs that result from Laboratory releases versus other anthropogenically derived COPCs that are not from Laboratory activities. For example, PAHs dominate carcinogenic risks in sediments and surface water, but available data indicate a primary source of PAHs is in urban runoff, as discussed in Section 7.1.3.1. Location PU-10155 in reach AC-3 was one of the water sampling locations where potentially unacceptable cancer risk was calculated. Four rounds of surface water sampling were conducted at PU-10155. A single sample yielded detected values of carcinogenic PAHs, with the other three samples having nondetects for all PAHs. The detection limits for PAHs in the sample with detected concentrations were substantially lower than the other three samples. The association of detected PAHs with low detection limits indicates that PAHs at similar concentrations may be more widespread in the Los Alamos and Pueblo watershed, and that similar risk may exist elsewhere from PAHs in surface water.

Underestimating EPCs for investigation reaches is another potential source of uncertainty. Three approaches were used to minimize that possibility. First, the emphasis of the geomorphic characterization and sediment sampling was to identify and sample post-1942 sediment deposits, which focuses sampling on potentially contaminated areas. The process of characterizing reaches and focusing sampling is discussed further in Section 4.1 and Section B-1 of Appendix B. Second, the canyon bottoms include other geomorphic units that are not impacted or are only minimally impacted by Laboratory releases. Samples from these other geomorphic units were not included in the area-weighted and volume-weighted averages to provide more protective estimates of COPC concentrations for use in the human health risk assessment. Third, weighted 95% UCLs on the weighted average sediment concentrations were employed as EPCs to minimize the chance of underestimating EPCs in a reach.

A similar uncertainty exists for estimating EPCs for water sampling locations. COPC concentrations often change with hydrologic conditions and can either increase or decrease with rising water levels. The SAP was designed to capture both high and low water conditions by sampling during snowmelt runoff, monsoon rainfall periods, and during the intervening dry periods. As discussed in Section 7.2.1, and Appendix B, Section B.2, the ranges of water level elevations, and variations in field parameters, such as

pH and dissolved oxygen, indicate that a range of hydrologic conditions was sampled by the four rounds of sampling of alluvial groundwater and surface water. The EPCs calculated from these data represent the range of COPC concentrations at the sampling locations. Using the 95% UCL on the average minimizes the chance of underestimating the EPCs for a sampling location. One aspect of uncertainty that cannot be addressed with these data is the ongoing drought. It is possible that if annual precipitation increases, there could be a shift in COPC concentrations, although trend analyses presented in Section 7.2 indicate that COPC concentrations in alluvial groundwater are generally stable or declining over time. Therefore, based on available data, significant increases in COPC concentration are not expected to occur.

An additional potential uncertainty for data collection and evaluation is that concentrations of all COPCs in each investigation reach are not quantified because not all analytical suites were obtained in all reaches. This is particularly the case for SVOCs in lower reaches of Los Alamos and Pueblo Canyons. In these cases, it is reasonable to assume that concentrations and associated risks are no greater than those found in upcanyon reaches because average concentrations generally decrease downcanyon from sources, as discussed in Section 7.1. The characterization was most thorough in reaches close to sources, typically including more comprehensive analytical suites and greater sampling density than downcanyon reaches. EPCs for SVOCs in upcanyon sediments were used as surrogate EPCs for downcanyon reaches when data were not available.

8.2.6.2 Exposure Assessment

Uncertainty pertaining to exposure parameters was addressed in the human health risk assessment by using RME estimates for several exposure parameters. The use of RME assumptions, coupled with upper-bound estimates of the average concentration of COPCs in sediment, is intended to produce a protective bias in the risk calculations. The results of the risk assessment, discussed in Section 8.2.5, include a description of the key COPCs and exposure pathways associated with potential health impacts. This evaluation of uncertainty in exposure is focused on these COPCs and pathways.

Key exposure pathways for contaminated sediments across hazard, ICR, and dose for trail user and extended backyard exposure scenarios include dermal absorption, incidental soil ingestion, and external irradiation. A common source of protective bias in the exposure assessment for these pathways is that the entire 1-hr daily exposure time defined for the trail user and extended backyard scenarios is consistently spent on contaminated sediment deposits within a reach. To the extent that time may be spent in other canyon areas such as uncontaminated stream terraces and colluvial slopes during recreational activities, exposure to contaminated sediment deposits is overestimated. This bias is probably more substantial in the trail user scenario, which presupposes walking across a relatively large area given an exposure duration of 1 hr.

Dermal contact with sediments and incidental soil ingestion exposure pathways each have a second exposure characteristic in addition to time spent on-site that was biased in a protective manner. The soil adherence factors that were used to define soil loading on skin for children and adults are both protectively biased. The adult adherence factor is based on a high-exposure activity (gardening) that probably would result in greater exposure than would be the case during walking. The child adherence factor pertains to the 95th percentile of a cohort of day-care children (an average-exposure activity) and the 50th percentile for children playing in wet soil (a high-exposure activity). Child incidental soil ingestion is based on a daily ingestion rate of 400 mg/day, which is an "upper percentile" value (EPA 1997, 66596). Adult soil ingestion was assumed to be 100 mg/day, which is twice the EPA-recommended value for adults (EPA 1997, 66596).

Exposure related to external irradiation from soil is primarily a function of time spent on-site. However, the external DCFs used in the calculation of external dose protectively assume an effectively infinite area and depth of contamination. The contaminated sediments in reach DP-2, where external irradiation was an important contributor to trail user dose, average approximately 12 m in width and 0.6 m in depth. The calculated dose via external irradiation from cesium-137, assuming an infinite source, is at least twice as large as would actually be the case given the described source geometry of reach DP-2. Actual external irradiation received during recreational activities would probably be even lower assuming that receptors are not consistently in the center of the contaminated area.

Key exposure pathways for contaminated surface water across hazard, ICR, and dose for trail user and extended backyard scenarios include dermal absorption and ingestion. Of these two pathways, dermal absorption (related to PAHs) is responsible for the greatest potential exposure. The presence of PAHs in surface water samples used in the risk assessment is associated with fine particulate matter in the unfiltered samples. If surface water exposure were limited to ingestion, ratios of EPCs to RBCs in water would be well below 1.0 for all health effects endpoints and scenarios. The ICR resulting from absorption of PAHs from water is almost certainly overestimated because "particulate-bound chemicals in an aqueous medium would be considered to be much less bioavailable for dermal absorption, because of inefficient adsorption of suspended particles onto the skin surface and a slower rate of absorption into the skin" (EPA 2001, 71431, Section 3.1.2.2, p. 3-10).

A second aspect of uncertainty in exposure to COPCs in surface water relates to exposure intensity. Dermal contact and surface water ingestion were assumed to occur 20 times per year over 6 years (extended backyard) or 30 years (trail user). There is no empirical basis for this assumption, which was developed to bound a high-end exposure condition. Actual contact by children or adults with surface water in Acid or Pueblo Canyons is probably highly intermittent at some locations at least in part because of the availability of water. The Pueblo Canyon location, PU-10231, which exceeded an EPC-to-RBC ratio of 1.0 for the trail user scenario, was dry for three of the four sampling rounds. The other location in Acid Canyon where the EPC-to-RBC ratio exceeded 1.0, PU-10155, was wet for all four rounds of sampling. Skin surface area exposed during each dermal exposure event was also biased in a protective manner to bound high-end exposure and therefore probably promotes overestimation of exposure via dermal absorption.

Ingestion of alluvial groundwater resulted in HI values ranging from 5 to 8 and ICR values of 2×10^{-4} to 4×10^{-5} for a resident in lower Los Alamos Canyon. Lower Los Alamos Canyon is the location of present-day residential land use for the canyon bottoms in the watershed. The source of potable water for those residences is a regional groundwater well. It is probable that any additional residential development in lower Los Alamos Canyon also will use water from the existing regional well. For this reason, chronic exposure to COPCs via ingestion of alluvial groundwater in the residential scenario at this location is unrealistic.

8.2.6.3 Toxicity Assessment

The evaluation of uncertainty pertaining to the toxicity assessment focuses primarily on the toxicology of PAHs, because these COPCs were primarily responsible for the ratios of EPCs to RBCs approaching or exceeding 1.0 in situations of probable exposure. The toxicity of alluvial groundwater COPCs in lower Los Alamos Canyon is not addressed, as exposure to alluvial groundwater in a residential context is unrealistic at this location.

The primary areas of uncertainty in the toxicology of PAHs for this human health risk assessment include extrapolation from carcinogenicity observed in animal studies to humans and use of toxicity equivalency

factors to estimate the carcinogenic potency of PAHs other than benzo(a)pyrene. As discussed in Section 8.2.4, uncertainty in the dose-response model of carcinogenicity often leads to the use of protectively biased SFs. In the case of benzo(a)pyrene, the oral SF is based on the geometric mean of four SFs derived using different modeling approaches on a combined data set of tumor data from both genders of multiple species of mice. Therefore, there is little apparent bias in the SF model.

The carcinogenic PAHs evaluated in the risk assessment include benzo(a)pyrene and six other PAHs (benzo[a]anthracene, benzo[b]fluoranthene, benzo[k]fluoranthene, chrysene, dibenz[a,h]anthracene, and indeno[1,2,3-cd]pyrene). These chemicals are identified as Class B2, or probable human carcinogens, based on several studies. The basis of the oral SF for benzo(a)pyrene, however, is animal studies. It is uncertain whether benzo(a)pyrene is indeed carcinogenic in humans and, if so, whether humans are more or less sensitive than the mice used in the carcinogenicity studies.

Among PAHs, an oral SF has been developed by EPA for only benzo(a)pyrene (EPA 2003, 76870). Because the available data are considered insufficient to calculate SFs for carcinogenic PAHs other than benzo(a)pyrene, SFs for these compounds have been derived based on a toxicity equivalence basis. Under this method, EPA has used the available toxicity data for the other PAHs to derive carcinogenic potencies for each carcinogenic PAH relative to that of benzo(a)pyrene. Confidence in these equivalency factors is less than that commonly associated with SFs.

Other COPCs contributing to calculated health impacts include Aroclor-1254, plutonium-239,240, and cesium-137. The oral RfD for Aroclor-1254, which was applied to the dermal absorption pathway, is based on toxicological studies on monkeys. The LOAEL in these studies (0.005 mg/kg-day) was protectively assigned an uncertainty factor of 300 to generate an RfD of 2×10^{-5} mg/kg-day. The uncertainty factor incorporates a 10-fold factor to account for sensitive individuals, a factor of 10 to account for the use of a LOAEL instead of a NOAEL, and a factor of 3 to extrapolate from rhesus monkeys to humans. As described in Section 8.2.4.3, uncertainties in the DCFs used for estimating radiation dose include applying these factors to children and using DCFs based on dose rates that are relatively high compared with the dose rates associated with this assessment.

8.2.6.4 Additional Results for the Supplemental Exposure Scenarios

As discussed in Sections 8.2.1 and 8.2.3, three supplemental exposure scenarios were also evaluated in the human health risk assessment. Uncertainties related to the results of the residential, construction worker, and resource user scenarios for areas of the watershed where these exposure scenarios presently occur were discussed in Sections 8.2.6.1 through 8.2.6.3. Risk assessment calculations for these scenarios were also conducted for areas of the watershed where these scenarios are infeasible, in order to allow comparison of theoretical risks across the watershed. The results of the calculations for these scenarios are provided in Appendix E and are discussed in this uncertainty analysis, as they may be used to bound potential health impacts under improbable exposure conditions.

Residential Scenario

The residential scenario does not represent widespread current use of canyon bottoms in the Los Alamos and Pueblo watershed. The assumptions for exposure rely on a residence being located within contaminated geomorphic units in the canyon bottoms and alluvial groundwater being used as the primary household water source. This is not representative of actual or potential exposures because the contaminated geomorphic units are narrow and adjacent to the channel and it is impractical to locate a house in these areas because of potential flooding. In addition, it is probable that the regional water supply wells would be used for any new residential development, and not shallow alluvial groundwater

that is largely supported by wastewater treatment plant effluents. A residential scenario was employed in areas of Los Alamos and Pueblo Canyons where it is not feasible because of topographic constraints or land ownership to provide a familiar context and reference for human health risk assessment results.

Tables E-5.3-10 and E-5.3-11 of Appendix E present sediment EPC-to-RBC ratios and COPC contributors to those ratios. The ratios of sediment EPCs to RBCs for the residential scenario were above 1.0 in multiple reaches in these areas. The highest ratios for sediments, approximately 60, were calculated for carcinogenic effects in reaches AC-1 and AC-2. In both cases, and for many of the ratios in other reaches, exposure to arsenic via fruit and produce ingestion was responsible for much of the projected risk, ranging from 80% to 100% of the summed carcinogen risk. Because maximum detected arsenic concentrations were generally less than a factor of 2 larger than the sediment BV (see Table E-1.0-3), much of the projected arsenic risk under the residential scenario is associated with background levels of arsenic. In addition, the spatial distribution of arsenic indicates a possible source in urban runoff, as discussed in Section 7.1.2.2.

Laboratory-derived COPCs influenced the residential results mostly through radionuclide contributions to dose. Reaches AC-3 and ACS in Acid Canyon have estimated radionuclide exposures for a residential scenario of 42 and 56 mrem/yr associated with plutonium-239,240. A series of reaches, starting with DP-2 in DP Canyon and continuing downcanyon into Los Alamos Canyon, have potential radionuclide doses associated with external irradiation from cesium-137 ranging from 120 mrem/yr in reach DP-2 to 27 mrem/yr in reach LA-3W.

The ratios of alluvial groundwater EPCs to RBCs for the residential scenario were greater than 1.0 for carcinogens and radionuclides at many sampling locations. As with sediment exposure, projected cancer risk was largely associated with exposure to arsenic. Tables E-5.3-13 and E-5.3-14 present ratios for alluvial groundwater EPCs to RBCs with and without the arsenic data to show the effects of other COPCs. There are no ratios greater than 1.0 when arsenic is removed, whereas 22 of 24 water sampling locations, including baseline locations, exceed the criterion (10^{-5}) for carcinogens when arsenic is included. These results indicate that there is no potential unacceptable cancer risk from alluvial groundwater from other COPCs. Available data indicate that the source of the arsenic is natural groundwater, as discussed in Section 7.2.

In a few cases, such as at locations LAUZ-1 and LAUZ-2 in reach DP-2, cancer risk was dominated by exposure to bis(2-ethylhexyl)phthalate via dermal absorption. Various COPCs, including molybdenum, fluoride, nitrate, perchlorate, thallium, iron, and manganese, were related to noncarcinogen ratios exceeding 1.0 resulting from alluvial groundwater ingestion. Most of these COPCs show no apparent trend relative to Laboratory COPC source areas. Molybdenum shows a Laboratory-derived signature in upper Los Alamos Canyon with an EPC-to-RBC ratio of 38 at well LAO-3a (LA-10035). For radionuclides, three locations exceeded the drinking water criterion of 4 mrem/yr resulting from strontium-90. Potential DP Canyon alluvial groundwater doses ranged from 18 to 20 mrem/yr at LAUZ-1 (21-01811) and LAUZ-2 (21-01812). The potential dose at well LAO-3a (LA-10035) in upper Los Alamos Canyon was 4 mrem/yr.

MMSs are presented in Tables E-5.3-19 and E-5.3-20 for filtered and unfiltered alluvial groundwater and Tables E-5.3-21 and E-5.3-22 for filtered and unfiltered data with the arsenic results removed. The MMSs are consistent with the results discussed separately for sediments and alluvial groundwater.

Construction Worker Scenario

The construction worker scenario represents activities that occasionally take place in the canyons but are infrequent in occurrence and are typically for short durations. Potential exposure to contaminated media is restricted to sediment, which is limited in extent along the stream channel. Job site planning is

designed to mitigate worker health risk and minimize exposure to suspended particulates. Potential exposure to contamination is restricted to areas of post-1942 sediment deposits and would occur for a fraction of the time that the construction worker is in the area. Relatively short duration construction activity, such as excavation for pipelines, is possible.

None of the EPC-to-RBC ratios exceeded 1.0 for carcinogen or noncarcinogen sums (Table E-5.3-8). Four reaches had radionuclide EPC-to-RBC ratio sums that ranged from 1.2 (18 mrem/yr) to 2.0 (30 mrem/yr): AC-3, ACS, DP-2 and DP-3. The Acid Canyon ratio sums are dominated by plutonium-239,240, and the DP Canyon ratio sums are dominated by cesium-137.

Resource User Scenario

The resource user scenario is not realistically represented by the contaminated areas within the canyon bottoms. This scenario requires a much larger area, where wild game and cattle may graze and wild plants and berries are available. Restricting this scenario to a reach and the channel deposits overestimates the exposure as well as the potential risk, hazard, and dose. Ranching and hunting do not occur in the canyon areas within Laboratory boundaries or on land owned by Los Alamos County; these activities are restricted to portions of lower Los Alamos Canyon.

The highest calculated ratios of sediment EPCs to RBCs in the human health risk assessment were from carcinogenic risk under the resource user scenario, although the highest ratios were limited to areas of the upper canyons where such resource use is currently prohibited. Ratios for sediments in reaches AC-1, DP-1W, and AC-3 were 231, 167, and 143, respectively. Ratios in other reaches assessed ranged from approximately 9 to 40. Exposure to PAHs, in particular benzo(a)pyrene, via the meat ingestion pathway was responsible for these high ratios. As noted in Section 8.2.3, it was assumed that 100% of the foraging range of the animals hunted or grazed was represented by the EPC, leading to the unrealistically high cancer risks calculated for this scenario.

The sediment ratio for radionuclides under the resource user scenario exceeded 1.0 only in reach DP-2 (20 mrem/yr) because of exposure to strontium-90 and cesium-137 through meat and plant ingestion. External irradiation from cesium-137 also contributes to the total exposure at this reach. The ratio of EPCs to RBCs associated with PAHs was exceeded only for surface water exposure for carcinogens at locations PU-10155 and PU-10231 in reaches AC-3 and P-2W, respectively (see Section 8.2.6.1 for discussion of PAHs in surface water at these locations).

8.2.7 Summary of the Human Health Risk Assessment

The health effects associated with COPCs in the Los Alamos and Pueblo watershed were assessed relative to a radiological dose criterion of 15 mrem/yr for sediment and 4 mrem/yr for water, a chemical cancer risk criterion of 1×10^{-5} , and a chemical hazard criterion of 1.0. The sediment risk assessment results are below these thresholds for the trail user and extended backyard exposure scenarios for the whole watershed, for residential and resource user scenarios in lower Los Alamos Canyon, and for the construction worker scenario in Pueblo Canyon. Water risk results are below the noncarcinogen and radionuclide thresholds for the trail user and extended backyard scenarios across the watershed. The carcinogen and noncarcinogen criteria for residential drinking water were exceeded by alluvial groundwater in lower Los Alamos Canyon. As described below, this exposure pathway is not complete because the potable water supply for area residents is regional groundwater. Radionuclide dose for alluvial groundwater in lower Los Alamos Canyon was below the criterion of 4 mrem/yr. No risks exceed thresholds in lower Los Alamos Canyon and middle Pueblo Canyon for the resource user and construction worker, respectively.

Maximum sediment HIs are approximately 0.05 for the trail user and approximately 0.4 for the extended backyard exposure scenarios. These values were related primarily to exposure to Aroclor-1254 in soil via dermal exposure in reach AC-3. Protective biases associated with these HI values include probable overestimation of exposure concentrations in sediments, conservative estimates of the amount of time spent on contaminated sediment deposits, the amount of soil adhering to exposed skin, and a protective uncertainty factor of 300 incorporated into the oral RfD of Aroclor-1254. HIs ranged from 5 to 8 in the residential exposure scenario in lower Los Alamos Canyon, resulting from ingestion of nitrate, nitrite, fluoride, and thallium in alluvial groundwater. Because residences in this area use a regional groundwater well for their domestic water, this exposure pathway is considered incomplete at this location. HIs related to the resource user in lower Los Alamos Canyon were well below the decision criterion of 1.

Maximum ICR estimates for carcinogenic chemical COPCs are 3×10^{-5} for the trail user and 2×10^{-5} for the extended backyard exposure scenario. These values were primarily related to exposure to benzo(a)pyrene in surface water via dermal absorption at location PU-10155 in reach AC-3. Secondary contributors to these ICR values were exposure to benzo(a)pyrene and Aroclor-1254 in sediments via incidental ingestion and dermal uptake. An ICR of 2×10^{-5} for the trail user was also calculated for exposure to benzo(a)pyrene in surface water via dermal absorption at location PU-10231 in reach P-2W. Protective biases associated with these ICR values include intermittent availability of water in the area, reduced bioavailability of PAHs in water resulting from adsorption of PAHs on particulates, conservative estimates of the amount of time spent on site, and the area of skin exposed to water. Cancer risk related to alluvial groundwater exposures in the residential scenario in lower Los Alamos Canyon were driven by arsenic. Available data indicate that these arsenic concentrations are naturally occurring. Present-day residences in lower Los Alamos Canyon obtain their potable water from a regional groundwater well. Therefore, exposures to alluvial groundwater in a residential context are not presently occurring at this location.

Maximum radiation dose estimates are approximately 2 mrem/yr for the trail user (reach DP-2) and approximately 8 mrem/yr for the extended backyard scenario (reach ACS). As discussed in Sections 8.2.4.3 and 8.2.4.4, potential health effects for radionuclides may also be expressed as cancer morbidity risk using radionuclide slope factors. Cancer risks calculated for reach DP-2 and ACS are 3×10^{-7} and 4×10^{-6} for trail user and extended backyard exposure scenarios, respectively. External irradiation from cesium-137 was the primary contributor to radionuclide dose and cancer risk in the trail user scenario. Exposure to plutonium-239,240 via incidental soil ingestion was the primary contributor to radiation dose and cancer risk in the extended backyard scenario. Protective biases associated with these values include use of an upper percentile value for child incidental soil ingestion, conservative estimates of the amount of time spent on site, and use of an external DCF for cesium-137 that assumes an effectively infinite source area.

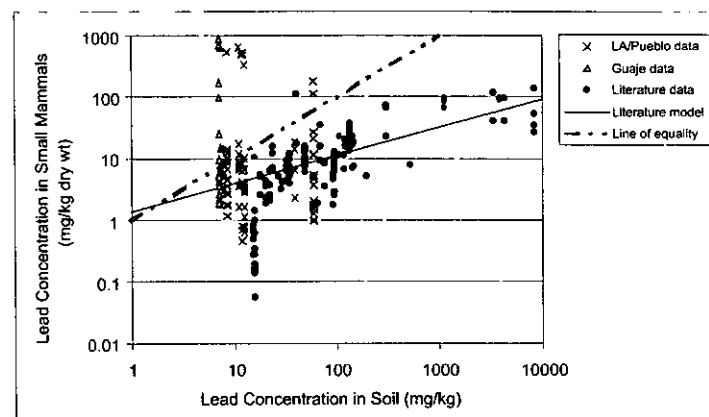
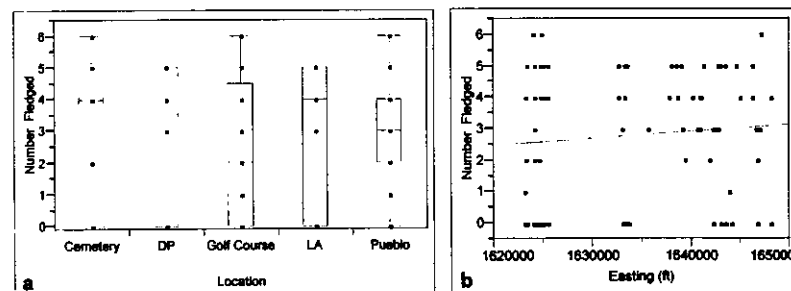
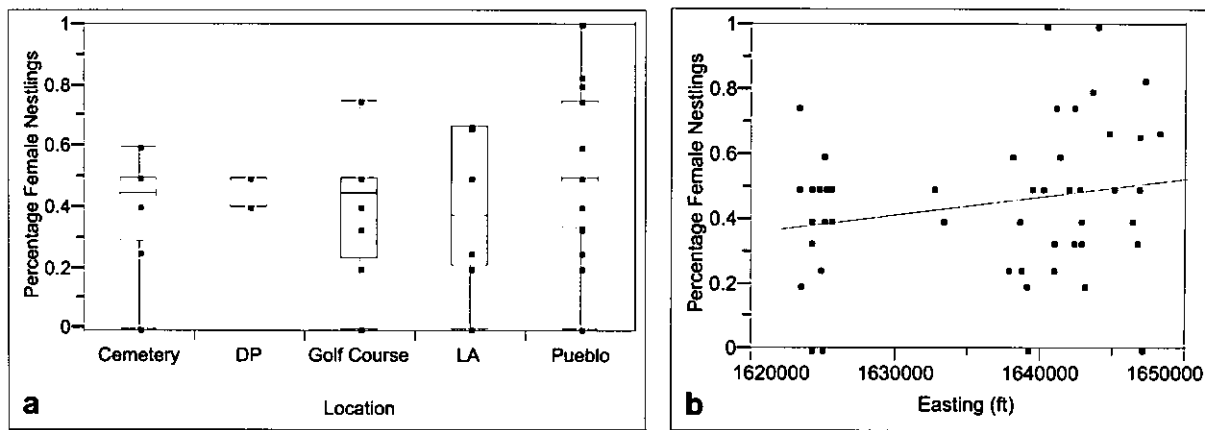


Figure 8.1-2. Concentrations of lead in small mammals versus soil concentrations



Note: In scatter plot b, the red line indicates linear regression through the data.

Figure 8.1-3. Spatial trends in the number of western bluebirds fledged per nest: (a) box plot versus location in the Los Alamos and Pueblo watershed and (b) scatter plot versus easting



Note: In scatter plot b, the red line indicates linear regression through the data.

Figure 8.1-4. Spatial trends in the percentage female nestlings in western bluebirds nests: (a) box plot versus location in the Los Alamos and Pueblo watershed and (b) scatter plot versus easting

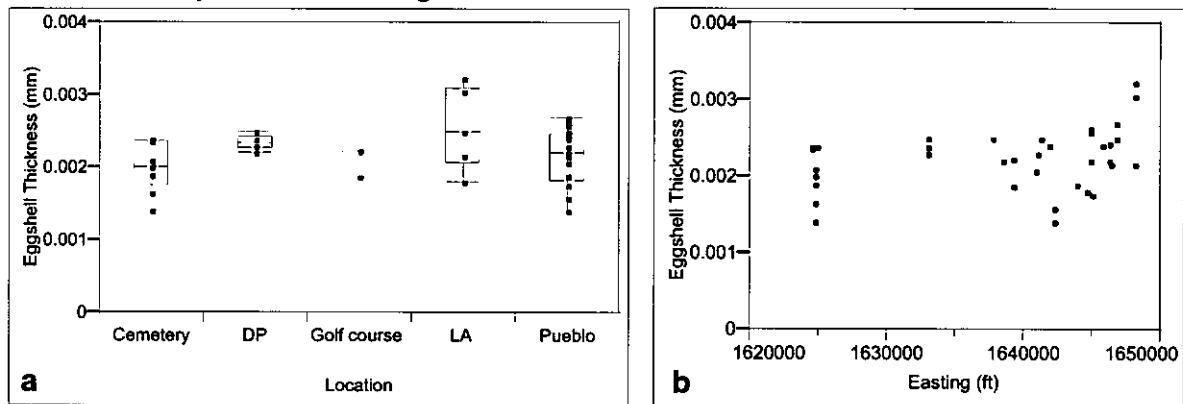


Figure 8.1-5. Spatial trends in eggshell thickness for western bluebird nests: (a) box plot versus location in the Los Alamos and Pueblo watershed and (b) scatter plot versus easting

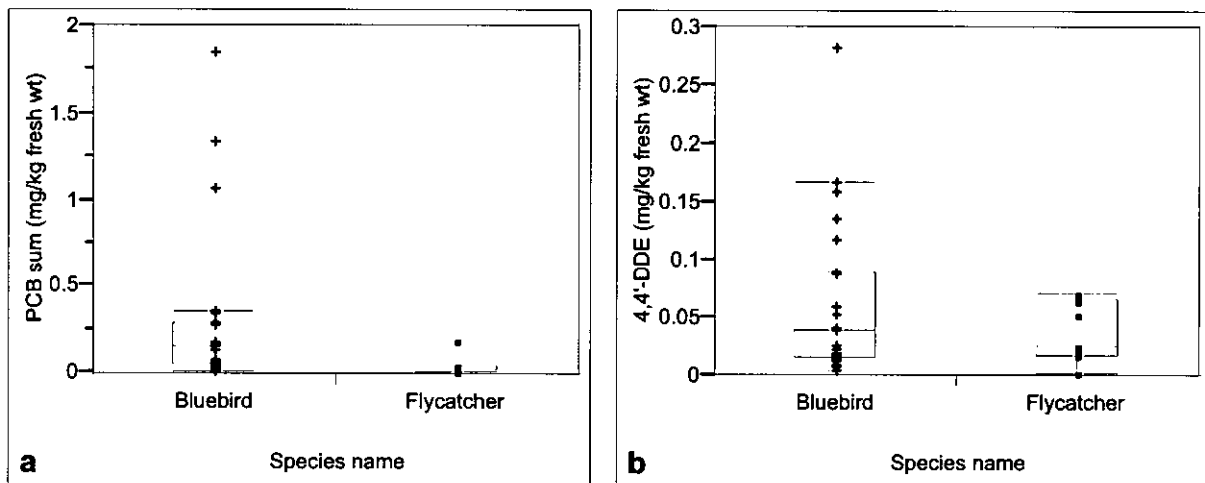


Figure 8.1-6. Box plot comparison of contaminants in western bluebird and ash-throated flycatcher eggs: (a) PCBs and (b) 4,4'-DDE

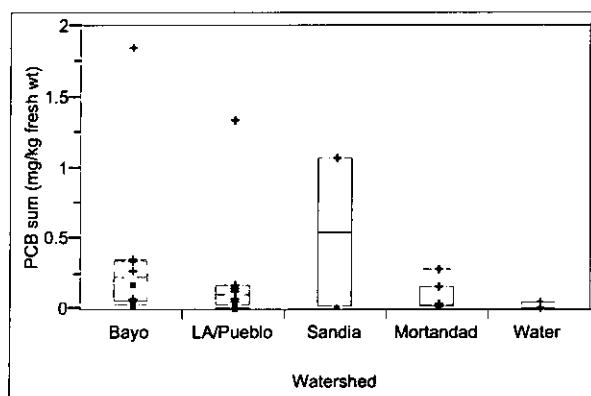


Figure 8.1-7. Box plot comparison of PCBs in western bluebird eggs versus watershed

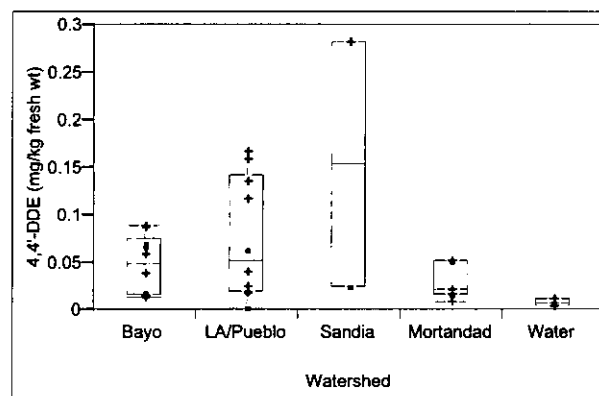
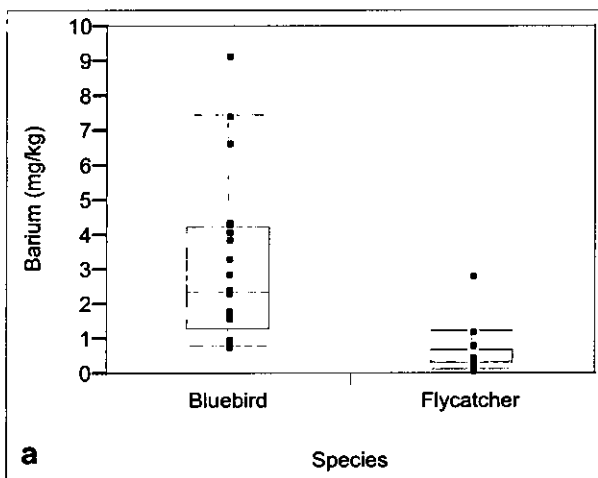
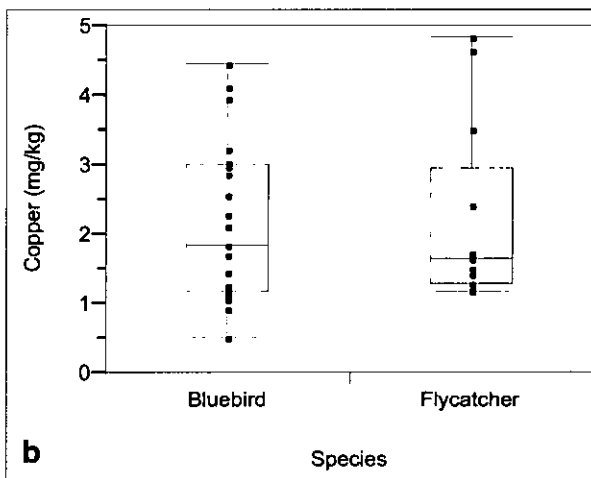


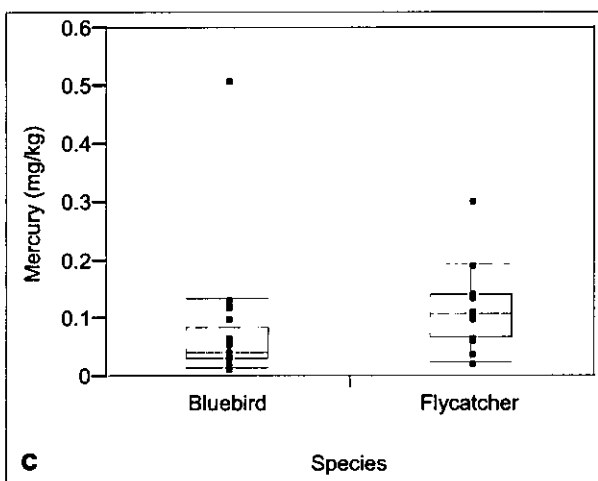
Figure 8.1-8. Box plot comparison of 4,4'-DDE in western bluebird eggs versus watershed



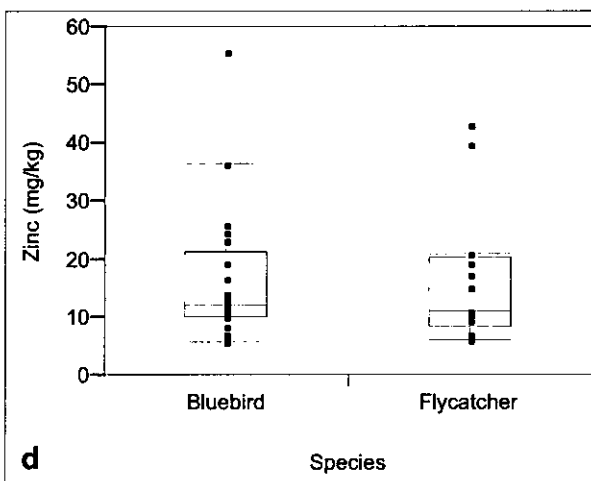
a



b



c



d

Figure 8.1-9. Box plot comparison of metals in western bluebird and ash-throated flycatcher eggs: (a) barium, (b) copper, (c) mercury, and (d) zinc

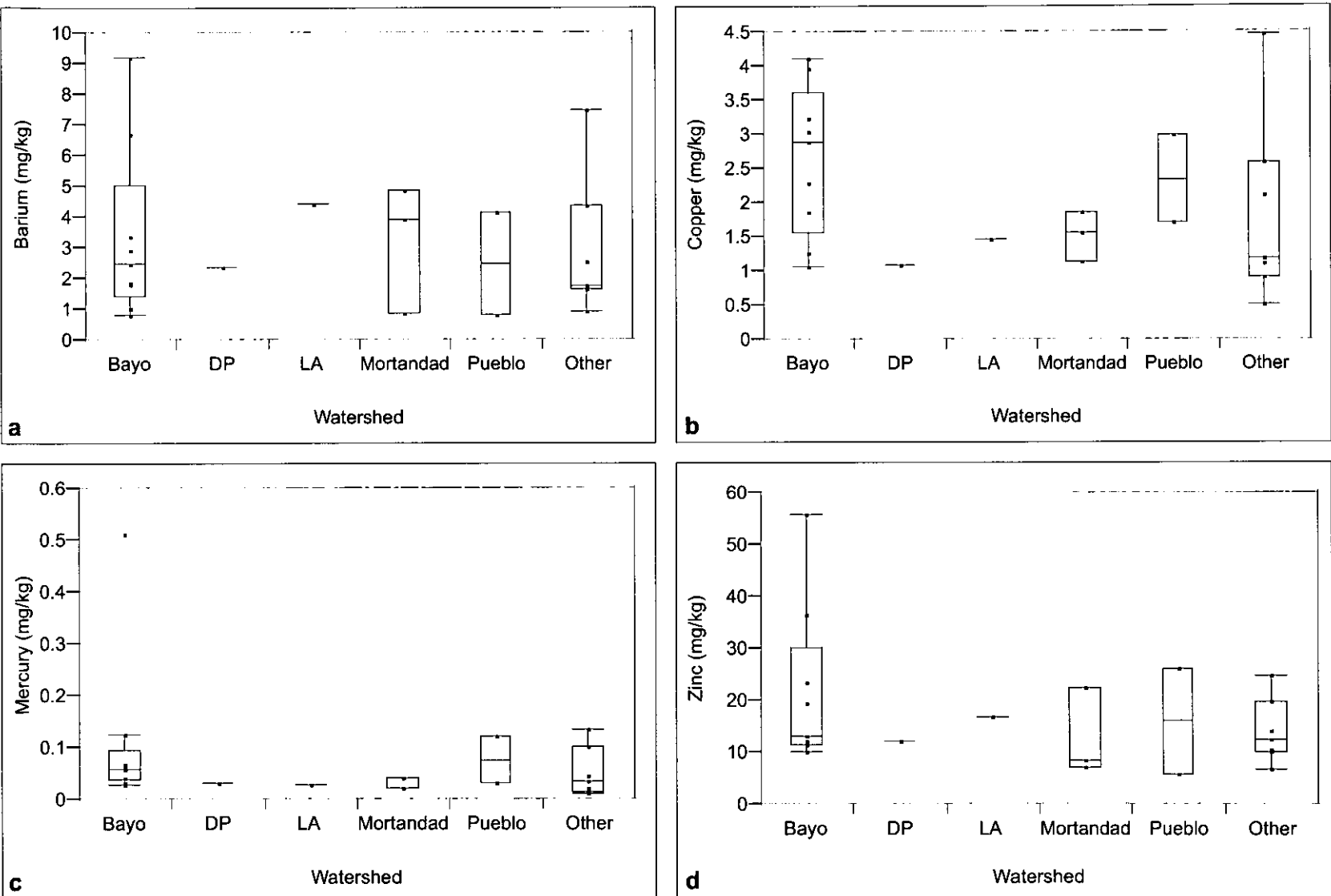


Figure 8.1-10. Box plot comparison of metals in western bluebird eggs versus watershed: (a) barium, (b) copper, (c) mercury, and (d) zinc

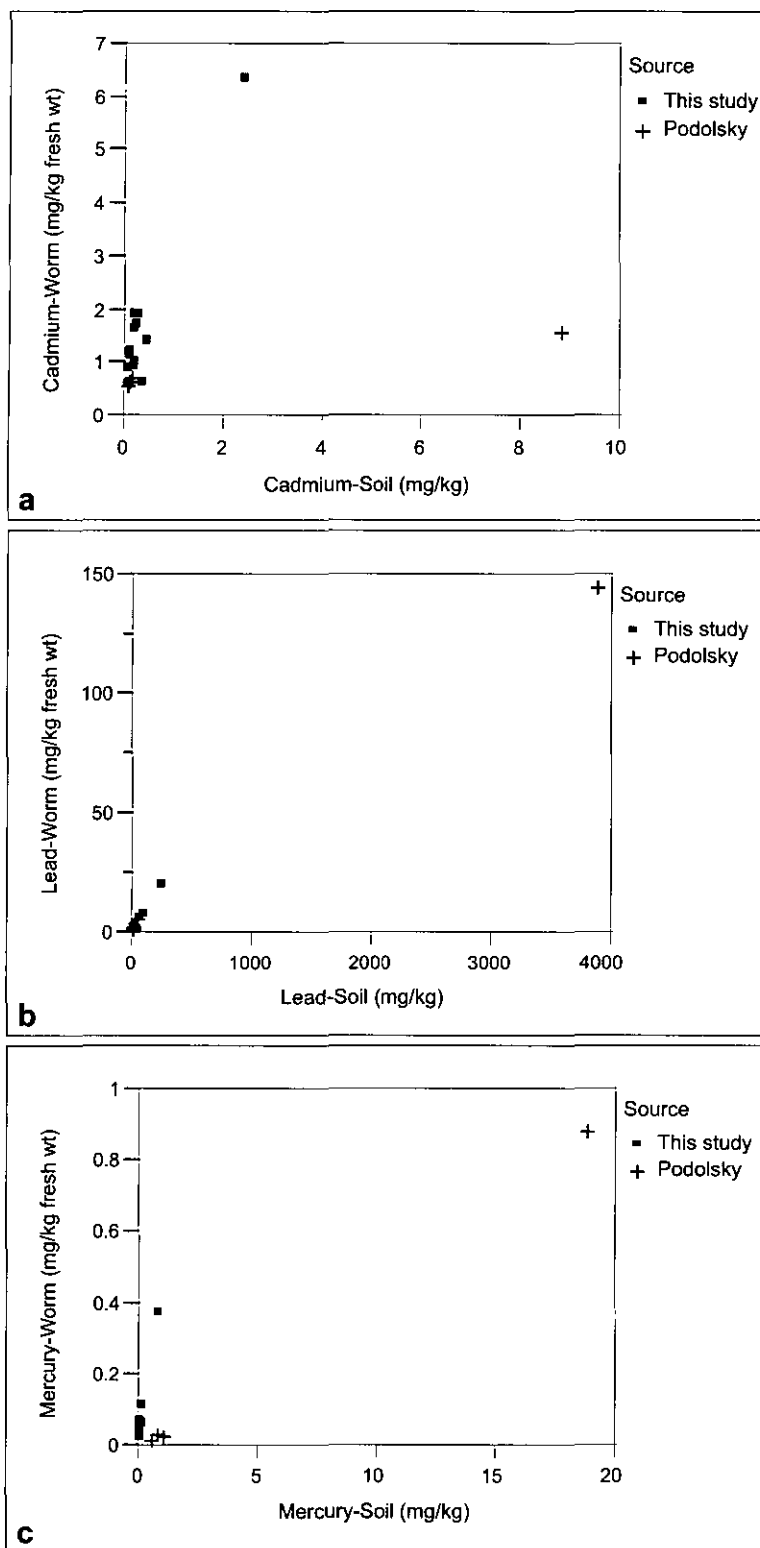


Figure 8.1-11. Scatter plot comparison of metals bioaccumulation in earthworms for this study data versus Podolsky (2000, 73477) data: (a) cadmium, (b) lead, and (c) mercury

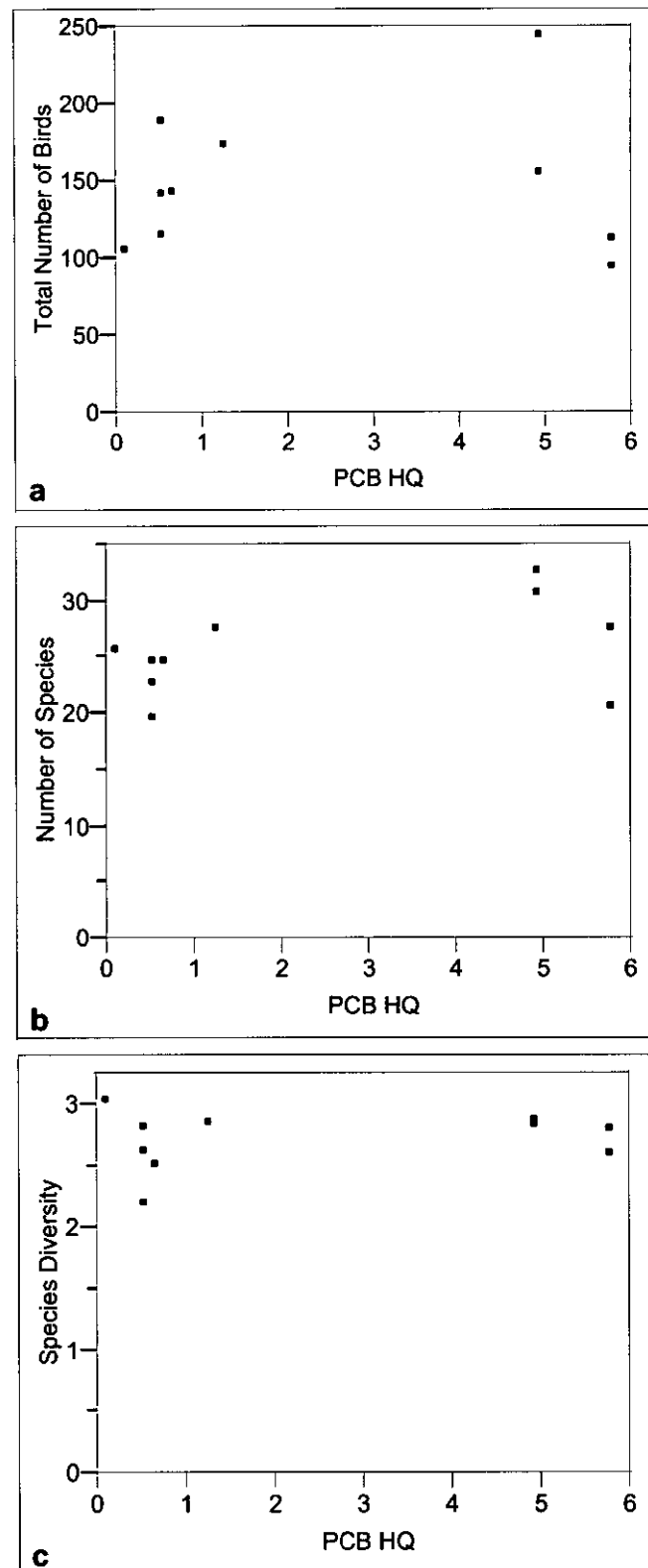


Figure 8.1-12. Robin PCB HQ versus (a) bird counts, (b) number of species, and (c) species diversity

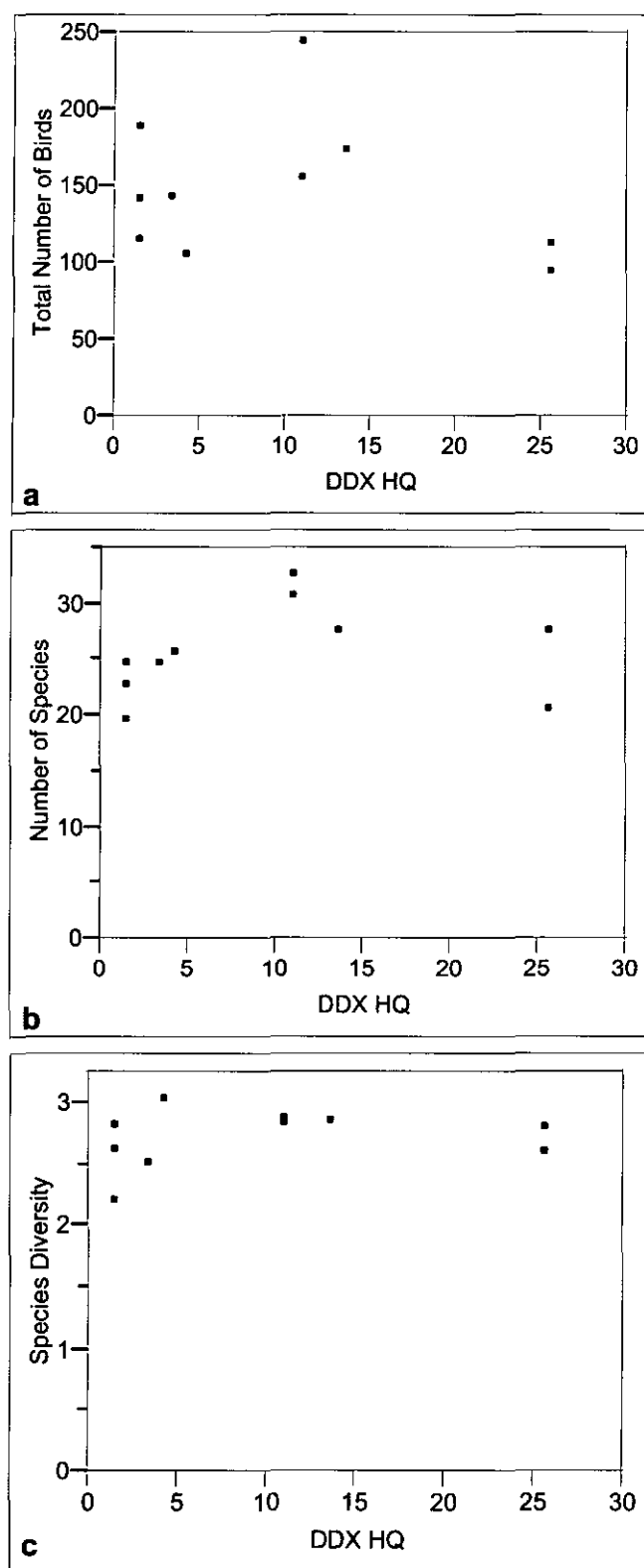


Figure 8.1-13. Robin DDX HQ versus (a) bird counts, (b) number of species, and (c) species diversity

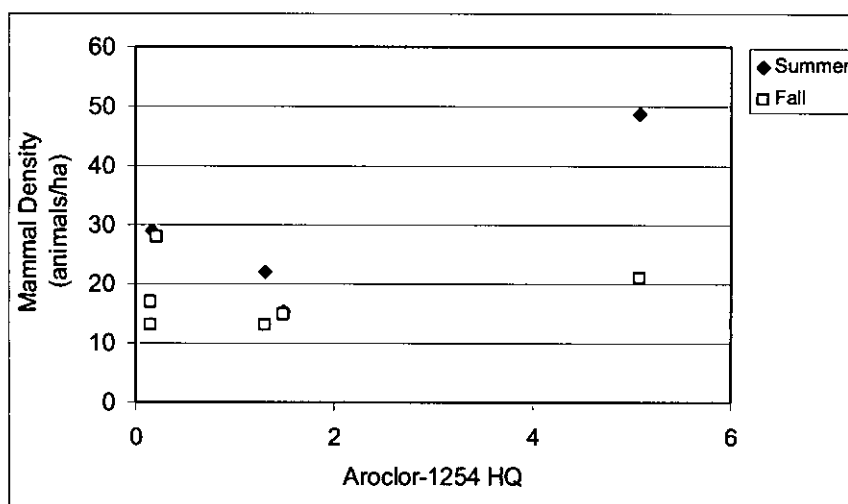
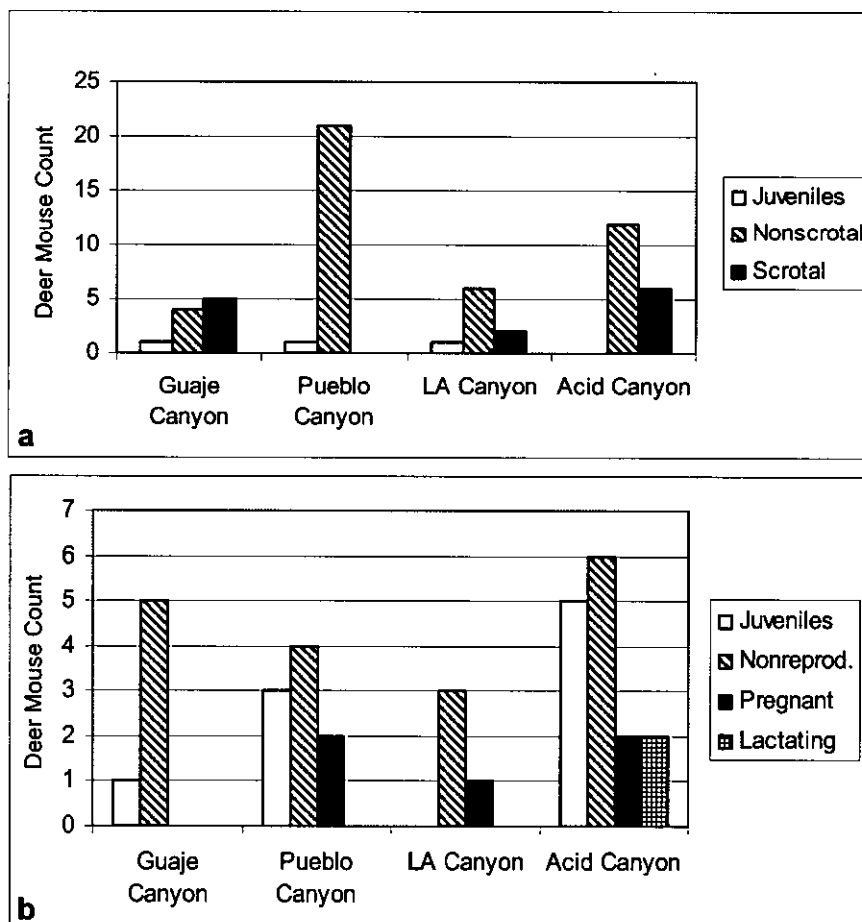
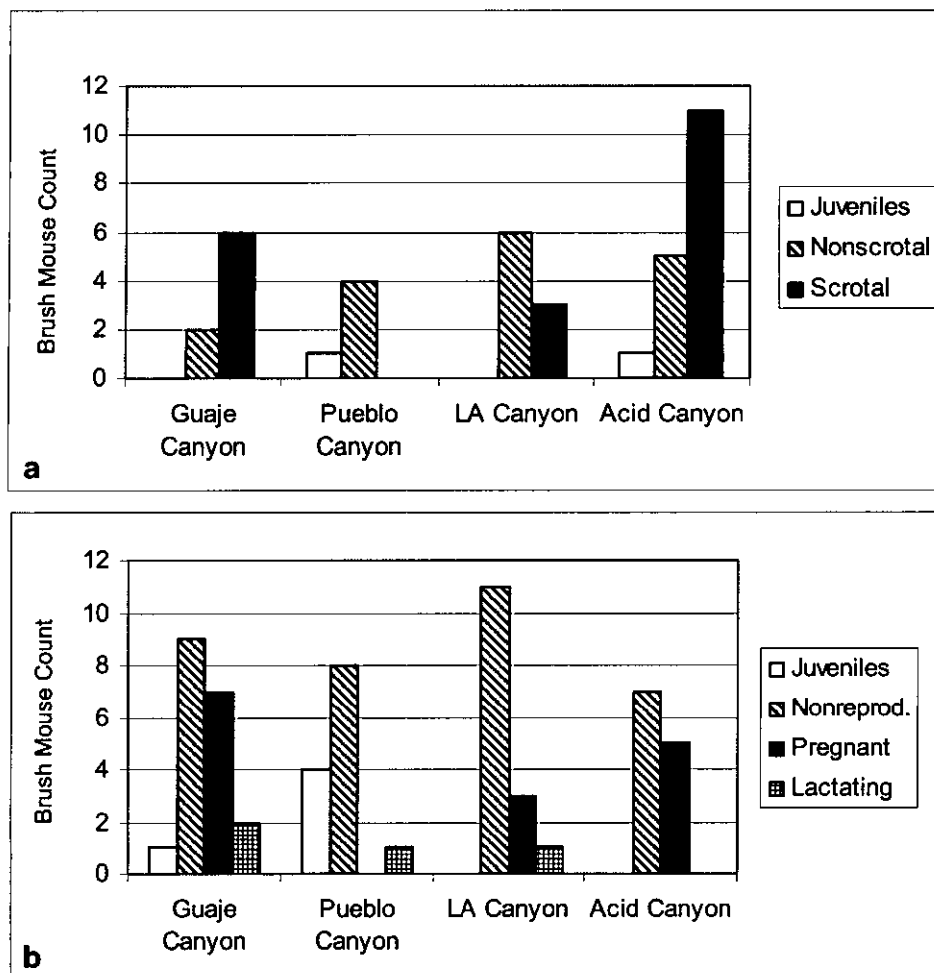


Figure 8.1-14. Scatter plot of small-mammal density versus the Aroclor-1254 HQ for the trapping array



Note: Locations are listed in increasing concentrations of Aroclor-1254.

Figure 8.1-15. Counts of deer mice in various reproductive categories by location: (a) males and (b) females



Note: Locations are listed in increasing concentrations of Aroclor-1254.

Figure 8.1-16. Counts of brush mice in various reproductive categories by location. Locations are listed in increasing concentrations of Aroclor-1254: (a) males and (b) females

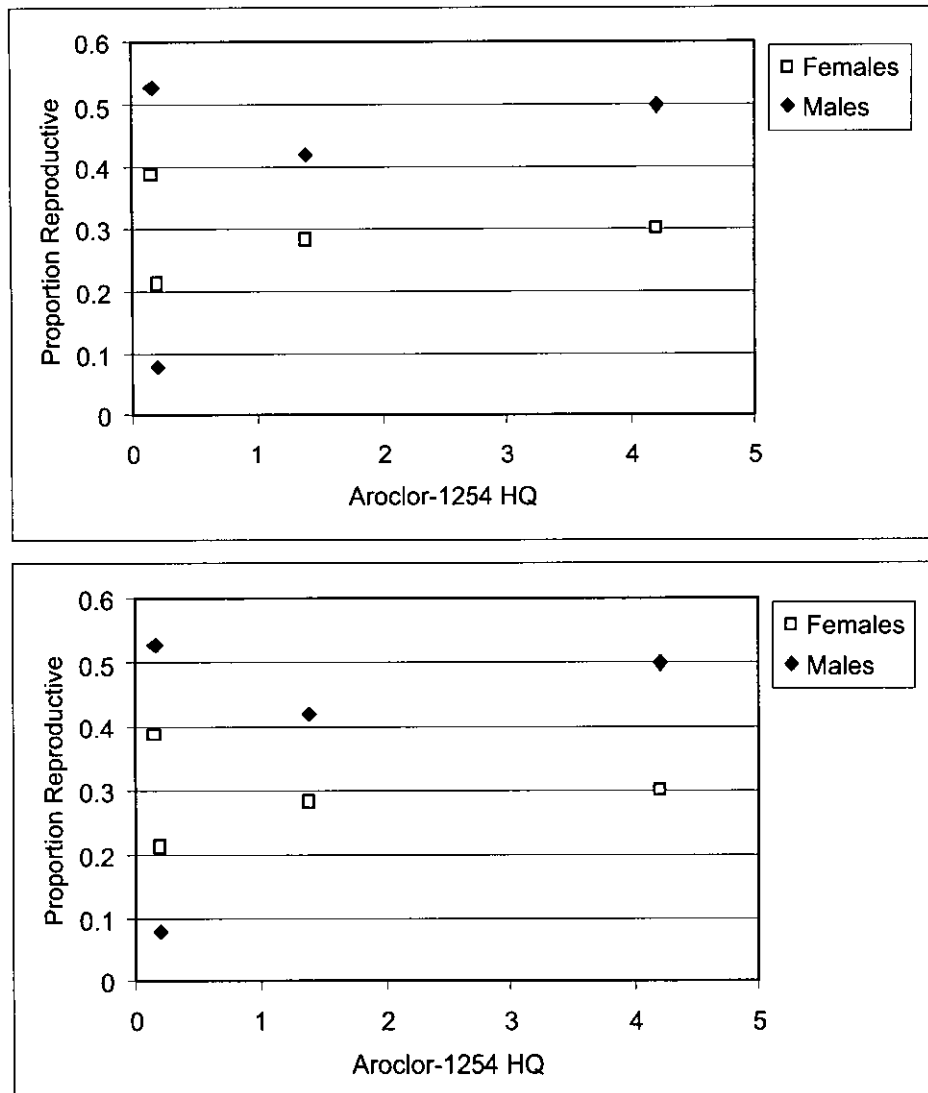
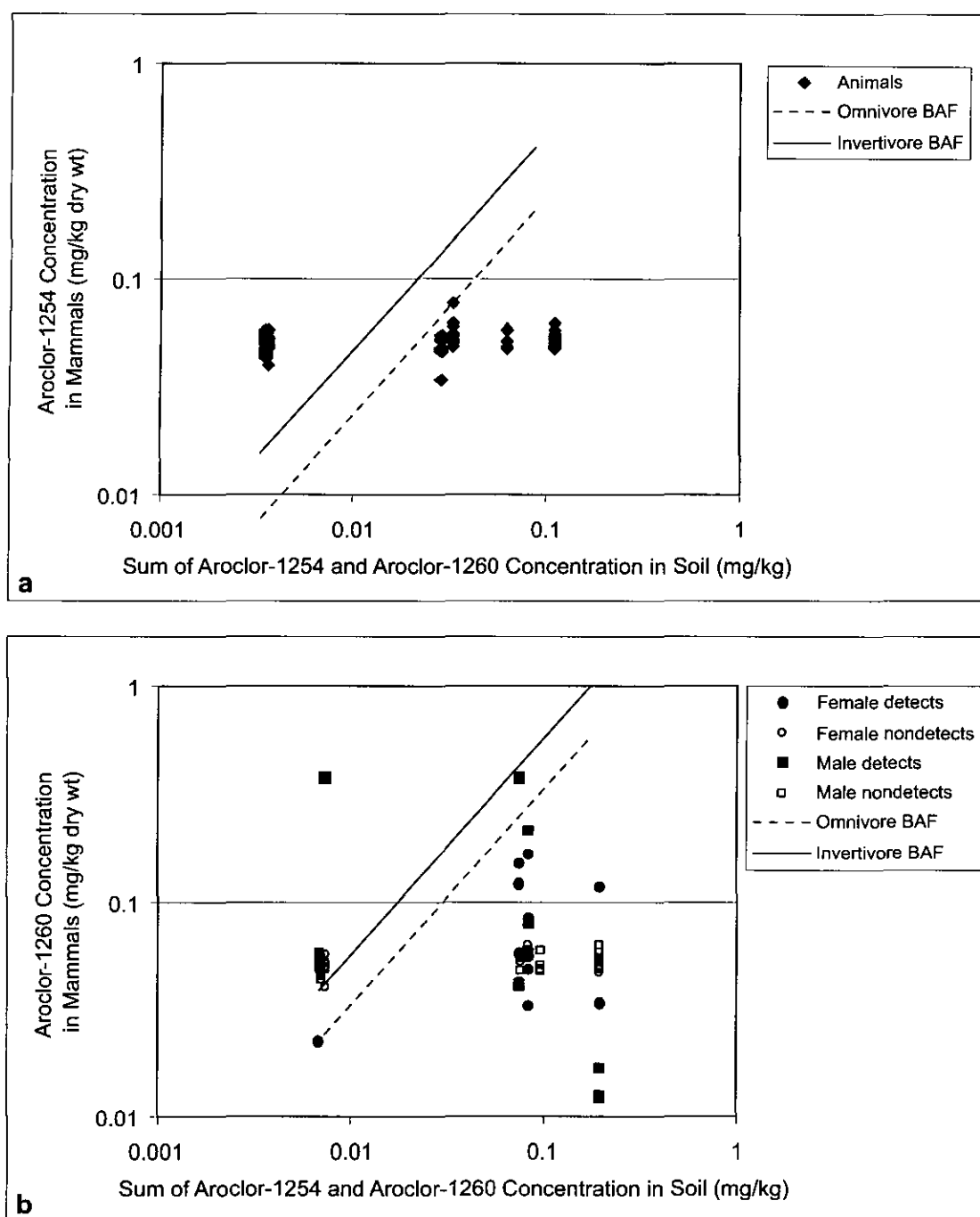


Figure 8.1-17. Proportion of reproductive mice versus the Aroclor-1254 HQ for the trapping array



Note: Lines represent predicted bioaccumulation based on invertivore and omnivore bioaccumulation factors (BAF).

Figure 8.1-18. Scatter plot of PCB concentrations in small mammals versus sum of Aroclor-1254 and Aroclor-1260 soil concentrations measured in the trapping arrays:
 (a) Aroclor-1254 in small mammals versus Aroclor-1254 in soil and (b) Aroclor-1260 in small mammals versus the sum of Aroclor-1254 and Aroclor-1260 in soil

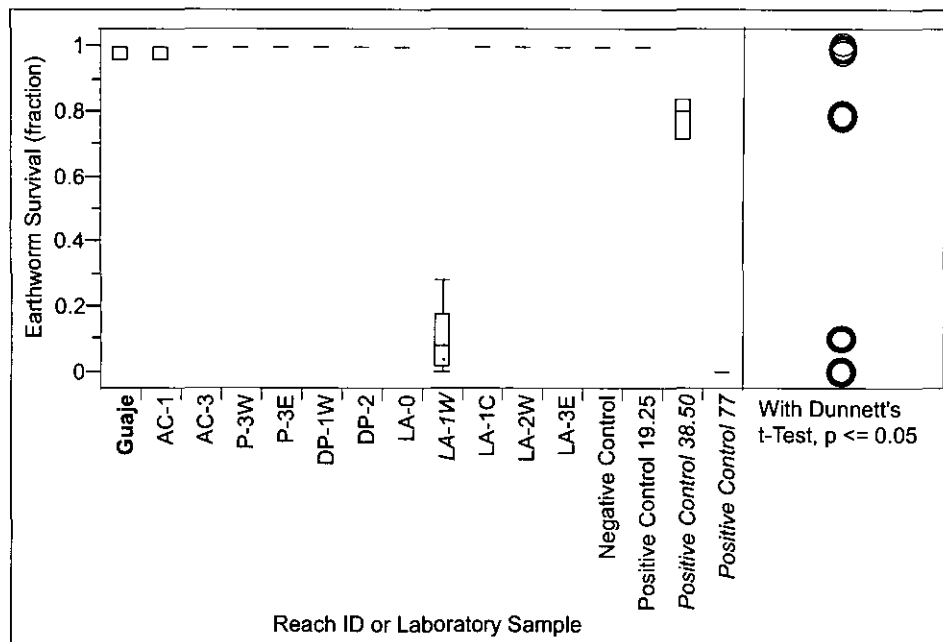


Figure 8.1-19. Box plot and comparison circles of earthworm survival fraction for samples tested (red groups are not different from control)

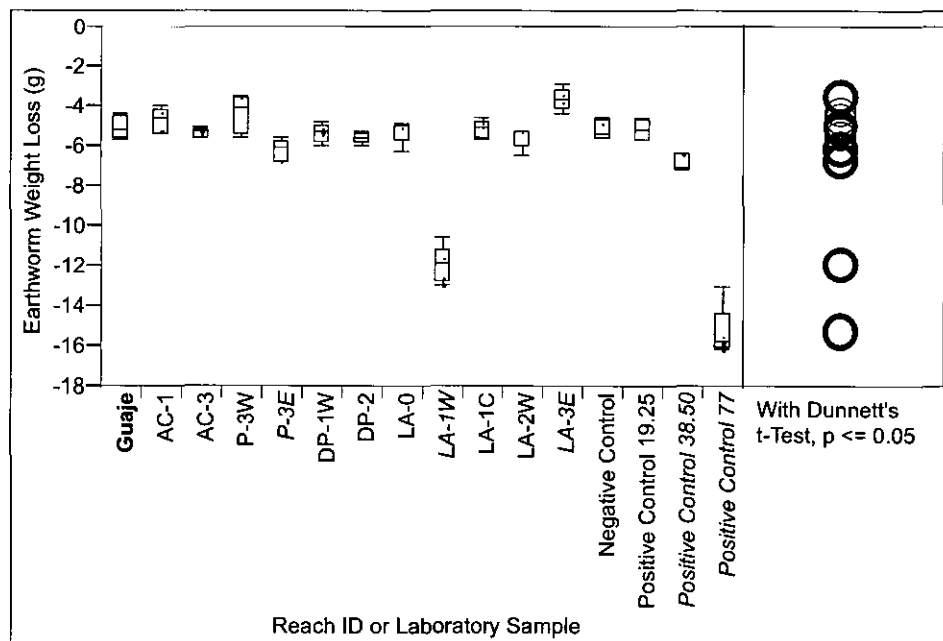


Figure 8.1-20. Box plot and comparison circles of earthworm weight change for samples tested (red groups are not different from control)

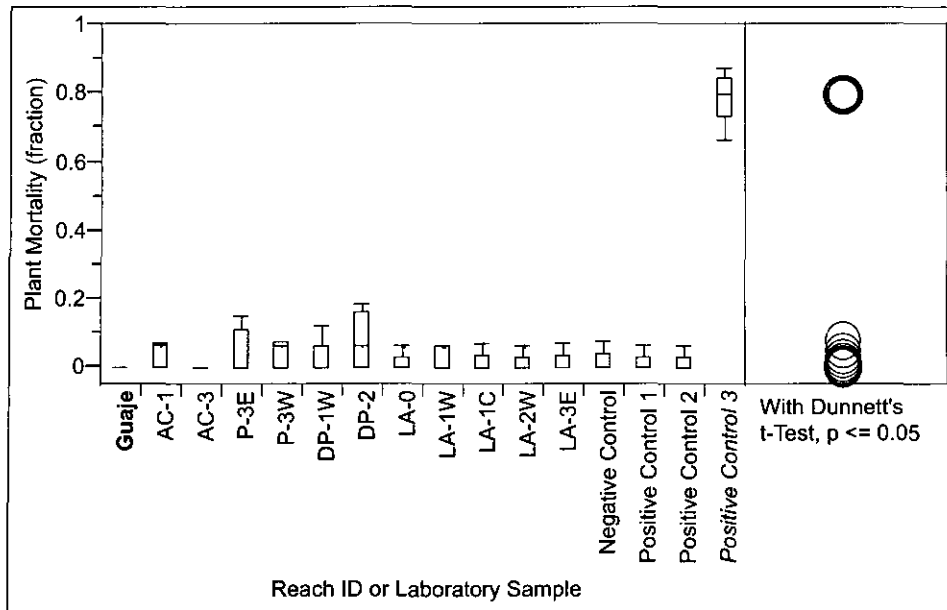


Figure 8.1-21. Box plot and comparison circles of plant mortality fraction for samples tested (red groups are not different from control)

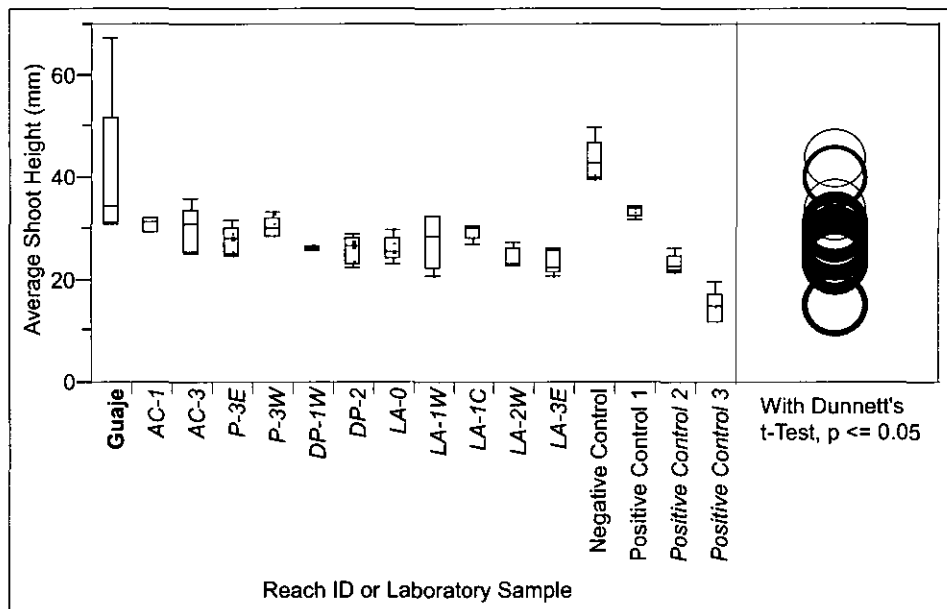


Figure 8.1-22. Box plot and comparison circles of plant shoot height for samples tested (red groups are not different from control)

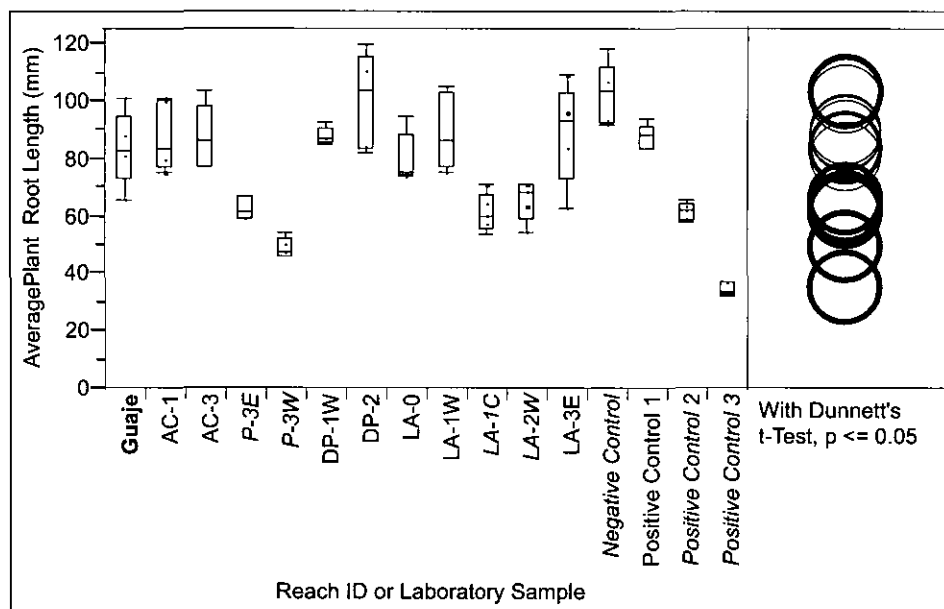


Figure 8.1-23. Box plot and comparison circles of plant root length for samples tested (red groups are not different from control)

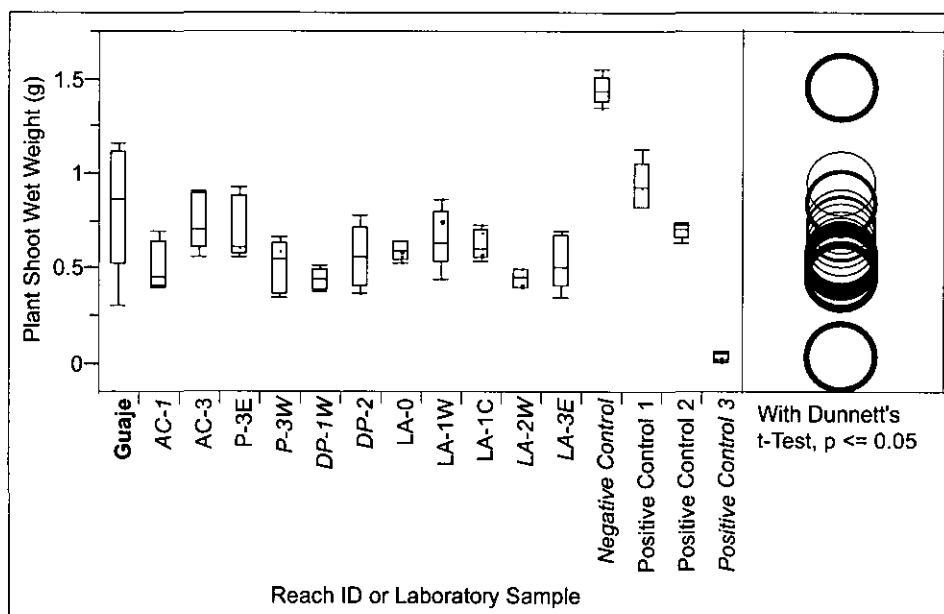


Figure 8.1-24. Box plot and comparison circles of plant shoot wet weight for samples tested (red groups are not different from control)

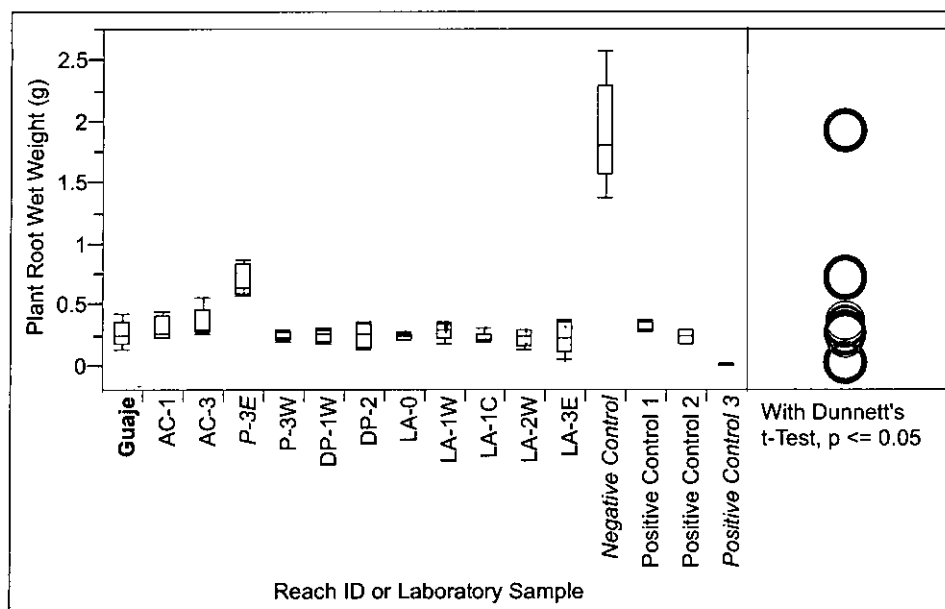


Figure 8.1-25. Box plot and comparison circles of plant root wet weight for samples tested (red groups are not different from control)

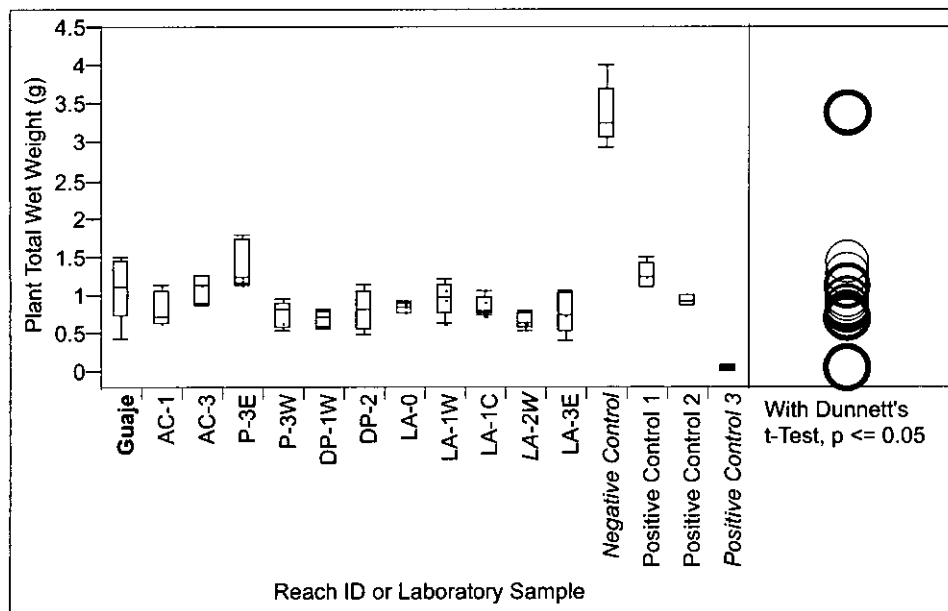


Figure 8.1-26. Box plot and comparison circles of plant total wet weight for samples tested (red groups are not different from control)

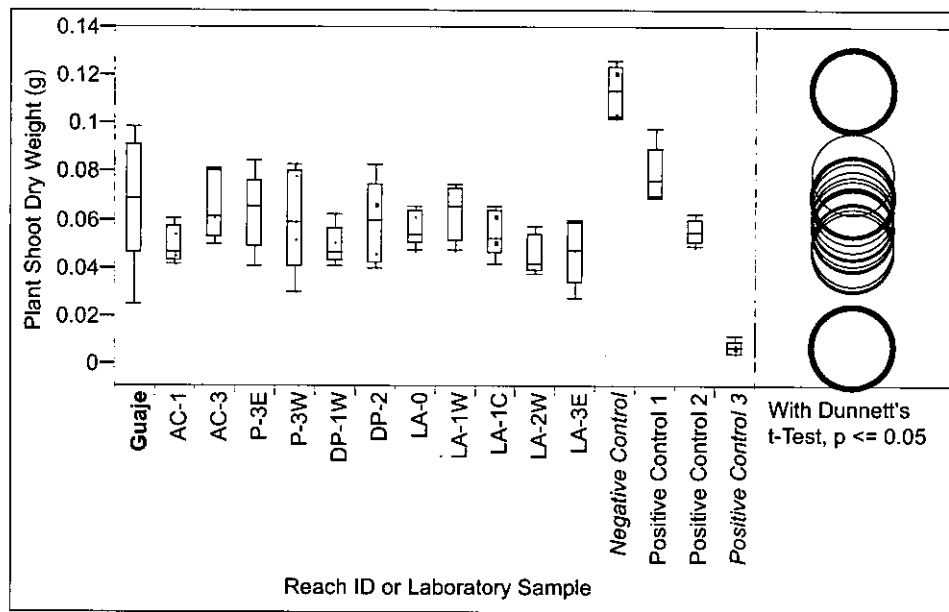


Figure 8.1-27. Box plot and comparison circles of plant shoot dry weight for samples tested (red groups are not different from control)

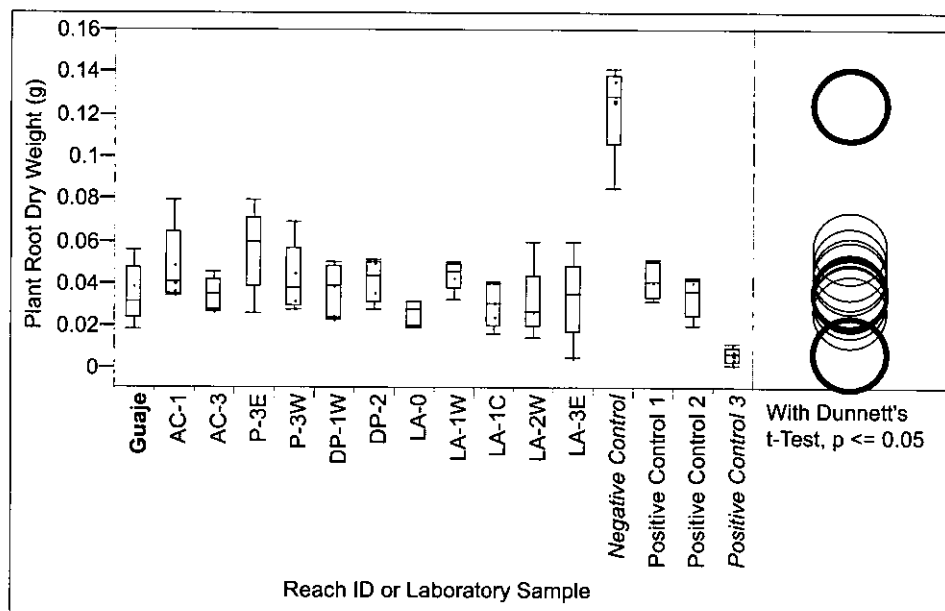


Figure 8.1-28. Box plot and comparison circles of plant root dry weight for samples tested (red groups are not different from control)

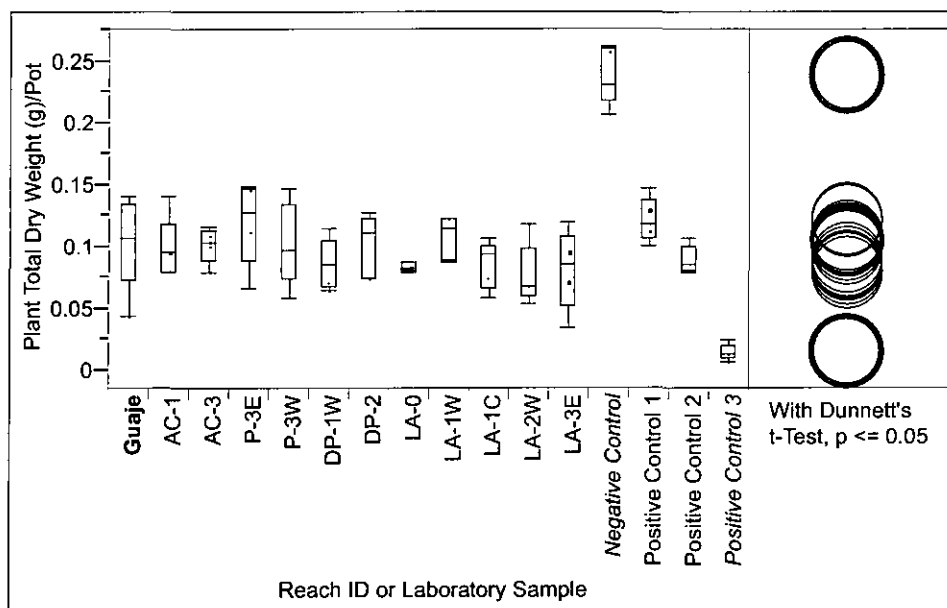


Figure 8.1-29. Box plot and comparison circles of plant total dry weight per pot for samples tested (red groups are not different from control)

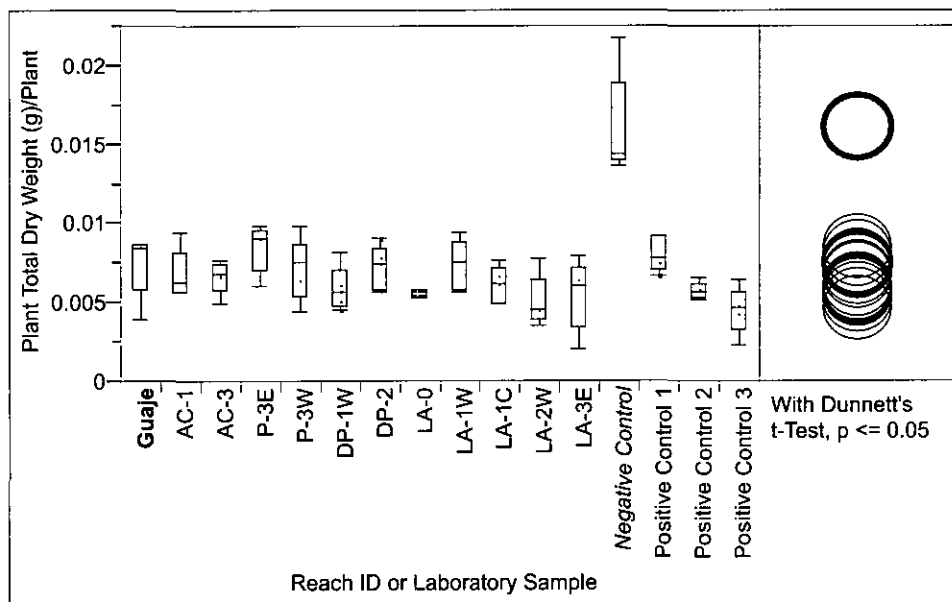


Figure 8.1-30. Box plot and comparison circles of plant total dry weight per plant for samples tested (red groups are not different from control)

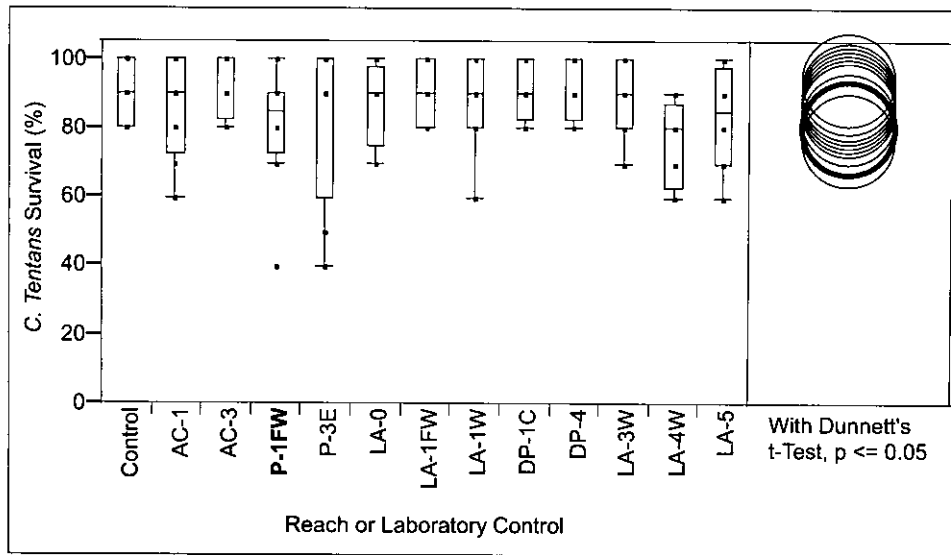


Figure 8.1-31. Box plot and comparison circles of *C. tentans* survival for samples tested. Dunnett's t-Test is based on reach P-1FW as the control (red groups are not different from control)

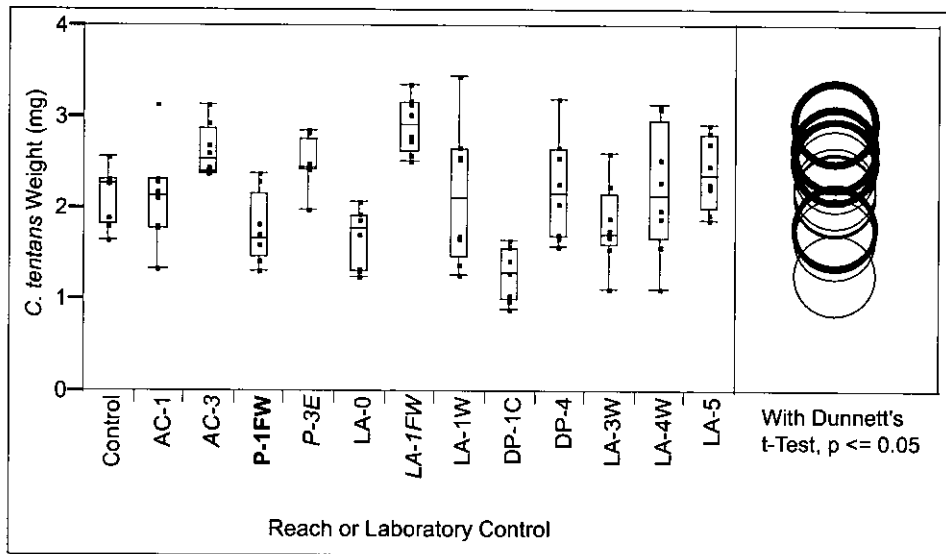


Figure 8.1-32. Box plot and comparison circles of *C. tentans* growth (weight) for samples tested. Dunnett's t-Test is based on reach P-1FW as the control (red groups are not different from control)

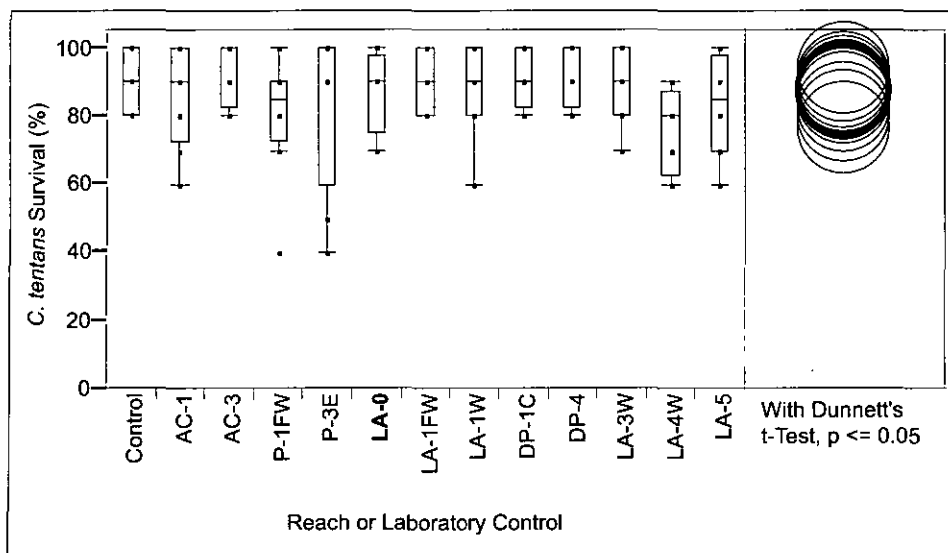


Figure 8.1-33. Box plot and comparison circles of *C. tentans* survival for samples tested. Dunnett's t-Test is based on reach LA-0 as the control (red groups are not different from control)

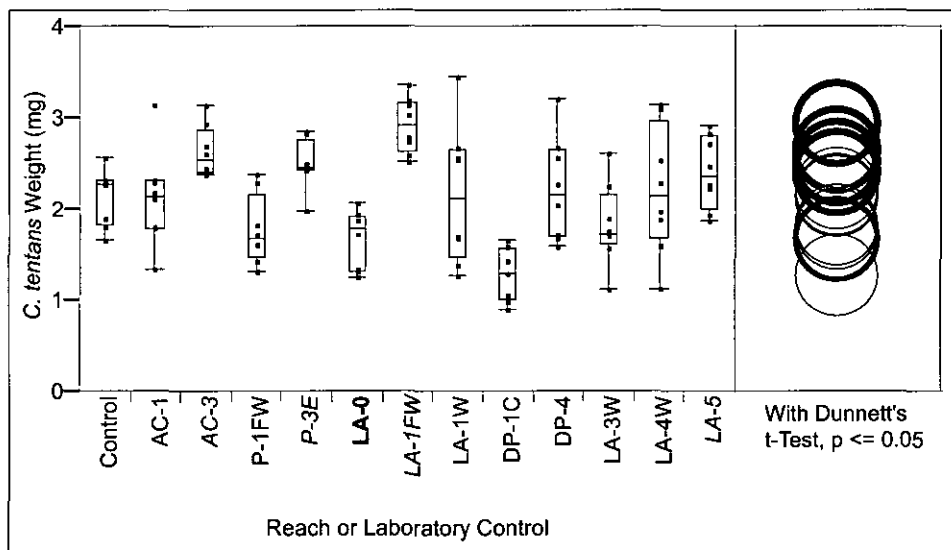


Figure 8.1-34. Box plot and comparison circles of *C. tentans* growth (weight) for samples tested. Dunnett's t-Test is based on reach LA-0 as the control (red groups are not different from control)

Table 8.1-1
Synopsis of Terrestrial HQ Analysis and
Study Design COPECs Using Ecorisk Database, Version 1.4

COPEC	Category Code ^a		Receptor with Highest HQ
	Los Alamos and DP	Acid and Pueblo	
Acenaphthene	0	0	n/a ^b
Americium-241	0	0	n/a
Antimony	1	3	Plant
Antimony detects only	2	2	Plant
Aroclor-1254	2	2	Shrew, robin
Aroclor-1260	0	0	n/a
Arsenic	3	2	Shrew
Barium	1	1	Shrew
Bis-2-ethylhexyl phthalate	0	0	n/a
Cadmium	4	4	n/a
Chromium	1	2	Plant, invertebrate
Chrysene	0	0	n/a
Cobalt	1	1	Robin, shrew
Copper	0	0	n/a
Cyanide	none ^c	none ^c	n/a
DDE	2	2	Robin
DDT	2	2	Robin
Endrin aldehyde	2	2	Plant, robin
Lead	0	0	n/a
Manganese	3	3	Plant
Methyl mercury	0	0	n/a
Mercury	2	2	Invertebrate
Naphthalene	3	3	Robin
Naphthalene detects only	3	3	Robin
Plutonium-239,240	4	2	Invertebrate
Selenium	3	3	Plant
Silver	2	2	Shrew, plant
Thallium	4	3	Plant, shrew
Titanium	4	2	Shrew
Uranium	0	0	n/a
Zinc	3	2	Plant

^a 0 = HQ for maximum concentration less than 5, COPEC not carried forward for biological sampling.

1 = High HQs occur over most of the canyon.

2 = High HQs occur at particular spots within canyon.

3 = Lower but still elevated HQs occur over most of the canyon.

4 = HQs are close to target hazard goal or background HQ throughout canyon; therefore, this constituent is unlikely to be a risk driver.

^b n/a = Not applicable.

^c Too few samples.

Table 8.1-2
Synopsis of Terrestrial and Aquatic COPECs

Suite	Analyte	Terrestrial			Aquatic		
		COPEC in Section 6 of this Report	Study Design COPEC (Katzman 2002, 73667)	Notes	COPEC in Section 6 of this Report	Study Design COPEC (Katzman 2002, 73667)	Notes
Inorganic	Aluminum	Yes	No	Not a COPEC if pH >5.5 (EPA 2003, 76077)	Yes	Yes	—*
	Antimony	Yes	Yes	—	No	No	—
	Arsenic	Yes	Yes	—	Yes	No	HQ >3
	Barium	Yes	Yes	—	Yes	Yes	—
	Beryllium	Yes	No	0.3<HQ<3	Yes	Yes	—
	Boron	Yes	No	0.3<HQ<3	Yes	No	0.3<HQ<3
	Cadmium	Yes	Yes	—	Yes	Yes	—
	Chloride	No	No	Not COPEC in sediment	Yes	No	Water only
	Chromium	Yes	Yes	—	Yes	No	0.3<HQ<3
	Cobalt	Yes	Yes	—	Yes	No	HQ >3
	Copper	Yes	No	HQ >3	Yes	Yes	—
	Cyanide, Total	Yes	Yes	—	Yes	Yes	—
	Fluoride	No	No	Not COPEC in sediment	Yes	No	Water only
	Lead	Yes	No	HQ >3	Yes	Yes	—
	Manganese	Yes	Yes	—	Yes	Yes	—
	Mercury	Yes	Yes	—	No	No	—
	Methylmercury	Yes	No	HQ >3	No	No	Not COPEC in sediment or water
	Nickel	Yes	No	HQ >3	Yes	No	HQ >3
	Selenium	Yes	Yes	—	Yes	No	0.3<HQ<3
	Silver	Yes	Yes	—	Yes	Yes	—
	Strontium	Yes	No	Not COPEC in sediment	Yes	No	Water only
	Thallium	Yes	Yes	—	Yes	No	HQ >3
	Titanium	Yes	Yes	—	No	No	Not COPEC
	Uranium	Yes	No	0.3<HQ<3	Yes	No	Water only
	Vanadium	Yes	No	HQ >3	Yes	No	HQ >3
	Zinc	Yes	Yes	—	Yes	Yes	—

Table 8.1-2 (continued)

Suite	Analyte	Terrestrial			Aquatic		
		COPEC in Section 6 of this Report	Study Design COPEC (Katzman 2002, 73667)	Notes	COPEC in Section 6 of this Report	Study Design COPEC (Katzman 2002, 73667)	Notes
PAH	Acenaphthene	Yes	No	HQ >3	No	No	—
	Anthracene	No	No	Not COPC in sediment	Yes	Yes	—
	Benzo(a)anthracene	Yes	No	0.3<HQ<3	Yes	Yes	—
	Benzo(a)pyrene	Yes	No	0.3<HQ<3	Yes	Yes	—
	Benzo(b)fluoranthene	Yes	No	0.3<HQ<3	Yes	Yes	—
	Benzo(g,h,i)perylene	Yes	No	0.3<HQ<3	Yes	No	0.3<HQ<3
	Benzo(k)fluoranthene	No	No	Not COPC in sediment	Yes	No	0.3<HQ<3
	Chrysene	Yes	No	0.3<HQ<3	Yes	No	0.3<HQ<3
	Fluoranthene	Yes	No	0.3<HQ<3	Yes	No	0.3<HQ<3
	Fluorene	Yes	No	0.3<HQ<3	Yes	No	Water only
	Indeno(1,2,3-cd)pyrene	Yes	No	Not COPC in sediment	Yes	Yes	—
	Naphthalene	Yes	Yes	—	Yes	No	HQ >3
	Phenanthrene	Yes	No	0.3<HQ<3	Yes	No	HQ >3
	Pyrene	Yes	No	0.3<HQ<3	Yes	Yes	—
PCB	Aroclor-1248	Yes	No	Only detect was in removed ACS samples	No	No	Not COPC
	Aroclor-1254	Yes	Yes	—	Yes	No	0.3<HQ<3
	Aroclor-1260	Yes	No	HQ >3 in removed ACS samples only	Yes	No	0.3<HQ<3
Pesticide	BHC(gamma-)	No	No	Not COPC in sediment	Yes	No	Water only
	Chlordane(alpha-)	No	No	Not COPC in sediment	Yes	No	HQ >3
	Chlordane(gamma-)	No	No	Not COPC in sediment	Yes	Yes	—
	DDE(4,4'-)	Yes	Yes	—	Yes	No	0.3<HQ<3
	DDT(4,4'-)	Yes	Yes	—	Yes	No	HQ >3
	Dieldrin	Yes	No	0.3<HQ<3	No	No	—
	Endrin	Yes	No	0.3<HQ<3	No	No	Not COPC
	Endrin Aldehyde	Yes	Yes	—	Yes	No	Water only

Table 8.1-2 (continued)

Suite	Analyte	Terrestrial			Aquatic		
		COPEC in Section 6 of this Report	Study Design COPEC (Katzman 2002, 73667)	Notes	COPEC in Section 6 of this Report	Study Design COPEC (Katzman 2002, 73667)	Notes
Radionuclide	Americium-241	Yes	No	0.3<HQ<3	Yes	Yes	—
	Cesium-134	No	No	Not COPC in sediment	Yes	No	0.3<HQ<3
	Cesium-137	Yes	No	0.3<HQ<3	Yes	Yes	—
	Europium-152	No	No	Not COPC in sediment	Yes	No	0.3<HQ<3
	Plutonium-238	Yes	No	Only HQ >0.3 in ACS removed samples	Yes	Yes	—
	Plutonium-239,240	Yes	Yes	—	Yes	Yes	—
	Strontium-90	No	No	Not COPC in sediment	Yes	No	0.3<HQ<3
	Thorium-232	Yes	No	0.3<HQ<3	No	No	Not COPC
	Uranium-234	Yes	No	Only HQ >0.3 in ACS removed samples	Yes	No	Water only
	Uranium-238	Yes	No	Only HQ >0.3 in ACS removed samples	No	No	Not COPC
SVOC	Benzoic Acid	Yes	No	0.3<HQ<3	Yes	Yes	—
	Bis(2)ethylhexyl phthalate	Yes	No	0.3<HQ<3	Yes	No	0.3<HQ<3
	Nitrobenzene	No	No	—	No	No	Not COPC
	Phenol	Yes	No	Only detected in post-fire baseline samples	No	No	Not COPC
	Tetryl	Yes	No	Only detected in post-fire baseline samples	No	No	Not COPC

*— = Not applicable.

Table 8.1-3
Comparison of Maximum Concentrations in Small-Mammal Tissues with Owl ESLs

COPEC ^a	Owl ESL (mg/kg fresh wt)	Los Alamos and Pueblo Canyons (study area)		Guaje Canyon (reference area)	
		Maximum Mammal Concentration (mg/kg fresh wt)	HQ ^b	Maximum Mammal Concentration (mg/kg fresh wt)	HQ
Arsenic	50.5	2.2	0.044	0.17	0.003
Barium	904	7.8	0.009	10	0.011
Cadmium	14.3	0.04	0.003	0.021	0.001
Copper	29.7	3.5	0.118	4	0.135
Lead	154	190	1.231	270	1.749
Manganese	5710	8.6	0.002	4.8	0.001
Mercury	0.73	0.089	0.122	0.023 U	0.032
Nickel	275	1.6	0.006	0.32	0.001
Selenium	4.33	0.56	0.129	0.53	0.123
Silver	53.5	0.049	0.001	0.063	0.001
Vanadium	10.8	0.31	0.029	0.17	0.016
Zinc	1180	190	0.161	160	0.136
Aroclor-1254	0.98	0.025 U ^c	0.025	0.017 U	0.017
Aroclor-1260	10.5	0.12	0.011	0.017 U	0.002
DDE[4,4'-]	0.069	0.0029	0.042	0.0019	0.027
DDT[4,4'-]	0.069	0.0028	0.040	0.0017 U	0.024
Dieldrin	0.76	0.0025 U	0.003	0.0017 U	0.002
Endrin	0.098	0.0025 U	0.025	0.0017 U	0.017
Endrin Aldehyde	0.098	0.0025 U	0.025	0.0017 U	0.017

^a All COPECs with an avian TRV are listed in this table (except cobalt, which was eliminated as a study design COPEC in Section 8.1.2).

^b HQ is calculated as the ratio of maximum mammal concentrations divided by the owl ESL.

^c U = Maximum is a nondetected sample result.

Table 8.1-4
HQ Summary for Key Mammalian Invertevore Feeding Guild COPECs

	Aroclor-1254	Antimony	Barium	Manganese	Silver
ESL (mg/kg)	0.022	0.57	2.4	520	0.091
Background mean (mg/kg)	0.038*	0.505	60.4	290	0.066
BV (mg/kg)	0.041*	0.83	127	543	1
HQ for Maximum Reach Sample Result					
AC-3	282	4.4	41.3	0.9	23.1
LA-1C	59.1	7.1	53.3	0.7	19.8
P-3W	1.0	1.1	62.5	1.3	7.7
BV	1.9	1.5	52.9	1.0	11.0
HQ of Average Reach Data					
AC-3	44.9	0.7	18.0	0.5	3.4
LA-1C	9.2	4.0	18.8	0.4	10.3
P-3W	0.9	0.6	25.3	0.6	4.7
Background mean	1.7	0.9	25.2	0.6	0.7
HQ for Composite Soil Sample Average					
AC-3	4.2	0.6	27.1	0.8	3.8
LA-1C	1.4	0.7	20.3	0.5	0.5
P-3W	0.2	0.7	28.0	0.6	0.8
Guaje	0.2	0.7	27.4	0.5	0.5

*Average and maximum Aroclor-1254 concentrations in baseline reaches LA-0 and P-1FW.

Table 8.1-5
Weight of Evidence Summary for Mexican Spotted Owl Assessment Endpoint

Lines of Evidence	Weight of Evidence Criteria	Result
(1) Modeled exposure and literature toxicity information to calculate spatially weighted HQ values using ECORSK.7 (includes consideration of nesting and foraging habitat based on vegetation class coverage)	Medium	No evidence for adverse effects; average, and maximum HQ/HI do not suggest potential for adverse effects
(2) Modeled and measured concentrations in prey species—determine if exposure concentrations differ within the watershed in relation to sediment concentrations; compare prey COPEC concentrations across gradient in the Los Alamos and Pueblo watershed and also compare concentrations with "reference" locations in Guaje Canyon	Medium	No evidence for adverse effects; maximum concentrations in small mammals are less than owl ESLs
(3) Compare the concentrations of COPECs in sediment with the soil ESL for the kestrel with the flesh diet	Low	Soil concentrations are greater than ESL; adverse effects are possible

Table 8.1-6

Weight of Evidence Summary for Avian Ground Invertevore Feeding Guild Assessment Endpoint

Lines of Evidence	Weight of Evidence Criteria	Result
(1) Nest box study—determine occupancy rate by bluebirds along a gradient of COPEC concentrations in the Los Alamos and Pueblo watershed; need to account for vegetation differences in the canyon as well as other factors known to influence nest site preferences	Medium* [expanded network] High* [established network]	No difference in occupancy rates versus COPECs; post-fire occupancy higher in burned canyons
(2) Nest box study—determine nest success rate by bluebirds along a gradient of COPEC concentrations in the Los Alamos and Pueblo watershed; need to account for other factors known to influence nest success (food, predators, etc.)	Medium* [expanded network] High* [established network]	No difference in nest success (numbers of eggs, nestlings, or fledglings) versus COPECs
(3) Nest box study—determine eggshell thickness for bluebirds along a gradient of COPEC concentrations in the Los Alamos and Pueblo watershed; need to account for other factors known to influence eggshell thickness (amount of calcium in diet, etc.)	Medium	No difference in eggshell thickness versus COPECs
(4) Nest box study—compare COPEC concentrations in eggs within the Los Alamos and Pueblo watershed and also compare concentrations with "reference" locations	Medium-low	Differences in PCBs between locations; concentrations less than levels of concern
(5) Modeled and measured concentrations in food (earthworm bioaccumulation test)—determine if exposure concentrations differ within the watershed in relation to sediment concentrations; design used a gradient in COPEC concentrations with the Los Alamos and Pueblo watershed and also compared concentrations with "reference" locations	Medium for metals only	Evidence for bioaccumulation of metals, primarily from a sample collected in reach AC-3
(6) Modeled exposure and literature toxicity information to calculate spatially weighted HQ values using ECORSK.7 (includes consideration of nesting and foraging habitat based on vegetation class coverage) for bluebird populations in the watershed; will be based on a frequency of HQ values >1 for the watershed (or population area)	Medium	Population effects for watershed are unlikely because small fraction of modeled nests with HI >1
(7) Field surveys of avian ground invertevore abundance and diversity in the Los Alamos and Pueblo watershed; and also compare abundance/diversity with "reference" locations	Low	No decrease in abundance/diversity versus COPECs
(8) Compare the concentrations of COPECs in sediment with the soil ESL for the robin with the invertevore diet	Low	Soil concentrations are greater than ESL; adverse effects are possible

*Tie breaking not possible for two closely related measures.

Table 8.1-7
Weight of Evidence Summary for Mammalian Invertevore Feeding Guild Assessment Endpoint

Lines of Evidence	Weight of Evidence Criteria	Result
(1) Field surveys of small-mammal abundance and diversity along gradient of COPEC concentrations in the Los Alamos and Pueblo watershed and also compare abundance/diversity with "reference" locations	Medium-low	No difference in abundance across COPEC gradient
(2) Field surveys to determine small mammal reproduction status along gradient of COPEC concentrations in the Los Alamos and Pueblo watershed and also compare reproduction rates with "reference" locations	Medium+	No difference in reproductive status across COPEC gradient
(3) Modeled and measured concentrations in food—could determine if exposure concentrations differ within the watershed in relation to sediment concentrations; design could use a gradient in COPEC concentrations with the Los Alamos and Pueblo watershed and also compare concentrations with "reference" location in Guaje	Medium- For metals only	Evidence for bioaccumulation of metals, primarily from a sample collected in reach AC-3
(4) Modeled exposure and literature toxicity information to calculate spatially weighted HQ values using ECORSK.6 [includes consideration of nesting and foraging habitat based on vegetation class coverage] for deer mouse populations in the watershed—could be based on a frequency of HQ values >1 for the watershed	Medium-	Population effects for watershed are unlikely, because small fraction of modeled focal points with HI >1
(5) Compare the concentrations of COPECs in sediment with the soil ESL for the shrew	Low	Soil concentrations are greater than ESL; adverse effects are possible

Table 8.1-8
Weight of Evidence Summary for Detritivore Assessment Endpoint

Lines of Evidence	Weight of Evidence Criteria	Result
(1) Toxicity bioassay (earthworm mortality) along gradient of COPEC concentrations in the Los Alamos and Pueblo watershed—compare mortality rates with "reference" locations	High	No evidence for adverse effects on earthworm mortality; no relationship of mortality over COPEC gradient; one sample with anomalously high mortality apparently because of a pathogen
(2) The concentration of COPECs in earthworms	n/a*	Evidence for bioaccumulation of metals, primarily from a sample collected in reach AC-3
(3) Compare the concentrations of COPECs in sediment to the soil ESL for the earthworm	Low	Soil concentrations are greater than ESL; adverse effects are possible

*n/a = Not applicable because this is a supporting measure to the toxicity bioassay.

Table 8.1-9
Weight of Evidence Summary for Primary Producer Assessment Endpoint

Lines of Evidence	Weight of Evidence Criteria	Result
1) Toxicity bioassay (seedling germination) along gradient of COPEC concentrations in the Los Alamos and Pueblo watershed and also compare germination rates with "reference" locations	High	No difference in seedling germination test endpoints across COPEC gradient
2) Abundance and diversity of plants along gradient of COPEC concentrations in the Los Alamos and Pueblo watershed and also compare plant abundance/diversity with "reference" locations	Medium	No difference in plant diversity across COPEC gradient
3) Compare the concentrations of COPECs in sediment to the soil ESL for the plant	Low	Soil concentrations are greater than ESL; adverse effects are possible

Table 8.1-10
Weight of Evidence Summary for Aquatic Community Assessment Endpoint

Lines of Evidence	Weight of Evidence Criteria	Result
(1) Estimates of growth and mortality of aquatic invertebrates based on toxicity tests using <i>Chironomus tentans</i> compared with the reference location	High	No difference in growth or mortality compared to the reference location
(2) A rapid bioassessment characterization to evaluate habitat ratings at selected locations based on watershed features, riparian vegetation, in-stream features, aquatic vegetation, and benthic substrate; assessment will also include measures of abundance and diversity of aquatic invertebrates	Medium	Assessment suggests that locations with more persistent water have poor habitat, and this prevents many aquatic species from being present
(3) Compare the concentrations of COPECs in sediment to the sediment ESL for the aquatic community organisms	Low	Concentrations are greater than ESL; adverse effects are possible

Table 8.2-1
Site-Specific Exposure Scenarios and Complete Exposure Pathways

Exposure Pathways	Exposure Scenarios				
	Trail User	Extended Backyard	Residential	Construction Worker	Resource User
Incidental ingestion of soil	X	X	X	X	X
Inhalation of dust	X	X	X	X	X
Dermal contact with soil	X	X	X	X	X
Ingestion of fruits and vegetables	—*	—	X	—	X
Ingestion of meat	—	—	—	—	X
Ingestion of alluvial groundwater	—	—	X	—	—
Dermal contact with alluvial groundwater	—	—	X	—	—
Ingestion of surface water	X	X	—	—	X
Dermal contact with surface water	X	X	—	—	X
External irradiation	X	X	X	X	X

* — = Incomplete pathway.

Table 8.2-2
Trail User Sediment Exposure Pathways EPC-to-RBC Ratio Sums, by Reach

Reach	Carcinogen Sum ^a	Noncarcinogen Sum	Radionuclide Sum ^b
AC-1	0.517	0.00191	— ^c
AC-2	0.321	0.00188	—
AC-3	0.161	0.0385	0.0877
ACS	0.0427	0.00573	0.0907
DP-1C	0.038	—	—
DP-1E	0.0816	—	—
DP-1W	0.292	—	—
DP-2	—	—	0.137
DP-3	0.0153	—	0.102
DP-4	—	—	0.0801
LA-2E	0.0594	0.000828	0.0643
LA-2FE	—	—	0.114
LA-3E	—	—	0.0214
LA-3W	—	—	0.0616
P-1E	0.0223	0.0000464	0.0113
P-1W	0.047	0.0012	—
P-4W	0.0413	0.00212	—

^a Convert to risk: Value x (1x10⁻⁵).

^b Convert to dose: Value x 15 mrem.

^c — = Value below screening criteria.

Table 8.2-3
Extended Backyard Sediment Exposure Pathways EPC-to-RBC Ratio Sums, by Reach

Reach	Carcinogen Sum ^a	Noncarcinogen Sum	Radionuclide Sum ^b
AC-1	0.909	0.0205	— ^c
AC-2	0.571	0.0202	—
AC-3	0.277	0.328	0.387
ACS	0.0823	0.051	0.502
DP-1C	0.0653	—	—
DP-1E	0.141	—	—
DP-1W	0.504	—	—
DP-2	—	—	0.165
DP-3	0.0264	—	0.135
DP-4	—	—	0.101
LA-2E	0.11	0.0089	0.0858
LA-2FE	—	—	0.115
LA-3E	—	—	0.0216
LA-3W	—	—	0.062
P-1E	0.0384	0.000395	0.0523
P-1W	0.0922	0.0129	—
P-4W	0.091	0.0228	—

^a Convert to risk: Value x (1x10⁻⁵).

^b Convert to dose: Value x 15 mrem.

^c — = Value below screening criteria.

Table 8.2-4
Surface Sediment Exposure Pathways EPC-to-RBC Ratios, by Reach

Reach COPC	Risk Class ^a	Surface Area Weighted Average ^b	95% Upper Confidence Limit, EPC ^b	Trail User RBC Ratio	Extended Backyard RBC Ratio
AC-1					
Arsenic	ca	3.47	3.8	0.0368	0.0811
Arsenic	nc	3.47	3.8	0.00191	0.0205
Benz(a)anthracene	ca	1.82	3.51	0.0358	0.0617
Benzo(a)pyrene	ca	1.96	3.75	0.382	0.659
Benzo(b)fluoranthene	ca	2.65	4.75	0.0484	0.0835
Indeno(1,2,3-cd)pyrene	ca	0.751	1.38	0.0141	0.0242
AC-2					
Arsenic	ca	3.28	3.74	0.0362	0.0799
Arsenic	nc	3.28	3.74	0.00188	0.0202
Benz(a)anthracene	ca	1.26	1.92	0.0196	0.0337
Benzo(a)pyrene	ca	1.35	2.15	0.219	0.378
Benzo(b)fluoranthene	ca	2.29	3.73	0.038	0.0655
Indeno(1,2,3-cd)pyrene	ca	0.582	0.816	0.00832	0.0143
AC-3					
Americium-241	rad	9.67	27.2	0.0181	0.101
Aroclor-1254	ca	0.668	2.24	0.0659	0.112
Aroclor-1254	nc	0.668	2.24	0.0385	0.328
Benz(a)anthracene	ca	0.831	— ^c	0.00847	0.0146
Benzo(a)pyrene	ca	0.718	—	0.0732	0.126
Benzo(b)fluoranthene	ca	1.35	—	0.0138	0.0237
Cesium-137	rad	2.18	5.59	0.0266	0.0266
Plutonium-239	rad	45.7	72.5	0.0426	0.259
Strontium-90	rad	2.38	5.67	0.000334	0.00101
ACS					
Americium-241	rad	3.26	4.34	0.00289	0.0161
Aroclor-1254	ca	0.185	0.278	0.00818	0.014
Aroclor-1254	nc	0.185	0.278	0.00477	0.0407
Arsenic	ca	1.72	1.9	0.0184	0.0406
Arsenic	nc	1.72	1.9	0.000953	0.0103
Benzo(a)pyrene	ca	0.158	—	0.0161	0.0278
Cesium-137	rad	1.26	1.92	0.00914	0.00914
Plutonium-239	rad	103	133	0.0782	0.475
Strontium-90	rad	0.485	0.667	0.0000392	0.000119
Uranium-234	rad	3.84	4.87	0.000375	0.0018

Table 8.2-4 (continued)

Reach COPC	Risk Class ^a	Surface Area Weighted Average	95% Upper Confidence Limit, EPC ^b	Trail User RBC Ratio	Extended Backyard RBC Ratio
DP-1C					
Aroclor-1260	ca	0.359	—	0.0106	0.018
Benzo(a)pyrene	ca	0.269	—	0.0274	0.0473
DP-1E					
Benz(a)anthracene	ca	0.44	0.643	0.00655	0.0113
Benzo(a)pyrene	ca	0.661	—	0.0674	0.116
Benzo(b)fluoranthene	ca	0.487	0.752	0.00766	0.0132
DP-1W					
Benz(a)anthracene	ca	1.07	2	0.0204	0.0351
Benzo(a)pyrene	ca	1.23	2.14	0.218	0.376
Benzo(b)fluoranthene	ca	1.47	2.61	0.0266	0.0459
Indeno(1,2,3-cd)pyrene	ca	2.67	—	0.0272	0.0469
DP-2					
Americium-241	rad	3.98	5.7	0.0038	0.0211
Cesium-137	rad	18.5	27.5	0.131	0.131
Plutonium-239	rad	2.51	3.18	0.00187	0.0114
Strontium-90	rad	4.64	6.78	0.000399	0.00121
DP-3					
Americium-241	rad	6.11	9.32	0.00621	0.0345
Benz(a)anthracene	ca	0.12	—	0.00122	0.00211
Benzo(a)pyrene	ca	0.116	—	0.0118	0.0204
Benzo(b)fluoranthene	ca	0.22	—	0.00224	0.00387
Cesium-137	rad	14.7	20	0.0952	0.0952
Plutonium-239	rad	1.03	1.33	0.000782	0.00475
Strontium-90	rad	1.28	2.11	0.000124	0.000377
DP-4					
Americium-241	rad	2.44	4.36	0.00291	0.0161
Cesium-137	rad	12.4	15.9	0.0757	0.0757
Plutonium-239	rad	1.32	2.28	0.00134	0.00814
Strontium-90	rad	2.16	3.02	0.000178	0.000539
LA-2E					
Americium-241	rad	4.67	6.9	0.0046	0.0256
Aroclor-1260	ca	0.0522	0.0722	0.00212	0.00363
Arsenic	ca	1.65	—	0.016	0.0352
Arsenic	nc	1.65	—	0.000828	0.0089
Benzo(a)pyrene	ca	0.204	0.405	0.0413	0.0712
Cesium-137	rad	9.95	12.5	0.0595	0.0595

Table 8.2-4 (continued)

Reach COPC	Risk Class ^a	Surface Area Weighted Average	95% Upper Confidence Limit, EPC ^b	Trail User RBC Ratio	Extended Backyard RBC Ratio
Strontium-90	rad	2.91	3.79	0.000223	0.000677
LA-2FE					
Cesium-137	rad	18.2	22.6	0.108	0.108
Strontium-90	rad	3.6	4.47	0.000263	0.000798
LA-2W					
Cesium-137	rad	1.24	1.28	0.0061	0.0061
Strontium-90	rad	0.469	0.855	0.0000503	0.000153
LA-3E					
Cesium-137	rad	3.76	4.47	0.0213	0.0213
Strontium-90	rad	1.15	2.02	0.000119	0.000361
LA-3W					
Cesium-137	rad	8.55	12.9	0.0614	0.0614
Strontium-90	rad	1.99	2.99	0.000176	0.000534
P-1E					
Americium-241	rad	0.27	0.316	0.000211	0.00117
Aroclor-1254	ca	0.0027	—	0.0000795	0.000136
Aroclor-1254	nc	0.0027	—	0.0000464	0.000395
Benz(a)anthracene	ca	0.132	—	0.00135	0.00232
Benzo(a)pyrene	ca	0.179	—	0.0182	0.0315
Benzo(b)fluoranthene	ca	0.233	—	0.00237	0.00409
Cesium-137	rad	0.656	0.659	0.00314	0.00314
Dibenz(a,h)anthracene	ca	0.00204	—	0.000208	0.000358
Plutonium-239	rad	9.76	13.4	0.00788	0.0479
Strontium-90	rad	0.776	—	0.0000456	0.000139
P-1W					
Arsenic	ca	2.1	2.4	0.0232	0.0512
Arsenic	nc	2.1	2.4	0.0012	0.0129
Benzo(a)pyrene	ca	0.181	0.233	0.0237	0.0409
P-4W					
Arsenic	ca	4.23	—	0.0409	0.0903
Arsenic	nc	4.23	—	0.00212	0.0228
Benzo(a)pyrene	ca	0	—	0	0
Benzo(b)fluoranthene	ca	0.0393	—	0.000401	0.000691

^a ca = Carcinogen, nc = noncarcinogen, rad = radionuclide.^b Units for radionuclide concentrations are pCi/g; units for nonradionuclide concentrations are mg/kg.^c Insufficient data to calculate a variance. In these cases, the weighted mean is used as the EPC.

Table 8.2-5
Trail User Surface Water Exposure Pathways EPC-to-RBC Ratio Sums, by Sampling Location

Location	Carcinogen Sum ^a	Noncarcinogen Sum	Radionuclide Sum ^b
00-10241	0.0305	0.00795	— ^c
21-01854	0.0285	0.0126	0.0168
21-10929	0.114	0.0058	—
21-11226	0.0885	0.0151	—
21-11269	—	—	0.0146
GU-10004	0.0641	0.00332	—
LA-00218	0.0652	0.00338	—
LA-00219	0.0523	0.0107	—
LA-02-20908	0.0541	0.00281	—
LA-02-20909	0.0374	0.002	—
LA-02-20913	0.0357	0.00185	—
LA-02-20914	0.0239	0.00561	—
LA-02-20915	0.0295	0.00644	—
LA-10005	0.0356	0.00627	—
LA-10006	—	0.00292	—
LA-10033	0.0153	0.00826	—
LA-10040	0.0417	0.0313	—
LA-10057	0.0793	0.00411	—
LA-10058	0.0224	0.00885	—
LA-10064	0.0788	0.0206	—
LA-10065	—	0.00743	—
LA-10126	—	—	—
LA-10179	0.0469	0.00243	—
PU-02-20920	0.152	0.022	—
PU-10068	0.0346	0.00551	—
PU-10069	0.0437	0.00719	—
PU-10070	0.0369	0.00191	—
PU-10071	0.062	0.0147	—
PU-10155	2.43^d	—	0.0126
PU-10175	0.0325	0.00223	0.0281
PU-10176	0.0183	0.000949	0.0183
PU-10229	0.0854	0.0115	—
PU-10230	0.187	0.0219	—
PU-10231	1.23	—	—

^a Convert to risk: Value x (1x10⁻⁵).

^b Convert to dose: Value x 4 mrem.

^c — = Value below screening criteria.

^d Bold text indicates sum that exceeds 1.

Table 8.2-6
Extended Backyard Surface Water
Exposure Pathway EPC-to-RBC Ratio Sums, by Sampling Location

Location	Carcinogen Sum ^a	Noncarcinogen Sum	Radionuclide Sum ^b
00-10241	0.0495	0.0314	— ^c
21-01854	0.0462	0.0496	0.0295
21-10929	0.184	0.0229	—
21-11226	0.144	0.0595	—
21-11269	—	—	0.0255
GU-10004	0.104	0.0131	—
LA-00218	0.106	0.0133	—
LA-00219	0.0849	0.0424	—
LA-02-20908	0.0878	0.0111	—
LA-02-20909	0.0608	0.00791	—
LA-02-20913	0.0579	0.0073	—
LA-02-20914	0.0387	0.0218	—
LA-02-20915	0.0479	0.0252	—
LA-10005	0.0578	0.0243	—
LA-10006	—	0.0112	—
LA-10033	0.0248	0.0318	—
LA-10040	0.0677	0.123	—
LA-10057	0.129	0.0162	—
LA-10058	0.0363	0.0349	—
LA-10064	0.128	0.0808	—
LA-10065	—	0.0292	—
LA-10126	—	—	—
LA-10179	0.0761	0.00959	—
PU-02-20920	0.246	0.0859	—
PU-10068	0.0561	0.0214	—
PU-10069	0.071	0.0279	—
PU-10070	0.0599	0.00755	—
PU-10071	0.101	0.0571	—
PU-10155	1.67^d	—	0.022
PU-10175	0.0528	0.00879	0.0493
PU-10176	0.0297	0.00375	0.032
PU-10229	0.139	0.0452	—
PU-10230	0.227	0.0821	—
PU-10231	0.857	—	—

^a Convert to risk: Value x (1x10⁻⁵).

^b Convert to dose: Value x 4 mrem.

^c — = Value below screening criteria.

^d Bold text indicates sum that exceeds 1.

Table 8.2-7
Surface Water Exposure Pathways EPC-to-RBC Ratio, by Sampling Location

Location	Name	Canyon	Class ^a	COPC	Units	Number of Samples	EPC ^b	Trail User RBC Ratio	Extended Backyard RBC Ratio
00-10241	Reach AC-2 SW	Acid	ca	Arsenic	µg/L	2	3	0.0305	0.0495
00-10241	Reach AC-2 SW	Acid	nc	Arsenic	µg/L	2	3	0.00158	0.00624
00-10241	Reach AC-2 SW	Acid	nc	Iron	µg/L	2	1200	0.000633	0.0025
00-10241	Reach AC-2 SW	Acid	nc	Thallium	µg/L	2	2.9	0.00574	0.0226
21-01854	DP Spring	DP	ca	Arsenic	µg/L	5	2.8	0.0285	0.0462
21-01854	DP Spring	DP	nc	Arsenic	µg/L	5	2.8	0.00148	0.00583
21-01854	DP Spring	DP	nc	Fluoride	µg/L	1	1100	0.0029	0.0114
21-01854	DP Spring	DP	nc	Iron	µg/L	5	1300	0.000686	0.0027
21-01854	DP Spring	DP	nc	Thallium	µg/L	5	3.8	0.00752	0.0296
21-01854	DP Spring	DP	rad	Strontium-90	pCi/L	5	110	0.0168	0.0295
21-10929	Reach DP-1W SW	DP	ca	Arsenic	µg/L	4	11	0.112	0.182
21-10929	Reach DP-1W SW	DP	ca	BHC[beta-]	µg/L	4	0.1	0.00208	0.00256
21-10929	Reach DP-1W SW	DP	nc	Arsenic	µg/L	4	11	0.0058	0.0229
21-11226	Reach DP-1C SW	DP	ca	Arsenic	µg/L	4	8.7	0.0885	0.144
21-11226	Reach DP-1C SW	DP	nc	Aluminum	µg/L	4	6610	0.00105	0.00413
21-11226	Reach DP-1C SW	DP	nc	Antimony	µg/L	4	2.15	0.000901	0.00352
21-11226	Reach DP-1C SW	DP	nc	Arsenic	µg/L	4	8.7	0.00459	0.0181
21-11226	Reach DP-1C SW	DP	nc	Iron	µg/L	4	4480	0.00236	0.00932
21-11226	Reach DP-1C SW	DP	nc	Manganese	µg/L	4	280	0.000396	0.00151
21-11226	Reach DP-1C SW	DP	nc	Thallium	µg/L	4	2.9	0.00574	0.0226
21-11226	Reach DP-1C SW	DP	nc	Uranium	µg/L	4	1.15	0.0000607	0.000239
21-11269	Reach DP-2 SW	DP	rad	Strontium-90	pCi/L	1	95.2	0.0146	0.0255
GU-10004	Guaje at LA Confluence	Guaje	ca	Arsenic	µg/L	2	6.3	0.0641	0.104
GU-10004	Guaje at LA Confluence	Guaje	nc	Arsenic	µg/L	2	6.3	0.00332	0.0131
LA-00218	Reach LA-4 SW	Los Alamos	ca	Arsenic	µg/L	8	6.41	0.0652	0.106

Table 8.2-7 (continued)

Location	Name	Canyon	Class ^a	COPC	Units	Number of Samples	EPC ^b	Trail User RBC Ratio	Extended Backyard RBC Ratio
LA-00218	Reach LA-4 SW	Los Alamos	nc	Arsenic	µg/L	8	6.41	0.00338	0.0133
LA-00219	Basalt Spring	Los Alamos	ca	Arsenic	µg/L	8	5.14	0.0523	0.0849
LA-00219	Basalt Spring	Los Alamos	nc	Antimony	µg/L	8	3	0.00126	0.00492
LA-00219	Basalt Spring	Los Alamos	nc	Arsenic	µg/L	8	5.14	0.00271	0.0107
LA-00219	Basalt Spring	Los Alamos	nc	Thallium	µg/L	8	3.4	0.00672	0.0265
LA-00219	Basalt Spring	Los Alamos	nc	Uranium	µg/L	3	1.05	0.0000552	0.000218
LA-02-20908	Eco	Los Alamos	ca	Arsenic	µg/L	1	5.32	0.0541	0.0878
LA-02-20908	Eco	Los Alamos	nc	Arsenic	µg/L	1	5.32	0.00281	0.0111
LA-02-20909	Eco	Los Alamos	ca	Arsenic	µg/L	1	3.61	0.0367	0.0596
LA-02-20909	Eco	Los Alamos	ca	DDT[4,4'-]	µg/L	1	0.32	0.00073	0.00119
LA-02-20909	Eco	Los Alamos	nc	Arsenic	µg/L	1	3.61	0.0019	0.00751
LA-02-20909	Eco	Los Alamos	nc	DDT[4,4'-]	µg/L	1	0.32	0.0001	0.000396
LA-02-20913	Eco	DP	ca	Arsenic	µg/L	1	3.51	0.0357	0.0579
LA-02-20913	Eco	DP	nc	Arsenic	µg/L	1	3.51	0.00185	0.0073
LA-02-20914	Eco	Los Alamos	ca	Arsenic	µg/L	1	2.27	0.0231	0.0375
LA-02-20914	Eco	Los Alamos	ca	DDT[4,4'-]	µg/L	1	0.34	0.000776	0.00127
LA-02-20914	Eco	Los Alamos	nc	Arsenic	µg/L	1	2.27	0.0012	0.00472
LA-02-20914	Eco	Los Alamos	nc	DDT[4,4'-]	µg/L	1	0.34	0.000106	0.000421
LA-02-20914	Eco	Los Alamos	nc	Iron	µg/L	1	2170	0.00114	0.00452
LA-02-20914	Eco	Los Alamos	nc	Manganese	µg/L	1	1640	0.00232	0.00887
LA-02-20914	Eco	Los Alamos	nc	Thallium	µg/L	1	0.422	0.000835	0.00329
LA-02-20915	Eco	Los Alamos	ca	Arsenic	µg/L	1	2.9	0.0295	0.0479
LA-02-20915	Eco	Los Alamos	nc	Aluminum	µg/L	1	4910	0.000777	0.00306
LA-02-20915	Eco	Los Alamos	nc	Arsenic	µg/L	1	2.9	0.00153	0.00603
LA-02-20915	Eco	Los Alamos	nc	Iron	µg/L	1	3300	0.00174	0.00687
LA-02-20915	Eco	Los Alamos	nc	Manganese	µg/L	1	1270	0.0018	0.00687

Table 8.2-7 (continued)

Location	Name	Canyon	Class ^a	COPC	Units	Number of Samples	EPC ^b	Trail User RBC Ratio	Extended Backyard RBC Ratio
LA-02-20915	Eco	Los Alamos	nc	Thallium	µg/L	1	0.302	0.000597	0.00236
LA-10005	SW at LAO-0.6	Los Alamos	ca	Arsenic	µg/L	3	3.5	0.0356	0.0578
LA-10005	SW at LAO-0.6	Los Alamos	nc	Arsenic	µg/L	3	3.5	0.00185	0.00728
LA-10005	SW at LAO-0.6	Los Alamos	nc	Iron	µg/L	3	1400	0.000738	0.00291
LA-10005	SW at LAO-0.6	Los Alamos	nc	Manganese	µg/L	3	2600	0.00368	0.0141
LA-10006	Upper Reach LA-0 SW	Los Alamos	nc	Iron	µg/L	2	1500	0.000791	0.00312
LA-10006	Upper Reach LA-0 SW	Los Alamos	nc	Manganese	µg/L	2	1500	0.00212	0.00812
LA-10033	LA Reservoir	Los Alamos	ca	Arsenic	µg/L	2	1.5	0.0153	0.0248
LA-10033	LA Reservoir	Los Alamos	nc	Arsenic	µg/L	2	1.5	0.000791	0.00312
LA-10033	LA Reservoir	Los Alamos	nc	Manganese	µg/L	2	4600	0.00651	0.0249
LA-10033	LA Reservoir	Los Alamos	nc	Thallium	µg/L	2	0.482	0.000953	0.00376
LA-10040	At E026	Los Alamos	ca	Arsenic	µg/L	1	4.1	0.0417	0.0677
LA-10040	At E026	Los Alamos	nc	Aluminum	µg/L	1	42800	0.00677	0.0267
LA-10040	At E026	Los Alamos	nc	Arsenic	µg/L	1	4.1	0.00216	0.00853
LA-10040	At E026	Los Alamos	nc	Barium	µg/L	1	467	0.0012	0.00466
LA-10040	At E026	Los Alamos	nc	Chromium	µg/L	1	18.8	0.00028	0.00103
LA-10040	At E026	Los Alamos	nc	Iron	µg/L	1	24200	0.0128	0.0504
LA-10040	At E026	Los Alamos	nc	Manganese	µg/L	1	2130	0.00302	0.0115
LA-10040	At E026	Los Alamos	nc	Thallium	µg/L	1	2.6	0.00514	0.0203
LA-10057	Upper Reach LA-5 SW	Los Alamos	ca	Arsenic	µg/L	2	7.8	0.0793	0.129
LA-10057	Upper Reach LA-5 SW	Los Alamos	nc	Arsenic	µg/L	2	7.8	0.00411	0.0162
LA-10058	Lower Reach LA-5 SW (at delta)	Los Alamos	ca	Arsenic	µg/L	1	2.2	0.0224	0.0363
LA-10058	Lower Reach LA-5 SW (at delta)	Los Alamos	nc	Arsenic	µg/L	1	2.2	0.00116	0.00458
LA-10058	Lower Reach LA-5 SW (at delta)	Los Alamos	nc	Iron	µg/L	1	1700	0.000897	0.00354
LA-10058	Lower Reach LA-5 SW (at delta)	Los Alamos	nc	Manganese	µg/L	1	330	0.000467	0.00179
LA-10058	Lower Reach LA-5 SW (at delta)	Los Alamos	nc	Perchlorate	µg/L	1	4	0.00633	0.025

Table 8.2-7 (continued)

Location	Name	Canyon	Class ^a	COPC	Units	Number of Samples	EPC ^b	Trail User RBC Ratio	Extended Backyard RBC Ratio
LA-10064	Reach LA-1W SW	Los Alamos	ca	Arsenic	µg/L	3	7.75	0.0788	0.128
LA-10064	Reach LA-1W SW	Los Alamos	nc	Aluminum	µg/L	3	27800	0.0044	0.0174
LA-10064	Reach LA-1W SW	Los Alamos	nc	Arsenic	µg/L	3	7.75	0.00409	0.0161
LA-10064	Reach LA-1W SW	Los Alamos	nc	Barium	µg/L	3	381	0.000982	0.0038
LA-10064	Reach LA-1W SW	Los Alamos	nc	Chromium	µg/L	3	18.1	0.000269	0.000994
LA-10064	Reach LA-1W SW	Los Alamos	nc	Iron	µg/L	3	14300	0.00754	0.0298
LA-10064	Reach LA-1W SW	Los Alamos	nc	Manganese	µg/L	3	1590	0.00225	0.0086
LA-10064	Reach LA-1W SW	Los Alamos	nc	Thallium	µg/L	3	0.42	0.000831	0.00328
LA-10064	Reach LA-1W SW	Los Alamos	nc	Uranium	µg/L	3	4.17	0.00022	0.000868
LA-10065	Reach LA-1C SW	Los Alamos	nc	Aluminum	µg/L	3	15000	0.00237	0.00936
LA-10065	Reach LA-1C SW	Los Alamos	nc	Iron	µg/L	3	7290	0.00384	0.0152
LA-10065	Reach LA-1C SW	Los Alamos	nc	Manganese	µg/L	3	728	0.00103	0.00394
LA-10065	Reach LA-1C SW	Los Alamos	nc	Uranium	µg/L	3	3.44	0.000182	0.000716
LA-10179	Otowi Spring	Los Alamos	ca	Arsenic	µg/L	1	4.61	0.0469	0.0761
LA-10179	Otowi Spring	Los Alamos	nc	Arsenic	µg/L	1	4.61	0.00243	0.00959
PU-02-20920	Eco	Pueblo	ca	Arsenic	µg/L	1	14.9	0.152	0.246
PU-02-20920	Eco	Pueblo	nc	Arsenic	µg/L	1	14.9	0.00786	0.031
PU-02-20920	Eco	Pueblo	nc	Barium	µg/L	1	391	0.00101	0.0039
PU-02-20920	Eco	Pueblo	nc	Iron	µg/L	1	14100	0.00744	0.0293
PU-02-20920	Eco	Pueblo	nc	Manganese	µg/L	1	4010	0.00568	0.0217
PU-10068	Reach P-1 Far West SW	Pueblo	ca	Arsenic	µg/L	4	3.4	0.0346	0.0561
PU-10068	Reach P-1 Far West SW	Pueblo	nc	Arsenic	µg/L	4	3.4	0.00179	0.00707
PU-10068	Reach P-1 Far West SW	Pueblo	nc	Iron	µg/L	4	2800	0.00148	0.00583
PU-10068	Reach P-1 Far West SW	Pueblo	nc	Manganese	µg/L	4	1580	0.00224	0.00855
PU-10069	Upper Reach P-1W SW	Pueblo	ca	Arsenic	µg/L	4	4.3	0.0437	0.071
PU-10069	Upper Reach P-1W SW	Pueblo	nc	Antimony	µg/L	4	3	0.00126	0.00492

Table 8.2-7 (continued)

Location	Name	Canyon	Class ^a	COPC	Units	Number of Samples	EPC ^b	Trail User RBC Ratio	Extended Backyard RBC Ratio
PU-10069	Upper Reach P-1W SW	Pueblo	nc	Arsenic	µg/L	4	4.3	0.00227	0.00895
PU-10069	Upper Reach P-1W SW	Pueblo	nc	Manganese	µg/L	4	2590	0.00367	0.014
PU-10070	Lower Reach P-1W SW	Pueblo	ca	Arsenic	µg/L	6	3.63	0.0369	0.0599
PU-10070	Lower Reach P-1W SW	Pueblo	nc	Arsenic	µg/L	6	3.63	0.00191	0.00755
PU-10071	Upper Reach P-1E SW	Pueblo	ca	Arsenic	µg/L	4	6.1	0.062	0.101
PU-10071	Upper Reach P-1E SW	Pueblo	nc	Arsenic	µg/L	4	6.1	0.00322	0.0127
PU-10071	Upper Reach P-1E SW	Pueblo	nc	Iron	µg/L	4	5200	0.00274	0.0108
PU-10071	Upper Reach P-1E SW	Pueblo	nc	Manganese	µg/L	4	6200	0.00878	0.0335
PU-10155	Lower Reach AC-3 SW (near Acid Weir)	Acid	ca	Benz(a)anthracene	µg/L	4	0.65	0.0659	0.047
PU-10155	Lower Reach AC-3 SW (near Acid Weir)	Acid	ca	Benzo(a)pyrene	µg/L	4	0.63	1.07	0.745
PU-10155	Lower Reach AC-3 SW (near Acid Weir)	Acid	ca	Benzo(b)fluoranthene	µg/L	4	0.49	0.0847	0.0587
PU-10155	Lower Reach AC-3 SW (near Acid Weir)	Acid	ca	Dibenz(a,h)anthracene	µg/L	4	0.43	1.12	0.766
PU-10155	Lower Reach AC-3 SW (near Acid Weir)	Acid	ca	Indeno(1,2,3-cd)pyrene	µg/L	4	0.47	0.0813	0.0564
PU-10155	Lower Reach AC-3 SW (near Acid Weir)	Acid	rad	Americium-241	pCi/L	4	0.134	0.000488	0.000854
PU-10155	Lower Reach AC-3 SW (near Acid Weir)	Acid	rad	Plutonium-239	pCi/L	4	2.58	0.00913	0.016
PU-10155	Lower Reach AC-3 SW (near Acid Weir)	Acid	rad	Strontium-90	pCi/L	4	19.2	0.00294	0.00514
PU-10175	Upper S. Fork Acid Canyon SW	Acid	ca	Arsenic	µg/L	2	3.2	0.0325	0.0528
PU-10175	Upper S. Fork Acid Canyon SW	Acid	nc	Arsenic	µg/L	2	3.2	0.00169	0.00666
PU-10175	Upper S. Fork Acid Canyon SW	Acid	nc	Uranium	µg/L	2	10.3	0.000541	0.00214
PU-10175	Upper S. Fork Acid Canyon SW	Acid	rad	Plutonium-239	pCi/L	2	7.11	0.0252	0.044

Table 8.2-7 (continued)

Location	Name	Canyon	Class ^a	COPC	Units	Number of Samples	EPC ^b	Trail User RBC Ratio	Extended Backyard RBC Ratio
PU-10175	Upper S. Fork Acid Canyon SW	Acid	rad	Uranium-234	pCi/L	2	7.3	0.00207	0.00362
PU-10175	Upper S. Fork Acid Canyon SW	Acid	rad	Uranium-238	pCi/L	2	3.4	0.000915	0.0016
PU-10176	Lower S. Fork Acid Canyon SW	Acid	ca	Arsenic	µg/L	2	1.8	0.0183	0.0297
PU-10176	Lower S. Fork Acid Canyon SW	Acid	nc	Arsenic	µg/L	2	1.8	0.000949	0.00375
PU-10176	Lower S. Fork Acid Canyon SW	Acid	rad	Plutonium-239	pCi/L	2	5.17	0.0183	0.032
PU-10229	Pueblo at SR-502	Pueblo	ca	Arsenic	µg/L	4	8.4	0.0854	0.139
PU-10229	Pueblo at SR-502	Pueblo	nc	Aluminum	µg/L	4	4000	0.000633	0.0025
PU-10229	Pueblo at SR-502	Pueblo	nc	Arsenic	µg/L	4	8.4	0.00443	0.0175
PU-10229	Pueblo at SR-502	Pueblo	nc	Boron	µg/L	2	384	0.000675	0.00266
PU-10229	Pueblo at SR-502	Pueblo	nc	Iron	µg/L	4	5990	0.00316	0.0125
PU-10229	Pueblo at SR-502	Pueblo	nc	Manganese	µg/L	4	1760	0.00249	0.00952
PU-10229	Pueblo at SR-502	Pueblo	nc	Uranium	µg/L	3	2.62	0.000138	0.000544
PU-10230	Pueblo 3	Pueblo	ca	Arsenic	µg/L	4	10.4	0.106	0.172
PU-10230	Pueblo 3	Pueblo	ca	Bis(2-ethylhexyl)phthalate	µg/L	4	6.8	0.0814	0.0548
PU-10230	Pueblo 3	Pueblo	nc	Arsenic	µg/L	4	10.4	0.00549	0.0216
PU-10230	Pueblo 3	Pueblo	nc	Bis(2-ethylhexyl)phthalate	µg/L	4	6.8	0.00678	0.0226
PU-10230	Pueblo 3	Pueblo	nc	Boron	µg/L	2	347	0.00061	0.00241
PU-10230	Pueblo 3	Pueblo	nc	Iron	µg/L	4	2550	0.00134	0.00531
PU-10230	Pueblo 3	Pueblo	nc	Manganese	µg/L	4	1240	0.00176	0.00671
PU-10230	Pueblo 3	Pueblo	nc	Thallium	µg/L	4	3	0.00593	0.0234
PU-10231	Pueblo 2	Pueblo	ca	Benzo(a)anthracene	µg/L	1	0.79	0.0801	0.0571
PU-10231	Pueblo 2	Pueblo	ca	Benzo(a)pyrene	µg/L	1	0.56	0.954	0.662
PU-10231	Pueblo 2	Pueblo	ca	Benzo(b)fluoranthene	µg/L	1	0.58	0.1	0.0695
PU-10231	Pueblo 2	Pueblo	ca	Indeno(1,2,3-cd)pyrene	µg/L	1	0.57	0.0987	0.0684

^a ca = Carcinogen, nc = noncarcinogen, rad = radionuclide.

^b The maximum detected value is used as the EPC when insufficient data are available to calculate a UCL.

Table 8.2-8
Trail User RME Multimedia Sums, by Reach and Sampling Station

Sediment Reach	Water Station Name	Water Location	Carcinogen Sum^a	Noncarcinogen Sum	Radionuclide Sum^b
DP-1W	DP-1W SW	21-10929	0.406	0.0058	— ^c
DP-1C	DP-1W SW	21-10929	0.152	0.0058	—
DP-1E	DP-1W SW	21-10929	0.196	0.0058	—
DP-1W	DP-1C SW	21-11226	0.38	0.0151	—
DP-1C	DP-1C SW	21-11226	0.127	0.0151	—
DP-1E	DP-1C SW	21-11226	0.17	0.0151	—
LA-2E	DP Spring	21-01854	0.0879	0.0134	0.0811
LA-2FE	DP Spring	21-01854	0.0285	0.0126	0.131
LA-2W	DP Spring	21-01854	0.0285	0.0126	0.0168
LA-3	DP Spring	21-01854	0.0285	0.0126	0.0168
LA-3FE	DP Spring	21-01854	0.0285	0.0126	0.0168
DP-2	DP Spring	21-01854	0.0285	0.0126	0.154
DP-3	DP Spring	21-01854	0.0438	0.0126	0.119
DP-4	DP Spring	21-01854	0.0285	0.0126	0.0969
AC-1	AC-2 SW	00-10241	0.547	0.00986	—
AC-2	AC-2 SW	00-10241	0.352	0.00983	—
AC-1	Upper S. Fork Acid SW	PU-10175	0.549	0.00414	0.0281
AC-2	Upper S. Fork Acid SW	PU-10175	0.354	0.00411	0.0281
ACS	Upper S. Fork Acid SW	PU-10175	0.0752	0.00796	0.119
AC-1	Lower S. Fork Acid SW	PU-10176	0.535	0.00286	0.0183
AC-2	Lower S. Fork Acid SW	PU-10176	0.339	0.00283	0.0183
ACS	Lower S. Fork Acid SW	PU-10176	0.061	0.00668	0.109
AC-3	lower AC-3 SW	PU-10155	2.59^d	0.0385	0.1
P-1W	lower AC-3 SW	PU-10155	2.48	0.0012	0.0126
P-1E	lower AC-3 SW	PU-10155	2.45	0.0000464	0.0239
P-1W	Upper P-1W SW	PU-10069	0.0907	0.00839	—
P-1W	Lower P-1W SW	PU-10069	0.0907	0.00839	—
P-1E	P-1E SW	PU-10071	0.0843	0.0147	0.0113
P-1W	P-1E SW	PU-10071	0.109	0.0159	—
AC-3	P-1E SW	PU-10071	0.223	0.0532	0.0877
P-3W	Pueblo 3	PU-10230	0.187	0.0219	—
P-4W	Pueblo 3	PU-10230	0.228	0.024	—
P-4E	Pueblo 3	PU-10230	0.187	0.0219	—
P-3W	Pueblo at 502	PU-10229	0.0854	0.0115	—
P-4W	Pueblo at 502	PU-10229	0.127	0.0136	—
P-4E	Pueblo at 502	PU-10229	0.0854	0.0115	—

^a Convert to risk: Value x (1x10⁻⁵).

^b Convert to dose: Value from Sediment Component (Value from Table 8.2-2 x 15 mrem) + Water Component (Value from Table 8.2-5 x 4 mrem).

^c — = Value below screening criteria.

^d Bold text indicates sum that exceeds 1.

Table 8.2-9
Extended Backyard RME Multimedia Sums, by Reach and Sampling Station

Sediment Reach	Water Station Name	Water Location	Carcinogen Sum ^a	Noncarcinogen Sum	Radionuclide Sum ^b
DP-1W	DP-1W SW	21-10929	0.688	0.0229	— ^c
DP-1C	DP-1W SW	21-10929	0.249	0.0229	—
DP-1E	DP-1W SW	21-10929	0.325	0.0229	—
DP-1W	DP-1C SW	21-11226	0.648	0.0595	—
DP-1C	DP-1C SW	21-11226	0.209	0.0595	—
DP-1E	DP-1C SW	21-11226	0.285	0.0595	—
LA-2E	DP Spring	21-01854	0.156	0.0585	0.115
LA-2FE	DP Spring	21-01854	0.0462	0.0496	0.145
LA-2W	DP Spring	21-01854	0.0462	0.0496	0.0295
LA-3	DP Spring	21-01854	0.0462	0.0496	0.0295
LA-3FE	DP Spring	21-01854	0.0462	0.0496	0.0295
DP-2	DP Spring	21-01854	0.0462	0.0496	0.195
DP-3	DP Spring	21-01854	0.0726	0.0496	0.165
DP-4	DP Spring	21-01854	0.0462	0.0496	0.131
AC-1	AC-2 SW	00-10241	0.959	0.0519	—
AC-2	AC-2 SW	00-10241	0.62	0.0516	—
AC-1	Upper S. Fork Acid SW	PU-10175	0.962	0.0293	0.0493
AC-2	Upper S. Fork Acid SW	PU-10175	0.624	0.029	0.0493
ACS	Upper S. Fork Acid SW	PU-10175	0.135	0.0598	0.551
AC-1	Lower S. Fork Acid SW	PU-10176	0.939	0.0243	0.032
AC-2	Lower S. Fork Acid SW	PU-10176	0.601	0.0239	0.032
ACS	Lower S. Fork Acid SW	PU-10176	0.112	0.0547	0.534
AC-3	Lower AC-3 SW	PU-10155	1.95^d	0.328	0.409
P-1W	Lower AC-3 SW	PU-10155	1.76	0.0129	0.022
P-1E	Lower AC-3 SW	PU-10155	1.71	0.000395	0.0743
P-1W	Upper P-1W SW	PU-10069	0.163	0.0408	—
P-1W	Lower P-1W SW	PU-10069	0.163	0.0408	—
P-1E	P-1E SW	PU-10071	0.139	0.0575	0.0523
P-1W	P-1E SW	PU-10071	0.193	0.07	—
AC-3	P-1E SW	PU-10071	0.378	0.385	0.387
P-3W	Pueblo 3	PU-10230	0.227	0.0821	—
P-4W	Pueblo 3	PU-10230	0.318	0.105	—
P-4E	Pueblo 3	PU-10230	0.227	0.0821	—
P-3W	Pueblo at 502	PU-10229	0.139	0.0452	—
P-4W	Pueblo at 502	PU-10229	0.23	0.068	—
P-4E	Pueblo at 502	PU-10229	0.139	0.0452	—

^a Convert to risk: Value x (1x10⁻⁵).

^b Convert to dose: Value from Sediment Component (Value from Table 8.2-3 x 15 mrem) + Water Component (Value from Table 8.2-6 x 4 mrem).

^c — = Value below screening criteria.

^d Bold text indicates sum that exceeds 1.

9.0 CONCLUSIONS AND RECOMMENDATIONS

Investigations of sediment, surface water, and alluvial groundwater in the Los Alamos and Pueblo watershed indicate that inorganic, organic, and radionuclide COPECs are present in these media at concentrations above ESLs or SALs. These COPECs are derived from several sources, including Laboratory SWMUs and AOCs, runoff from the Los Alamos townsites, redistribution of ash from the Cerro Grande burn area, and uncontaminated soils and sediments.

The spatial distribution of contaminants in the Los Alamos and Pueblo watershed indicates that the primary Laboratory sources most important for assessing potential human health risk are the former TA-1 and TA-45 outfalls into the South Fork of Acid Canyon (active from 1944 to 1964) and the SWMU 21-011(k) outfall into DP Canyon (active from 1952 to 1986). Source areas for Laboratory-derived COPECs that are most important in the assessment of potential ecological risk include outfalls into the South Fork of Acid Canyon and sites in upper Los Alamos Canyon (such as TA-2 and perhaps former TA-1 and/or TA-21 outfalls). The impacts of several additional Laboratory sources (e.g., outfalls from TA-53 and SWMU 0-030[g] and the former Pueblo Canyon WWTP) may be inferred from the characterization data, although the concentrations, extent, and inventory of COPECs from these sources are minor compared to the sources listed above.

Contaminant concentrations in canyons sediment and water have generally decreased over time, indicating that the initial SWMU and AOC sources are no longer major contributors to contamination in canyons media. The canyon bottom sediment deposits contain the largest inventory of contaminants susceptible to remobilization and transport in floods and are the primary source for ongoing surface water and alluvial groundwater contamination. Therefore, any future efforts to address contaminants in canyons media should focus on the current distribution of contaminants in sediment instead of the original source areas at Laboratory outfalls.

Many organic, inorganic, and radionuclide COPECs have been identified in the ecological screening assessments; subsequently, a plan for a baseline ecological risk assessment (BERA) was developed. The BERA process is based upon the eight-step EPA ecological risk assessment guidance for Superfund (ERAGS) (EPA 1997, 59370). The study design and sampling plan was developed in collaboration with the NMED and is described in Katzman (2002, 73667). The BERA evaluated evidence of ecological risks from COPECs to omnivorous mammals, insect-eating birds, plants, earthworms, aquatic invertebrates, and the Mexican spotted owl, a threatened and endangered species. The multiple lines of evidence did not identify adverse effects to terrestrial or aquatic receptors. Therefore, no mitigation is necessary.

The site-specific human health risk assessment uses extended backyard and trail user exposure scenarios to represent the present-day and reasonably foreseeable future land use in canyons throughout the watershed. Residential and resourceuser scenarios were also assessed for San Ildefonso Pueblo land in lower Los Alamos Canyon and the construction worker scenario for Pueblo Canyon in the vicinity of a planned new wastewater treatment plant. The assessment results indicate that for the trail user and extended backyard scenarios, no areas in the Los Alamos and Pueblo watershed have contaminant concentrations greater than levels acceptable for noncarcinogens in sediment or water (HI of 1) or radionuclides (dose limit of 4 mrem/yr in water and 15 mrem/yr in sediment). However, combined exposures to sediment and water at two locations, one in Acid Canyon and one in Pueblo Canyon, have estimated RME risks that exceed the cancer risk criterion of 1×10^{-5} . Reach AC-3 has the highest calculated RME risk of 3×10^{-5} for the trail user exposure scenario and 2×10^{-5} for the extended backyard exposure scenario. These potential risks are dominated by PAHs in surface water, with a minor contribution from PAHs in sediment. Reach P-2W in Pueblo Canyon has a calculated trail user RME risk of 2×10^{-5} that is also dominated by PAHs in surface water. As described in Section 8.2.6, these potential

risks result mostly from dermal exposure to PAHs and are probably overestimated because of several protectively biased assumptions of the exposure assessment.

Investigation data indicate that the dominant source of PAHs is runoff from the Los Alamos townsite, not Laboratory SWMUs or AOCs. The highest concentrations of PAHs in sediment in the Los Alamos and Pueblo watershed were measured in reach AC-1, upcanyon from SWMU 0-030(g) and downcanyon from commercial and residential areas and roads in the Los Alamos townsite. Relatively high concentrations of PAHs are also present in sediment at the head of DP Canyon, which is also downcanyon from developed areas in the townsite. Similarly, the source of PAHs in surface water is townsite runoff. This conclusion is consistent with studies in other regions that show PAHs to be common contaminants in sediment and surface water near roads and developed areas.

For the residential and resource user scenarios, COPC concentrations in sediment in lower Los Alamos Canyon on San Ildefonso Pueblo land are below target risk levels. For the residential scenario in this part of the canyon, noncarcinogens and carcinogens in alluvial groundwater have HIs ranging from 5 to 8 and ICRs ranging from 4×10^{-5} to 2×10^{-4} . The noncarcinogen HI is attributed to fluoride, nitrite, nitrate, and thallium; the ICR is from arsenic. Radionuclide concentrations in alluvial groundwater are below the dose limits of 4 mrem/yr for the residential scenario. The residences in this part of the canyon currently use potable water from a regional groundwater well. Additional residences in the area probably use regional groundwater as well. Although the target cancer risk level is exceeded in lower Los Alamos Canyon by the alluvial groundwater pathway, this exposure pathway is not complete and is therefore not representative of actual exposure conditions. Available data indicate that these COPCs are not from Laboratory SWMUs or AOCs but are either naturally occurring or from Bayo WWTP discharges. The carcinogen, noncarcinogen, and radionuclide risk results for the construction worker scenario in Pueblo Canyon are all below target risk levels.

For radionuclides, which are the primary contaminants derived from Laboratory SWMUs or AOCs, the highest combined dose from water and sediment for the extended backyard scenario is in reach ACS in the South Fork of Acid Canyon, at 8 mrem/yr (4×10^{-6} cancer incidence risk); 93% of this dose is from plutonium-239,240 in sediments, 2% is from plutonium-239,240 in surface water, and the remainder is from other radionuclides in sediment, including americium-241 and cesium-137. These estimates for reach ACS use data collected following sediment removal in an IA in 2001, which met cleanup goals in an NMED-approved IA plan. For the trail user scenario, the highest calculated dose is in reach DP-2 in DP Canyon, with a potential radionuclide dose of 2 mrem/yr (3×10^{-7} cancer incidence risk); 93% of this dose is from cesium-137 in sediments, 3% is from strontium-90 in surface water, and the remainder is from other radionuclides in sediment.

Evaluations of the changes in COPC concentrations over time for sediment, surface water, and alluvial groundwater indicate that concentrations are either relatively stable or are decreasing for contaminants derived from Laboratory SWMUs or AOCs. These decreases are associated with processes that remobilize, transport, and mix sediment- and water-borne constituents. Flooding and changes in sediment and water chemistry that resulted from the Cerro Grande fire did not change the nature of these processes but may have accelerated the rates of these processes because of increased flood frequency and magnitude. Only minor post-fire perturbations in COPC concentrations have been observed in surface water and alluvial groundwater. Larger changes in COPC concentrations have been observed in sediment associated with the redistribution of ash derived from the Cerro Grande burn area. Radioactive decay also contributes to decreasing concentrations for some radionuclides (e.g., cesium-137, strontium-90, and tritium). Therefore, the potential for impacts to human health or ecosystems from Laboratory-derived contaminants are expected to continue to decrease in the absence of new sources.

The concentrations of contaminants originating in the townsite, such as PAHs, may not decrease because of the effects of nonpoint source runoff from urbanized portions of the watershed.

In summary, for contaminants released from Laboratory SWMUs and AOC, the results of this investigation indicate that human health risks are within acceptable risk ranges for present-day and foreseeable future land uses. Nor were adverse ecological effects observed within terrestrial and aquatic systems in the watershed. Therefore, corrective actions are not needed to mitigate unacceptable risks. Available data also indicate that potential risks or doses from Laboratory-derived COPCs either will remain relatively stable or will decrease in the absence of new contaminant sources. The analysis and conclusions in this report are predicated on present-day and foreseeable future land uses. In the event that the type or extent of land-use changes, the human health risk assessment may need to be reassessed for some parts of the watershed. Continued monitoring of sediment, surface water, alluvial groundwater, and biota is appropriate to document trends in contaminant concentrations over time and to verify conceptual models and risk assessment results. The assessments in this report form the basis for focusing the types, analytical suites, locations, and frequencies of such future monitoring. The persistent surface water and alluvial groundwater monitoring should be conducted under the long-term watershed monitoring plan for the Los Alamos and Pueblo watershed, which is scheduled for annual revision with review and approval by the NMED. Sediment and biota monitoring will also be conducted and reported by the Laboratory.

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10.0 REFERENCES

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Appendix A

Acronyms and Abbreviations and Conversion Table

A-1.0 ACRONYMS AND ABBREVIATIONS

ABS	absorption factor
AF	adherence factor
ALSM	airborne laser swath mapping
AOC	area of concern
asl	above sea level
ASTM	American Society for Testing and Materials
BAF	bioaccumulation factor
BERA	baseline ecological risk assessment
BTEX	benzene, toluene, ethylbenzene, xylene
BV	background value
CFR	Code of Federal Regulations
cpm	counts per minute
csf	cubic feet per square inch
CMS	corrective measures study
COPC	chemicals of potential concern
COPEC	chemical of potential ecological concern
CY	calendar year
D&D	decontamination and decommissioning
DC	direct current
DCG	US Department of Energy-derived concentration guidelines
DCF	dose conversion factor
DDE	dichlorodiphenyltrichloroethylene
DDT	dichlorodiphenyltrichloroethane
DDX	sum of DDE and DDT
DI	desk instruction
DO	dissolved oxygen
DOE	US Department of Energy
DOE OB	US Department of Energy Oversight Bureau
DOE-LASO	US Department of Energy-Los Alamos Site Office
dpm	disintegrations per minute
DRI	Desert Research Institute
DRO	diesel range organic
Eco-SSL	ecological soil screening level

EES	Earth and Environmental Sciences (Laboratory Division)
EO	element occurrence
EPA	US Environmental Protection Agency
EPC	exposure point concentration
ER	Environmental Restoration (Project)
ERAGS	ecological risk assessment guidance for Superfund
ERDB	Environmental Restoration Database
ESL	ecological screening level
ET	evapotranspiration
FR	Federal Register
FUSRAP	Formerly Utilized Sites Remedial Action Program
GIS	Geographical Information System
GRO	gasoline range organic
HE	high explosive
HEAST	Health Effects Assessment Summary Tables
HI	hazard index
HQ	hazard quotient
HSWA	Hazardous and Solid Waste Amendments
HWA	Hazardous Waste Act (New Mexico)
HWB	Hazardous Waste Bureau (New Mexico)
IC	ion chromatography
ICR	incremental cancer risk
IA	interim action
ID	identification number
IFRAT	Interagency Flood Risk Assessment Team
IRIS	Integrated Risk Information System
ISE	ion selective electrodes
KGS	Kansas Geological Survey
Laboratory	Los Alamos National Laboratory
LANL	Los Alamos National Laboratory
LOAEL	lowest observed adverse effect level
MCL	maximum contaminant level
MDA	minimum detectable activity
MMS	multimedia sum

mrem	millirem
NCEA	National Center for Environmental Assessment
NIST	National Institute of Standards and Technology
NMAC	New Mexico Administrative Code
NMED	New Mexico Environment Department
NMWQCC	New Mexico Water Quality Control Commission
NOAEL	no observed adverse effect level
NOD	notice of deficiency
NTU	nephelometric turbidity unit
OU	operable unit
OWR	Omega West Reactor
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
PEF	particulate emission factor
PPCC	probability plot correlation coefficient
PRS	potential release site
psi	pounds per square inch
PVC	polyvinyl chloride
QA	quality assurance
QC	quality control
QHA	quantitative habitat analysis
QP	quality procedure
RAC	Risk Assessment Corporation
RAGS	Risk Assessment Guidance for Superfund
RAWS	remote area weather stations
RBC	risk-based concentration
RCRA	Resource Conservation and Recovery Act
RfC	reference concentration
RfD	reference dose
RFI	RCRA facility investigation
RME	reasonable maximum exposure
RPF	Records-Processing Facility
RRES	Risk Reduction and Environmental Stewardship (a Laboratory Division)
RRES-RS	Risk Reduction and Environmental Stewardship—Remediation Services

RRES-WQH	Risk Reduction and Environmental Stewardship–Water Quality and Hydrology Group
RSI	Request for Supplemental Information
SAL	screening action level
SAP	sampling and analysis plan
SF	slope factor
SFNF	Santa Fe National Forest
SNOTEL	snowpack telemetry
SOP	standard operating procedure
SVOC	semivolatile organic compound
SWMU	solid waste management unit
T&E	threatened and endangered (species)
TA	technical area
TDS	total dissolved solids
TPH	total petroleum hydrocarbon
TRV	toxicity reference value
TSCA	Toxic Substances Control Act
UCL	upper confidence limit
UTL	upper tolerance limit
USFS	US Forest Service
USGS	US Geological Survey
VCA	voluntary corrective action
VCM	voluntary corrective measure
VOC	volatile organic compound
WWTP	wastewater treatment plant

A-2.0 METRIC TO US CUSTOMARY UNIT CONVERSION TABLE

Multiply SI (Metric) Unit	by	To Obtain US Customary Unit
kilometers (km)	0.622	miles (mi)
kilometers (km)	3281	feet (ft)
meters (m)	3.281	feet (ft)
meters (m)	39.37	inches (in.)
centimeters (cm)	0.03281	feet (ft)
centimeters (cm)	0.394	inches (in.)
millimeters (mm)	0.0394	inches (in.)
micrometers or microns (μm)	0.0000394	inches (in.)
square kilometers (km^2)	0.3861	square miles (mi^2)
hectares (ha)	2.5	acres
square meters (m^2)	10.764	square feet (ft^2)
cubic meters (m^3)	35.31	cubic feet (ft^3)
kilograms (kg)	2.2046	pounds (lb)
grams (g)	0.0353	ounces (oz)
grams per cubic centimeter (g/cm^3)	62.422	pounds per cubic foot (lb/ft^3)
milligrams per kilogram (mg/kg)	1	parts per million (ppm)
micrograms per gram ($\mu\text{g/g}$)	1	parts per million (ppm)
liters (L)	0.26	gallons (gal.)
milligrams per liter (mg/L)	1	parts per million (ppm)
degrees Celsius ($^{\circ}\text{C}$)	$9/5 + 32$	degrees Fahrenheit ($^{\circ}\text{F}$)

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Appendix B

Field Investigation Methods and Results

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B-1.0 SEDIMENT INVESTIGATIONS IN REACHES

The former Environmental Restoration (ER) Project at Los Alamos National Laboratory (LANL or the Laboratory) conducted sediment investigations in several reaches in the Los Alamos and Pueblo Canyon watershed after reports were completed in 1998 and 1999 (Reneau et al. 1998, 59159; Reneau et al. 1998, 59160; Reneau et al. 1998, 59667; Katzman et al. 1999, 63915). This appendix summarizes results from field investigations in these reaches that have not been presented in previous reports. Investigations associated with evaluating potential adverse ecological impacts are presented separately in Section B-3.0 of this appendix and in investigations that focus on the impact of the May 2000 Cerro Grande fire are presented in Section B-4.0.

Geomorphic mapping at a scale of 1:200 occurred in each new reach and focused on delineating geomorphic units with differences in physical characteristics and/or contaminant levels. These maps are presented on Plates 2 to 11. Unit designations followed those used in previous reports, with "c" designating post-1942 channel units and "f" designating post-1942 floodplain units. Sediment thickness measurements distinguished between fine facies sediment, with typical median particle size of silt to fine sand (0.015 to 0.25 mm) in the less than 2 mm fraction, and coarse facies sediment, with typical median particle size of coarse to very coarse sand (0.5 to 2 mm) in the less than 2 mm fraction. Samples with median particle size of medium sand (0.25 to 0.5 mm) were classified either as fine or coarse facies, depending on the stratigraphic context and the particle size of adjacent layers. Coarse facies sediment is characteristic of material transported along the streambeds as bed load, and fine facies sediment is characteristic of material transported in suspension (Malmon 2002, 76038, pp. 94–97; Malmon et al. 2003, 82311, pp. 12–14). Several methods were used to identify the bottom of post-1942 sediment deposits, including determining the depth of buried trees and associated buried soils and noting the presence or absence of materials imported to the watershed after 1942 (e.g., quartzite gravel, coal). Analytical data from sediment samples were also used to help identify the bottom of post-1942 sediment deposits, as discussed below.

Average facies thickness in each unit was combined with unit area, as determined from digitized geomorphic maps, to obtain an estimated unit volume. The estimates of unit volume were combined with estimates of contaminant levels, where available, to allocate samples using a stratified sample allocation process (Gilbert 1987, 56179, pp. 45–57) designed to reduce uncertainties in the contaminant inventory in each reach. In this process, samples were preferentially allocated to units and sediment facies with either high variability in contaminant concentrations or a large portion of the total inventory, or both. This process is discussed in more detail in Rytí et al. (2004, 85206). One result of this sample allocation process is a high bias in sample results because of a disproportionately large number of samples were collected from the more contaminated geomorphic units and sediment facies. Weighted averages are generally used in this investigation to remove this bias introduced during sample collection.

Additional samples were collected from specific locations or layers in the reaches to help define the horizontal and vertical extent of contaminated sediments. For example, samples may be collected from surface or subsurface layers on floodplains or terraces where field evidence was inconclusive as to whether the layer pre- or post-dated contaminant releases. The presence of analytes at concentrations significantly above background values was used to infer that the sampled sediments were younger than 1942. Concentrations slightly above background values, and lower than overlying layers, are interpreted to record the downward translocation of trace levels of contaminants into pre-1942 sediment. Concentrations slightly above background levels in surface layers are interpreted to indicate minimal thicknesses of post-1942 overbank sediment or wind deposition of trace amounts of contaminated sediments.

Field radiological screening data were obtained in reaches where the levels of radionuclide contaminants were high enough that post-1942 sediment exhibited higher levels of radiation, as measured with field instruments, than nearby pre-1943 sediment. In these cases field radiological measurements were useful in delineating areas with varying contaminant levels. Screening data were not routinely obtained in reaches with low levels of radionuclides because previous studies in other reaches had indicated these data were not useful in characterizing variations in contaminant concentrations. Investigations in reaches where cesium-137 levels were sufficiently high to be detectable above background gamma radiation levels included gross gamma radiation walkover surveys by CHEMRAD (Oak Ridge, Tennessee) using Ludlum Model 44-2 detectors (1-in. by 1-in. NaI probes) with Ludlum Model 3 scaler/rate meters (single-channel analyzers).

Investigations also included fixed-point measurements of alpha and/or gamma radiation at various depths in reaches where levels of either plutonium-239,240 (an alpha emitter) or cesium-137 (a gamma emitter) resulted in detectable increases above background radiation levels. Fixed-point gamma radiation measurements utilized a Ludlum Model 44-10 detector encased in a lead- and copper-lined, polyethylene shield with a Ludlum Model 2221 scaler/rate meter. Fixed-point alpha radiation measurements utilized a Model 2221 rate meter with a 43-1 alpha scintillator probe. The measurement procedures are discussed further in Reneau et al. (1998, 59160, Appendix B, Section B-4.0) and Reneau et al. (2002, 73660, Appendix B, Section B-1.0).

Particle-size analyses from sediment samples were obtained at an off-site laboratory at the Desert Research Institute (DRI) following the procedures described in Janitzky (1986, 57674) to examine the effect of particle-size distribution on contaminant concentrations. Organic-matter content was determined for some of the samples at DRI using the loss-on-ignition method to provide additional information about the physical characteristics of potentially contaminated sediment deposits. Dendrochronological analyses (tree-ring dating) were obtained in some reaches to provide supplemental information on the age of sampled sediment deposits. These analyses followed the methodology described in Stokes and Smiley (1968, 57644) and Phipps (1985, 58477) and are discussed further in Reneau et al. (1998, 59160, Appendix B, Section B-1.0).

Reaches LA-2FE and LA-3W

Investigation of two new reaches (LA-2FE and LA-3W) in the area between reaches LA-2E and LA-3E (previously referred to as LA-3 in Reneau et al. 1998, 59160) was undertaken to (1) evaluate a gamma radiation anomaly identified in aerial surveys (Fritzsche 1990, 58971); (2) reduce uncertainties in radionuclide inventory in upper Los Alamos Canyon; and (3) evaluate possible contributions from the TA-53 drainage. LA-2FE extends for 1.0 km (0.6 mi) upcanyon from the confluence of the tributary canyon east of TA-53 and Los Alamos Canyon, and LA-3W extends for 0.5 km (0.3 mi) downcanyon from the confluence. Table B-1.0-1 summarizes the characteristics of these reaches. Plate 5 shows the geomorphic units, field radiological measurement locations, dendrochronological measurement locations, and sample locations in these reaches. Plate 12 presents gross gamma walkover radiation data obtained from these reaches in 2000. Tables B-1.0-2 and B-1.0-3 present fixed-point radiological field data, Tables B-1.0-4 and B-1.0-5 present thickness measurements of sediment, Tables B-1.0-6 and B-1.0-7 present particle-size and organic-matter data, and Table B-1.0-8 presents dendrochronological data obtained from these reaches in 2001.

Organic Chemicals in Upper Los Alamos Canyon

Investigations to reduce uncertainties in the sources and concentrations of organic chemicals in upper Los Alamos Canyon included sampling in previously investigated reaches and in new reaches in 2000

and 2001. Geomorphic maps for these reaches are shown in Plates 2 to 6. Samples were collected in reach LA-3E to replace results that had been rejected because of quality assurance (QA) deficiencies (reach LA-3 in Reneau et al. 1998, 59160; pp. 3-11 and C-8). Samples were collected from previous sample locations in reaches LA-1W+, LA-1W, LA-1C, LA-1E, and LA-2W to increase data sets for pesticides, polychlorinated biphenyls (PCBs) and semivolatile organic compounds (SVOCs). Samples were collected in new study reaches upcanyon (LA-1FW and LA-0) to further evaluate sources of organic chemicals of potential concern (COPCs), including possible contributions from solid waste management units (SWMUs) and areas of concern (AOCs) at Technical Area (TA-) 3 and TA-43 (reach LA-1FW) and runoff from another source (reach LA-0). Tables B-1.0-9 and B-1.0-10 summarize the physical characteristics and sediment thickness measurements from the new reaches.

Inorganic and Organic Chemicals in Upper Pueblo and Walnut Canyons

Investigations to reduce uncertainties in the sources and concentrations of inorganic and organic chemicals in upper Pueblo Canyon and Walnut Canyon included sampling in previously investigated reaches and in new reaches in 1999. Most samples were collected in new study reaches to further evaluate sources of inorganic and organic COPCs, including relative contributions from the former Pueblo Canyon waste water treatment plant ([WWTP] (reach P-1W) and townsite runoff (reaches P-1FW and Walnut Canyon). Geomorphic maps for these reaches are shown on Plate 8. One sample was also collected in reach P-1E to further evaluate the presence of organic chemicals in this reach. Reach P-1W includes two discontinuous mapping areas, one immediately downcanyon from the former Pueblo Canyon WWTP (investigated in 1999) and the other immediately upcanyon from Acid Canyon (investigated in 1996 and 1997). For P-1W, tables in this appendix combine information from both areas, some of which was presented in Reneau et al. (1998, 59159). Table B-1.0-11 summarizes the characteristics of the new reaches of Pueblo and Walnut Canyons. Table B-1.0-12 presents thickness measurements of sediment, and Tables B-1.0-13 and B-1.0-14 present particle-size data obtained from the new reaches. Reaches P-1FW and P-1W have been heavily impacted by post-fire floods, and the data reported here pertain to pre-fire conditions.

Acid Canyon

Investigations were conducted in a series of reaches in Acid Canyon to evaluate sources and concentrations of inorganic chemicals, organic chemicals, and radionuclides. Some of the investigation results for reach ACS (the South Fork of Acid Canyon) are presented in Reneau et al. (2000, 66867; Reneau 2002, 73660). The investigations in Acid Canyon included the evaluation of the relative contributions from SWMU 0-030(g) (reach AC-2) and from upcanyon townsite runoff (AC-1), and supplementing the data reported in the "RFI Report for SWMU 0-030(g)" (LANL 2001, 70273). Table B-1.0-15 summarizes the characteristics of the Acid Canyon reaches. Geomorphic units for reach ACS include revisions made subsequent to the "Interim Report on Sediment Contamination in the South Fork of Acid Canyon" (Reneau et al. 2000, 66867), as discussed in the "Interim Action Completion Report for the South Fork of Acid Canyon" (Reneau et al. 2002, 73660). Characteristics of both pre-Interim Action (IA) and post-IA geomorphic units are presented for reach ACS for completeness, with "c.a." indicating the IA cleanup area. Reach AC-2 includes two discontinuous mapping areas, one immediately downstream from the 0-030(g) drainage (investigated in 1998 and previously reported in by the Laboratory [LANL 2001, 70273]) and the other immediately upcanyon from ACS (investigated in 1999). For AC-2, the tables combine information from both areas. For completeness, the tables also include geomorphic characterization data from the 0-030(g) drainage that were not included in the previous report (LANL 2001, 70273). Geomorphic maps of the Acid Canyon reaches are shown in Plate 8. For reach

ACS, Plate 8 shows post-IA geomorphic units (Plate 1 of Reneau et al. 2002, 73660, shows the pre-IA units in ACS).

Tables B-1.0-16 through B-1.0-19 present fixed-point field radiological screening data from reaches AC-1, AC-2, AC-3, and ACS. For reach ACS, only data collected prior to the IA are presented because these data have not been reported previously. Data collected during the implementation of the IA are presented in Reneau et al. (2002, 73660, Table B-1.0-1, pp. B-2 to B-5). Tables B-1.0-20 through B-1.0-22 present thickness measurements of sediment obtained prior to the IA, and Tables B-1.0-23 and B-1.0-24 present particle-size data obtained from Acid Canyon reaches. Although most of the reach ACS sample locations were excavated, the characteristics of these locations are included to document pre-IA conditions, which are important for estimating pre-IA contaminant inventories and for constraining a conceptual model of contaminant distribution. Data from samples collected in AC-3 in 1996 and 1997 and reported in Reneau et al. (1998, 59159) are included for completeness. Separate sample IDs were obtained for particle-size and organic-matter analyses and other analyses for some reach ACS samples, and a crosswalk between sample IDs is presented in Table B-1.0-25.

B-2.0 ALLUVIAL GROUNDWATER AND SURFACE WATER INVESTIGATIONS

B-2.1 Sample Collection Methodology

B-2.1.1 Surface Water Sampling

Surface water samples were collected using the direct-grab method according to ER Project standard operating procedure (SOP)-06.13. Sample bottles for nonfiltered samples were filled by dipping them into the stream in an area of moderate flow. Filtered samples were collected by first dipping a bottle into the stream, then filtering the sample through a disposable 0.45- μ m filter into a separate sample container using a GeoPump. QA duplicate samples were collected at a frequency of one duplicate for every 20 samples collected.

Measurements of field parameters for surface water samples were taken to provide data that could be useful for evaluating contaminant variability. Field parameters were measured for each sample collected according to LANL-ER-SOP-6.02, Field Analytical Measurements of Groundwater (the methodology described in this SOP also applies to surface water). Specific conductance, pH, and temperature were measured using an YSI 63 multiparameter probe and meter. The YSI 63 was calibrated each day prior to sampling using National Institute of Standards and Technology (NIST) traceable standards. Turbidity was measured using a Hach 2100p portable turbidimeter. The Hach turbidimeter was calibrated every three months using NIST traceable standards. The field parameters were recorded on a water-quality stabilization record form for each surface water sample and are presented according to canyon and location in Tables B-2.1-1 and B-2.1-2. Table B-2.1-3 summarizes the range of field-parameter values recorded at samples surface locations. All samples have a corresponding sample collection log that is completed in the field, including information about the date and time the sample was collected, the appearance and odor of the sample, the location information, the weather conditions, and other relevant observations.

B-2.1.2 Alluvial Groundwater Sampling

Alluvial groundwater samples were collected according to LANL-ER-SOP-06.01, Purging and Sampling Methods for Single Completion Wells. Samples were drawn from the well using an electric submersible pump with Teflon tubing. The intake for the pump was typically set near the bottom of the screened interval. Three casing volumes were purged from the well prior to sample collection. The typical pump

rate for an alluvial well was 1.5 gal. per min. Pump rates were reduced in wells with a recharge rate of less than 1.5 gal. per min to minimize turbidity and prevent drawing the water down to a level where samples could not be collected. Groundwater samples were collected after purging three casing volumes and after obtaining stable pH and specific conductance readings. Whenever possible, samples were collected after a turbidity value of less than 5 nephelometric turbidity units (NTU) was achieved. Wells were purged at a lower rate than 1.5 gpm if turbidity was greater than 5 NTU in an attempt to lower the turbidity. In some instances, the wells were purged more than three casing volumes in an attempt to reduce turbidity. On some occasions, the wells would not produce a sample of less than 5 NTU despite these efforts. Samples collected for analysis of volatile organic compounds (VOCs) were collected according to LANL-ER-SOP-06.03. A stainless steel bailer or Teflon tubing was used to collect VOC samples from alluvial groundwater wells. QA duplicate samples were collected at a frequency of one duplicate for every 20 samples collected in accordance with LANL-ER-SOP-01.05.

Measurements of field parameters for groundwater samples were taken to provide data potentially useful for evaluating contaminant variability. Field parameters were measured at least twice for every purged casing volume to evaluate the efficacy of purging. Specific conductance, pH, and temperature were measured using an YSI 63 multiparameter probe and meter. Once the parameters stabilized, the field parameters values associated with the samples collected were recorded. The YSI 63 was calibrated each day prior to sampling using NIST traceable standards. Turbidity was measured using a Hach 2100p portable turbidimeter. The Hach turbidimeter was calibrated every three months using NIST traceable standards. The field parameters were recorded on a water-quality stabilization record form for each groundwater sample. Water-level measurements were also made when the wells were sampled prior to purging the well using an electronic Solinst® Model 101 water-level meter. Water-level measurements were taken from the top of the casing at a permanent marked location on the casing. The water-level measurements associated with sampling are discussed further in Section B-2.2. The field parameters and water levels are presented by canyon and location in Tables B-2.1-4 and B-2.1-5. Table B-2.1-6 summarizes the range of field-parameter values recorded at sampled wells.

B-2.2 Water-Level Measurements

Since 1996, manual water-level measurements have been taken at alluvial groundwater wells in Los Alamos and Pueblo Canyons. Measurements were made with a Solinst Model 101 or similar model water-level meter. The instrument's graduated tape provided a measurement accuracy of 0.01 ft. Tape readings were made at the top of the well casing adjacent to a mark or notch made on one side of the casing to ensure consistent measurements. Readings of the water-level depths below the top of the casing were recorded in a field notebook along with the date and time of measurement. Plots of water level versus measurement date are shown in Figures B-2.2-1(a-j). The distribution of manual groundwater levels measurements is calculated from the period of record for each well and is shown as 25th and 75th quartiles on the water-level plots, which also include groundwater levels for each sampling event at a well. Plotting the groundwater level associated with sampling events on the long-term water-level record shows how contaminant concentrations relate to variations in groundwater levels. The quartiles provide a frame of reference to examine whether the sampling is representative of the range of groundwater levels at a well.

Automated, high-frequency water-level data were collected with multiparameter MPTROLL-8000 probes (0–15 pounds per square inch [psi] operating range) with integrated dataloggers manufactured by In-Situ® Corporation. These probes were installed in each of these wells in August 2000 and have operated continuously since to monitor water levels and the following field parameters: temperature, electrical conductance, pH, and dissolved oxygen (DO). Measurements were recorded at 30-min intervals through mid-2002, after which measurements were taken once every hour. The pressure transducers were factory

calibrated, and calibrations were verified annually in accordance with LANL-ER SOP-7.01, Pressure Transducers, to check for drift and measurement accuracy. These tests verified that pressure readings were accurate within the manufacturer's specifications ($\pm 0.05\%$ of full scale over operating temperature range of 0° to 50° C; equivalent to ± 0.02 ft). Pressure readings were made from the top of casing and were calibrated to a manual water-level measurement taken at the time that the execution program for each probe was initiated.

Plots of groundwater level versus each of the field parameters are shown in Figure B-2.2-2(a–h). Several problems were encountered during the deployment of the multiparameter probes. The DO sensor calibrations were particularly problematic and occasionally resulted in negative DO readings immediately after the sensors were deployed. In these cases, the data illustrate relative variations in DO, but absolute values are erroneous. Sensor readings sometimes showed a tendency to drift between calibrations, resulting in apparent shifts in parameter values when the recalibrated probes were installed. The pH sensors also required continuous submersion to maintain calibration, and some wells periodically dried up, resulting in erratic readings after re-saturation occurred. Therefore, the values should not be considered absolute. However, the data and plots are still useful for assessing overall patterns and trends. The plots of water level versus time are shown in Figure B-2.2-3(a–g). The distribution of groundwater level measurements is calculated from the period of record for each well and is shown as 25th and 75th quartiles on the water level plots. They also include groundwater levels for each sampling event at a well. Plotting the groundwater level associated with sampling events on the long-term water level record allows an assessment of how variations in contaminant concentrations might relate to variations in groundwater levels. The quartiles provide a frame of reference to examine whether the sampling is representative of the range of groundwater levels at a well.

Pressure transducers were also used to collect high frequency water-level data in several piezometers and piezometer nests using model SSP-100 miniTROLL probes (0–15 psi operating range) with integrated dataloggers manufactured by In-Situ Corporation. These probes were installed in each of these piezometers in 2001 and have operated more or less continuously since (some probes were for a few months). Pressure and temperature readings were collected at 30-min intervals. Calibration and operation procedures employed for these probes were identical to those described above for the MPTROLL-8000 probes, the only difference being that the miniTROLL instrument's accuracy is $\pm 0.2\%$ of full scale (equivalent to ± 0.03 ft). Each time the probe data were downloaded, a manual water-level measurement was taken to verify the accuracy of the measurement recorded by the pressure transducer. An analysis of the water-level data quality is presented in Appendix F.

B-2.3 Multiparameter Probe Data

The discussion below is a review of field-parameters data collected from dedicated down-hole multiparameter probes installed in a series of wells following the Cerro Grande fire. The measured parameters, including pH, specific conductance (SC), temperature, and DO, are shown in Figure B-2.2-2(a–h). Wells monitored in Los Alamos Canyon include LAO-B, LAO-0.3, LAO-0.91, and LAO-1.6(g). Wells monitored in Pueblo Canyon include PAO-1, PAO-3, PAO-4, and PAO-5n. The method for collecting these data is presented in Section B-2.2. Comparison of the relation of these parameters to water level at a series of wells and over time provides a means of evaluating the effect of the Cerro Grande fire in alluvial groundwater and provides insight into the nature and duration of potential consequences of a large fire. A detailed discussion of the potential effects on contamination is presented in Section 7 of this report.

B-2.3.1 Water Level and pH

The conceptual model for variations in pH in alluvial groundwater is related to very high concentrations (up to 90,000 mg/kg) of calcium carbonate present in ash following the Cerro Grande fire. Interactions of surface water with ash were expected to yield increases in pH. Subsequent infiltration of surface water to the alluvial system may cause perturbations in the pH of the alluvial groundwater. The variations in pH could cause increased mobility of some contaminants.

Upper Los Alamos Canyon

At LAO-B, periods of low pH tend to correlate with winter months where surface water flow is dilute with respect to ash content. The number and magnitude of high pH spikes generally diminished with time after the fire consistent with a return to lower alkalinity as the amount of ash in the system decreased. Further downcanyon at LAO-0.3, there is no apparent correlation between water-level response and pH. Spikes in pH occur in all seasons and seem to be related to both summer flood recharge and underflow recharge. The highest pH spikes tend to be related to summer runoff events. The number and magnitude of high pH spikes generally diminished with time after the fire, which is consistent with a return to lower alkalinity as the amount of ash in the system decreased. Spikes of high pH at LAO-0.91 are generally associated with increases in water level but not in all cases. The variability may relate to whether surface water flow and associated recharge contained significant ash content or had long residence time in contact with ash. The pH values also decrease over time indicating progressively less ash in the system. At LAO-1.6(g), spikes in pH correlate well with water-level spikes related to the onset of spring underflow recharge and to summer and fall floods. In each case, the return to lower pH values is relatively rapid regardless of how long the increased water-level condition persists. For example, the spring 2001 underflow recharge produced an elevated water level that persisted for approximately two months, but the initial pH spike lasted only about one week, which is comparable to the duration of the spikes associated with flood recharge.

Pueblo Canyon

At PAO-1, short-term increases in pH appear to be associated with summer and fall flood events that are known to have transported significant quantities of ash. However, the spring 2001 snowmelt recharge correlates with a lowering of pH, indicating that the runoff was relatively dilute with respect to ash content. At PAO-3, a good correlation occurs between spikes in pH and the abrupt increases in water level, probably resulting from either infiltration of ash-rich flood water or from mobilization of interstitial ash within alluvium during increases in water level associated with winter and spring snowmelt runoff. The data also show an overall decrease in the magnitude of pH spikes and a general decline in pH over time. The relation of pH to water level is difficult to discern at PAO-4 because of variations in water quality from the Bayo WWTP. Good correlations exist for some flood events early in the record, but the correlations diminish. However, an overall decrease in the frequency and magnitude of pH spikes occurs over time, suggesting a progressive decline in ash in the system. The pH data from PAO-5n do not show a good correlation with water level variations. Here, as at PAO-4, potential influences of the Bayo WWTP cause difficulty in interpretation.

B-2.3.2 Water Level and SC

SC is typically used as a surrogate for total dissolved solids (TDS). The conceptual model for variations in SC is that higher SC values are associated with dissolved solids derived from the interaction of surface water and alluvial groundwater with soluble constituents in Cerro Grande ash.

Los Alamos Canyon

At LAO-B, higher SC seems to be inversely related to water level. Low water levels in the late fall and early winter correlate with higher SC, whereas higher water levels in the spring correlate with lower SC values. Seasonal effects on SC variation are strong as peak SC levels were consistently recorded in mid-November during 2000, 2001, and 2002, after which sharp declines in SC coincided with rising saturation levels in the alluvium. It is possible that the relatively high concentration of TDS in groundwater was diluted by alluvial groundwater recharge with low TDS concentrations during late winter to early spring. The consistent timing of the annual SC declines suggests that recharge in the upper canyon is dominated by upgradient underflow derived from late summer/fall monsoon rainfall over the upper basin of the watershed rather than from direct infiltration of streamflow runoff. Overall, the trend appears to show higher SC with time, which seems counter to the expected post-fire trend. That trend may, however, be related to reduced runoff volumes during the spring and summer seasons in 2002 and 2003 that would have further diluted the existing TDS concentrations, as was seen in 2001.

The 2000–2001 data from LAO-0.3 are generally inconclusive with respect to the relation between water level and SC and the strong seasonal effects seen at LAO-B are absent at this location. Sensor operation problems may account for the discrepancy between the early 2001 data and that collected after April 2001. Fairly consistent SC values recorded afterward during a lengthy hydrograph recession persisted until the spring of 2002 when a strong correlation between rising water levels and SC is apparent. Similar responses again occurred in the fall of 2002 and spring of 2003. One possible explanation is that recharge of surface water with high TDS concentrations may be a factor in the vicinity of LAO-0.3. The SC record is incomplete at LAO-0.91 because the alluvium dried out periodically at this location and sensor problems developed in the final months of record. However, the available data indicate a similar relation as was seen at LAO-0.3, with increasing SC values generally associated with rising water levels. The increase in SC associated with the spring 2001 underflow recharge is longer lived than the increases associated with water-level spikes related to summer and fall floods. The data from LAO-1.6(g) suggest a similar water level/SC relationship at this location, although its effect was highly suppressed until the large increase that accompanied the June 2002 recharge event.

Pueblo Canyon

At PAO-1, a slight correlation is observed between water-level increases and increases in SC, although in some cases a significant lag occurs in the SC response. This correlation is not consistent during the record. Some recharge events caused increases in SC and others did not, indicating variability in TDS levels of the recharge water, perhaps because of differing recharge sources (i.e., underflow versus surface water infiltration). Potential problems with proper SC sensor functioning are suggested by apparent plateaus in the SC values for the spring of 2001 and the summer through fall of 2001. However, the elevated SC levels recorded in the fall of 2001 in PAO-1 correspond to similar increases seen downgradient at the PAO-4 and PAO-5n sites, lending credence to the PAO-1 record. In Pueblo Canyon, a possible explanation for increases in SC in during the winter and spring is runoff containing salts applied to roads in the townsite during the winter.

Although the SC curve at PAO-3 is incomplete because the alluvium at this site frequently dries out, it is still possible to discern a good correlation between several rises in water level and increases in SC during 2001. This effect is presumably related to recharge from flood water and winter and spring runoff. However, a recharge event in October 2000 was accompanied by a marked decrease in SC, suggesting that prior to spring 2001, recharge waters had a lower TDS than the aquifer, but afterwards, the recharge waters are associated with elevated TDS relative to the aquifer. The lack of persistent saturation after spring 2002 and associated sensor calibration maintenance problems impacted the quality of the subsequent data collected at this site.

At PAO-4, many frequent and significant fluctuations in SC levels cannot be directly tied to known flood events in Pueblo Canyon. However, a positive correlation between several short-lived recharge events and sharp increases in SC is apparent in the record through spring 2002. Afterwards, fluctuations in SC levels were significantly lower in magnitude and lesser in frequency, suggesting a progressive decline in ash in the system. Much of the variability in SC levels at this site is probably related to variations in the quality water discharged from the Bayo WWTP. In general, the higher SC values at PAO-5n occur in the summer and fall, whereas low SC values tend to occur in the winter and spring. This pattern may be related to generally lower, less dilute water levels that tend to occur in the summer in the portion of Pueblo Canyon below the Bayo WWTP. The lower water levels result from diversion of water from the WWTP for the municipal golf course.

B-2.3.3 Water Level and Temperature

Variations in temperature are not specifically related to a possible Cerro Grande effect but, rather, they provide insights into the nature and timing of surface water recharge to the alluvial system.

Los Alamos Canyon

At LAO-B, minimum groundwater temperatures occur in February through April, and maximum temperatures occur in October and November. The temperature pattern is inversely correlated with water level. A possible explanation is that recharge in this portion of the canyon is from underflow originating as surface water higher in the watershed. It also suggests a lag in the arrival of recharge water in this portion of the canyon and that underflow recharge is a larger component than stream recharge. The temperature patterns at LAO-0.3 are similar to those at LAO-B, with the exception that maximum temperatures occur earlier, in August and September. Temperatures are also generally inversely correlated to water level at LAO-0.3. Temperature fluctuations at LAO-0.91 are also similar to those in the upcanyon wells, except that longer periods of maximum temperatures occur at this location, lasting from September through November in 2002 and from August through November in 2003. Lengthier periods of minimum temperatures were also recorded, beginning in February and extending through May in both 2002 and 2003. Temperatures are also generally inversely correlated to water level in this well. Temperature fluctuations are significantly damped out at LAO-1.6(g) relative to those in the upper canyon monitoring wells. Also, maximum water temperatures at LAO-1.6(g) tend to occur in January and February, and minimum water temperatures generally occur in May through June. The timing of the temperature variations at LAO-1.6(g) is out of phase with seasonal air temperatures, indicating that underflow from upcanyon is the most significant source of recharge at this location. Temperature variations at LAO-1.6(g) show a weak inverse relation to water level.

Pueblo Canyon

At PAO-1, maximum groundwater temperatures occur in late August through September and minimum temperatures occur from December through March. The timing of temperature fluctuations in upper Pueblo Canyon tends to show a stronger seasonal signature than in upper Los Alamos Canyon, indicating that less alluvial groundwater storage in Pueblo Canyon. At PAO-3, maximum groundwater temperatures occur from August through September, and minimum temperatures occur from January through April. As with PAO-1, there is good correlation between alluvial groundwater temperatures and seasonal air temperatures; in fact, the seasonal relation seems more important than the relation to water level. Maximum groundwater temperatures at PAO-4 occur from August through September, and minimum temperatures occur from February through March. It is difficult to discern whether a relation between water-level variations and temperature exists because PAO-4 is maintained at full or nearly full

saturation because of effluent from the Bayo WWTP. The seasonal variation of the groundwater temperature data from this well is probably related to the temperature of the water processed at the WWTP. At PAO-5n, the maximum groundwater temperatures occur from September through October, and the minimum temperatures occur from January through March. The slight shift in the maximum and minimum values at PAO-5n relative to wells further up Pueblo Canyon suggests a slight lag in the arrival of recharge water in this portion of Pueblo Canyon.

B-2.3.4 Water Level and DO

The conceptual model for DO predicts that surface water with high ash content will have lower DO content. Infiltration of surface water with low DO content may also affect contaminant mobility.

Los Alamos Canyon

At all four wells in Los Alamos Canyon, the DO record is somewhat incomplete and spans only from August 25, 2000, through July 13, 2001. At LAO-B, the relative stability in groundwater level during the period of DO measurements does not allow for an accurate assessment of the relation between alluvial water levels and DO. A few pronounced DO spikes occur in the LAO-B data and may be related to precipitation events. At LAO-0.3, several DO spikes correspond to increasing water levels, while others do not. Similar observations were made at LAO-0.91 and LAO-1.6(g). Thus, the data suggest a more complex mechanism for DO variation in the alluvium than a simple correlation to water-level fluctuations, although the infiltration of recharge water is clearly related to significant DO increases in some cases.

Pueblo Canyon

For the wells in Pueblo Canyon, the DO record is somewhat incomplete and spans from August 22, 2000, through July 11, 2001. The DO record in the wells located above the Bayo WWTP shows several distinct spikes, and, in some cases such as at PAO-3, the spikes relate to abrupt increases in water level related to flood events and to snowmelt recharge. However, a consistent relationship between water levels and DO concentrations is not apparent in these data. Variations in DO below the Bayo WWTP are probably affected by the WWTP discharges. The DO data in Pueblo Canyon, like the data from Los Alamos Canyon, suggest a more complex mechanism for DO variation in the alluvium than a simple correlation to water-level fluctuations, although the infiltration of recharge water is clearly related to significant DO increases in some cases.

B-2.4 DP Canyon Tracer Study

A bromide tracer study was conducted in DP Canyon to fulfill a requirement in the sampling plan for DP Canyon (LANL 1998, 59373). The following goals were used to design, implement, and evaluate the tracer study:

- develop and confirm a conceptual model for hydrologic connectivity between the alluvial groundwater in reach DP-2 and DP Spring,
- determine travel time and residence time for groundwater within reach DP-2 and between reach DP-2 and DP Spring, and
- evaluate the potential movement of water into bedrock and fractures along the surface water and alluvial groundwater flow paths.

The location of the tracer study includes reaches DP-2, DP-3, and DP-4 and is situated directly north of TA-21 and just south of the Los Alamos County airport (Figure B-2.4-1). Strontium-90 is identified as the most important COPC in the surface water and alluvial groundwater in DP Canyon and is discussed in detail in Section 7.2. The following sections describe the investigation methods, results, and conceptual model for solute transport.

B-2.4.1 Drilling Activities

A drilling program was implemented in September 2002 to install a network of monitoring points for the bromide tracer. As part of the program, additional boreholes were drilled to assess the stratigraphy of the alluvial aquifer and to delineate the extent of saturation. Well construction diagrams and borehole logs detailing the stratigraphy are presented in a report on alluvial well and piezometer completion in the reach DP-2 (LANL 2004, 85537).

Alluvial Stratigraphy

Borehole logs and field observations indicate a coarse-grained, well-sorted sand horizon is present at depth within the alluvium and generally occurs along the trend of the present-day channel. This body of coarse sand is thickest in the middle of the valley floor and thins progressively laterally onto the bedrock and colluvial slope. The coarse sand overlies weathered bedrock and is itself overlain by finer-grained sands and silts with local coarse lenses. The coarse sand represents a highly transmissive conduit that focuses groundwater and tracer movement in the alluvial aquifer. The stratigraphy was an important factor in the design of the monitoring network described below.

Extent of Saturation

Twenty-eight boreholes were advanced in the canyon bottom during the drilling program to determine the lateral extent of the alluvial aquifer (Figure B-2.4-2). Nine wells were installed along the margins of the valley floor to monitor groundwater levels and the tracer along the edge of the alluvial aquifer. Several boreholes were advanced in transects to identify the lateral extent of saturation, and a monitoring well was installed where sufficient groundwater was found. Data from these wells were used to characterize water table fluctuations and to monitor tracer movement along the margins of the aquifer.

Monitoring Network

The monitoring network, shown in Figure B-2.4-2, is made up of nested 1-in. monitoring wells, 2-in. monitoring wells, piezometer nests, and surface water locations. The network was designed to characterize the different subsurface conditions present in reach DP-2.

Eight multilevel transects consisting of three 1-in. well bundles with staggered screens and six fully screened wells were installed to monitor tracer migration (Figure B-2.4-3a). Several of these wells were instrumented with dedicated TempHion[®] bromide-specific electrodes.

Piezometer nests were installed to monitor vertical hydraulic gradients in the alluvial aquifer. Each nest consists of three 2-in. piezometers with screen intervals at discrete zones within the saturated portion of the alluvium (Figure B-2.4-3b). The piezometers were installed in different boreholes to eliminate hydraulic communication between screened intervals. Water levels were measured regularly (every two to four weeks) and evaluated for potential vertical hydraulic gradients.

Two ISCO® sampler pairs in reach DP-2 and a single ISCO® sampler in DP-3 were deployed to monitor the tracer in surface water in the event of groundwater/surface water exchange. An additional ISCO® sampler was placed at DP Spring to monitor the breakthrough of the bromide and to account for the bromide mass moving through the system.

B-2.4.2 Tracer Injection

The tracer solution consisted of 47 kg of potassium bromide (KBr) and 100 gal. of groundwater from DP Canyon mixed in two 50-gal. drums and circulated for 24 hr to ensure homogeneity. Calculated concentrations were 83.34 g/L bromide and 40.77 g/L potassium, well below the solubility limit of potassium bromide salts. The tracer was injected into the aquifer at approximately 3 L/min in well DPW-1S, located in the upper end of the reach on February 24, 2003 (Figure B-2.4-2). Piezometer nest DPPN-1.1-1 and bromide monitor well DPBN-1A1 were instrumented with transducers to monitor change in pressure head throughout the injection. The maximum response of the water table was a 3-cm (1 in.) rise observed at location DPPN-1.1-1, approximately 6 m (20 ft) away from the injection well. TempHion probes located at bromide monitoring well transect-2 showed an immediate response during injection as displaced groundwater moved through the aquifer. Water samples were collected several times a day in the upper part of the reach during the initial phase of the test and collected less frequently, but over a much larger area, during later phases of the study.

Alluvial groundwater samples were collected with a peristaltic pump equipped with Tygon® tubing. The intake for the pump was typically set near the center of the screened interval. Screening samples collected for bromide analysis were not filtered and were stored at room temperature until they were analyzed with an ion selective electrode.

B-2.4.3 Analytical Methods

Bromide concentrations were measured using ion selective electrodes (ISE) and ion chromatography (IC) techniques. Groundwater samples were analyzed in the laboratory with an Orion® model 9635-ioplus™ series bromide ISE. Measurements were performed according to Laboratory bromide screening guidelines (LANL 2003, 77439). In addition, select samples were submitted to the EES-6 analytical laboratory for low-level bromide analysis. These samples were analyzed according to, EPA Method SW-846 for chemical analysis of water and wastes, using an ion chromatography method to analyze anions. Dedicated ISE TempHion® probes, coupled with Campbell Scientific data loggers, were deployed at select wells to measure in situ bromide concentrations in groundwater. TempHion® temperature and the ISE signals were recorded every 30 min. and downloaded for processing. Bromide standards for conversion of ISE signals were prepared using DP Canyon groundwater and KBr salt from Fisher Scientific. Site groundwater was used to account for potential interference from elevated levels of chloride derived from Los Alamos townsite runoff. The detection limits for the Orion® probe were approximately 1 mg/L; the limit of detection for the TempHion® probe was approximately 10 mg/L; the IC detection limits ranged from 5 to 10 parts per billion.

B-2.4.4 Conceptual Model for Solute Transport

Transport in Alluvial Groundwater

Groundwater showed a range of different responses as the tracer moved through the alluvial aquifer. Bromide concentrations plotted through time define curves unique to each monitoring location. These shapes or configurations depend upon travel velocities, plume location with respect to injection location, time after injection (t_0), and proximity to the influence of surface water flow in the channel. Bromide curves

from individual screens at nested wells proximal to the channel are shown in Figure B-2.4-4. Bromide concentrations are generally higher in the lower screen perhaps because of (1) the greater density of the tracer compared to the surrounding groundwater especially close to the injection well where the tracer initially pooled on the bottom of the aquifer, or (2) the presence of basal coarse-sand facies that act as preferential flow paths within the alluvial sequence. Generally, bromide concentrations measured from individual screens have greater separation closer to the injection well and become more coincident as the bromide tracer migrated to the lower portion of reach DP-2. The merging of curves reflects mixing and dilution through hydrodynamic dispersion as the tracer is transported down gradient.

Tracer dilution occurred as the bromide plume was transported through the alluvial aquifer. Bromide concentration scales on the vertical axis range from 10,000 mg/L close to the injection well to 100 mg/L bromide distant from the injection well in the lower part of reach DP-2 of Figure B-2.4-4. In addition, locations proximal to the injection well (Figure B-2.4-4, graphs a and b) show very steep ascending limbs and asymmetrical profiles, and locations distant from the injection well show a more symmetrical profile and gentler ascending limb (Figure B-2.4-4, graphs g and h). The symmetry increases as the concentration gradients are reduced and the centroid of the tracer is elongated during transport. Hydrodynamic dispersion diluted and mixed the tracer with ambient groundwater and expanded the volume of the plume as it was transported downgradient from the injection well.

Visualization techniques of the bromide concentrations from both automated and manual sampling illustrate the expansion of the plume through hydrodynamic dispersion (Figure B-2.4-5). Initially the tracer was restricted to the region around the injection well. As the tracer was transported downgradient, the centroid of the bromide mass expanded and the bromide concentrations decreased. Although bromide was detected in low concentrations laterally away from the channel, the tracer mass was generally confined to the center of the valley floor in upper DP-2. The mass spread laterally in lower DP-2, diverging to the south and ultimately discharged to the bedrock channel where alluvium pinches out at the east end of the reach.

Transport in Surface Water

Surface water is an important mechanism for bromide transport. Figure B-2.4-6 shows bromide results for surface water sample locations in upper DP-2, lower DP-2, DP-3, and DP Spring. Average bromide background concentrations ranged from 0.034 mg/L in DP-2 (n=9 location) to 0.018 mg/L at DP Spring (n = 5 samples). Bromide was detected above groundwater background values in the majority of the surface water samples and was observed at concentrations up to 117 mg/L in upper DP-2 shortly after tracer injection on February 24, 2003. Groundwater discharge to the channel in the bottom of reach DP-2 maintained bromide concentrations ranging from 0.6 to 12.6 mg/L throughout the tracer study. Results from the early summer, when evapotranspiration was high and channel flow minimal, may not be completely representative because of the potential concentrating effects of evaporation. Samples from DP-3 showed the effects of evapotranspiration, where the sample intake port was in a scour hole in the bedrock. Relatively little alluvium is present in DP-3, and the water is derived from a combination of groundwater and surface flow from upcanyon reaches.

The travel time for bromide from the point of injection to DP Spring was approximately 24 to 27 days (Figure B-2.4-6). Bromide, measured at three times above background (0.09 mg/L), arrived at DP Spring 24 days after injection; bromide at seven times above background (0.23 mg/L) was measured 27 days after injection. Preliminary transport velocities, calculated using a distance of 1220 m (4000 ft) from the tracer injection well to DP Spring and 24-day arrival time, are approximately 50.8 m (167 ft) a day. Considering the 27-day arrival time, the transport rate is 45.2 m (148 ft) per day, which accounts for both surface and groundwater flow transport processes and is most likely highly variable. Therefore, water

discharged at DP Spring may be derived from surface water and from shallow, discontinuous aquifers that temporarily store infiltrated surface water.

Surface Water/Groundwater Interaction

Observations indicate that runoff events from the Los Alamos townsite, resulting from both rainfall and snowmelt, provide recharge into the alluvial aquifers in DP Canyon. The response of the water table is immediate with measured heads greater near the channel and diminishing away from it. Water table elevations rise above the channel for a short period of time during runoff events and are maintained throughout the rising limb up to peak discharge. During the receding limb of the hydrograph, the water table gradients are reversed, allowing groundwater and solute to flow back into the channel. As a result, surface water/groundwater interactions episodically flush the aquifer adjacent to the channel and result in discharge of groundwater solutes into surface water. The recharge events also cause enhanced transport of solutes in groundwater.

Bromide and temperature signals from the automated TempHion[®] probes were used to identify where the surface water/groundwater exchange occurred. Automated probe data from the middle screens are shown in Figure B-2.4-7, along with surface water discharge, precipitation, and seepage velocity in the second and third nested bromide well transects from May 24 through May 27, 2003, or Julian days 144 through 147 (the Julian day starts on the first day of the calendar year, January 1). Precipitation was measured approximately one mile to the southeast at the TA-53 gage and generally coincides with channel flow, showing a parallel response. Surface water flow was recorded at gaging station E039 at the east end of reach DP-2. The mean seepage velocity was calculated from the head differential between the upper and middle screens at nested piezometer DPPN-4.5N. The negative seepage velocity indicates upward flow as surface water infiltrates the aquifer. Bromide concentrations shift, in some cases dramatically, in response to infiltration of water from the channel at locations where direct communication occurs between the alluvial aquifer and the channel. The response of bromide to a flow event in the channel is almost immediate, exhibiting a rise or decrease in concentration as the tracer plume is displaced by infiltrating surface water. Some locations are responsive (Figure B-2.4-7, graphs b, d, and f), while others exhibit only a minimal response (Figure B-2.4-7, graphs a, c, and e). The data show that pulsed exchange between channel runoff and alluvial groundwater mobilizes solutes in the alluvial aquifer, and this mechanism provides a fast path from DP-2 to DP Spring.

Figure B-2.4-8 depicts a conceptual model of surface water/groundwater exchange in the alluvial aquifer adjacent to the channel in reach DP-2. Groundwater/surface water exchange appears to facilitate tracer migration in the aquifer close to the channel (hyporheic zone), with diminishing effects in the aquifer away from the channel. Chloride concentrations measured in groundwater as part of this study confirm this model. Chloride concentrations also decrease laterally away from the channel, indicating greater surface water/groundwater interaction adjacent to and less interaction away from the channel. Chloride from road salting is present at high concentrations in groundwater and, although more diffuse, provides an additional tracer for evaluating surface water/groundwater exchange. This "short-circuiting" effect is responsible for fast path solute transport to DP Spring.

Transducer data measured at the nested piezometers indicate that vertical hydraulic gradients are generally minimal, with upward gradients occurring during flood events and occasional, minor downward gradients occurring in response to groundwater discharge to the surface between flow events. Data from a direct current (DC) resistivity survey conducted in reach DP-2 indicate that groundwater recharge from alluvium to underlying bedrock does not occur (Figure B-2.4-9). Results of the geophysical survey and drilling information indicate that the top of the Bandelier Tuff contains copious clay weathering products and provides a barrier to downward migration of groundwater.

B-2.4.5 Summary of Tracer Study Results

Field and tracer results indicate that groundwater flow generally follows a coarse-sand horizon bound above and laterally by finer-grained sediments and below by weathered Bandelier Tuff. Groundwater flow is transient, primarily controlled by episodic recharge from townsite runoff that is routed down the channel. This study shows that the bromide tracer moved from reach DP-2 to DP Spring in less than 30 days. Surface water/groundwater exchange was identified as an important mechanism for transporting solutes from DP-2 to DP Spring and eventually to Los Alamos Canyon. Flushing of the alluvial aquifer and solute transport is dependent upon the position in the aquifer, is fastest at locations near the channel, and is affected by the magnitude and duration of runoff events.

B-3.0 BIOTA INVESTIGATIONS

This appendix contains supplemental information on biota investigations conducted to support the evaluation of potential adverse ecological impacts presented in Section 8.1.

Following the study plan in Katzman (2002, 73667), sediment characterization in support of the small mammal study involved collecting composite samples from each trapping grid or array to obtain representative concentrations of constituents within the foraging area. With the exception of the upper array in reach AC-3, each trapping array was divided into thirds, and a composite sample was obtained from each third. The upper array in AC-3 was shorter than the other arrays because of geographic restrictions and was divided in half instead of thirds. Each composite sample consisted of equal portions of sediment from a subset of the trapping locations within that area. All the sediment samples were collected from depths of 0–15 cm (0–6 in.). The specific trapping locations were selected randomly using a random number generator and included nine trapping locations per each one-third array, except for the upper array in Acid Canyon where nine locations were selected in each half array. For the typical array of 20 trapping locations, 9 out of the 20, or 45%, of the locations were sampled. At each location, field notes were taken on the geomorphic unit and sediment facies and on the percent of the sample, if any, that consisted of sediment deposited by post-fire floods. Tables B-3.0-1 through B-3.0-4 present information on the trap number, geomorphic unit, and sediment thickness for each portion of each composite sample for reaches AC-3, LA-1C, P-3W, and for the Guaje Canyon reference area, respectively. Table B-3.0-5 presents a summary of the characteristics of the sampled sediment in each composite sample.

Tables B-3.0-6 to B-3.0-10 present additional details of samples submitted for analysis associated with the biota investigation. Table B-3.0-6 presents specific information on the small mammals submitted for laboratory analyses, including sample ID, ear tag number, species, reach, and trapping array. Table B-3.0-7 lists each sediment sample submitted for laboratory analyses, including reach, location ID, sample type, depth, data collected, and analytical suite. Table B-3.0-8 presents a crosswalk between sample IDs for samples associated with earthworm mortality tests. This crosswalk is necessary because separate sample IDs were assigned for chemical analyses of sediment, chemical analyses of earthworms, and results of the mortality tests. Table B-3.0-9 lists samples of active channel (c1) sediment and surface water submitted for chemical analysis associated with the *Chironomus tentans* tests. Table B-3.0-10 presents a crosswalk between sample IDs for sediment, surface water, and *Chironomus tentans* growth and mortality toxicity bioassays.

B-4.0 POST-FIRE ASH AND SEDIMENT CHARACTERIZATION

Samples of ash and sediment were collected after the Cerro Grande fire to help evaluate the effects of the fire on the chemical composition of sediment deposits. Samples were collected from areas both

upcanyon and downcanyon from Laboratory SWMUs and AOCs, as well as from canyons not affected by Laboratory activities. The locations, analytic suites, and other information on the ash and fire-affected sediment samples collected by the Canyons investigation team are summarized in the following sections. Analytical data from these samples are presented in Appendix C, and used in other sections of this investigation report. Additional analyses from fire-affected sediment samples have been obtained from active channels by the Environmental Surveillance Program and presented in its annual reports (ESP 2001, 71301; ESP 2002, 73876; ESP 2004, 83635). Some of the composite sediment samples collected from small mammal trapping arrays also include components of fire-affected sediment deposits, as discussed in Section B-3.

B-4.1 Ash Sampling

Samples of ash were collected from 17 locations in the Cerro Grande burn area in the Chupaderos, Los Alamos, Pueblo, and Rendija watersheds in 2000 and 2001. Results of the samples from 2000 were used to help focus the analytical suites in 2001. The sample locations, dates of collection, analytical suites, and other information about these ash samples are presented in Table B-4.1-1.

B-4.2 Sediment Sampling

Samples of post-fire sediment were collected from locations within or downcanyon from the Cerro Grande burn area in 2000 and 2001, including samples from 39 "baseline" locations in parts of eight canyons that are not downcanyon from significant Laboratory SWMUs or AOCs (Garcia, Guaje, Los Alamos, Pajarito, Pueblo, Rendija, South Fork Pajarito, and Water Canyons). Included in this group are seven samples from Rendija Canyon downcanyon from some SWMUs or AOCs with no known releases of radionuclides and relatively minor concentrations of other contaminants (LANL 2001, 71060). The Rendija Canyon sample sites are also downcanyon from some developed areas in the northern part of the Los Alamos townsite. Roughly half (19) the baseline samples were collected from the Los Alamos Reservoir, including samples from all major sediment layers deposited in 2000 and 2001, which were exposed during excavation of accumulated sediment in fall 2001. The sampled sediment included a range of particle sizes and ash content, ranging from samples of "muck" (silty post-fire sediment dominated by reworked ash) to samples of coarse or very coarse sand. The sample locations, dates of collection, analytical suites, and other information about these baseline samples are presented in Table B-4.1-2.

In Los Alamos and Pueblo Canyons, post-fire samples were collected from 80 sediment layers downcanyon from SWMUs and AOCs (Tables B-4.1-3 and B-4.1-4). Half of these sediment layers (40) were in Pueblo Canyon, which is particularly susceptible to post-fire floods and which contained plutonium in sediment deposits along the channel that were partially eroded during these floods. Most of the Pueblo Canyon samples were collected from sediment deposited during the largest post-fire flood in this canyon (July 2, 2001) to determine how the concentrations of plutonium varied both within reaches and downcanyon among reaches in deposits from a single large flood. Samples were collected from six Pueblo Canyon reaches in 2001, extending from above Acid Canyon (reach P-1W) to near the confluence with Los Alamos Canyon (reach P-4E). Twenty eight sediment layers were sampled in lower Los Alamos Canyon on San Ildefonso Pueblo land near the residences at Totavi (reach LA-4FE) and immediately upcanyon from the Rio Grande (reach LA-5E). In both reaches, sampling included collecting deposits from floods in both 2000 and 2001, the latter including deposits from the July 2, 2001, flood. The remaining 12 sampled sediment layers were in upper Los Alamos Canyon behind the low-head weir near the White Rock Y (reach LA-3FE).

Particle-size and organic-matter data for fire-affected sediment samples are presented in Table B-4.1-5.

B-5.0 REFERENCES

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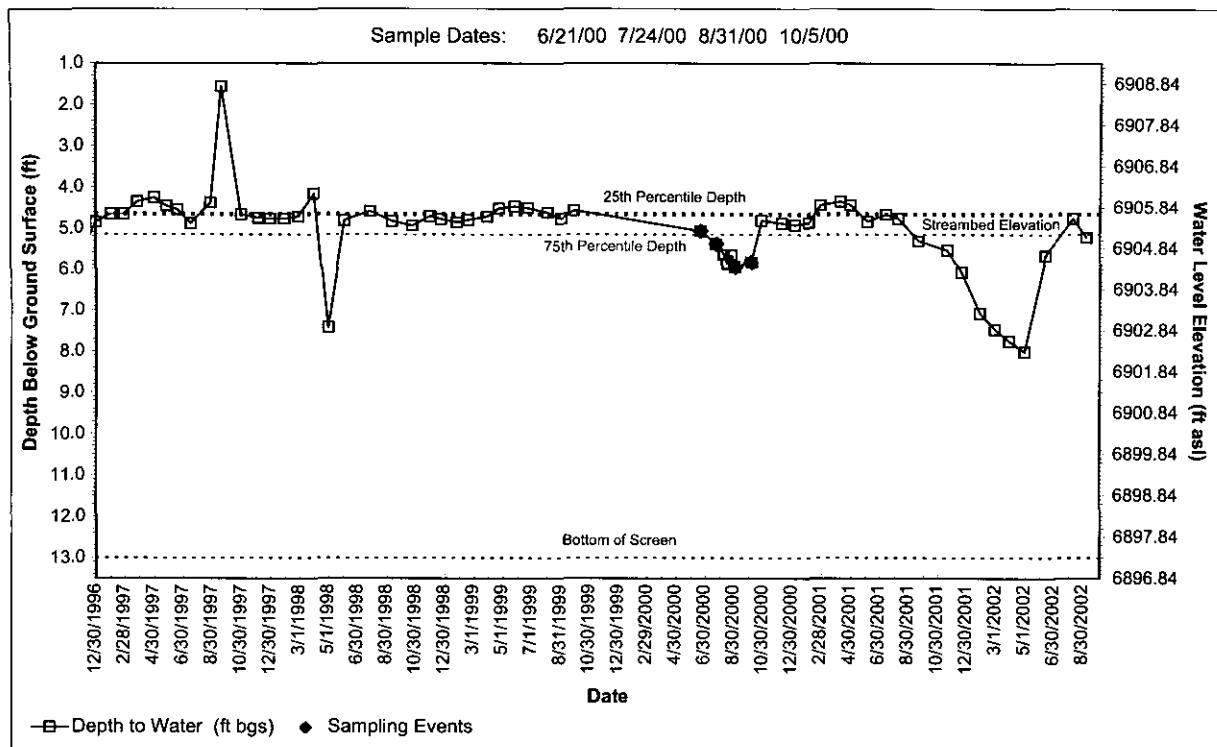


Figure B-2.2-1a. Manual water level vs. measurement date for well LAO-0.6

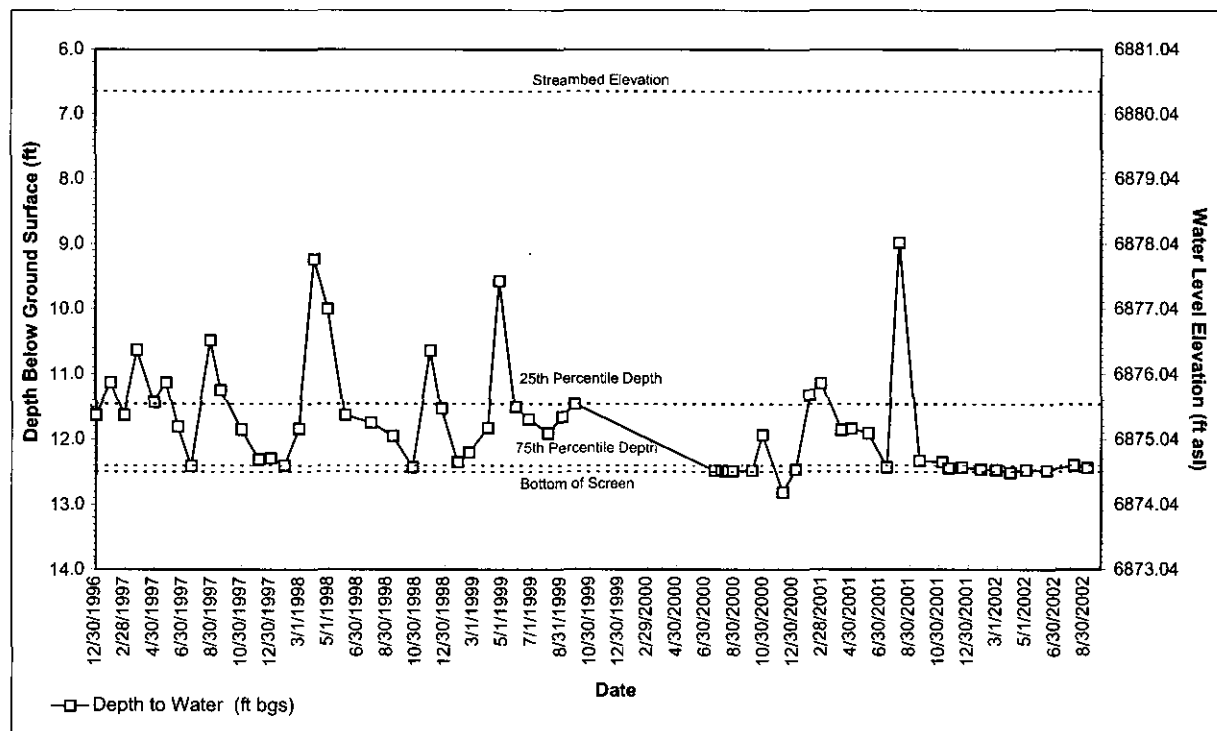


Figure B-2.2-1b. Manual water level vs. measurement date for well LAO-0.8

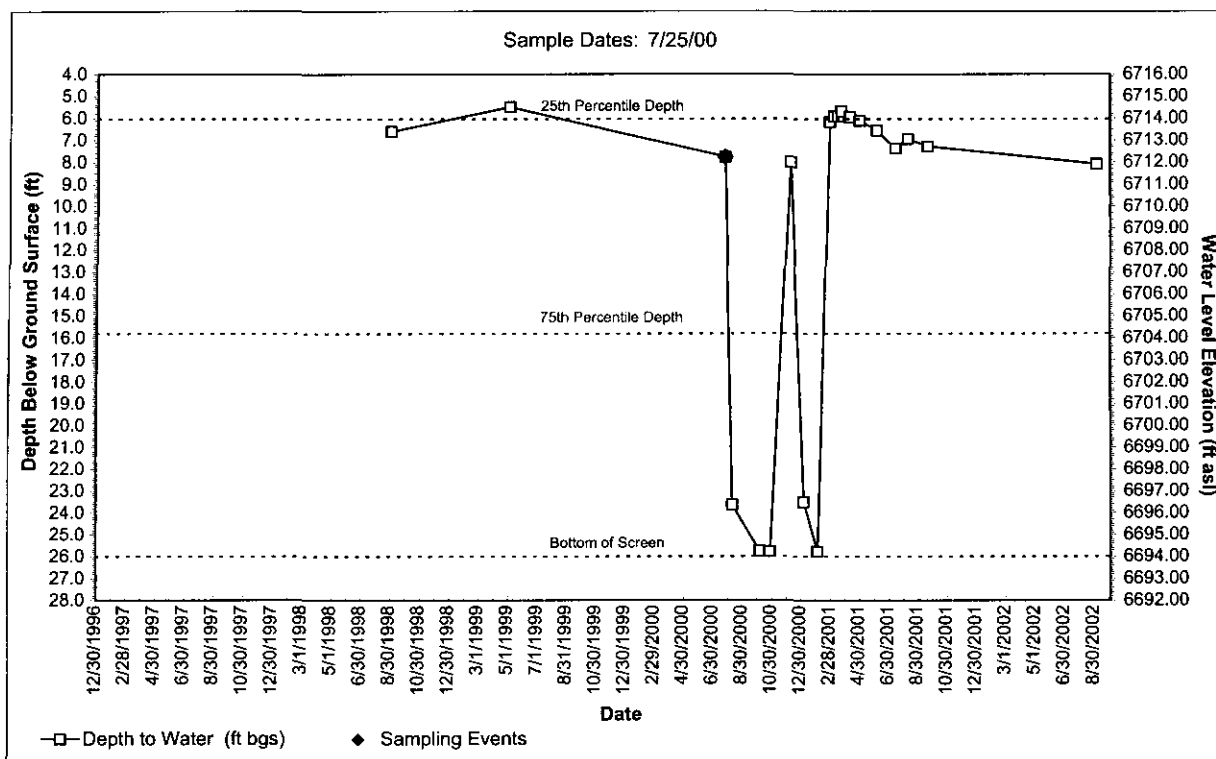


Figure B-2.2-1c. Manual water level vs. measurement date for well LAO-1.2

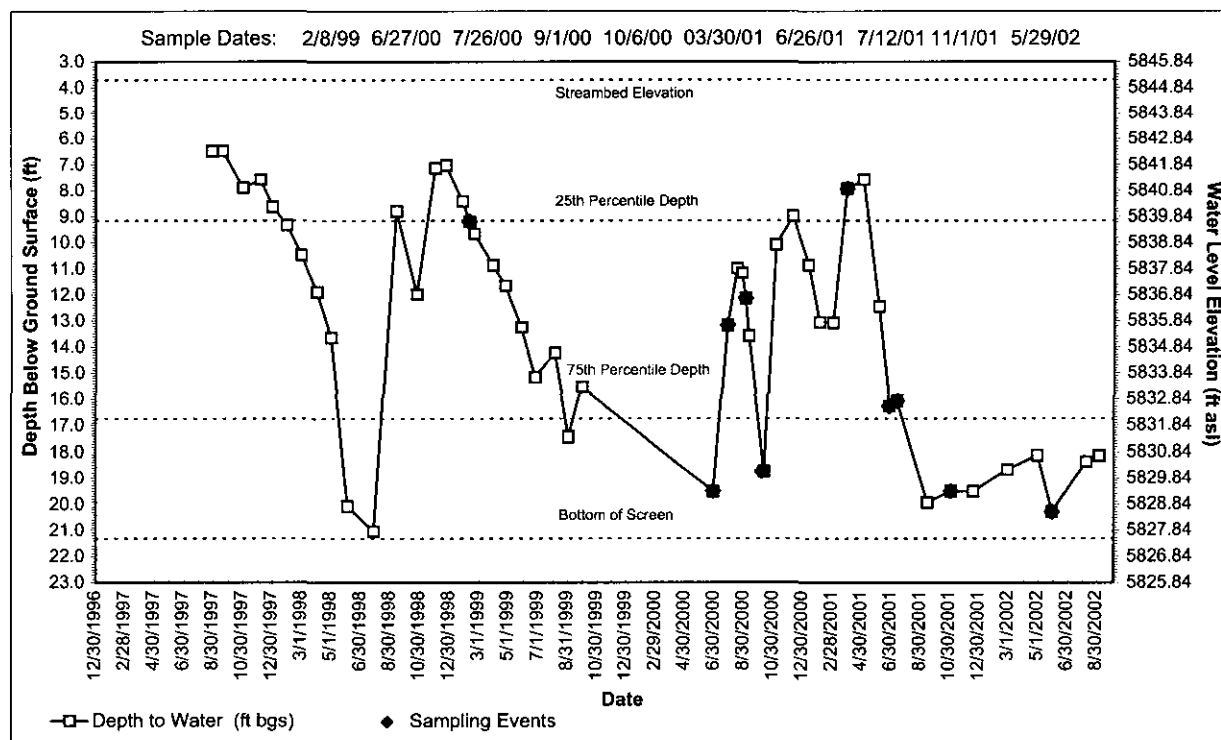


Figure B-2.2-1d. Manual water level vs. measurement date for well LLAO-1(b)

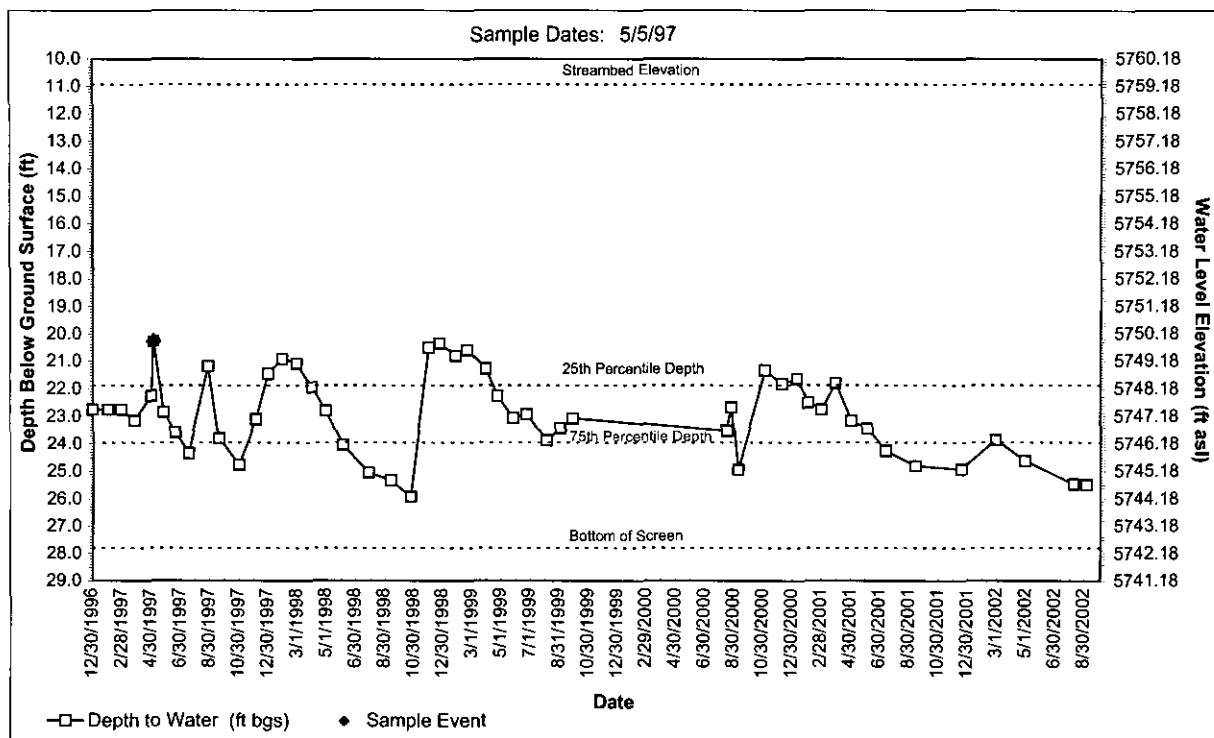


Figure B-2.2-1e. Manual water level vs. measurement date for well LLAO-2

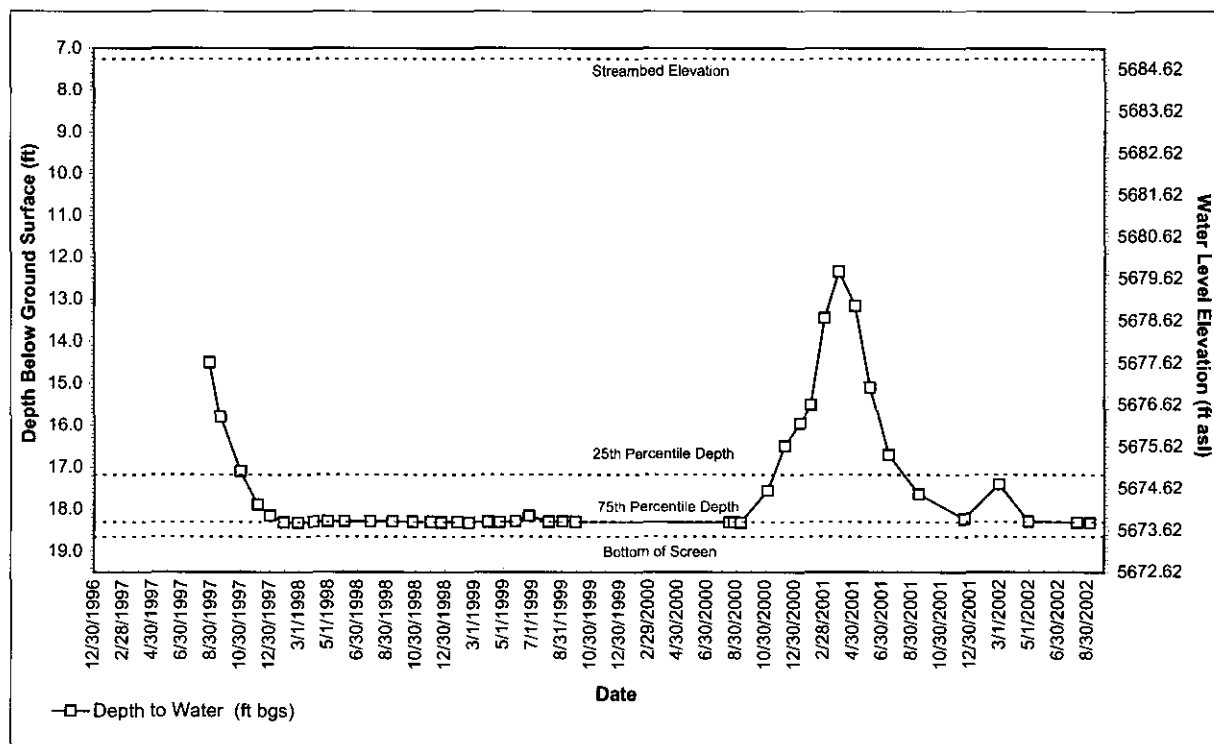


Figure B-2.2-1f. Manual water level vs. measurement date for well LLAO-3

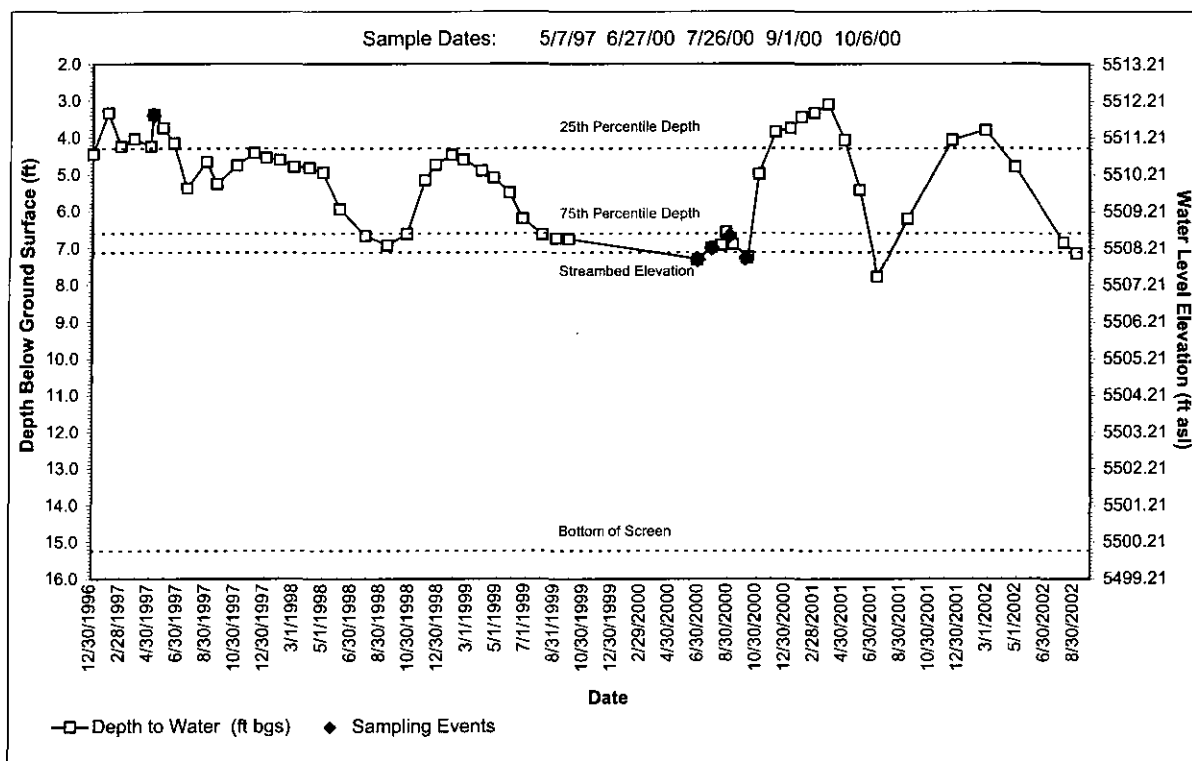


Figure B-2.2-1g. Manual water level vs. measurement date for well LLAO-4

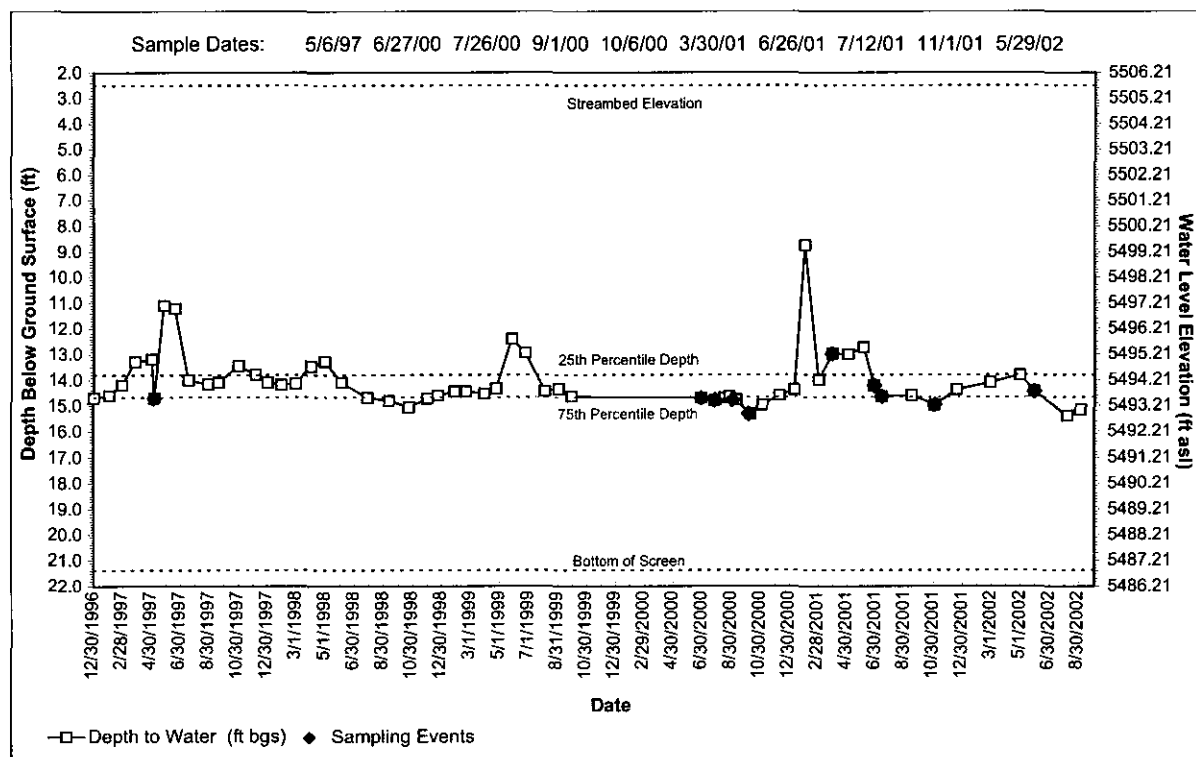


Figure B-2.2-1h. Manual water level vs. measurement date for well LLAO-5

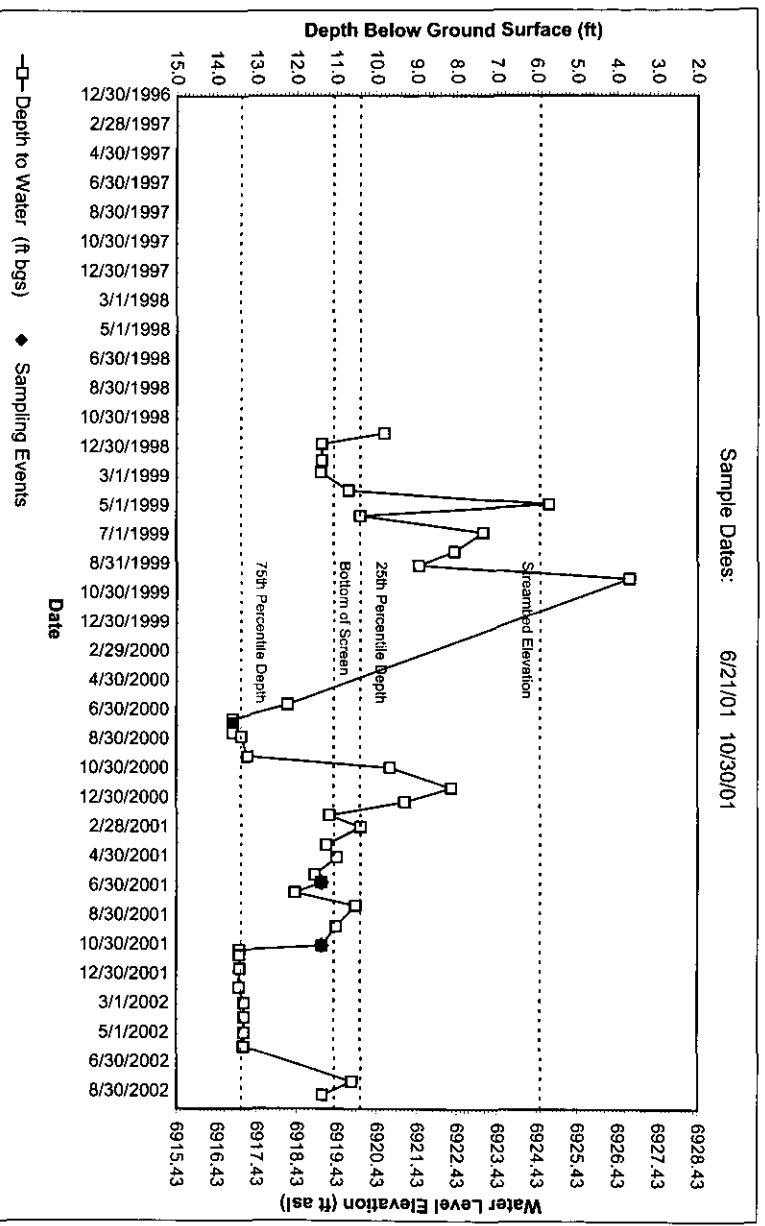


Figure B-2.2-1i. Manual water level vs. measurement date for well PAO-2

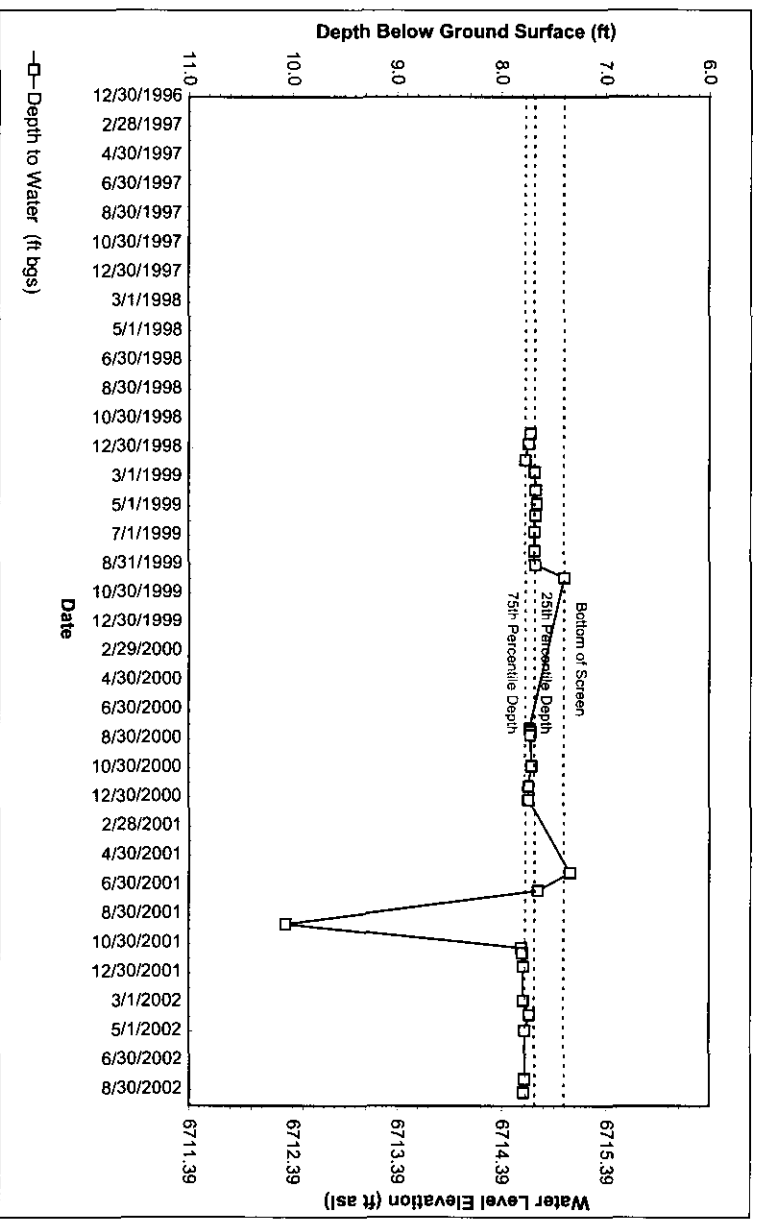


Figure B-2.2-1j. Manual water level vs. measurement date for well PAO-2.5

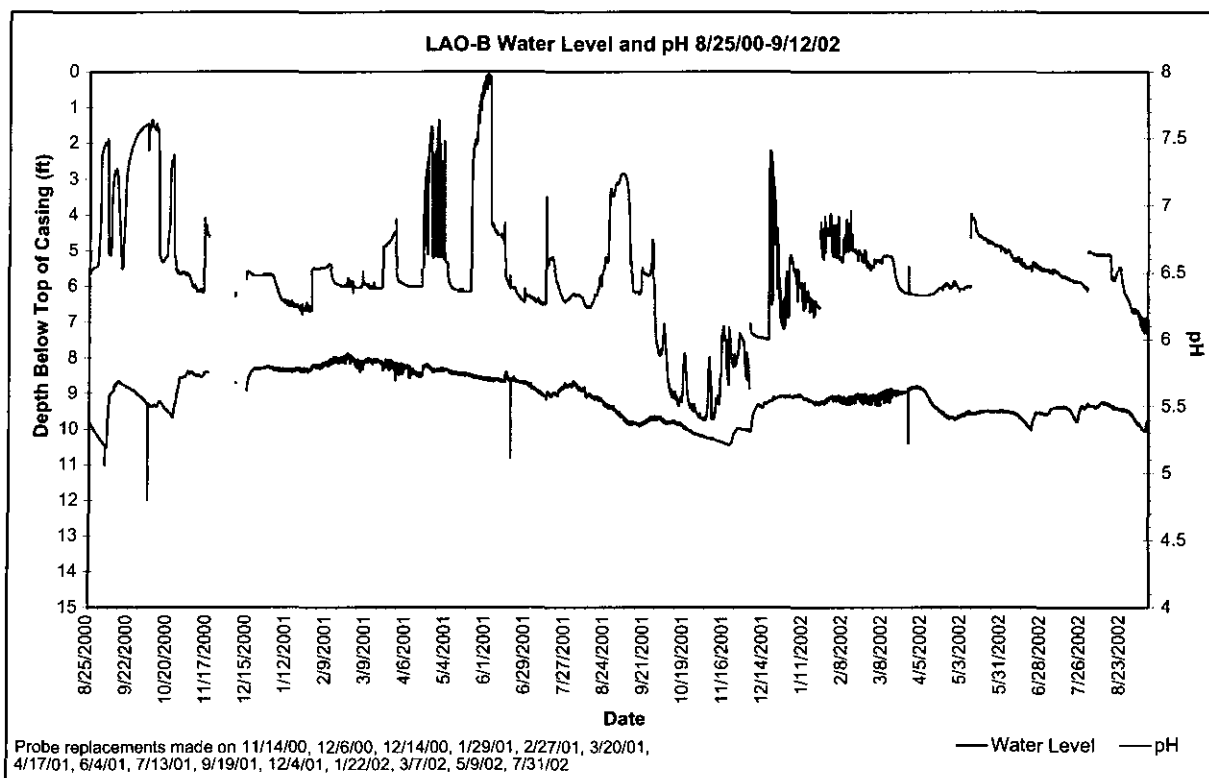
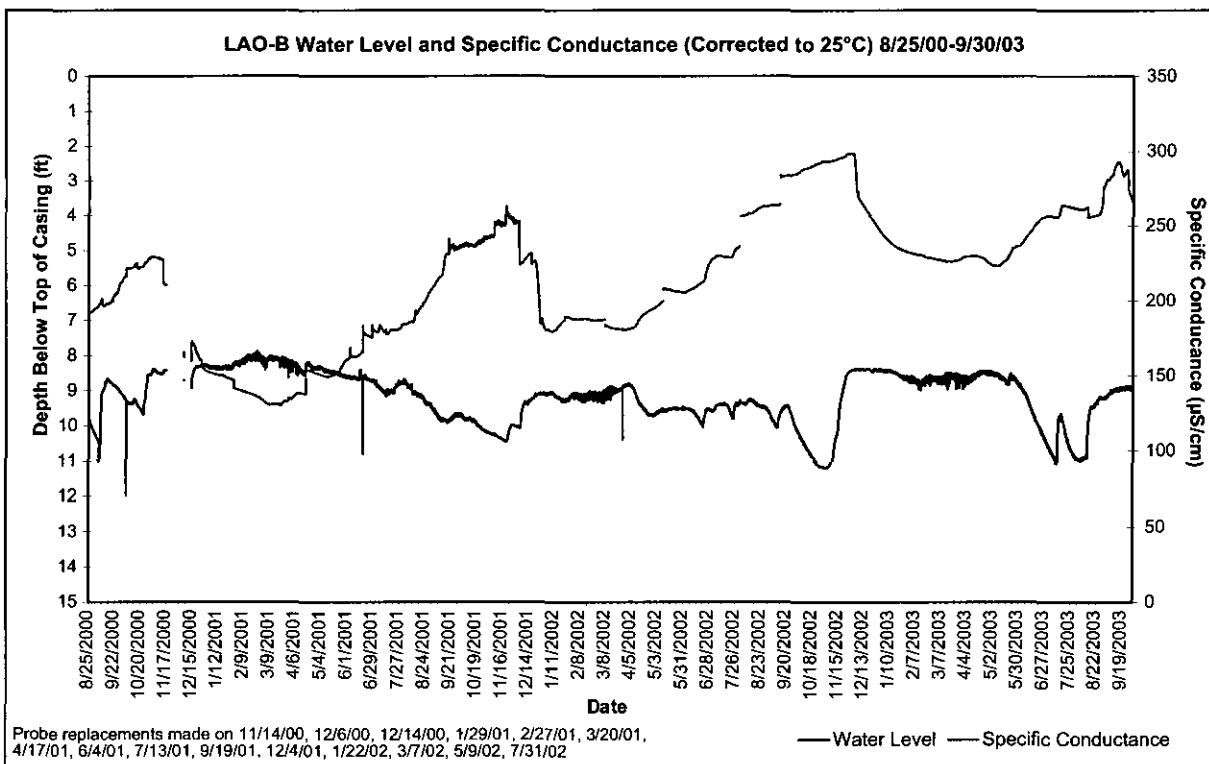


Figure B-2.2-2a. Water level vs. pH, specific conductance, temperature, and dissolved oxygen for alluvial groundwater wells in Los Alamos and Pueblo Canyons collected using multi-parameter probes, well LAO-B

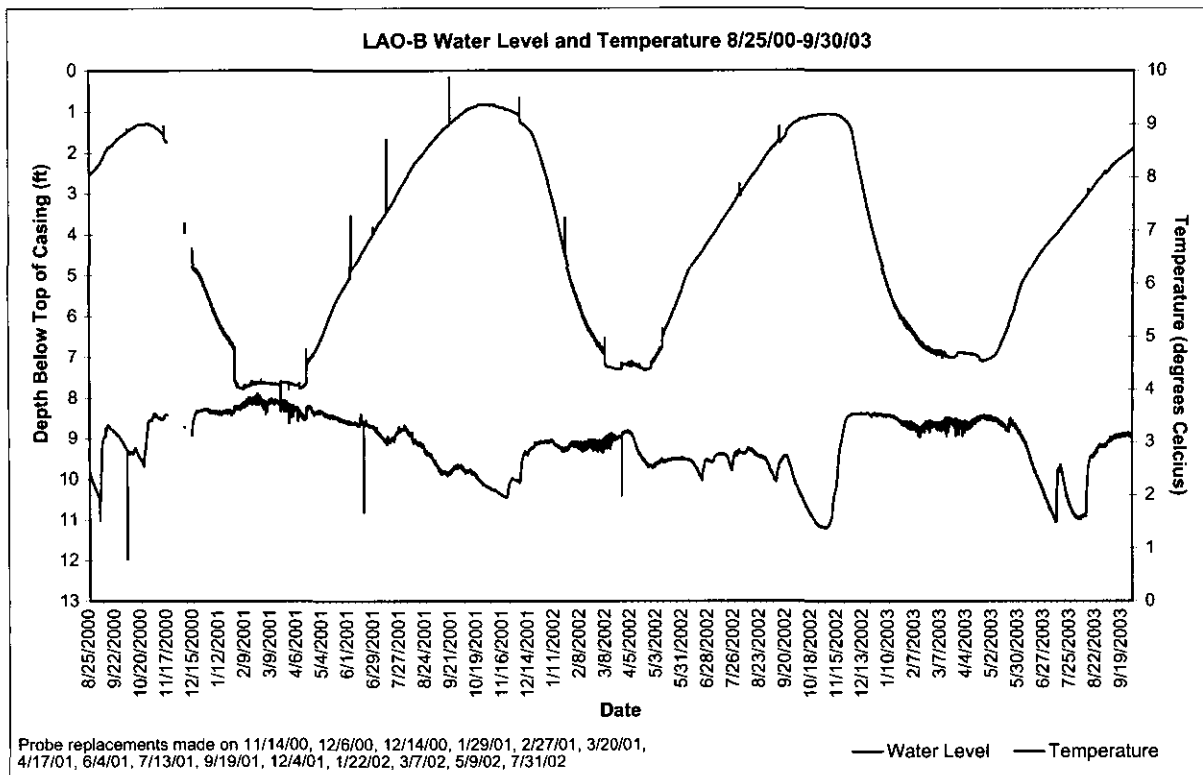
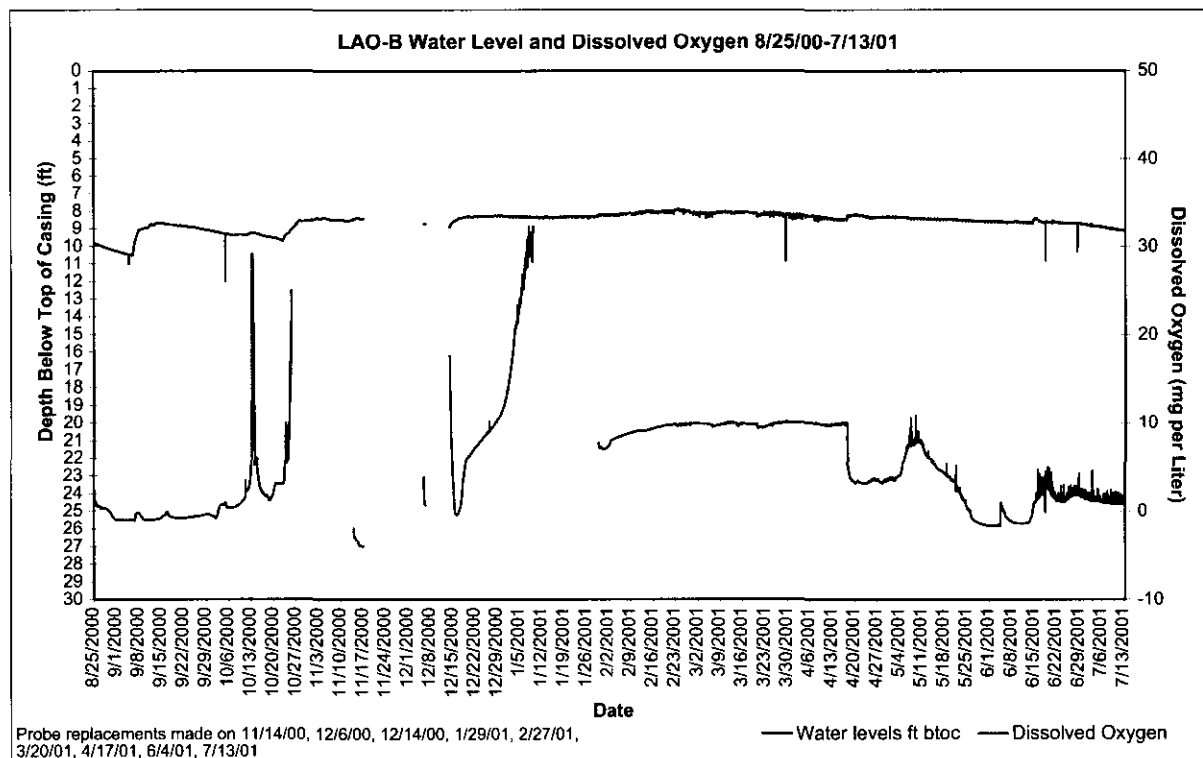


Figure B-2.2-2a (continued). Water level vs. pH, specific conductance, temperature, and dissolved oxygen for alluvial groundwater wells in Los Alamos and Pueblo Canyons collected using multi-parameter probes, well LAO-B

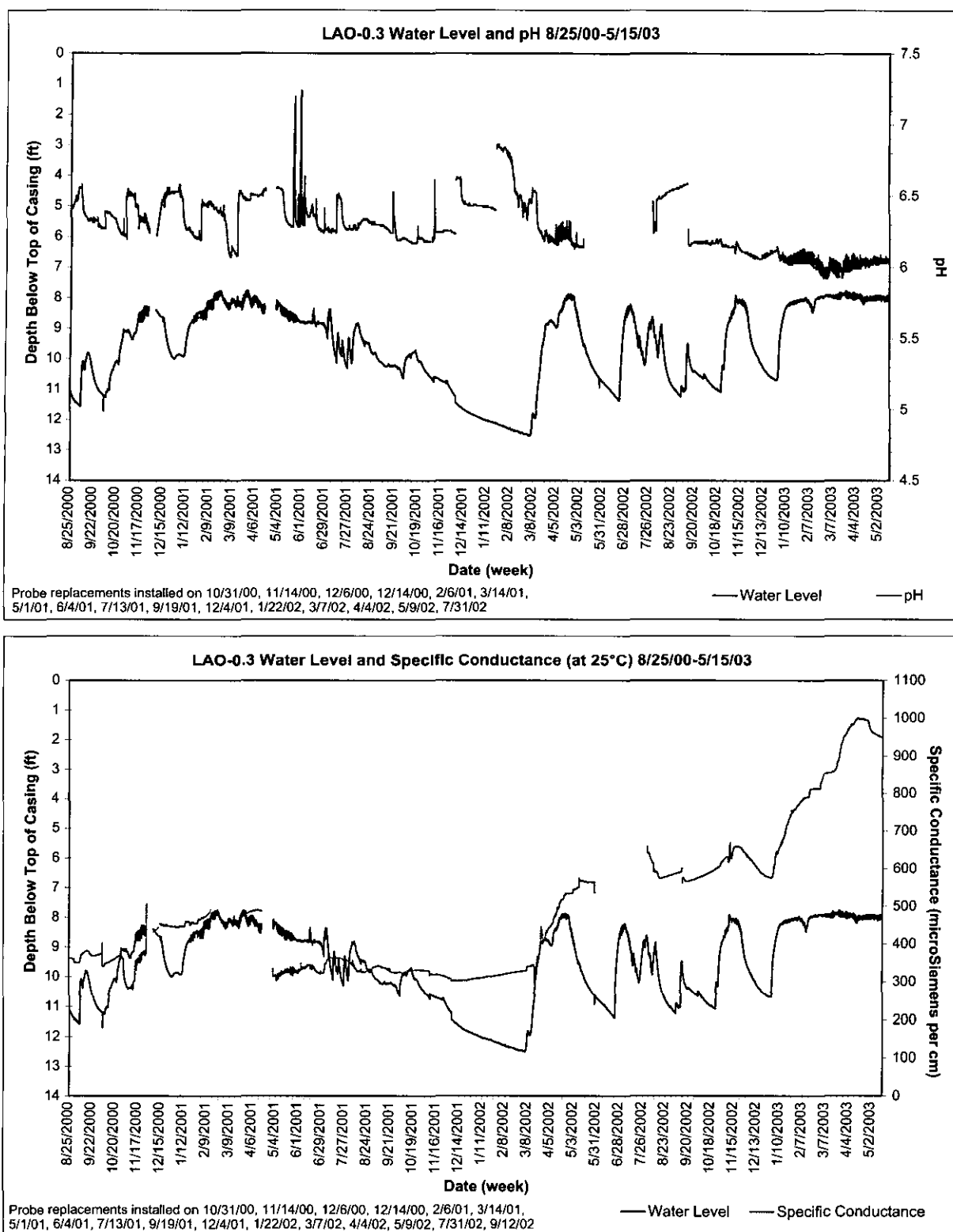


Figure B-2.2-b. Water level vs. pH, specific conductance, temperature, and dissolved oxygen for alluvial groundwater wells in Los Alamos and Pueblo Canyons collected using multi-parameter probes, well LAO-0.3

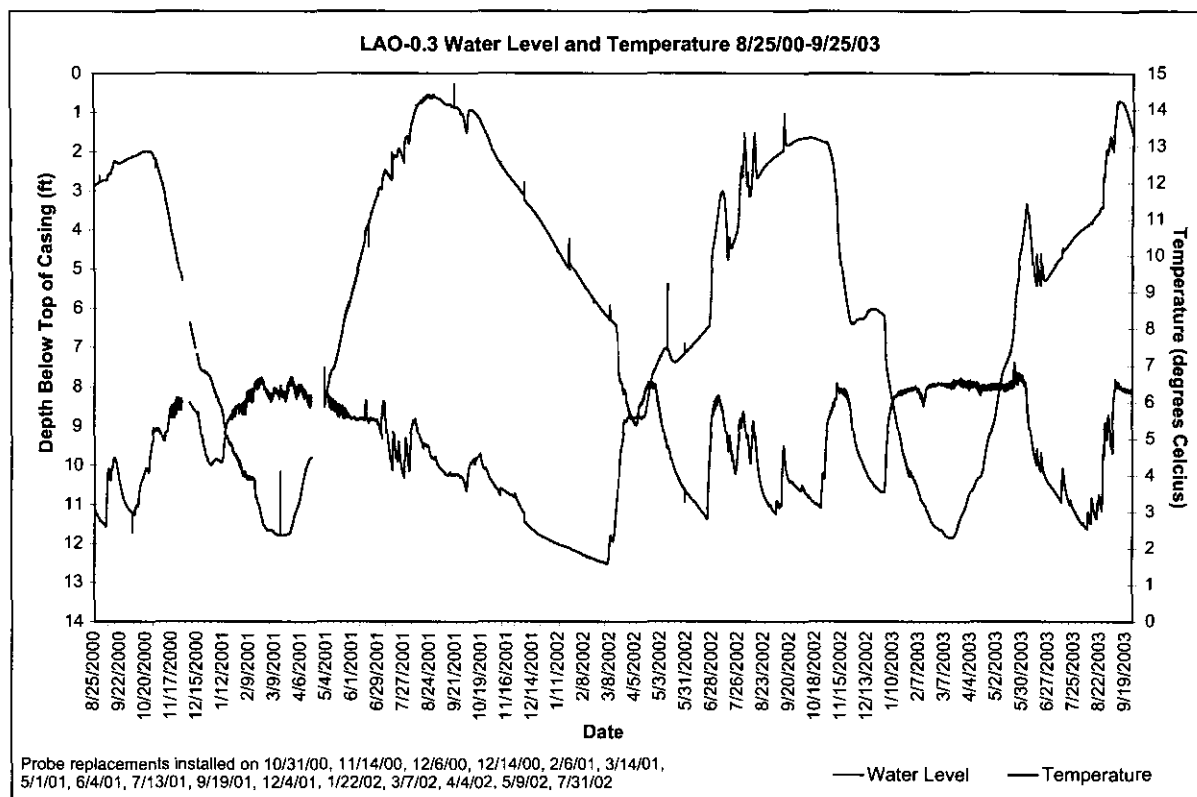
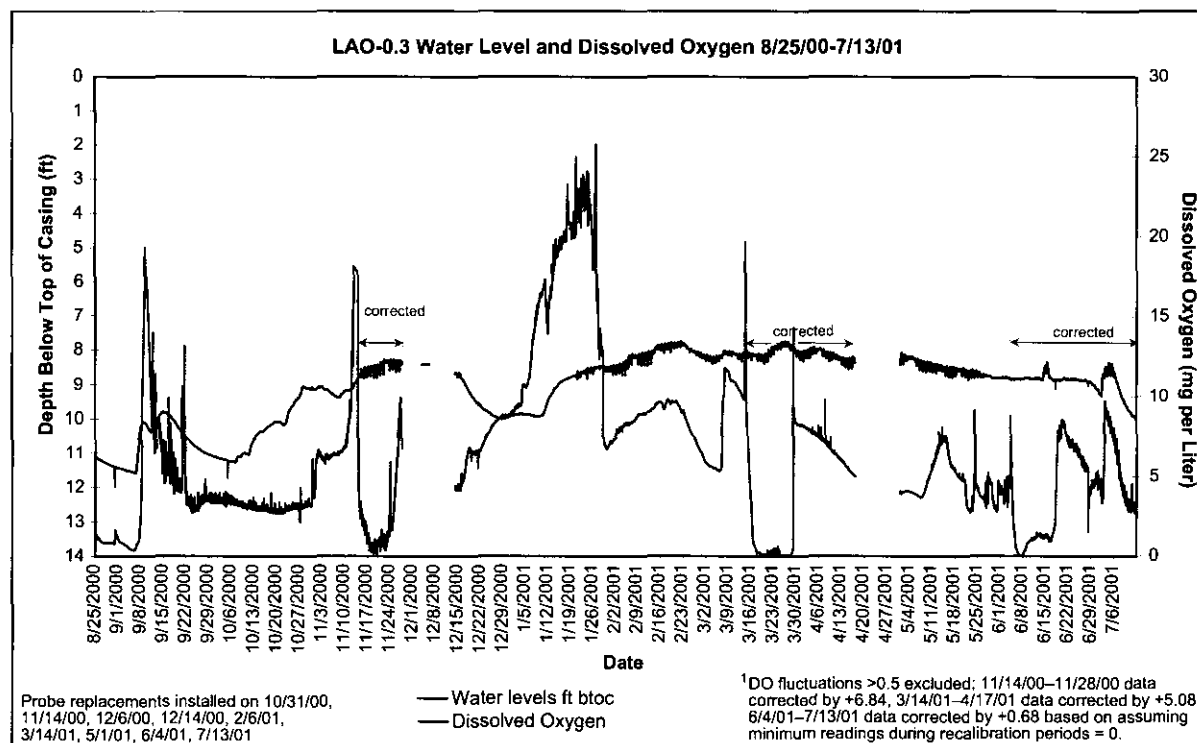


Figure B-2.2-2b (continued). Water level vs. pH, specific conductance, temperature, and dissolved oxygen for alluvial groundwater wells in Los Alamos and Pueblo Canyons collected using multi-parameter probes, well LAO-0.3

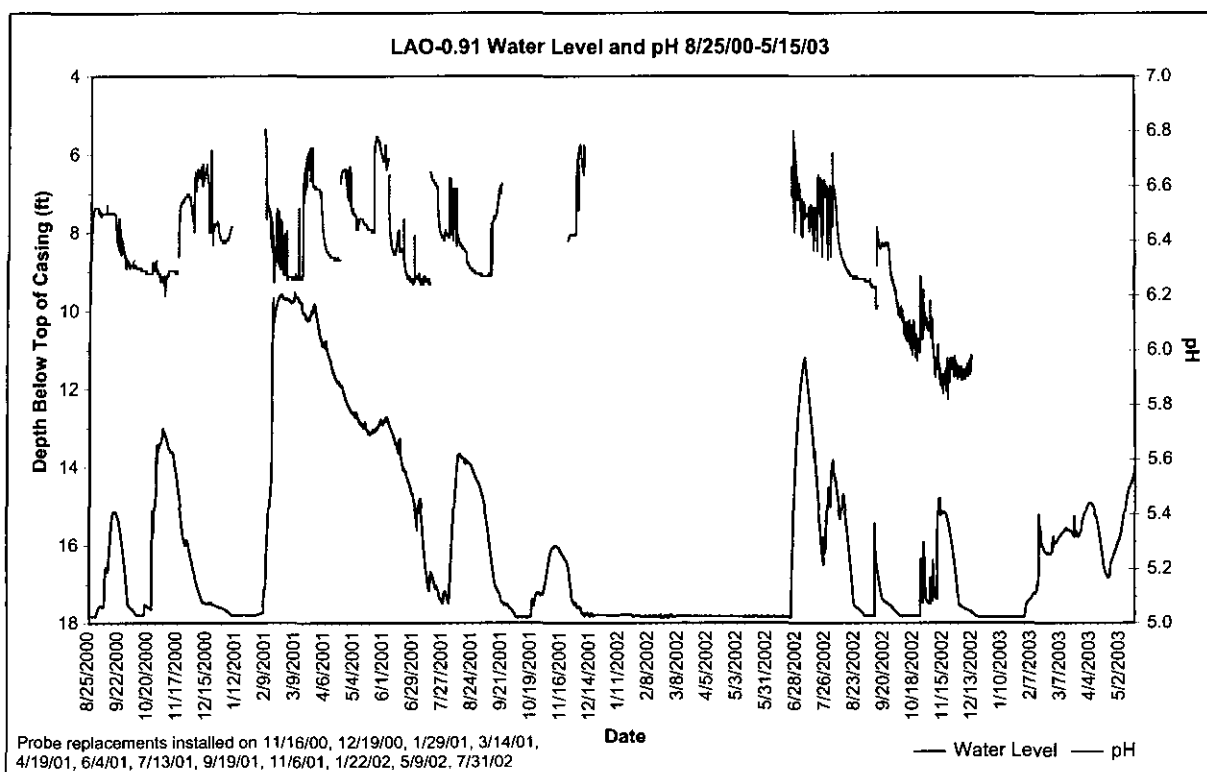
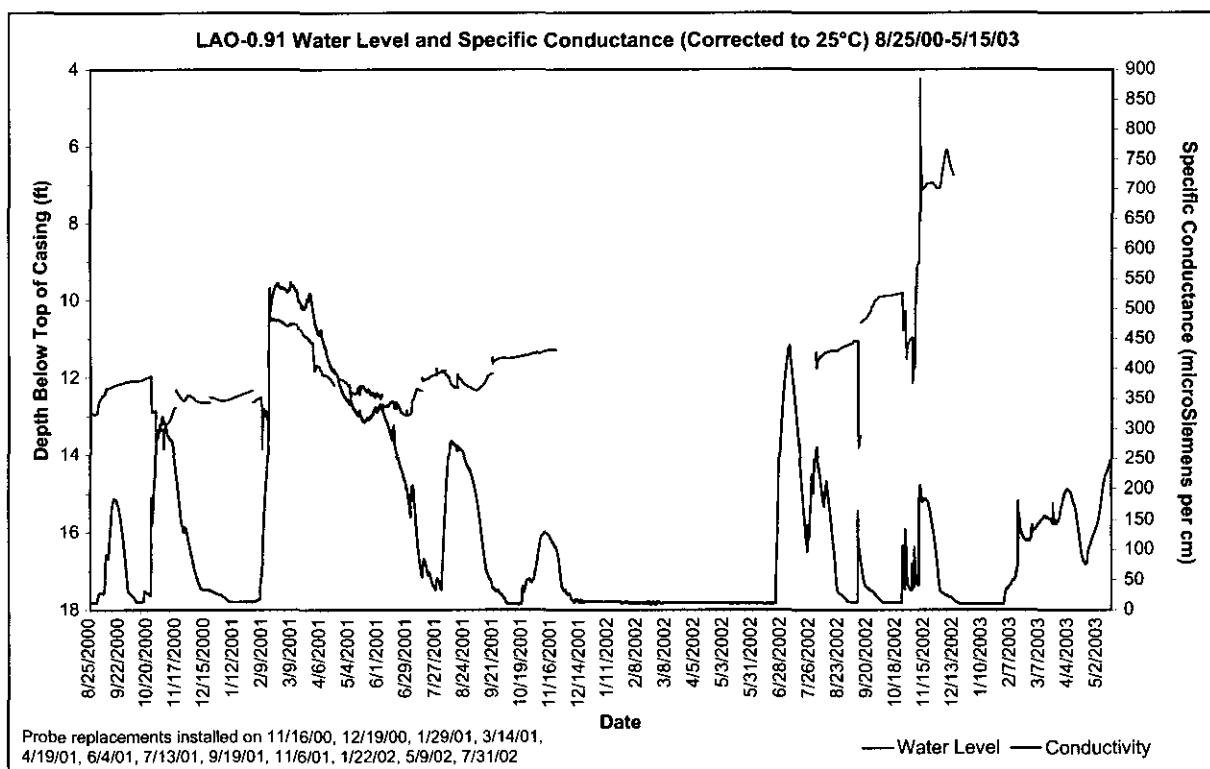


Figure B-2.2-2c. Water level vs. pH, specific conductance, temperature, and dissolved oxygen for alluvial groundwater wells in Los Alamos and Pueblo Canyons collected using multi-parameter probes, well LAO-0.91

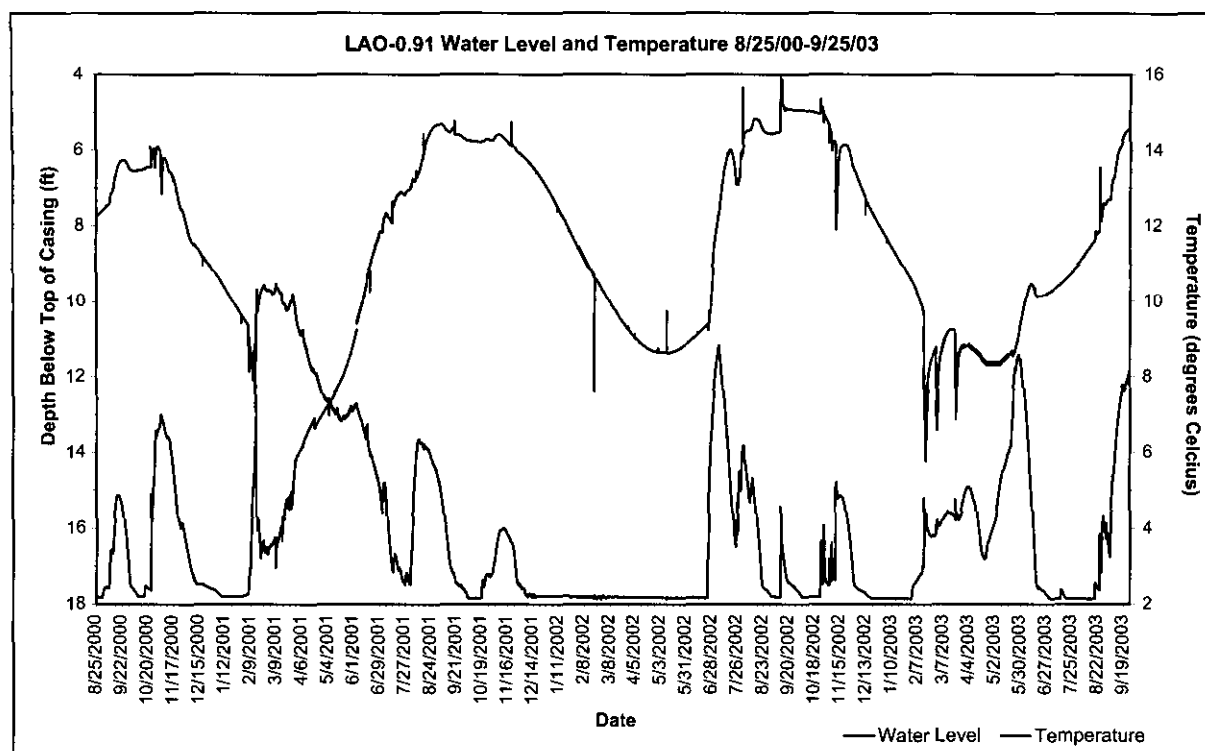
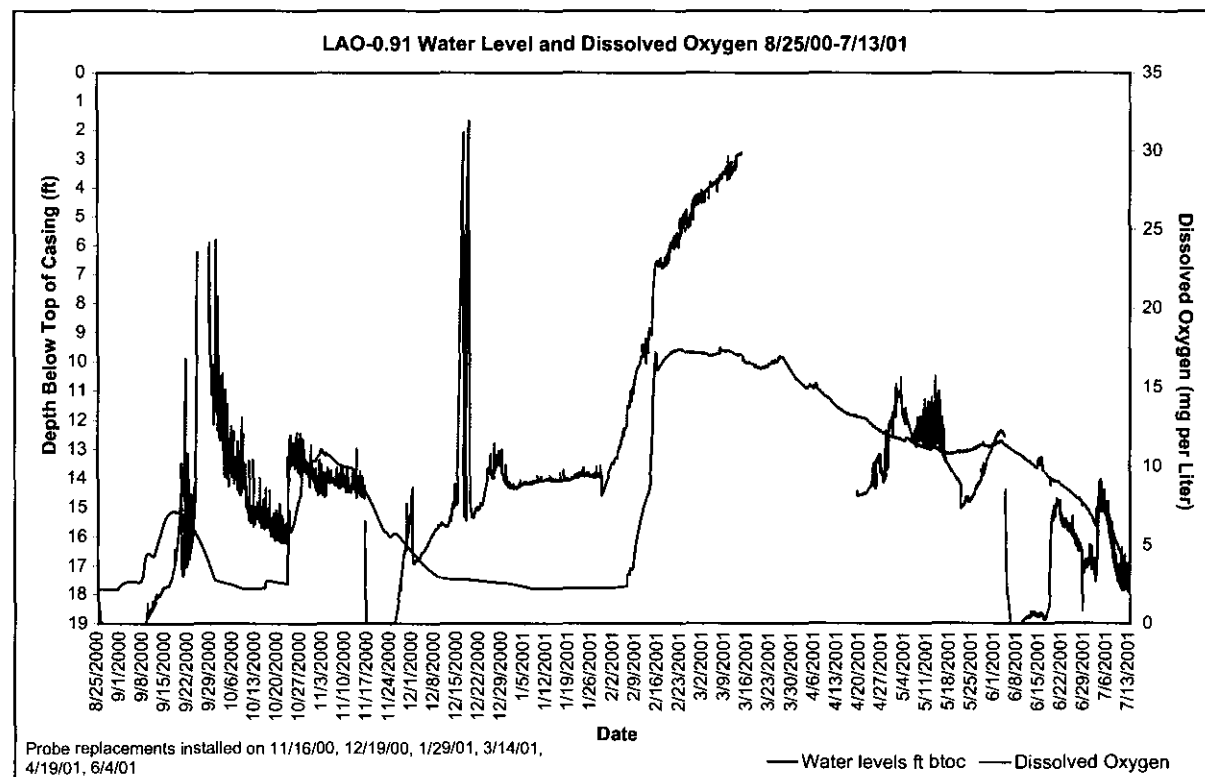


Figure B-2.2-2c (continued). Water level vs. pH, specific conductance, temperature, and dissolved oxygen for alluvial groundwater wells in Los Alamos and Pueblo Canyons collected using multi-parameter probes, well LAO-0.91

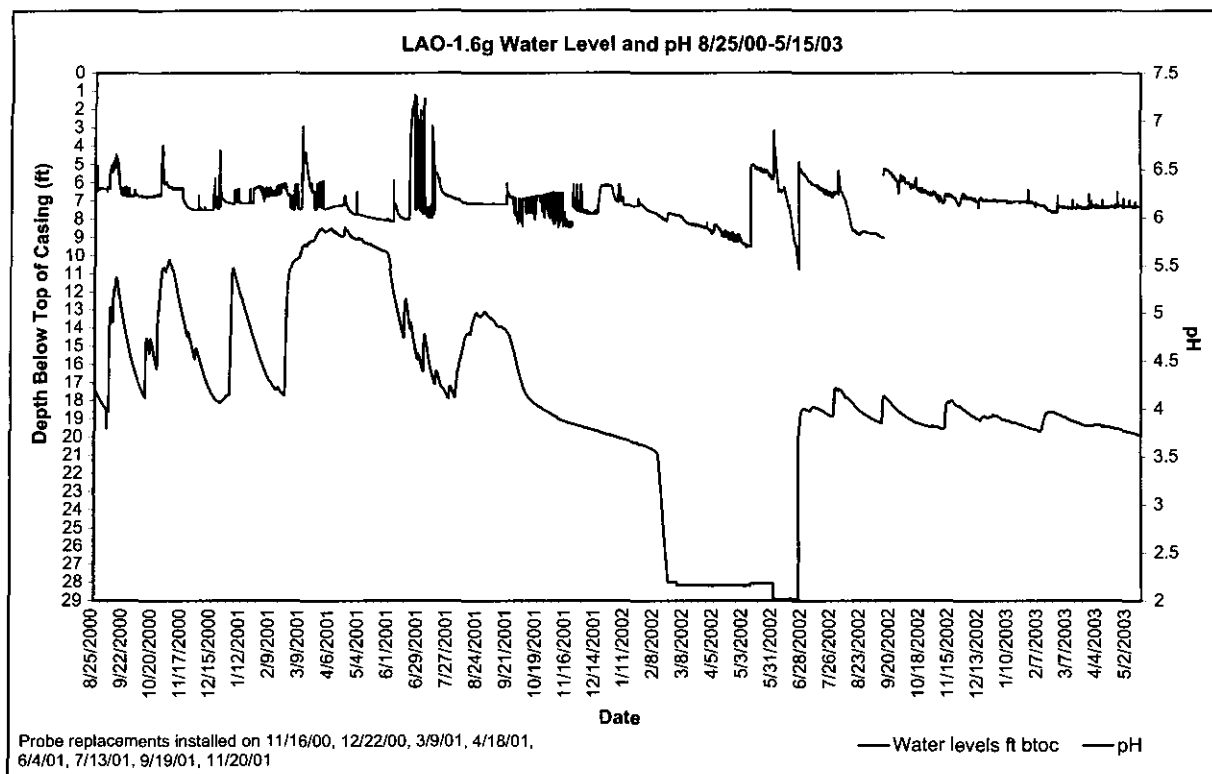
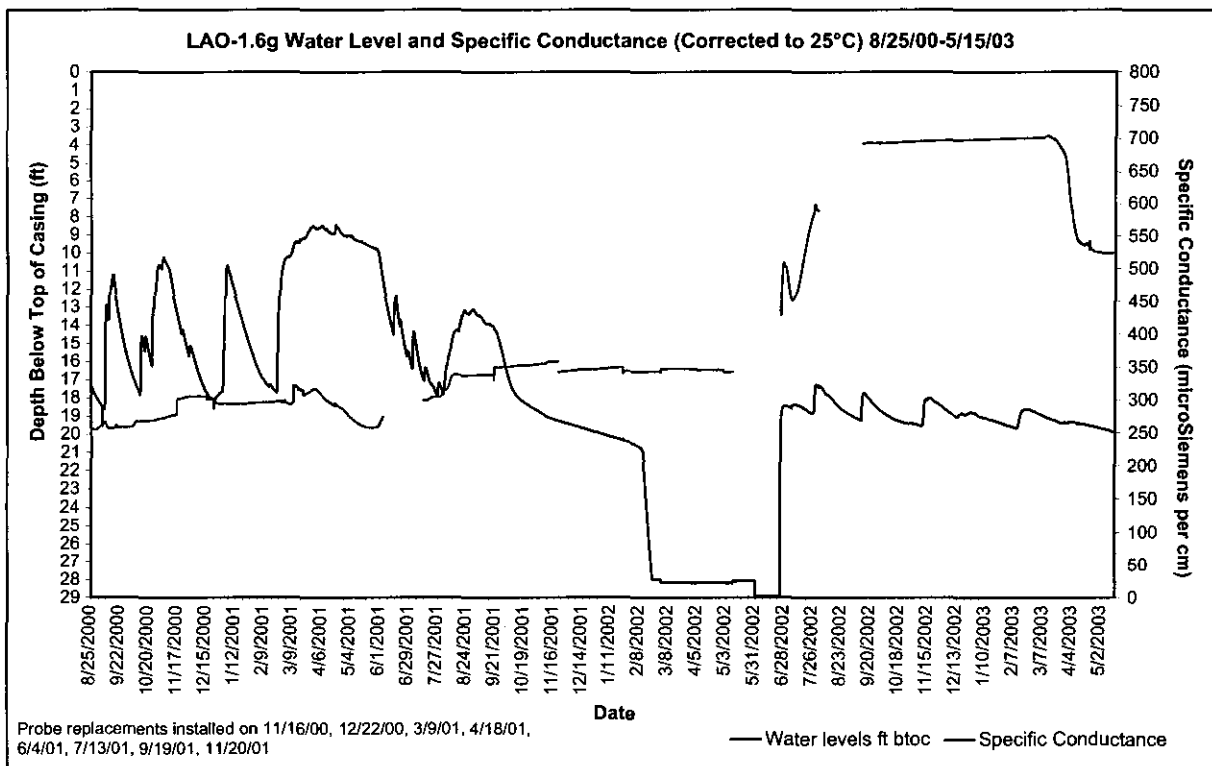


Figure B-2.2-2d. Water level vs. pH, specific conductance, temperature, and dissolved oxygen for alluvial groundwater wells in Los Alamos and Pueblo Canyons collected using multi-parameter probes, well LAO-1.6(g)

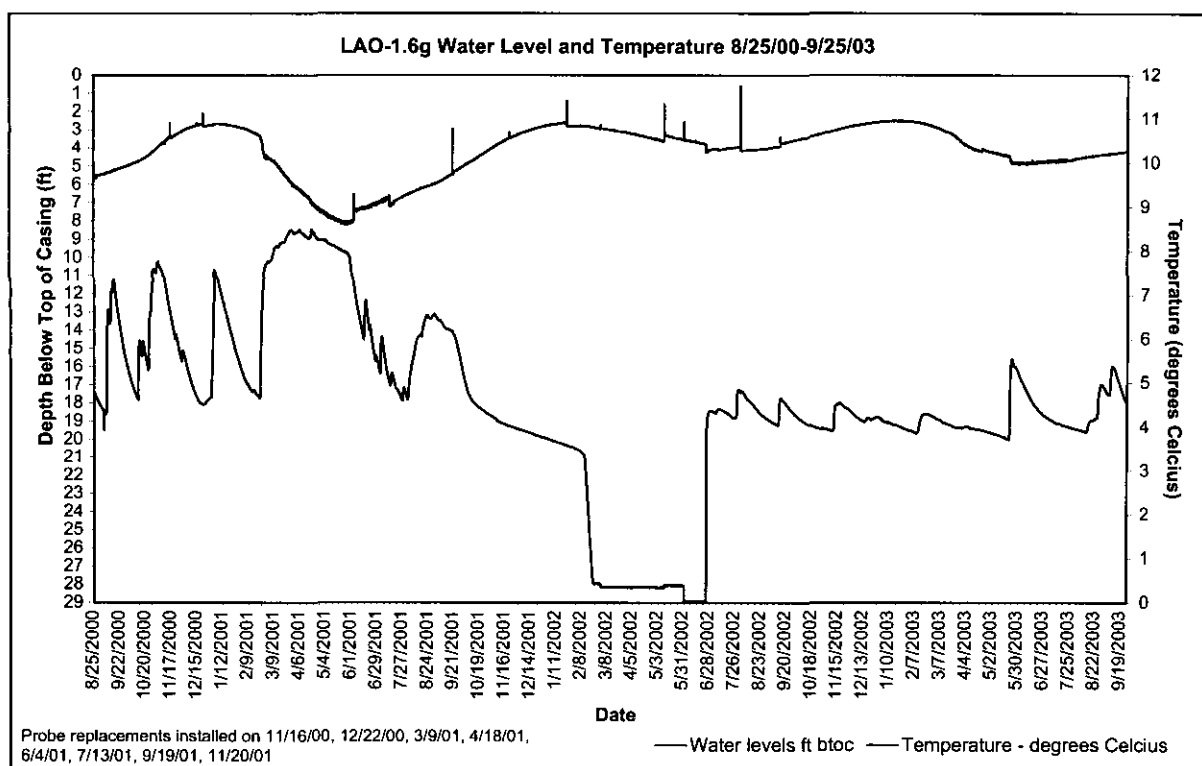
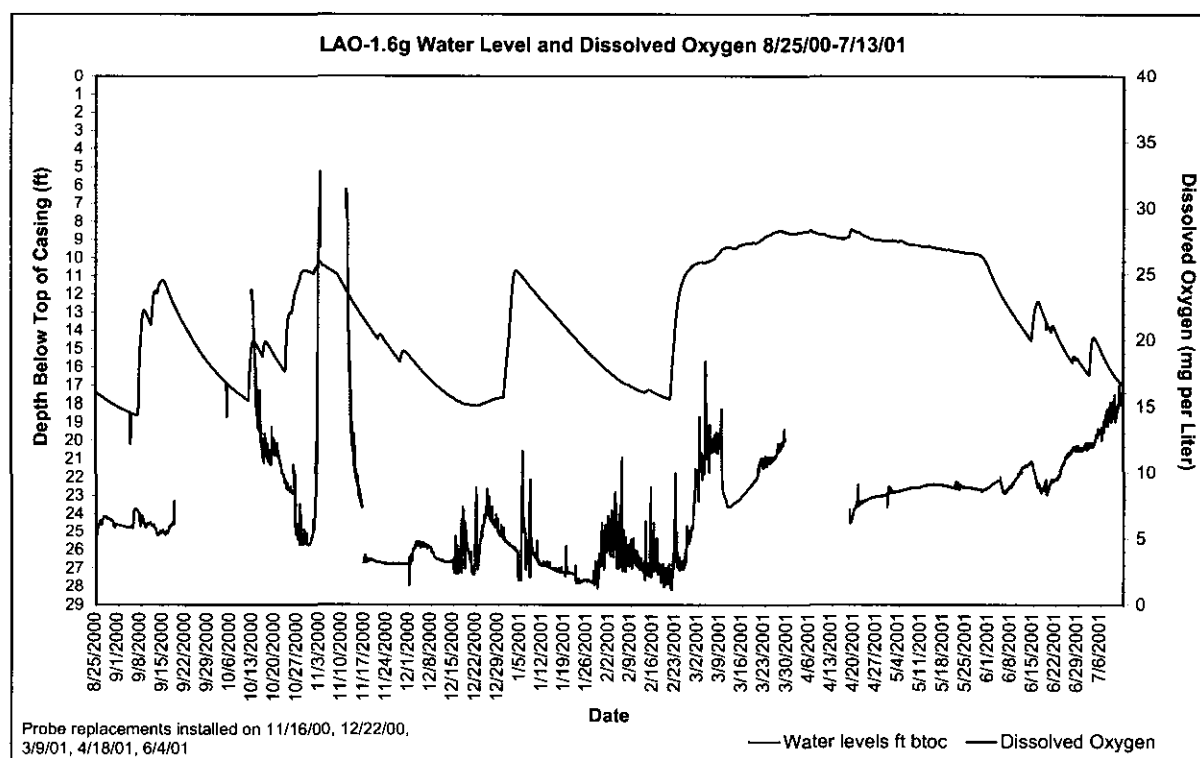


Figure B-2.2-2d (continued). Water level vs. pH, specific conductance, temperature, and dissolved oxygen for alluvial groundwater wells in Los Alamos and Pueblo Canyons collected using multi-parameter probes, well LAO-1.6(g)

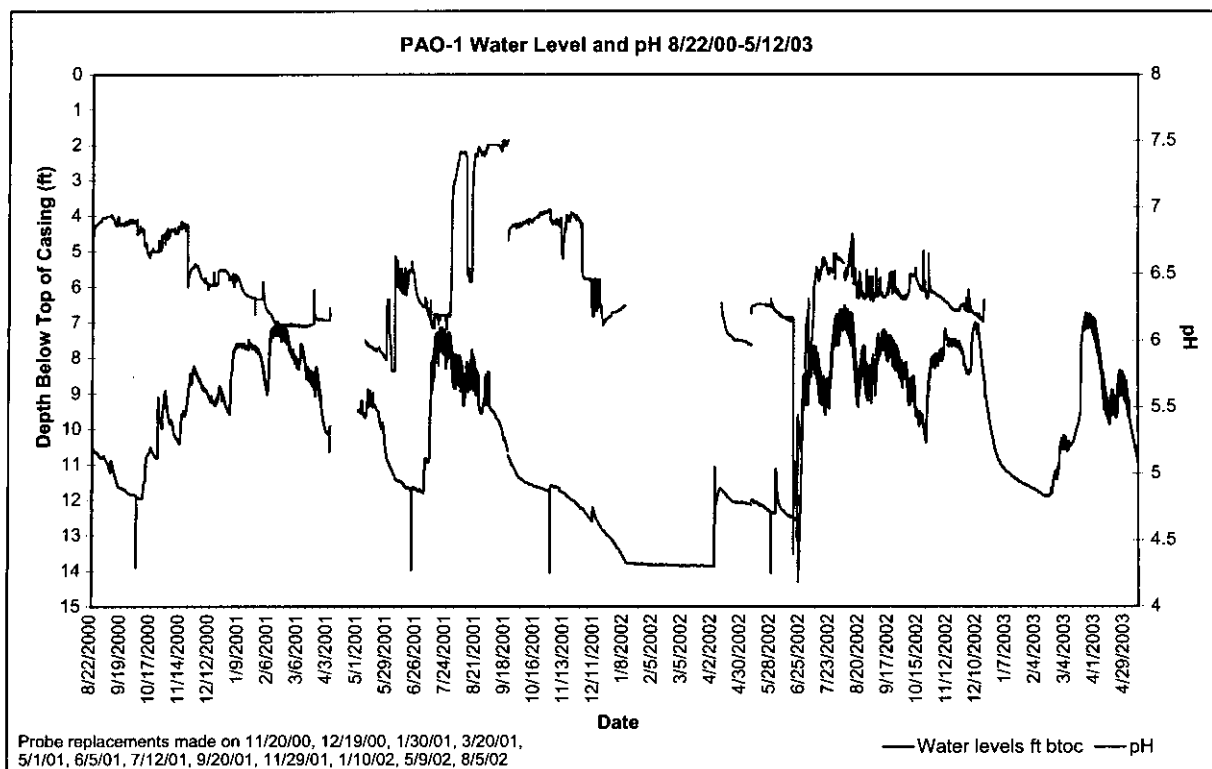
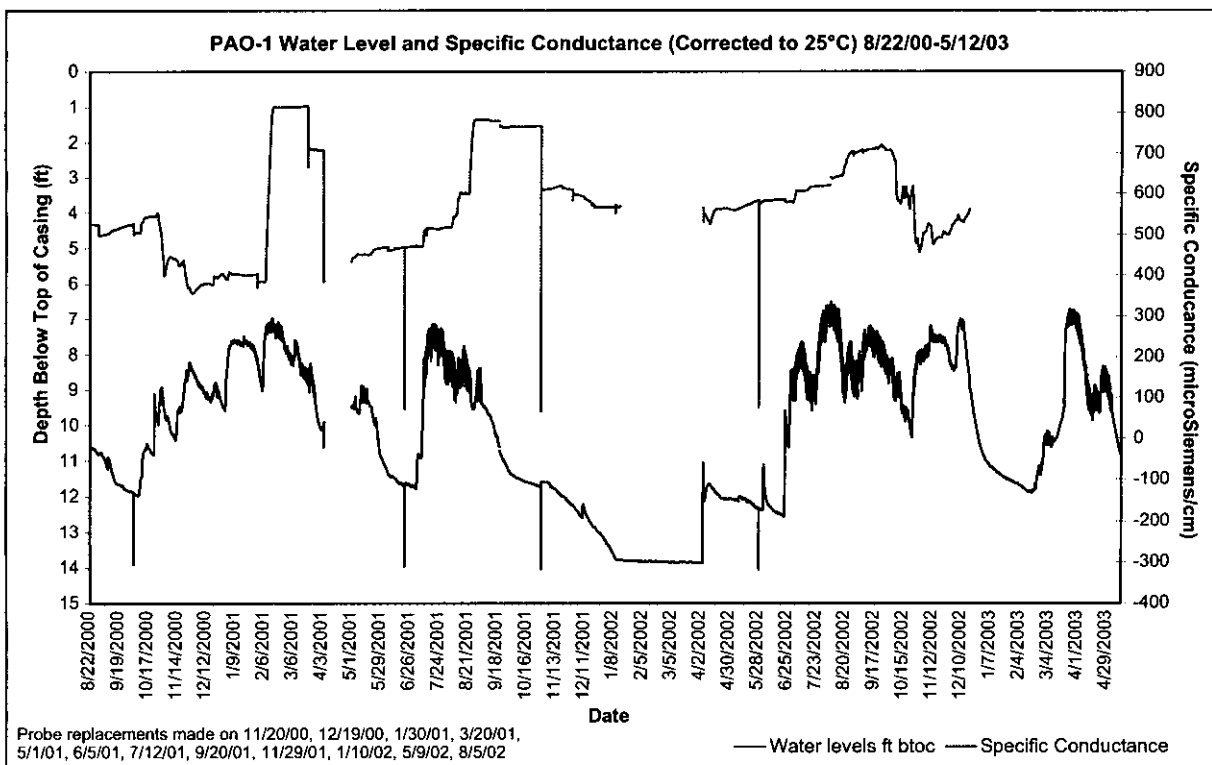


Figure B-2.2-2e. Water level vs. pH, specific conductance, temperature, and dissolved oxygen for alluvial groundwater wells in Los Alamos and Pueblo Canyons collected using multi-parameter probes, well PAO-1

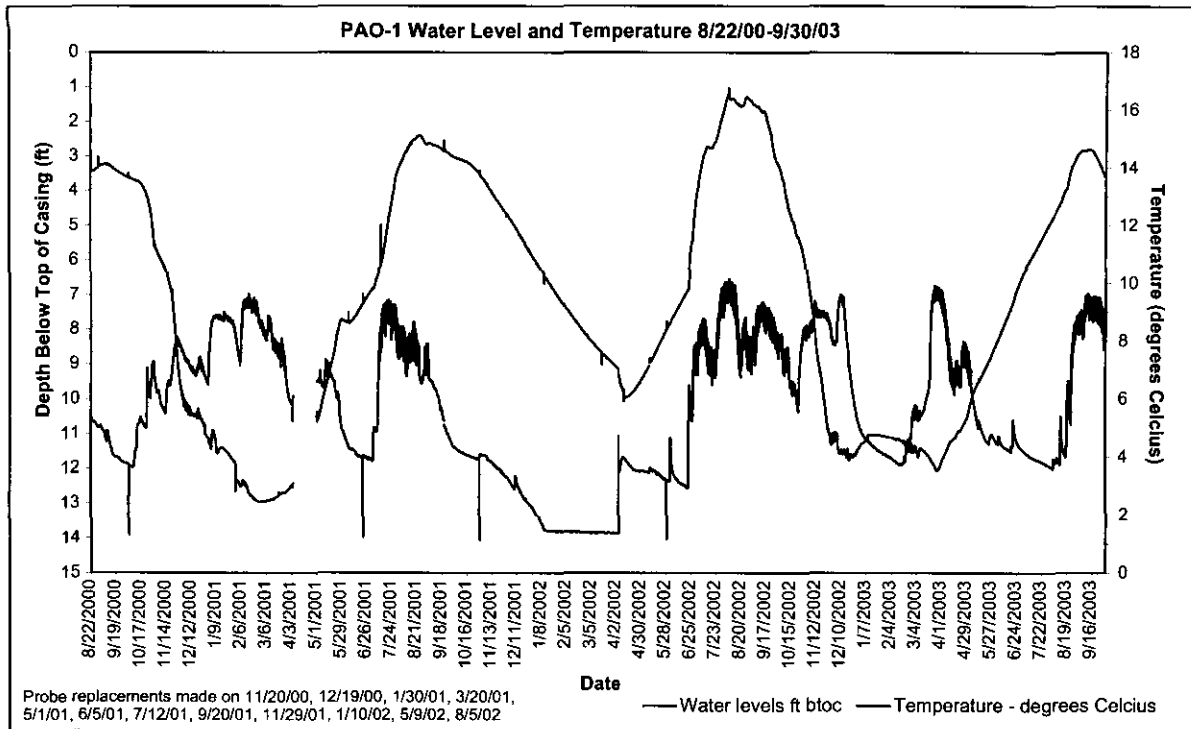
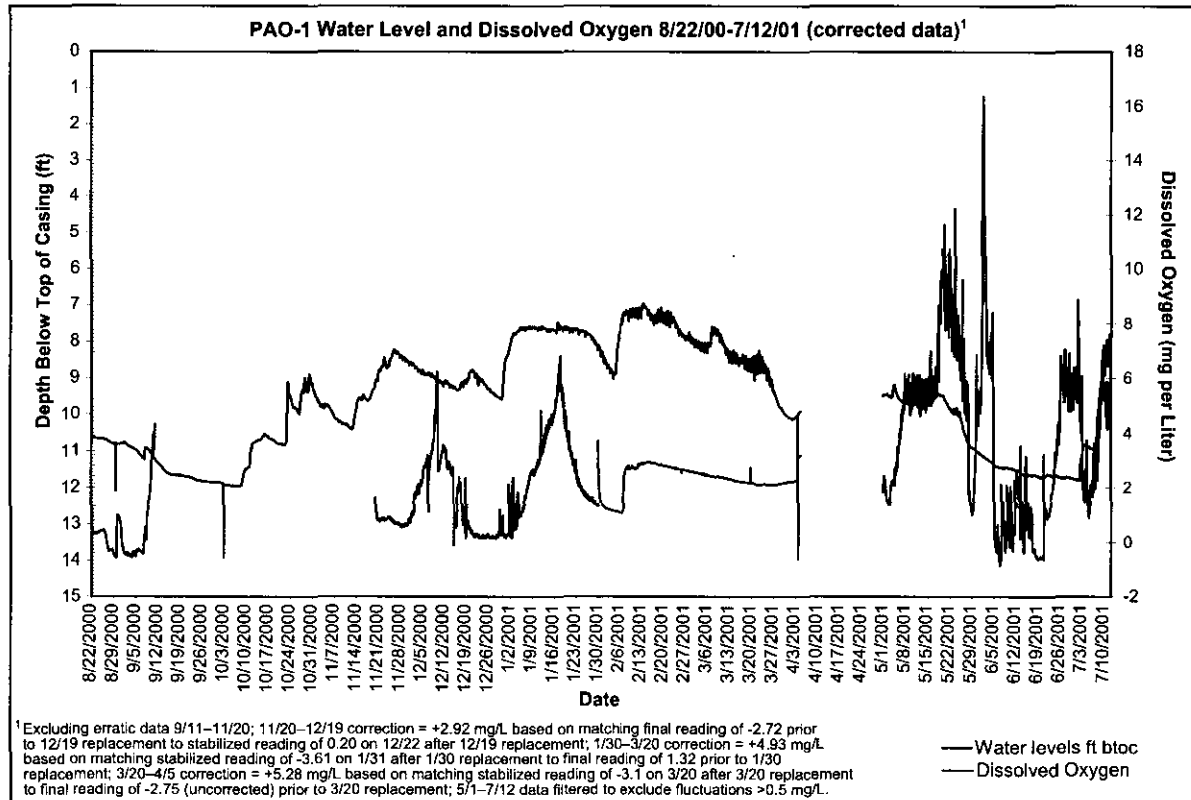


Figure B-2.2-2e (continued). Water level vs. pH, specific conductance, temperature, and dissolved oxygen for alluvial groundwater wells in Los Alamos and Pueblo Canyons collected using multi-parameter probes, well PAO-1

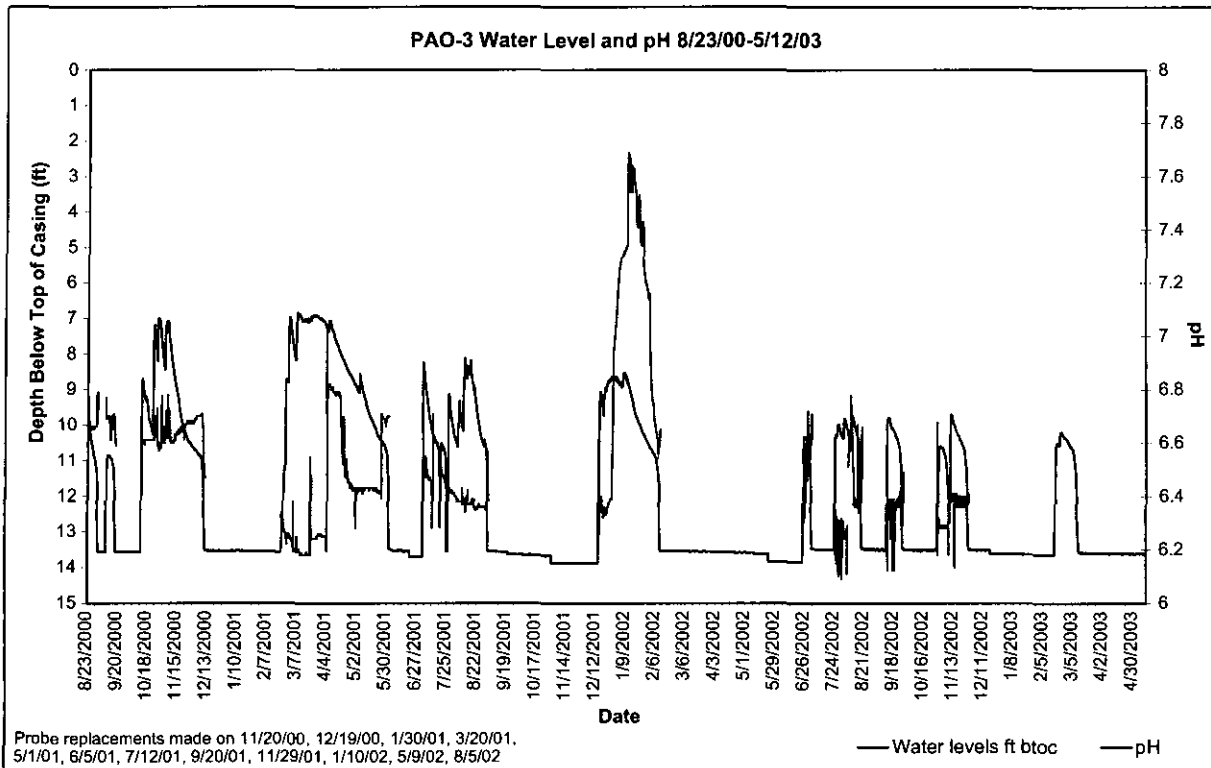
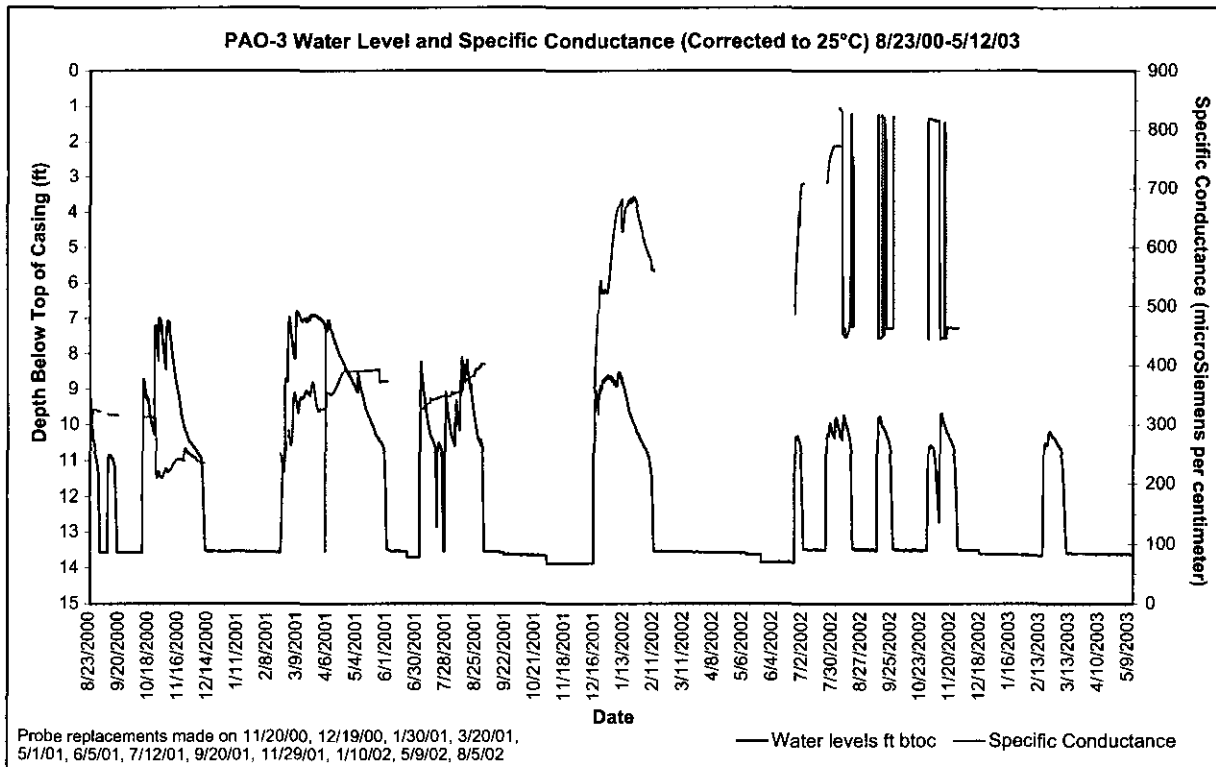


Figure B-2.2-2f. Water level vs. pH, specific conductance, temperature, and dissolved oxygen for alluvial groundwater wells in Los Alamos and Pueblo Canyons collected using multi-parameter probes, well PAO-3

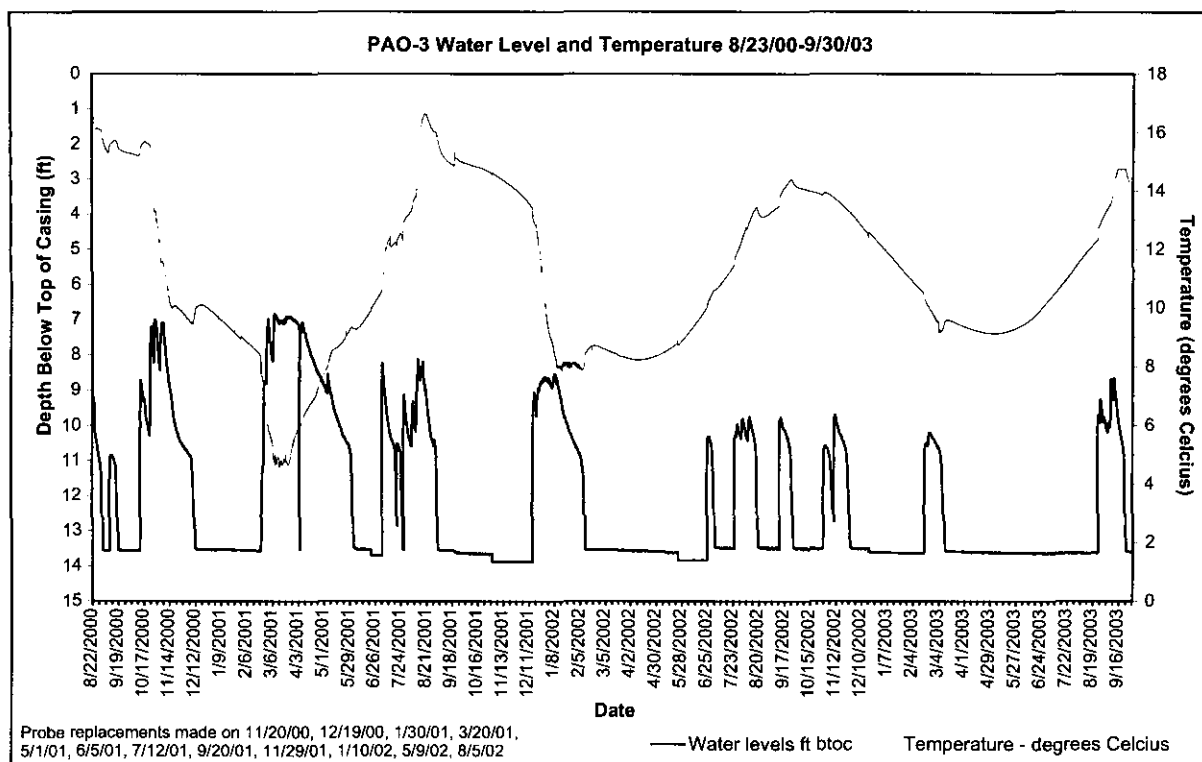
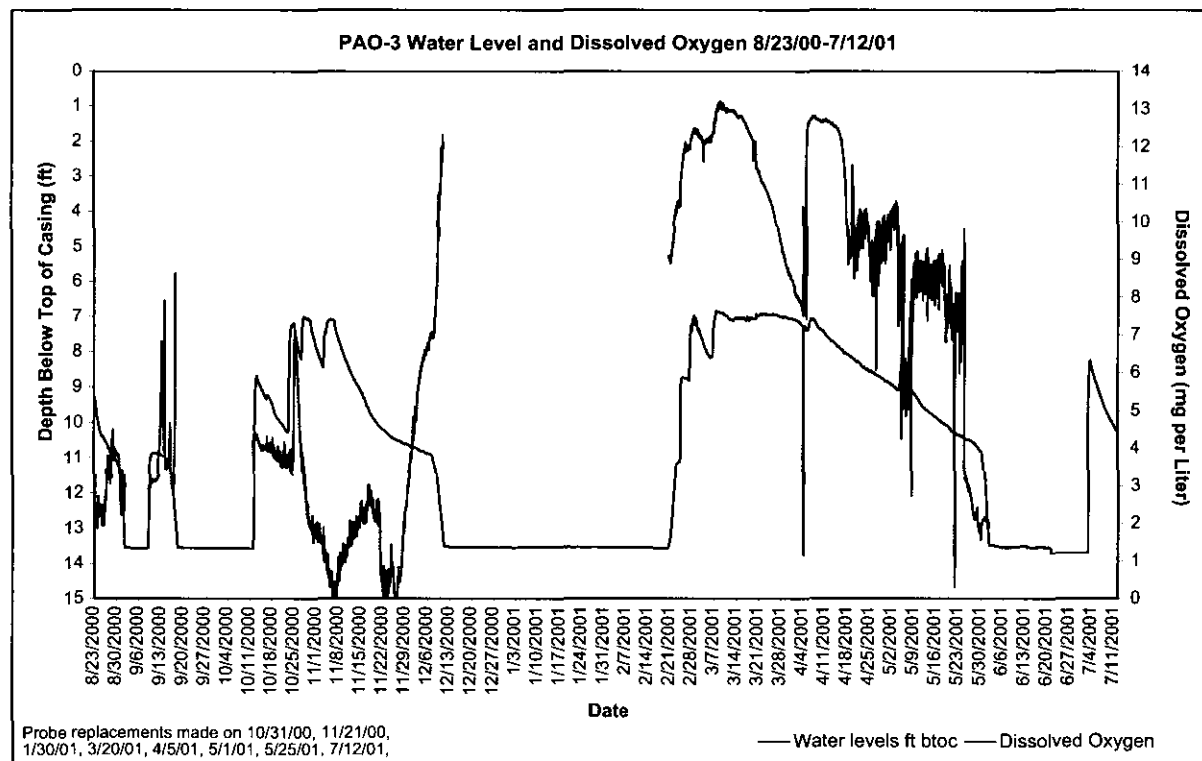


Figure B-2.2-2f (continued). Water level vs. pH, specific conductance, temperature, and dissolved oxygen for alluvial groundwater wells in Los Alamos and Pueblo Canyons collected using multi-parameter probes, well PAO-3

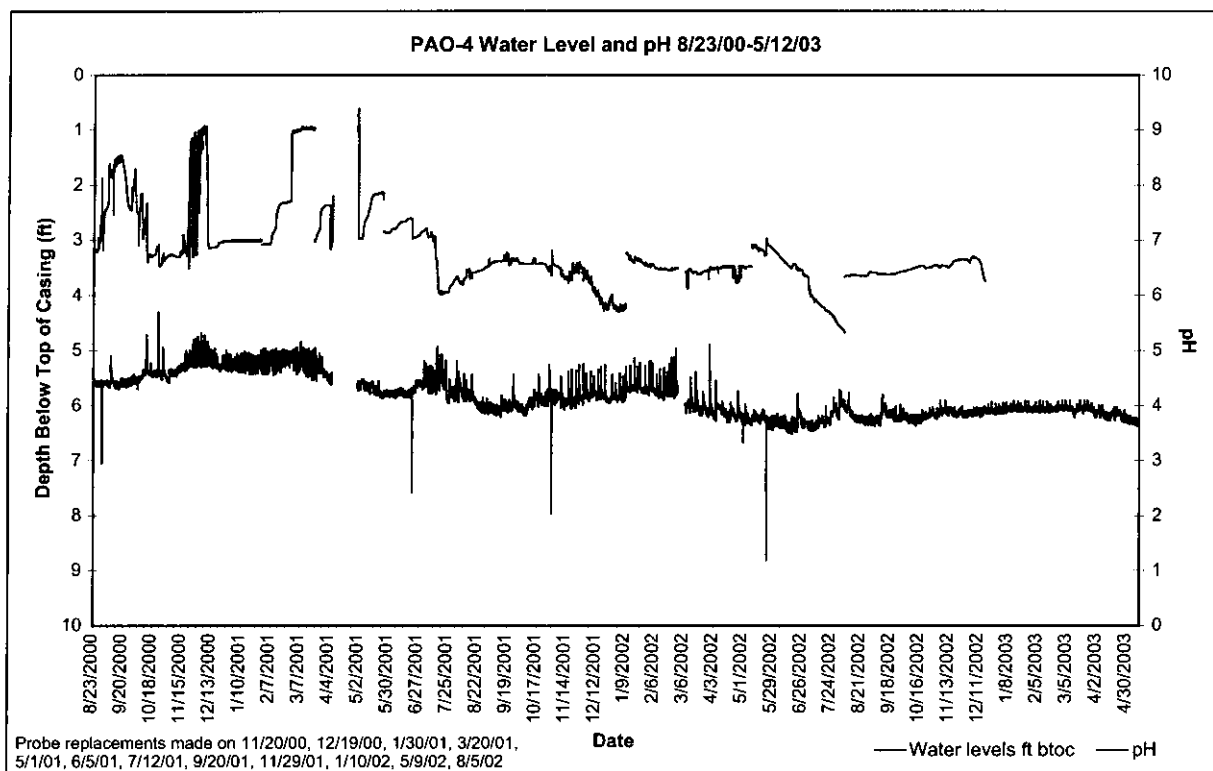
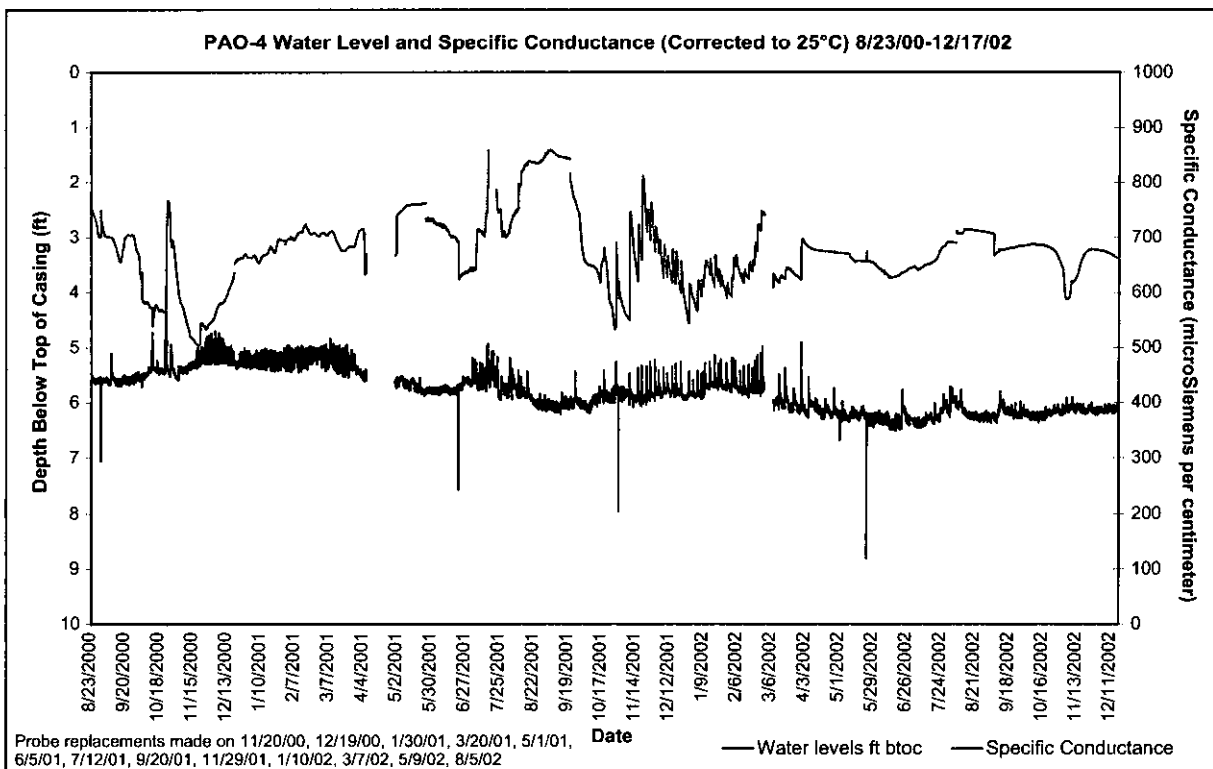


Figure B-2.2-2g. Water level vs. pH, specific conductance, temperature, and dissolved oxygen for alluvial groundwater wells in Los Alamos and Pueblo Canyons collected using multi-parameter probes, well PAO-4

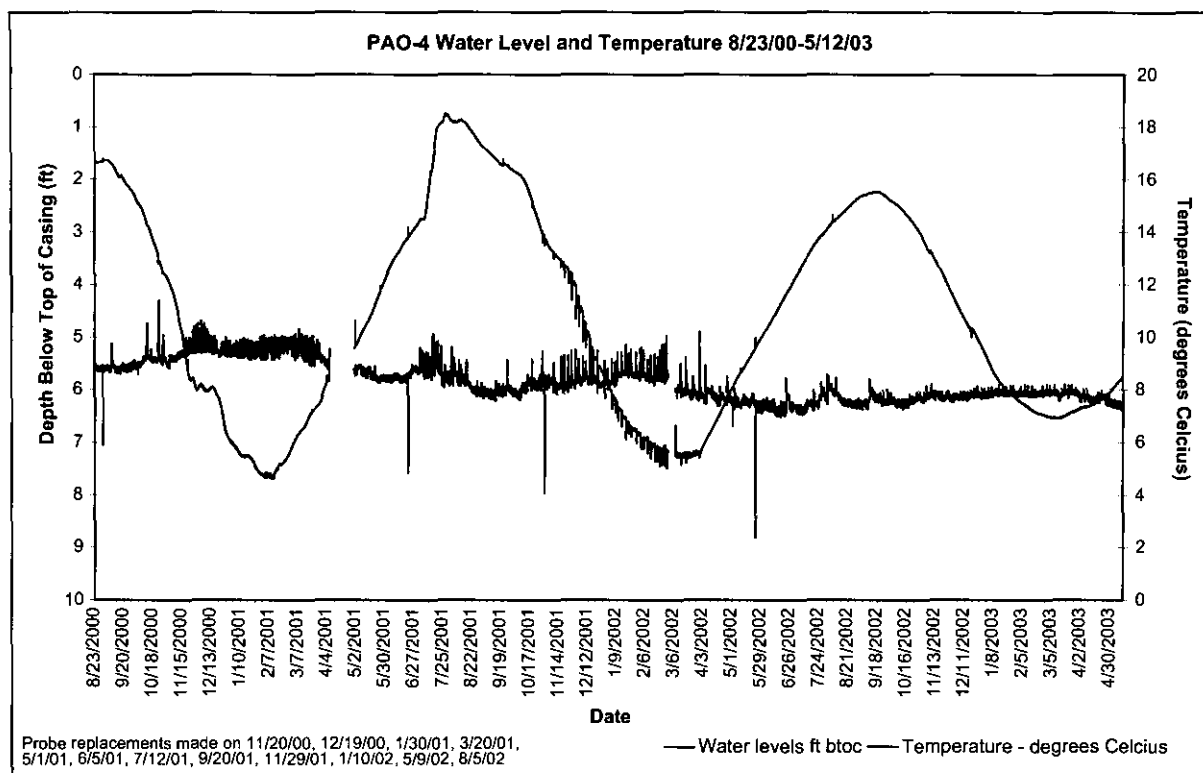
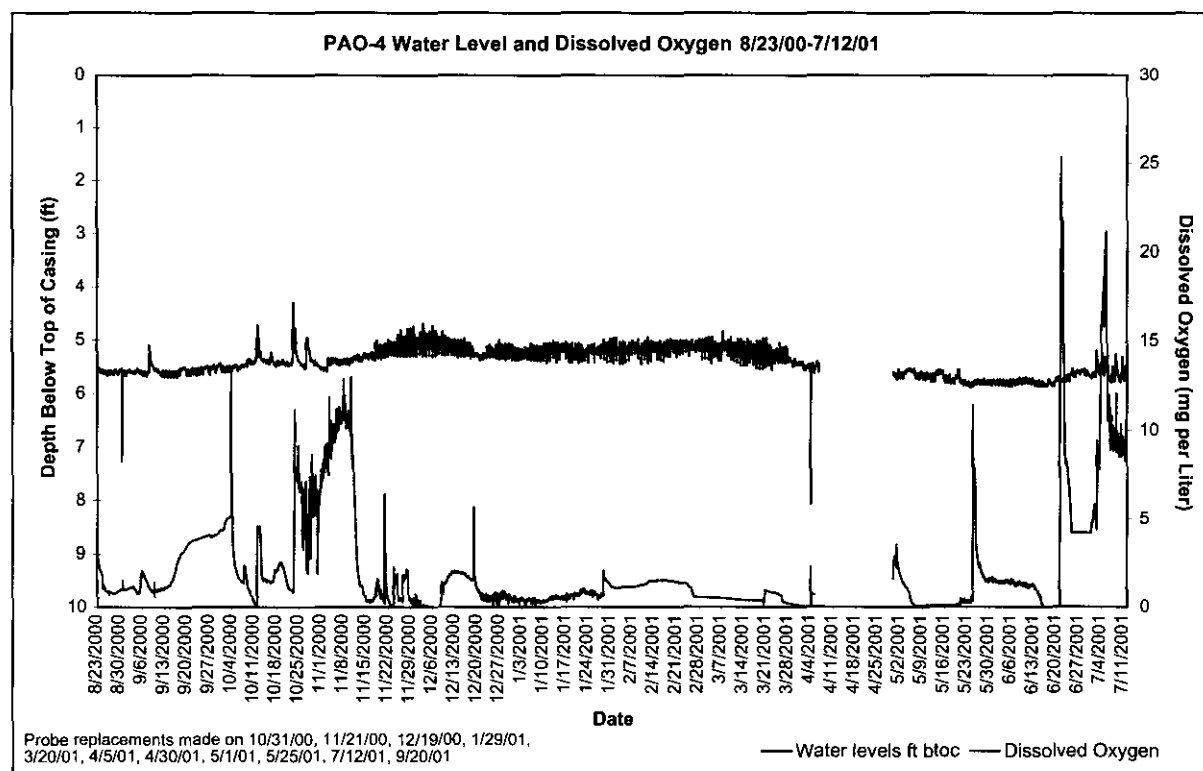


Figure B-2.2-2g (continued). Water level vs. pH, specific conductance, temperature, and dissolved oxygen for alluvial groundwater wells in Los Alamos and Pueblo Canyons collected using multi-parameter probes, well PAO-4

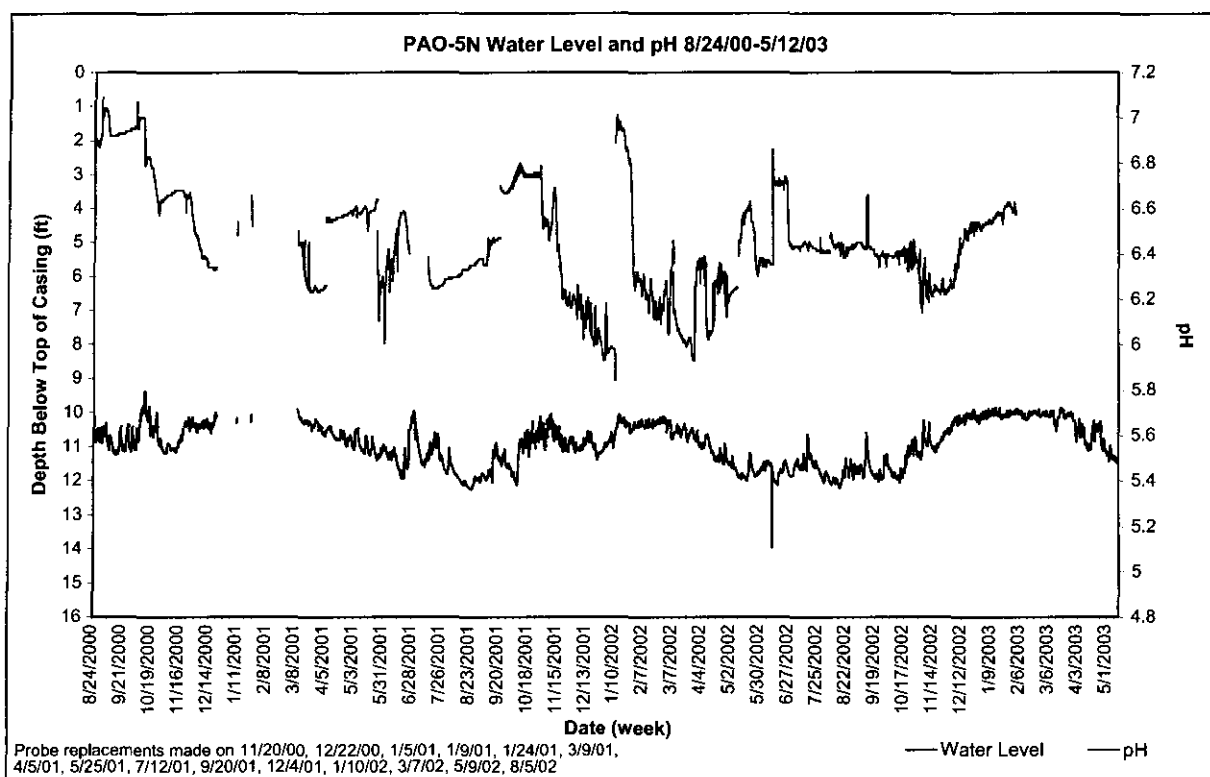
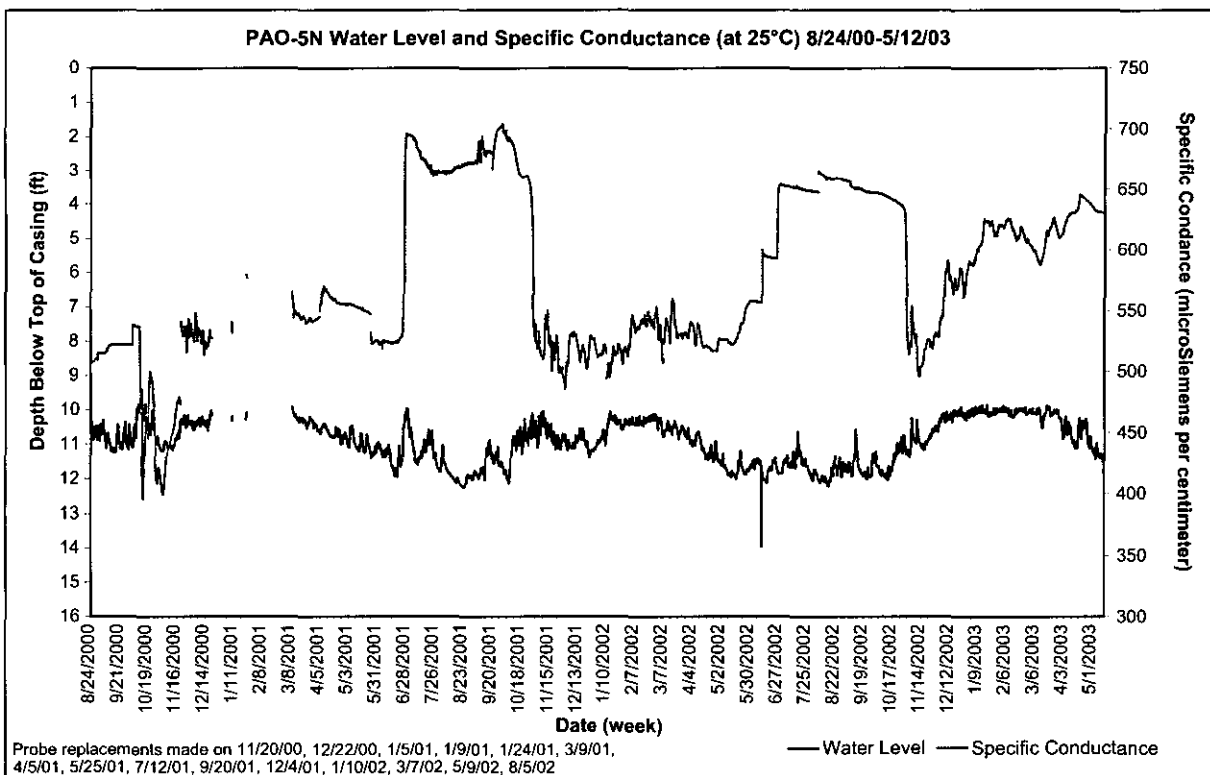


Figure B-2.2-2h. Water level vs. pH, specific conductance, temperature, and dissolved oxygen for alluvial groundwater wells in Los Alamos and Pueblo Canyons collected using multi-parameter probes, well PAO-5N

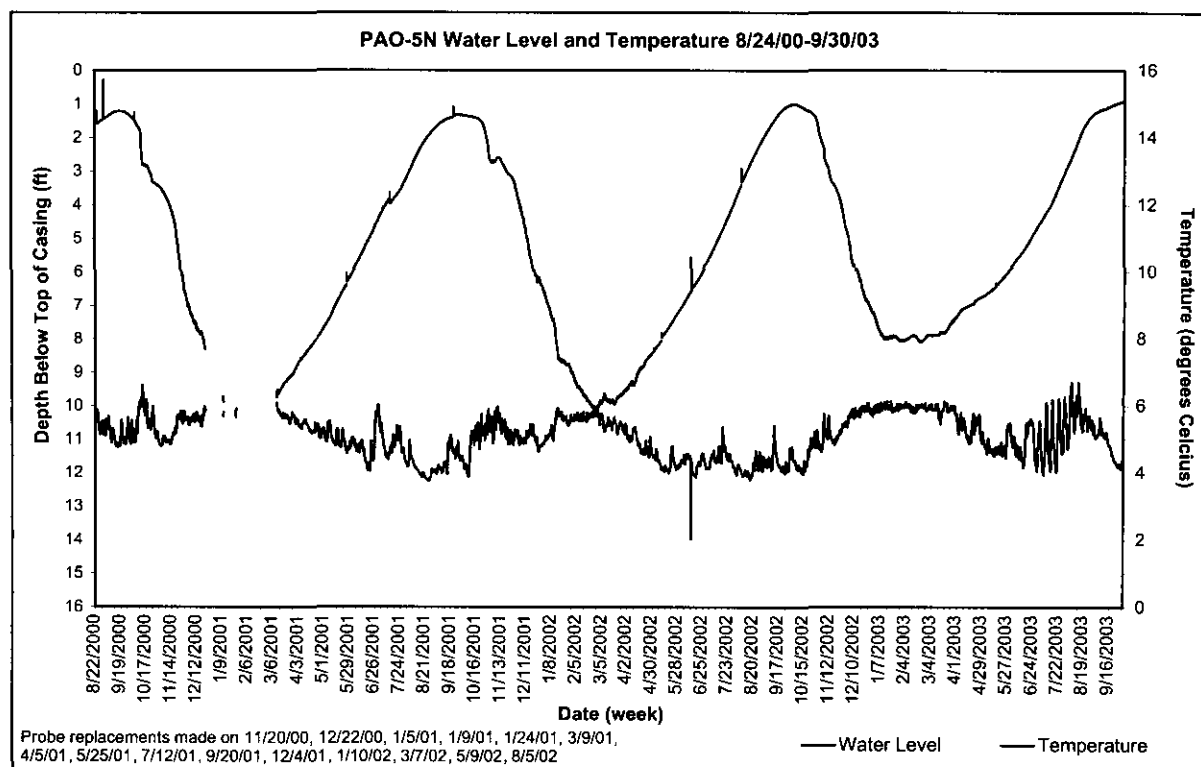
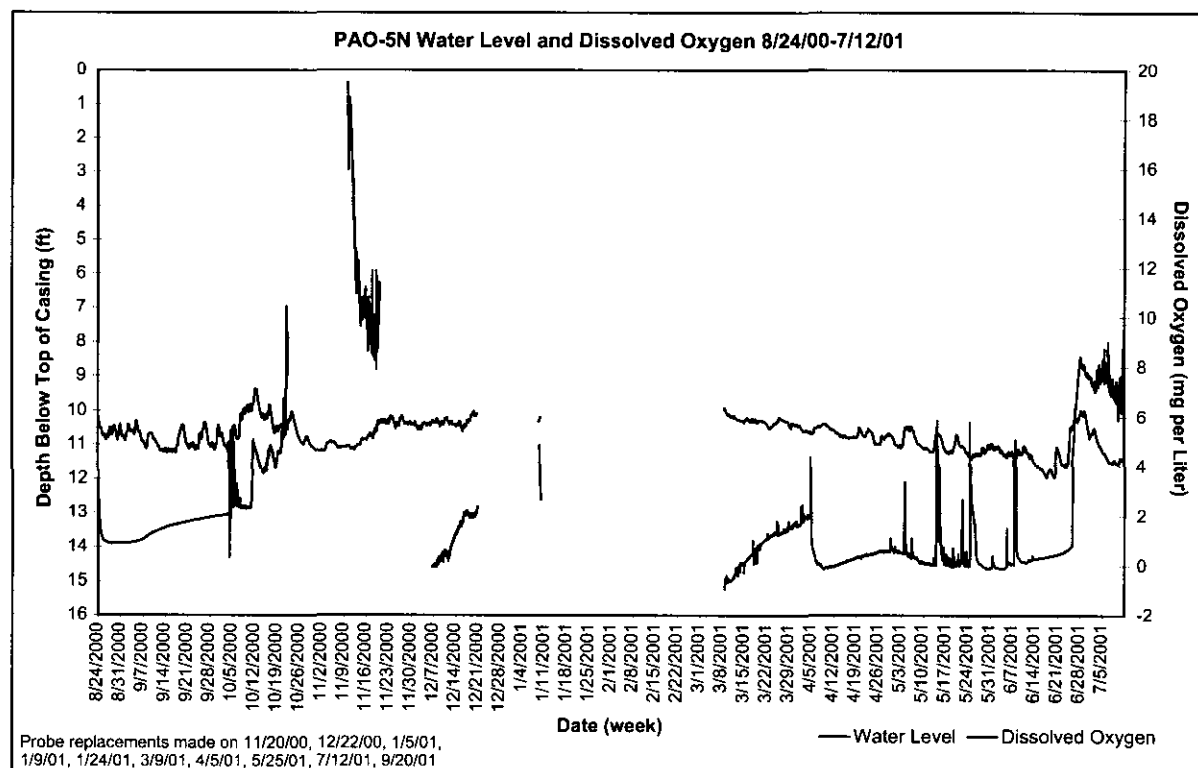


Figure B-2.2-2h (continued). Water level vs. pH, specific conductance, temperature, and dissolved oxygen for alluvial groundwater wells in Los Alamos and Pueblo Canyons collected using multi-parameter probes, well PAO-5N

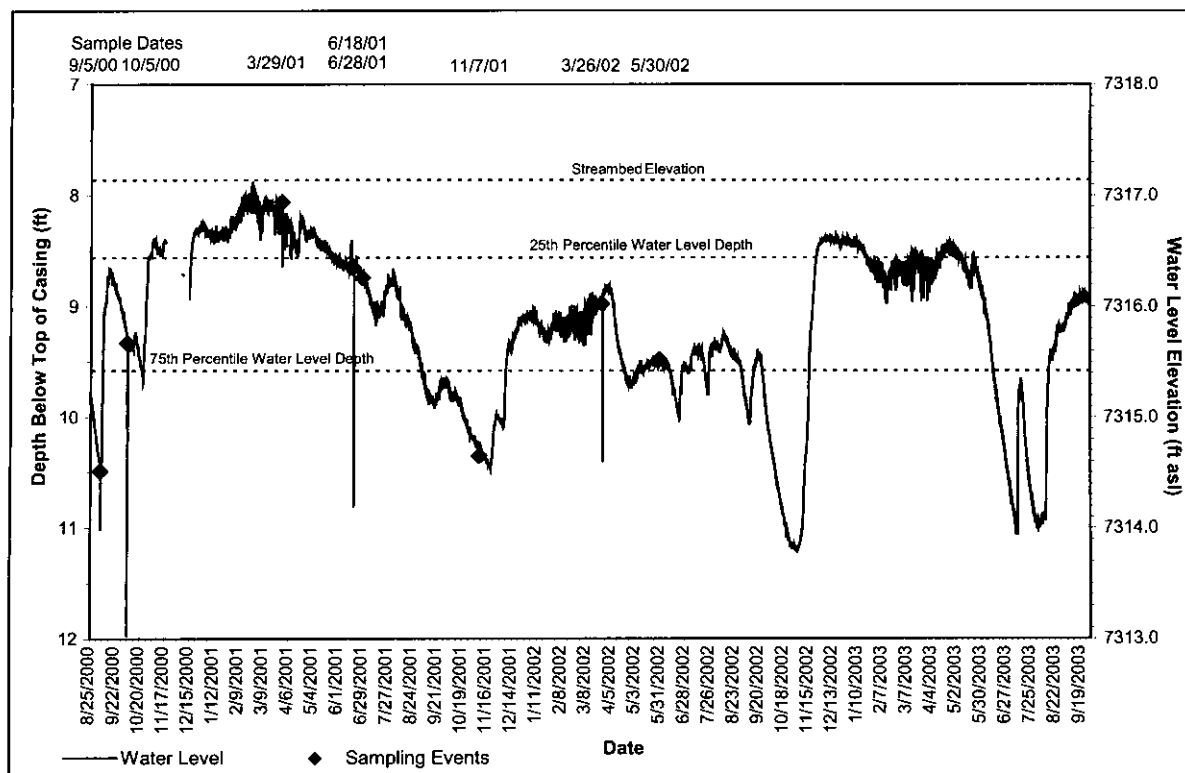


Figure B-2.2-3a. Automated water level vs. date for well LAO-B (8/25/00–9/30/03)

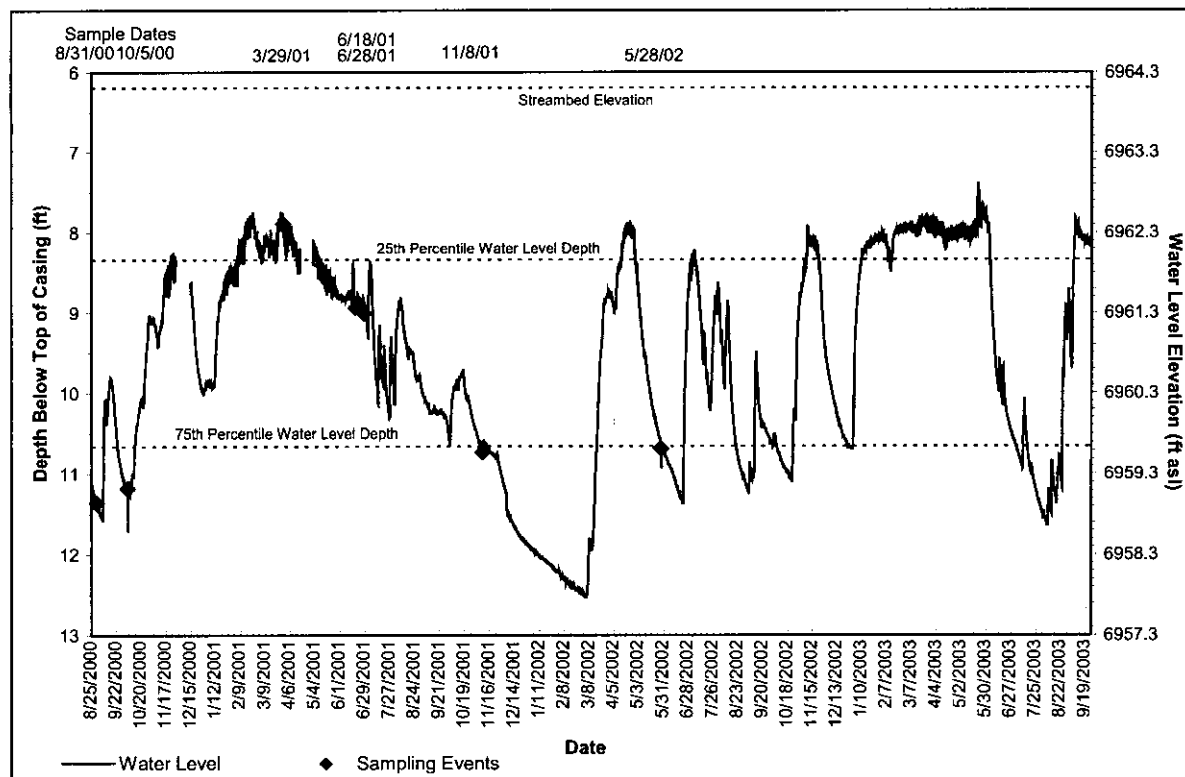


Figure B-2.2-3b. Automated water level vs. date for well LAO-0.3 (8/25/00–9/25/03)

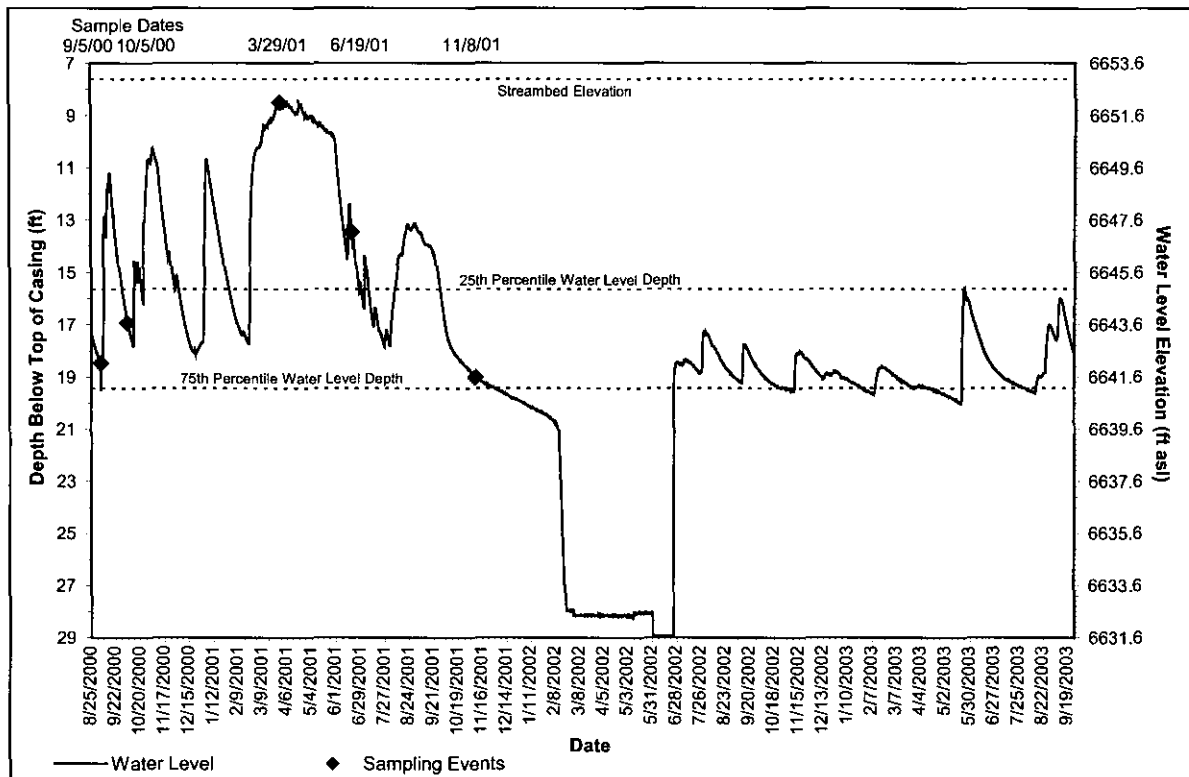


Figure B-2.2-3c. Automated water level vs. date for well LAO-1.6(g) (8/25/00–9/25/03)

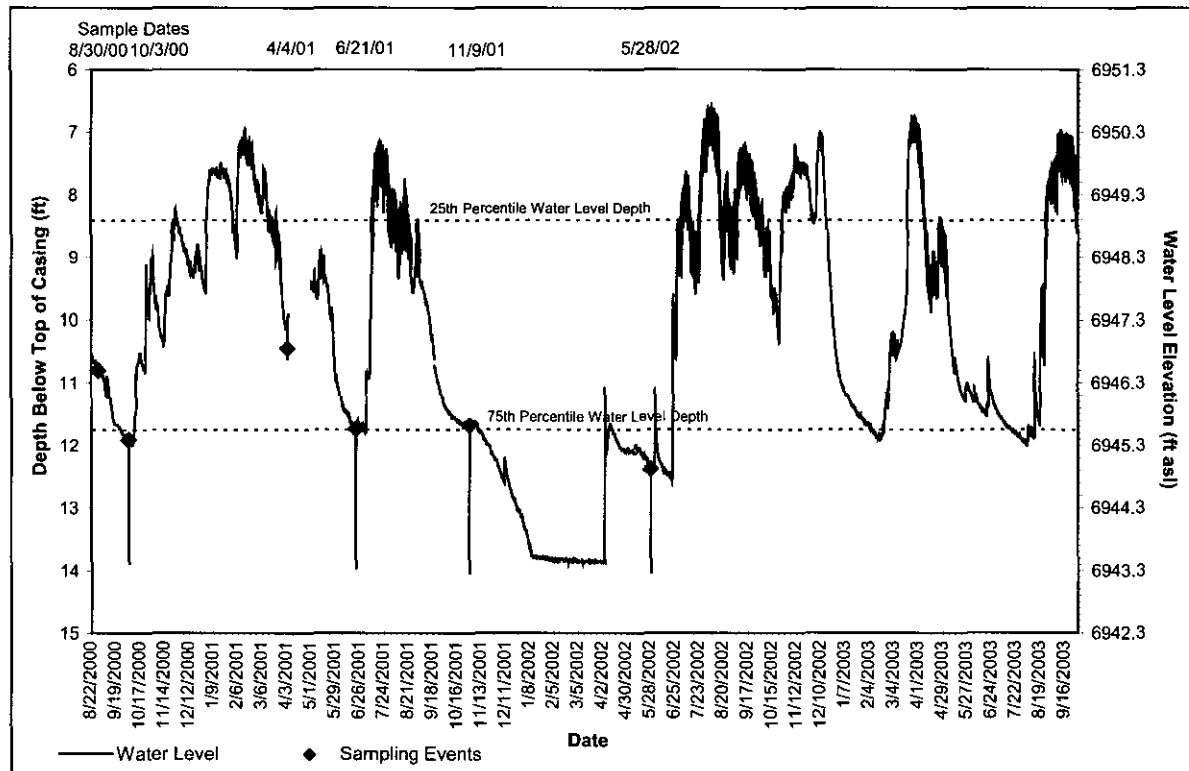


Figure B-2.2-3d. Automated water level vs. date for well PAO-1 (8/22/00–9/30/03)

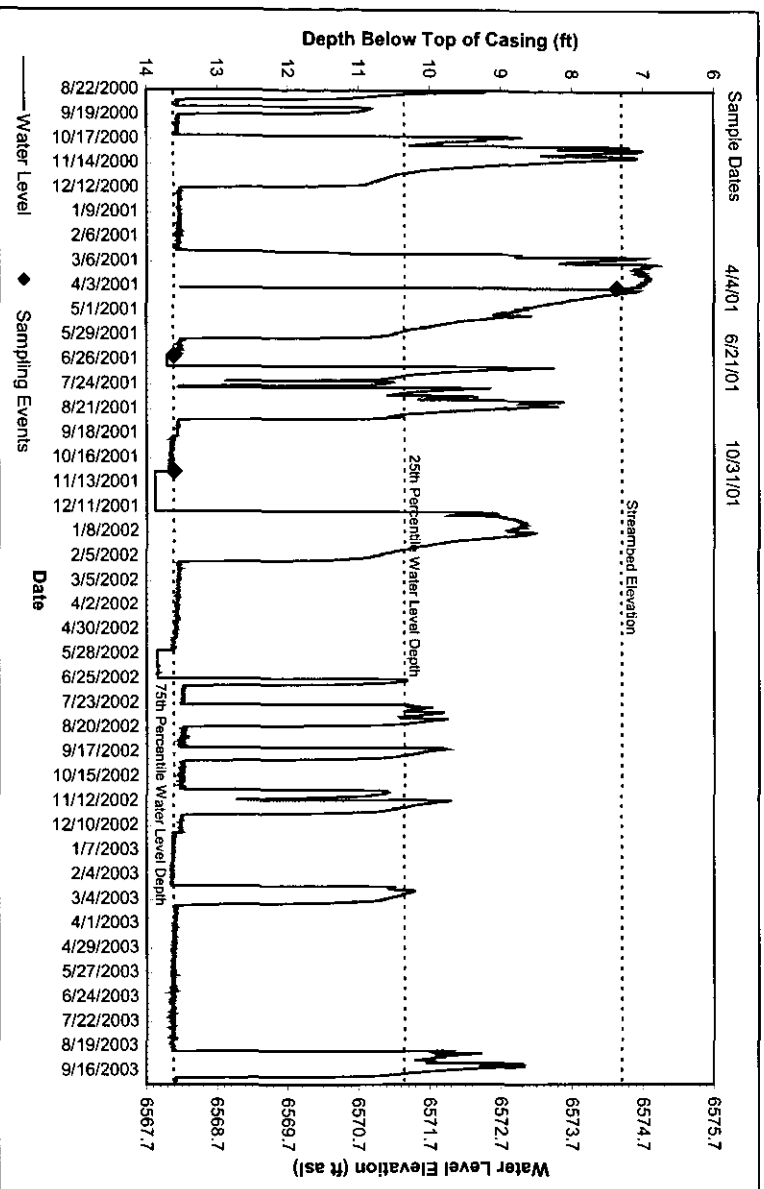


Figure B-2.2-3e. Automated water level vs. date for well PAO-3 (8/23/00-9/30/03)

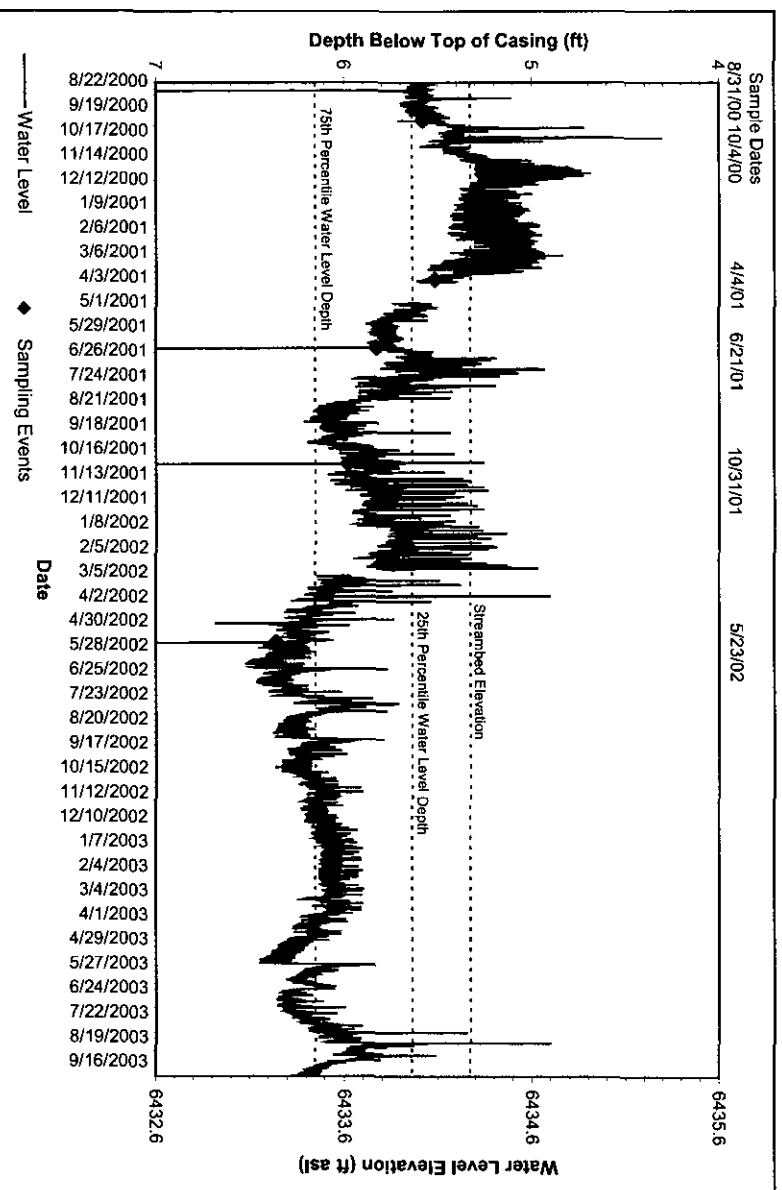


Figure B-2.2-3f. Automated water level vs. date for well PAO-4 (8/23/00-9/30/03)

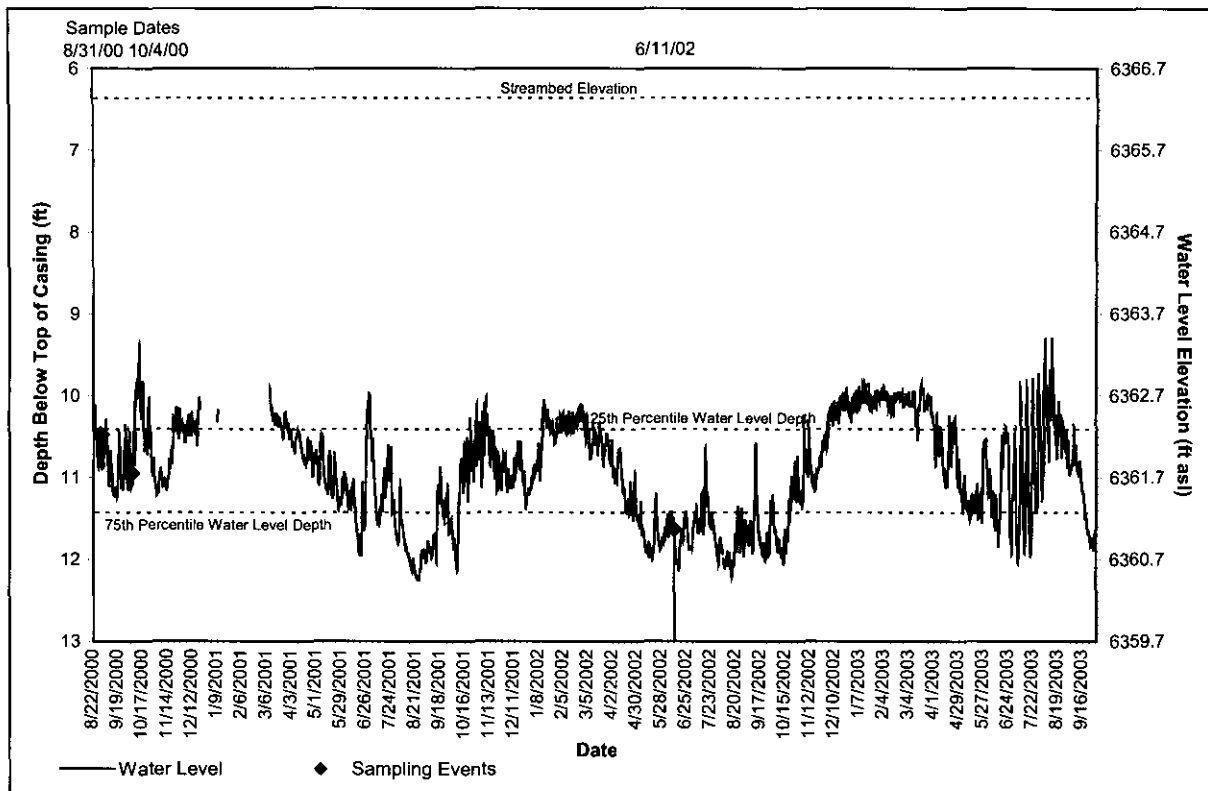
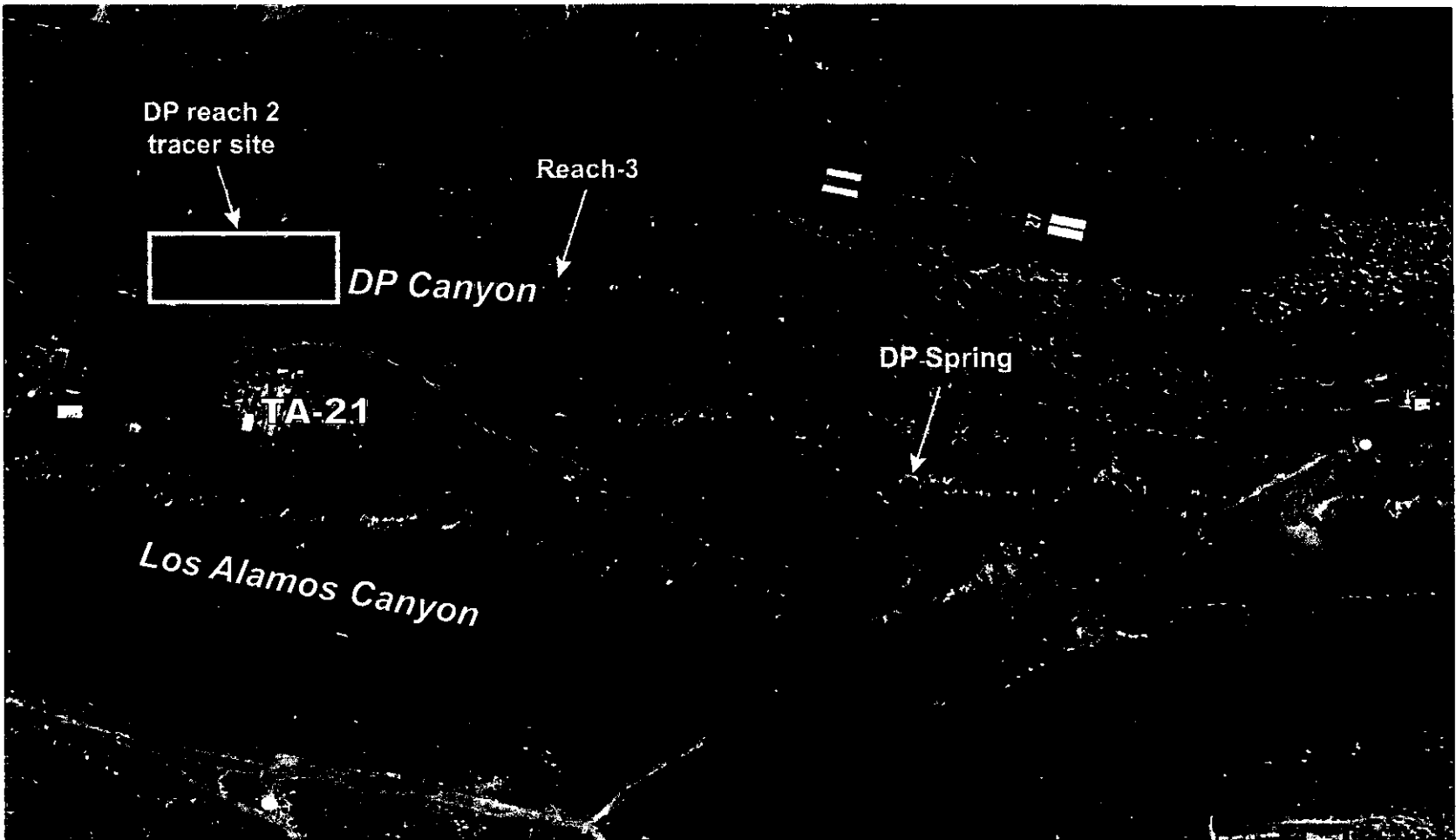


Figure B-2.2-3g. Automated water level vs. date for well PAO-5N (8/24/00–9/30/03)



Source: A. Groffmann, 04/04_Rev. for FB-2.4-1, LAPCIR, 041304, of

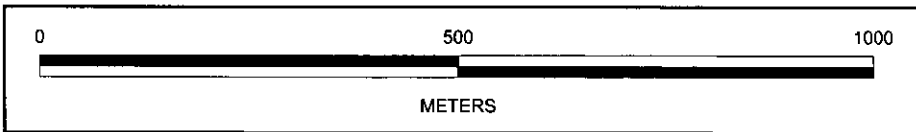
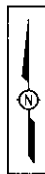
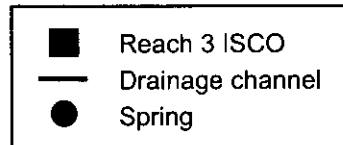


Figure B-2.4-1. DP Canyon and surrounding environments

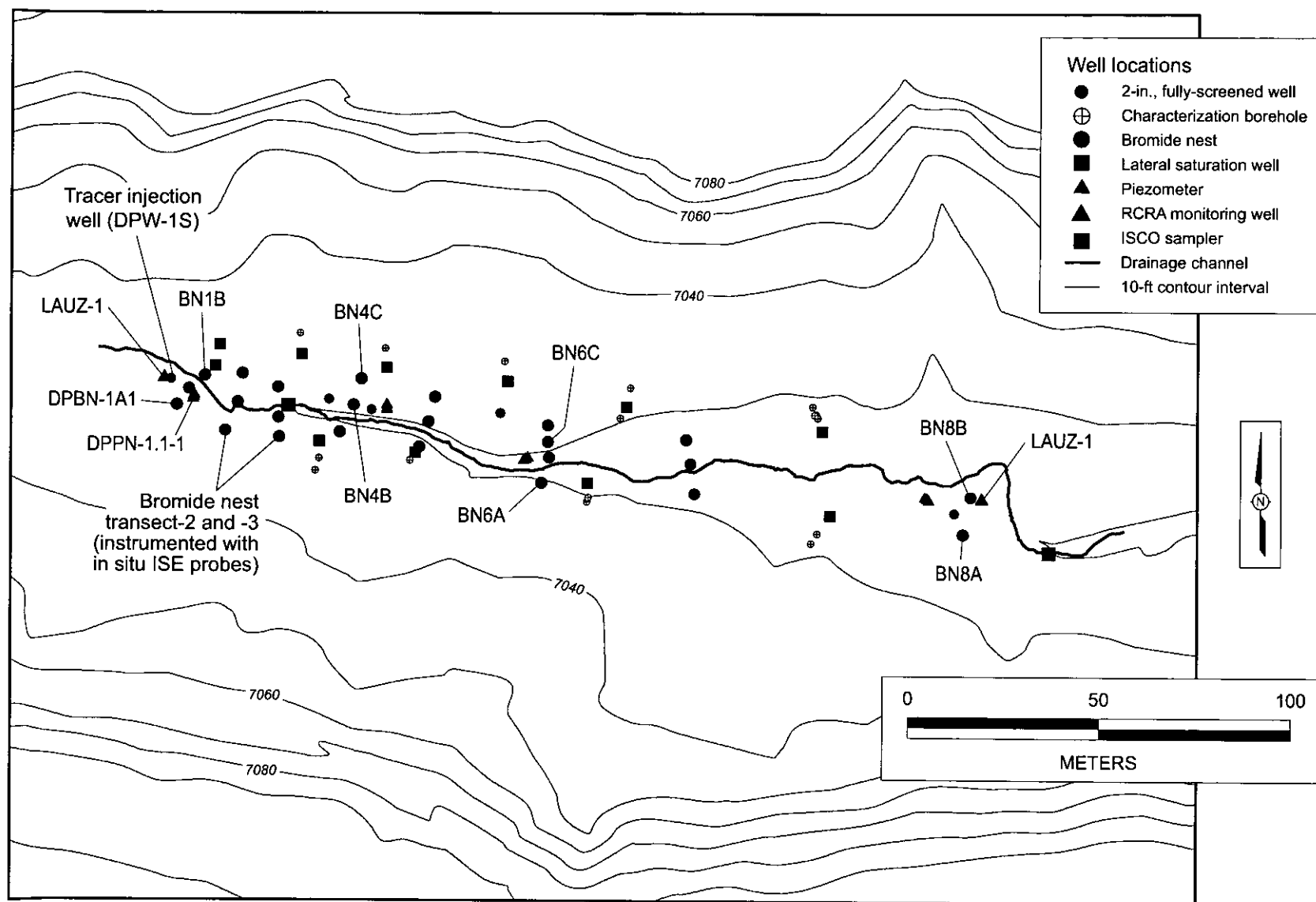


Figure B-2.4-2. Distribution of wells and sampling locations in reach DP-2

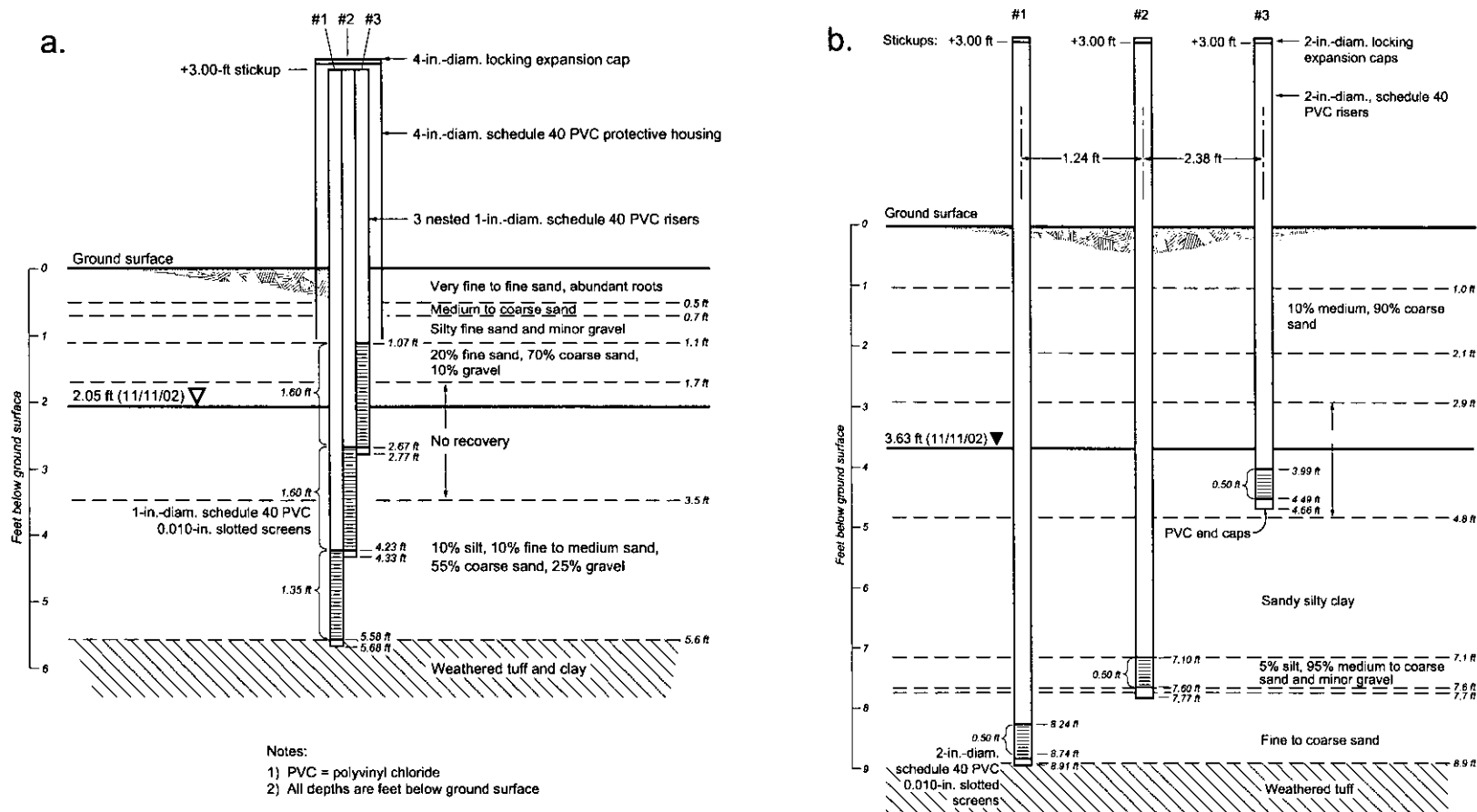
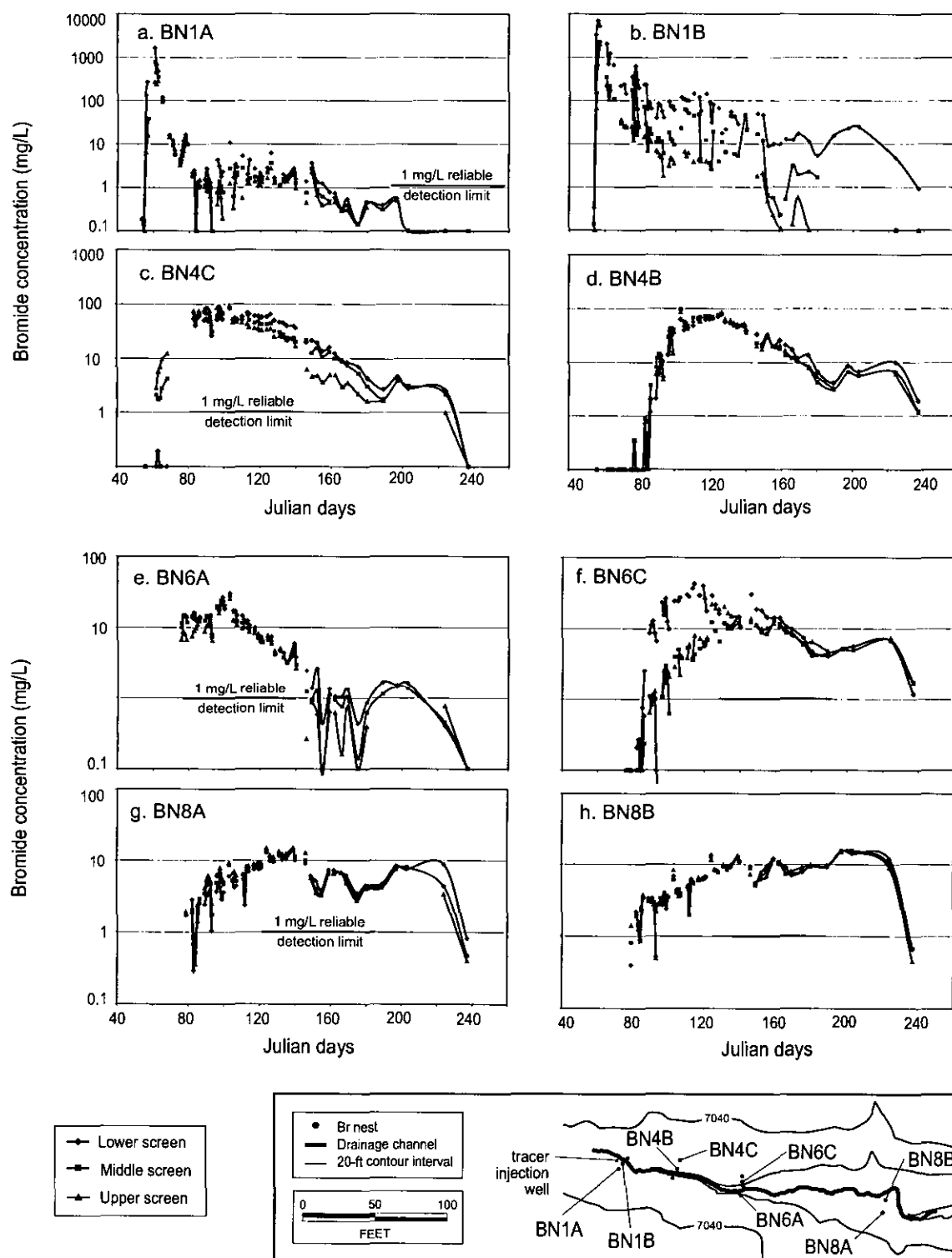
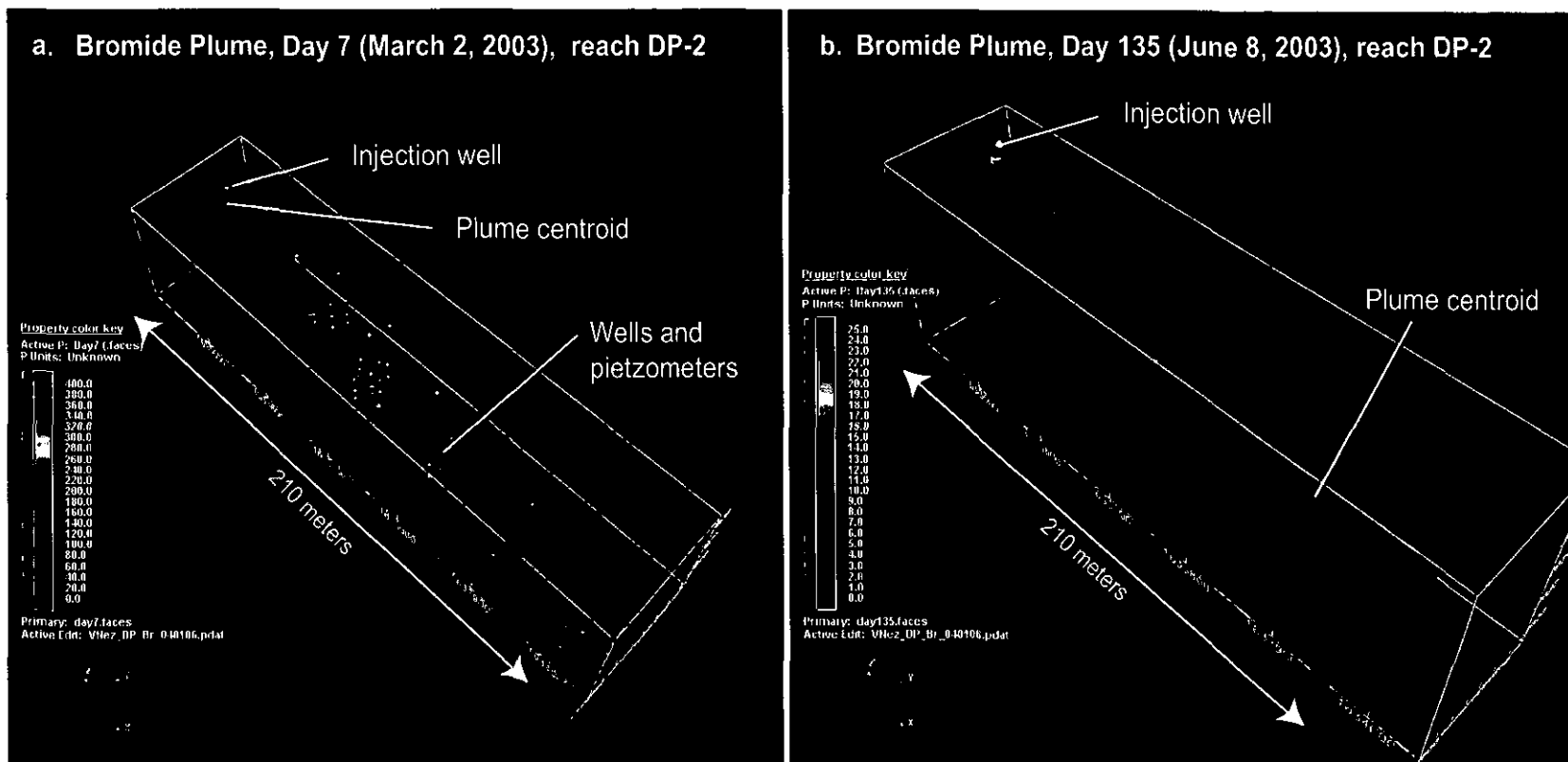


Figure B-2.4-3. Examples of well construction diagrams for nested alluvial wells and piezometers in reach DP-2



Note: Curves from individual screens illustrate timing and the range of tracer movement in the system. Locations are shown on the map.

Figure B-2.4-4. Bromide tracer curves from nested wells in for transects 2 and 3



Source: A. Groffman, 4/04
FB-2.4-5, LAPCIR, 042704, cf

Figure B-2.4-5. Visualization of bromide plume geometry on (a) day 7 (March 2) and (b) day 135 (June 8, 2003). The tracer was injected on February 24, 2003

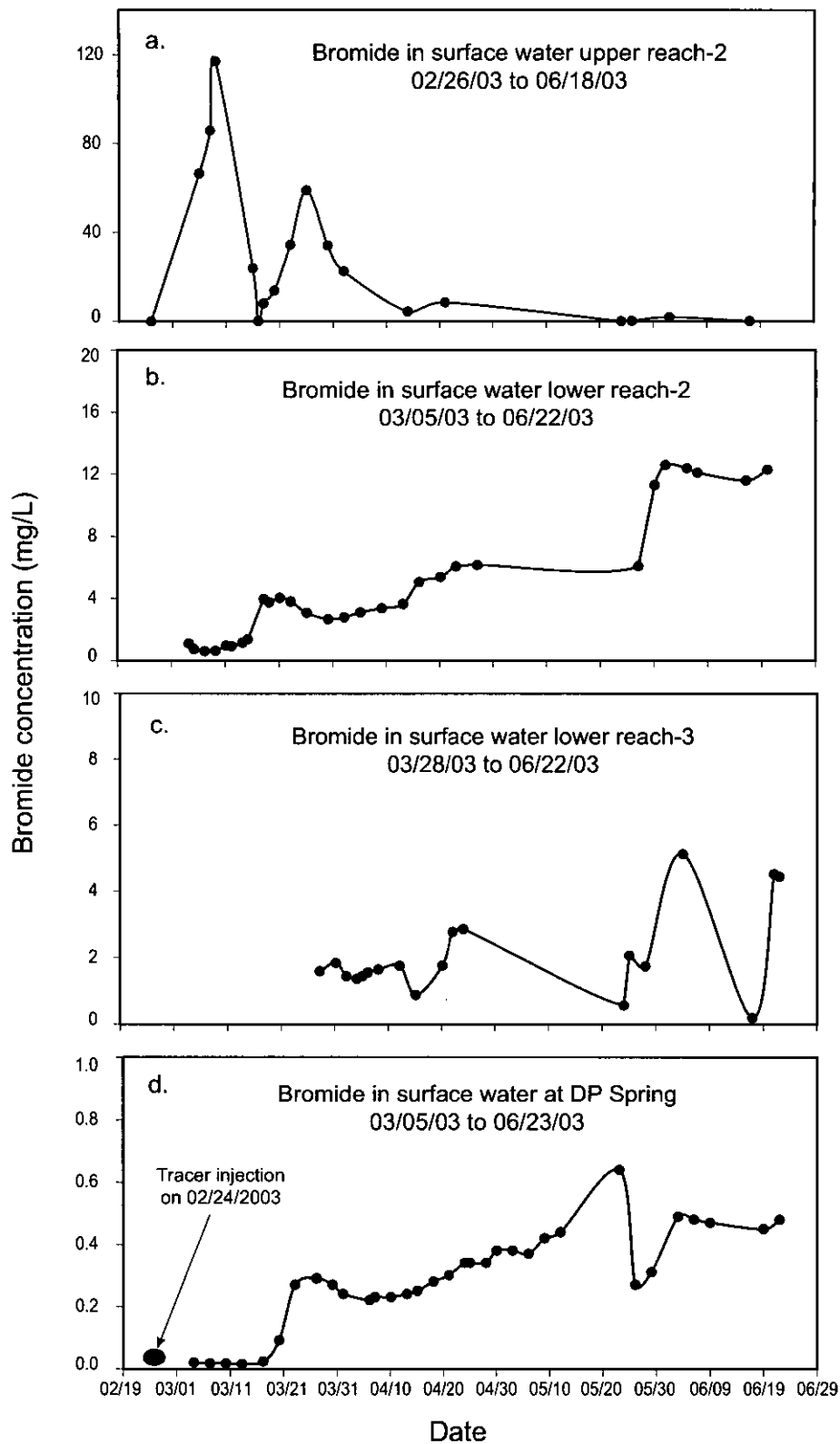
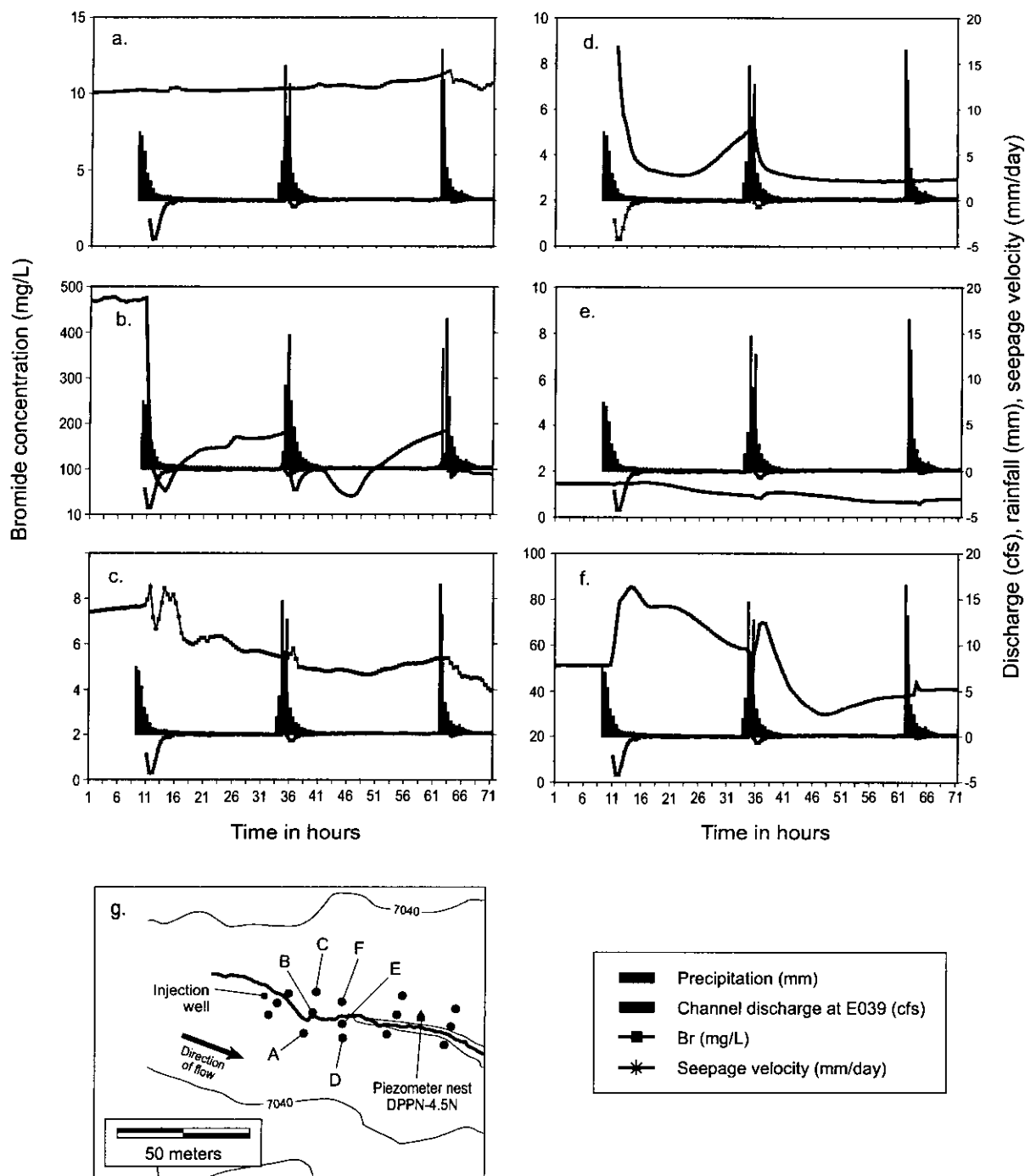


Figure B-2.4-6. Bromide in surface water at reaches 2 and 3 and at DP Spring



Notes: Automated bromide data are from the middle screen of the bromide-nested wells, with the exception of e, from the bottom screen. Locations are shown on the map in plot g. The bromide scales on right vertical axis are different for each plot.

Figure B-2.4-7. Response of bromide at transects 2 and 3 (see map inset), and seepage velocity (at DPPN-4.5N) to precipitation and channel flow from May 24 to May 27, 2003

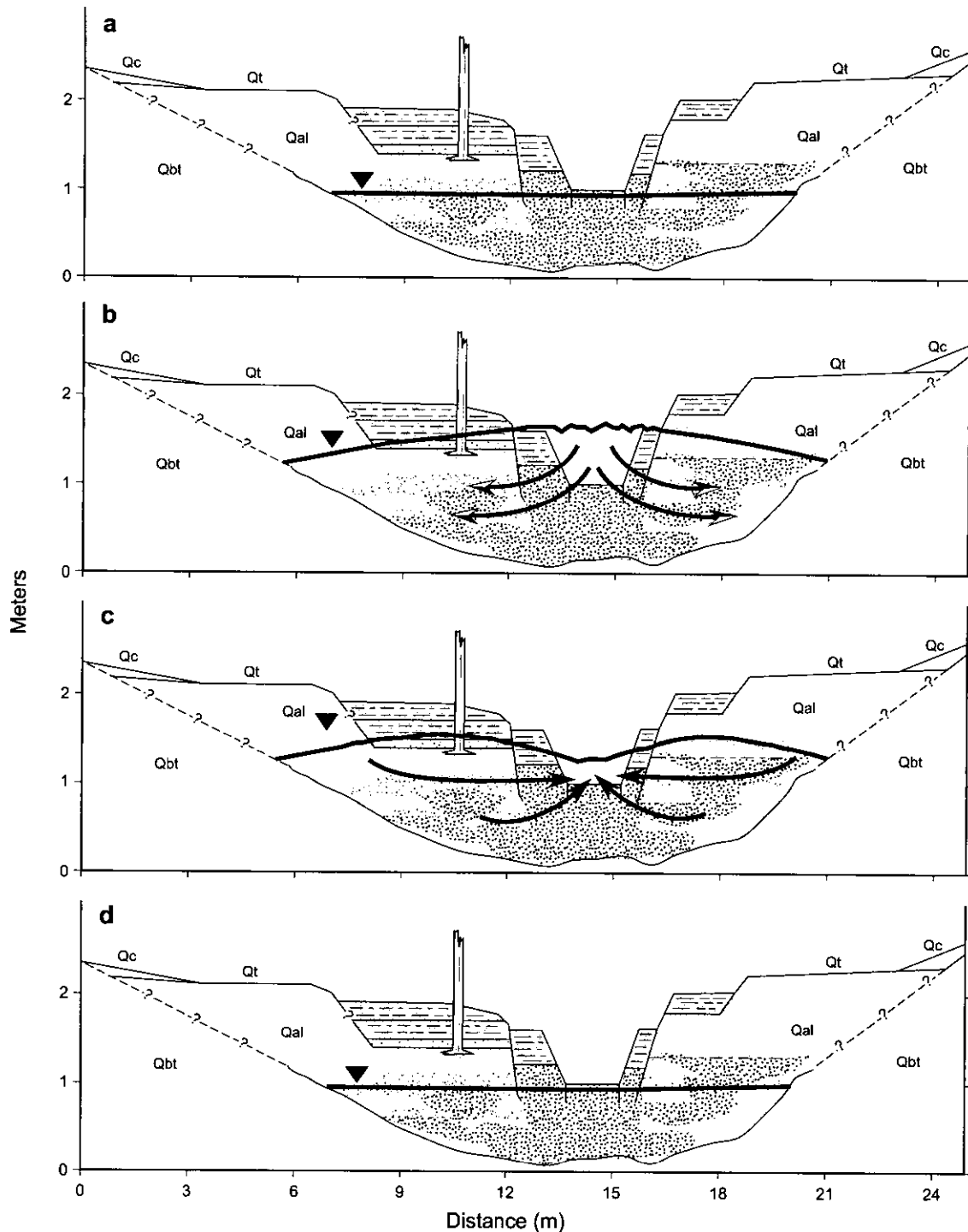


Figure B-2.4-8. Conceptual model of surface/groundwater exchange initiated by channel flow in reach DP-2. Plot a shows the water table is generally below the channel bed throughout most of the year. Plot b shows the hydraulic gradients pushing water into the adjacent alluvial aquifer during a flood; Plot c shows the aquifer then draining back into the channel as the gradients reverse. Plot d shows equilibrium conditions re-established as the water table relaxes.

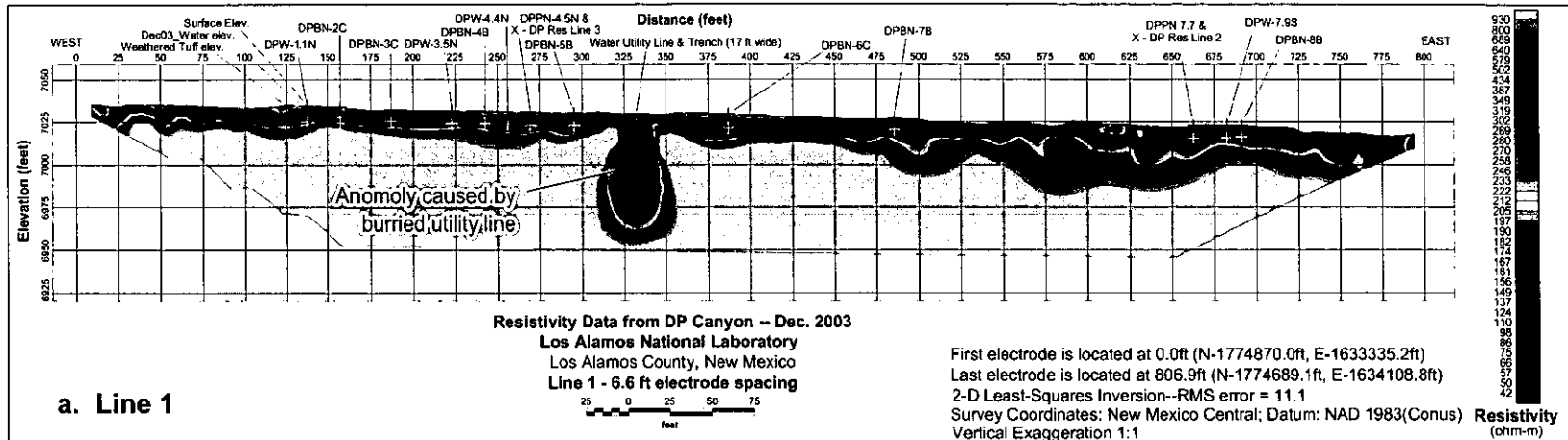
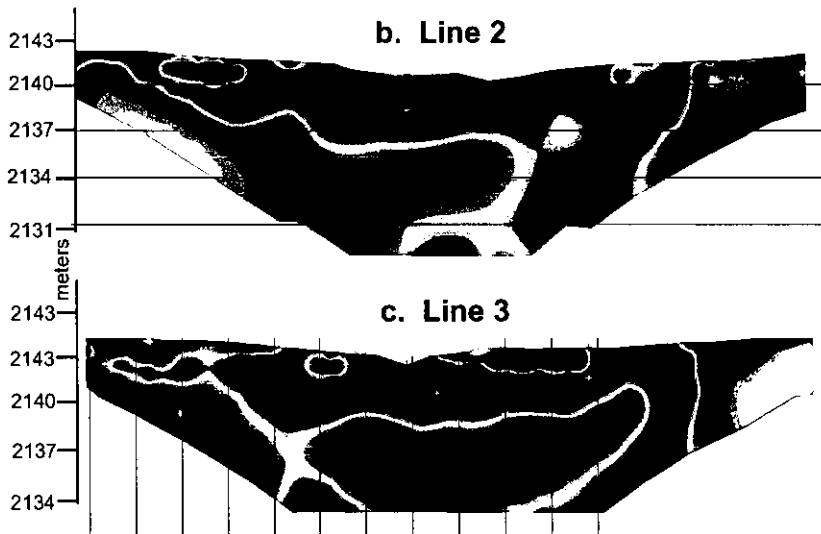
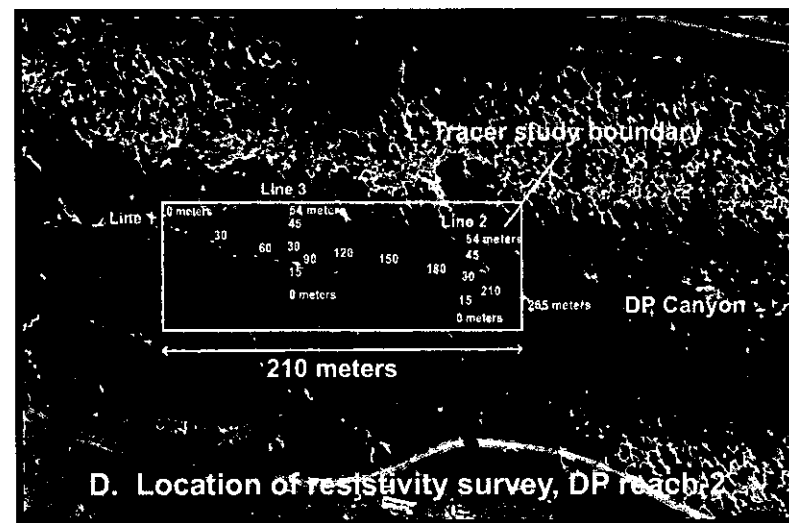


Figure B-2.4-9. Resistivity survey results in reach DP-2

Table B-1.0-1
Physical Characteristics of Post-1942 Geomorphic Units in Reaches LA-2 Far East and LA-3 West

Reach	Geomorphic Unit	Average Unit Width (m)*	Sediment Facies	Estimated Average Sediment Thickness (m)	Typical Median Particle Size Class (<2 mm fraction)	Notes
LA-2 Far East	c1	2.2	Fine	0.01	Very fine sand	Active channel
			Coarse	0.5	Coarse sand	
	c2	3.1	Fine	0.35	Very fine sand	Young abandoned channel with relatively low cesium-137
			Coarse	0.5	Coarse sand	
	c3	4.0	Fine	0.16	Very fine sand	Old abandoned channel with intermediate cesium-137
			Coarse	0.5	Coarse sand	
	c3a	0.5	Fine	0.72	Coarse silt	Old abandoned channel with relatively high cesium-137
			Coarse	0.5	Coarse sand	
	f1	6.1	Fine	0.29	Very fine sand	Post-1942 floodplain
			Coarse	0.04	Medium sand?	
	f2	4.9	Fine	0.16	Very fine sand	Possible post-1942 floodplain
			Coarse	0.05	Medium sand?	
Total	20.8					
LA-3 West	c1	1.8	Coarse	0.5	Coarse sand	Active channel
	c2	2.8	Fine	0.35	Very fine sand	Young abandoned channel with relatively low cesium-137
			Coarse	0.5	Coarse sand	
	c3	3.0	Fine	0.39	Very fine sand	Intermediate-age abandoned channel with intermediate cesium-137
			Coarse	0.5	Coarse sand	
	f1	2.9	Fine	0.15	Very fine sand	Post-1942 floodplain
			Coarse	0.04	Medium sand?	
	f2	2.8	Fine	0.06	Very fine sand?	Possible post-1942 floodplain
			Coarse	0.04	Medium sand?	
	Total	13.1				

*Average unit width is total area of unit in reach divided by reach length.

Table B-1.0-2
Field Radiological Data Obtained from Reach LA-2 Far East

Fixed-Point Site	Location ID	Geomorphic Unit	Distance from Upstream End of Reach (m)	Depth (cm)	Shielded Gamma Radiation (cpm ^a)
LA2FE-r1	— ^b	c2	0	0–10	19120
				10–20	20900
				20–30	22800
LA2FE-r2	—	f2? (c3?)	0	0–10	13560
				10–20	14390
				20–30	15390
				30–40	16360
LA2FE-r3	LA-10139	Qt swale	8	0–10	13280
				10–20	13870
LA2FE-r4	—	c2	8	0–10	18900
				10–20	21300
				20–30	23000
				30–40	23300
				40–50	23200
				50–60	23800
LA2FE-r5	LA-10138	f2? (Qt?)	8	0–10	14700
				10–20	15500
				20–30	16410
				30–40	18870
LA2FE-r6	—	c2	50	0–10	18160
				10–20	20600
				20–30	23800
				30–40	26800
				40–50	27900
				50–60	27400
LA2FE-r7	—	f2? (Qt?)	50	0–10	13750
				10–20	14880
				20–30	15970
				30–40	16830
LA2FE-r8	—	f2? (c3?)	50	0–10	12700
				10–20	13910
				20–30	15830
				30–40	17220
				40–50	18300
				50–60	19020
				60–70	19440
LA2FE-r9	—	c2	100	0–10	19790
				10–20	22200
				20–30	24300
				30–40	26200
				40–50	26600
				50–60	25900
				60–70	27000

Table B-1.0-2 (continued)

Fixed-Point Site	Location ID	Geomorphic Unit	Distance from Upstream End of Reach (m)	Depth (cm)	Shielded Gamma Radiation (cpm ^a)
LA2FE-r10	—	f2? (Qt?) swale	100	0-10	15690
				10-20	16900
				20-30	18010
				30-40	17770
				40-50	18820
LA2FE-r11	—	c2	100	0-10	20600
				10-20	23400
				20-30	25800
				30-40	28000
				40-50	29100
				50-60	29500
				60-70	29300
				70-80	30400
LA2FE-r12	—	Qt	100	0-10	13050
				10-20	14340
				20-30	15180
LA2FE-r13	LA-10142	c2	120	0-10	20000
				10-20	22600
				20-30	25500
				30-40	27300
LA2FE-r14	—	c2	150	0-10	17190
				10-20	20800
				20-30	20300
				30-40	19750
				40-50	18830
				50-60	19130
				60-70	19100
				70-80	19510
LA2FE-r15	LA-10143	c3	150	0-10	19770
				10-20	21100
				20-30	22600
LA2FE-r16	—	Qt	150	0-10	13930
LA2FE-r17	—	f2 swale	150	0-10	14770
				10-20	16300
				20-30	17520
				30-40	18560
				40-50	19120
LA2FE-r18	—	Qt	150	0-10	15110
				10-20	17080
				20-30	17130
				30-40	17450
				40-50	14820
				50-60	14460
				60-70	14740
				70-80	18650

Table B-1.0-2 (continued)

Fixed-Point Site	Location ID	Geomorphic Unit	Distance from Upstream End of Reach (m)	Depth (cm)	Shielded Gamma Radiation (cpm ^a)
LA2FE-r19	—	c2	200	0-10	17930
				10-20	18540
				20-30	18100
				30-40	20000
				40-50	20500
LA2FE-r20	—	c3	200	0-10	26600
				10-20	29100
				20-30	32700
				30-40	37700
				40-50	37300
				50-60	37400
				60-70	34700
				70-80	32300
				80-90	29500
				90-100	28600
LA2FE-r21	—	c2	205	0-10	18470
				10-20	18530
				20-30	18940
				30-40	18600
				40-50	18590
				50-60	19450
				60-70	20500
LA2FE-r22	—	c3	210	0-10	23900
				10-20	27500
				20-30	29300
				30-40	28700
				40-50	27300
				50-60	24400
				60-70	22300
LA2FE-r23	LA-10145	f2	200	0-10	14850
LA2FE-r24	LA-10075	c3	240	0-10	31600
				10-20	38800
				20-30	42500
				30-40	41500
				40-50	36400
LA2FE-r25	—	c2	250	50-60	33300
				0-10	19050
				10-20	19820
				20-30	20200
				30-40	19900
				40-50	20200
				50-60	19930
				60-70	19650

Table B-1.0-2 (continued)

Fixed-Point Site	Location ID	Geomorphic Unit	Distance from Upstream End of Reach (m)	Depth (cm)	Shielded Gamma Radiation (cpm ^a)
LA2FE-r26	LA-10077	c3a	255	0-10	40300
				10-20	51300
				20-30	59000
				30-40	67000
				40-50	72000
				50-60	71900
				60-70	51600
				70-80	33900
LA2FE-r27	—	f1? (c3?)	295	0-10	23900
				10-20	24700
				20-30	24400
				30-40	24300
				40-50	23300
				50-60	23600
				60-70	23400
LA2FE-r28	—	c2	300	0-10	17130
				10-20	20400
				20-30	21900
				30-40	22300
				40-50	22100
				50-60	22000
				60-70	22600
LA2FE-r29	—	f1	310	0-10	36000
				10-20	41100
				20-30	39300
				30-40	33700
				40-50	28900
				50-60	25500
				60-70	23800
LA2FE-r30	LA-10081	c3a swale	310	0-10	79000
				10-20	91500
				20-30	65900
				30-40	104400
				40-50	86100
				50-60	118800
				60-70	111800
				70-80	102800
				80-90	76700
				90-100	95400
				100-110	96700
				110-120	99600
				120-130	100400
				130-140	83700
				140-150	80000
				150-160	76800

Table B-1.0-2 (continued)

Fixed-Point Site	Location ID	Geomorphic Unit	Distance from Upstream End of Reach (m)	Depth (cm)	Shielded Gamma Radiation (cpm ^a)
LA2FE-r31	—	f1	310	0–10	29200
				10–20	29200
				20–30	28200
				30–40	26500
				40–50	24900
				50–60	24200
				60–70	23600
LA2FE-r32	—	c3a swale	335	0–10	59100
				10–20	64800
				20–30	62500
				30–40	72000
				40–50	75100
				50–60	76400
				60–70	75000
				70–80	77200
				80–90	78000
				90–100	79100
				100–110	61700
				110–120	71100
LA2FE-r33	LA-10082	f1A	340	0–10	46000
				10–20	51500
				20–30	52900
				30–40	47900
				40–50	41500
LA2FE-r34	—	f1	330	0–10	27600
				10–20	27100
				20–30	25700
LA2FE-r35	—	f1	330	0–10	23400
				10–20	21900
				20–30	21500
				30–40	21800
LA2FE-r36	—	c2	340	0–10	20200
				10–20	20500
				20–30	21100
				30–40	22500
				40–50	22800
				50–60	23400
LA2FE-r37	—	c1	350	0–10	15330
				10–20	15270
				20–30	15890
				30–40	16300
				40–50	17330
LA2FE-r38	—	Qt	356	0–10	14150
				10–20	14580
LA2FE-r39	—	f1	355	0–10	28600
				10–20	28900
				20–30	27900

Table B-1.0-2 (continued)

Fixed-Point Site	Location ID	Geomorphic Unit	Distance from Upstream End of Reach (m)	Depth (cm)	Shielded Gamma Radiation (cpm ^a)
LA2FE-r40	LA-10085	c3	360	0-10	19950
				10-20	18830
				20-30	18670
				30-40	18600
				46-56	19640
				56-66	20400
				66-76	21300
LA2FE-r41	—	f1	360	0-10	30300
				10-20	31100
				20-30	30000
LA2FE-r42	—	f1	360	0-10	41800
				10-20	42400
				20-30	39500
				30-40	36100
				40-50	30000
				50-60	28400
				60-70	27700
				70-80	26800
				80-90	27400
LA2FE-r43	—	c2	405	0-10	21400
				10-20	24300
				20-30	26600
				30-40	27200
				40-50	26200
				50-60	25900
LA2FE-r44	—	Qt	390	0-10	15000
				10-20	15960
				20-30	16340
LA2FE-r45	LA-10086	f2? (Qt?)	390	0-10	16350
				10-20	17530
				20-30	18390
				30-40	18900
				40-50	19820
				50-60	20100
				60-70	20300
LA2FE-r46	—	f1	390	0-10	32200
				10-20	32200
				20-30	31300
				30-40	29200
				40-50	26000
				50-60	25300
				60-70	23600
				70-80	23100
				80-90	22500
LA2FE-r47	—	f1	410	0-10	20700
				10-20	21100
				20-30	22100
LA2FE-r48	—	c1	450	0-10	16150

Table B-1.0-2 (continued)

Fixed-Point Site	Location ID	Geomorphic Unit	Distance from Upstream End of Reach (m)	Depth (cm)	Shielded Gamma Radiation (cpm ^a)
LA2FE-r49	—	c2	450	0–10	14430
				10–20	15580
				20–30	16730
				30–40	21900
				40–50	22400
LA2FE-r50	—	f2? (Qt?)	455	0–10	16940
				10–20	18200
				20–30	19730
				30–40	20300
				40–50	20800
LA2FE-r51	—	c2	455	0–10	18630
				10–20	19380
				20–40	20600
				40–50	19990
LA2FE-r52	—	f2? (Qt?)	450	0–10	18720
				10–20	19560
				20–30	19800
				30–40	20200
LA2FE-r53	—	c2	500	0–10	18600
				10–20	19030
				20–30	20800
				30–40	21900
				40–50	23100
				50–60	23500
				60–70	23200
				70–80	22500
LA2FE-r54	—	c2	500	80–90	22300
				0–10	16800
				10–20	17530
				20–30	19190
				30–40	19690
				40–50	22100
				50–60	23200
				60–70	25200
LA2FE-r55	—	f2? (Qc?)	505	70–80	24700
				0–10	15210
LA2FE-r56	—	c2	550	10–20	15840
				0–10	20500
				10–20	21400
				20–30	24400
				30–40	26600
LA2FE-r57	—	f2? (f1?)	550	40–70	27000
				0–10	15770
				10–20	16990
				20–30	18040
				30–40	18670

Table B-1.0-2 (continued)

Fixed-Point Site	Location ID	Geomorphic Unit	Distance from Upstream End of Reach (m)	Depth (cm)	Shielded Gamma Radiation (cpm ^a)
LA2FE-r58	—	c2	555	0–10	18920
				10–20	21200
				20–30	23100
				30–50	24000
				50–60	24400
LA2FE-r59	—	Qt	555	0–10	15230
				10–20	15500
				20–30	15950
LA2FE-r60	—	f1? (f2?)	560	0–10	16450
				10–20	18040
				20–30	19210
				30–40	19830
				40–50	20300
				50–60	20500
LA2FE-r61	LA-10087	c2	594	0–10	24500
				10–20	28300
				20–30	28600
				30–40	32700
				40–50	34600
				50–60	35700
				60–70	35500
				70–80	34900
LA2FE-r62	—	f2? (f1?)	588	0–10	14460
				10–20	15110
LA2FE-r63	—	c2	600	0–10	20500
				10–20	23000
				20–30	24300
				30–40	25400
				40–50	25000
				50–60	25200
				60–70	25400
LA2FE-r64	LA-10088	f2? (Qt?)	600	0–10	14440
				10–20	14870
LA2FE-r65	—	c2	648	0–10	17700
				10–20	19870
				20–30	24400
				30–50	25300
				50–60	24700
				60–70	24300
LA2FE-r66	—	Qt swale	650	0–10	15070
				10–20	16190
				20–30	17030
LA2FE-r67	LA-10092	f2? (Qt?)	660	0–10	14870
				10–20	16890
				20–30	18610

Table B-1.0-2 (continued)

Fixed-Point Site	Location ID	Geomorphic Unit	Distance from Upstream End of Reach (m)	Depth (cm)	Shielded Gamma Radiation (cpm ^a)
LA2FE-r68	LA-10089	f2? (Qt?)	660	0-10	15050
				10-20	16910
				20-30	17850
				30-40	18660
				40-50	20300
				50-60	21500
				60-70	22300
				70-80	22700
LA2FE-r69	—	c2	695	0-10	19560
				10-20	20800
				20-30	20900
				30-40	21300
				40-50	20500
				50-60	21100
LA2FE-r70	—	c2	700	0-10	19740
				10-20	20800
				20-30	22700
				30-40	23300
				40-50	22400
				50-60	21600
				60-70	21700
LA2FE-r71	—	Qt	705	0-10	13690
				10-20	14060
LA2FE-r72	—	f2 swale	705	0-10	14390
				10-20	15480
				20-30	17100
LA2FE-r73	—	Qt+Qc	710	0-10	15570
				10-20	16060
				20-30	17460
LA2FE-r74	—	f2? (f1?)	710	0-10	14970
				10-20	17040
				20-30	18180
LA2FE-r75	LA-10093	f1	740	0-10	25400
				10-20	27600
				20-30	26500
				30-40	25100
LA2FE-r76	—	c2	750	0-10	19450
				10-20	21100
				20-30	21600
				30-40	23300
				40-50	24100
				50-60	24000
				60-70	22600
LA2FE-r77	—	f1	750	0-10	16830
				10-20	18710
				20-30	20000

Table B-1.0-2 (continued)

Fixed-Point Site	Location ID	Geomorphic Unit	Distance from Upstream End of Reach (m)	Depth (cm)	Shielded Gamma Radiation (cpm ^a)
LA2FE-r78	—	Qt swale	770	0–10	15610
				10–20	16540
				20–30	17830
				30–40	18390
				40–50	18910
LA2FE-r79	—	c2	800	0–10	20200
				10–20	22400
				20–30	26900
				30–40	28400
				40–50	29200
				50–60	29600
				60–70	29400
LA2FE-r80	LA-10094	f1	800	0–10	15670
				10–20	16960
				20–30	17220
LA2FE-r81	—	f2? (Qt?)	800	0–10	14220
				10–20	14810
LA2FE-r82	LA-10095	f2	800	0–10	15800
				10–20	17220
				20–30	17900
				30–40	18320
LA2FE-r83	LA-10096	f1	840	0–10	20400
				10–20	21400
				20–30	22300
LA2FE-r84	LA-10097	c2	855	0–10	16580
				10–20	17500
				20–30	18710
				30–40	18960
LA2FE-r85	LA-10098	f1	860	0–10	24100
				10–20	26000
				20–30	26600
				30–40	25900
				40–50	24600
				50–60	24100
LA2FE-r86	—	c2? (c3?)	865	0–10	25200
				10–20	27100
				20–30	29500
				30–40	30800
				40–50	30700
LA2FE-r87	—	c2	900	0–10	17880
				10–20	18850
				20–30	21300
				30–40	24500
				40–50	26700
				50–60	28400

Table B-1.0-2 (continued)

Fixed-Point Site	Location ID	Geomorphic Unit	Distance from Upstream End of Reach (m)	Depth (cm)	Shielded Gamma Radiation (cpm ^a)
LA2FE-r88	—	c3	900	0–10	16120
				10–20	15400
				20–30	16230
				30–40	17570
				40–50	17940
				50–60	20300
LA2FE-r89	—	f2	910	0–10	14580
				10–20	15140
LA2FE-r90	—	f1	930	0–10	18090
				10–20	20300
				20–30	22200
				30–40	22700
				40–50	23400
LA2FE-r91	—	c2	955	0–10	17450
				10–20	17990
				20–30	19760
				30–40	21000
				40–50	22400
				50–60	22800
LA2FE-r92	—	c2	995	0–10	17880
				10–20	19920
				20–30	20000
				30–40	21300
				40–50	22700
				50–60	24200
LA2FE-r93	—	c3 + disturbed	995	0–10	19520
				10–20	22800
				20–30	24900
				30–40	27900
				40–50	30900
LA2FE-r94	—	c3	995	0–10	17990
				10–20	18480
				20–40	20000
				40–50	20400
				50–60	21200
LA2FE-r95	LA-10141	Qt	100	0–10	12540
				10–20	13680
				20–30	14140
LA2FE-r96	—	c3	186	0–10	20800
				10–20	23100
				20–30	26200
				30–40	27600
				40–50	27400

Table B-1.0-2 (continued)

Fixed-Point Site	Location ID	Geomorphic Unit	Distance from Upstream End of Reach (m)	Depth (cm)	Shielded Gamma Radiation (cpm ^a)
LA2FE-r97	LA-10144	c3	188	0-10	22000
				10-20	25300
				20-30	30600
				30-40	33100
				40-50	33600
LA2FE-r98	—	f1	224	0-10	28500
				10-20	28200
				20-30	26900
				30-40	24800
				40-50	23400
LA2FE-r99	—	c3	228	0-10	23100
				10-20	25500
				20-30	27200
				30-40	27600
LA2FE-r100	—	c3	227	0-10	23700
				10-20	26000
				20-30	26900
				30-40	26300
				40-50	24000
LA2FE-r101	—	c3	241	0-10	24500
				10-20	26200
				20-30	28400
				30-40	29700
				40-50	28800
LA2FE-r102	—	c3	249	0-10	27200
				10-20	30000
				20-30	29300
				30-40	26100
				40-50	23700
LA2FE-r103	—	c3 swale	262	0-10	29400
				10-20	30700
				20-30	29700
				30-40	27600
				40-50	25600
				50-60	23800
				60-70	23500
				70-80	22600

Table B-1.0-2 (continued)

Fixed-Point Site	Location ID	Geomorphic Unit	Distance from Upstream End of Reach (m)	Depth (cm)	Shielded Gamma Radiation (cpm ^a)
LA2FE-r104	LA-10076	c3a	238	0-10	26800
				10-20	31000
				20-30	36700
				30-40	43600
				40-50	51000
				50-60	57300
				60-70	55600
				70-80	49700
LA2FE-r105	—	c3	219	0-10	21200
				10-20	24300
				20-30	25600
				30-40	26200
LA2FE-r106	—	c3 swale	258	0-10	34700
				10-20	41700
				20-30	43100
				30-40	36600
LA2FE-r107	—	f1	287	0-10	33700
				10-20	34800
				20-30	31900
				30-40	28300
				40-50	24800
				50-60	22900
				60-70	22000
				70-80	21200
				80-90	21000
				90-100	21100
LA2FE-r108	—	c3 swale	245	0-10	27700
				10-30	30700
				20-30	30700
				40-50	26500
LA2FE-r109	—	c3	274	0-10	36300
				10-20	44600
				20-30	45500
				30-40	42800
				40-50	39400
LA2FE-r110	—	c3	269	0-10	22600
				10-20	25400
				20-30	27200
				30-40	27600
				40-50	27400
				50-60	27100
LA2FE-r111	LA-10079	c3 channel	290	0-10	20300
				10-20	21100
				20-30	21400
				30-50	20900

Table B-1.0-2 (continued)

Fixed-Point Site	Location ID	Geomorphic Unit	Distance from Upstream End of Reach (m)	Depth (cm)	Shielded Gamma Radiation (cpm ^a)
LA2FE-r112	—	c3 channel	331	0–10	38000
				10–20	44200
				20–30	49300
				30–40	49600
				40–50	46000
LA2FE-r113	—	f1	318	0–10	38800
				10–20	42000
				20–30	41500
				30–40	36700
				40–50	32600
				50–60	28900
				60–70	26900
LA2FE-r114	LA-10080	c3 swale	297	70–80	25400
				0–10	24600
				10–20	26400
				20–30	28900
				30–40	29600
				40–50	27000
				50–60	26600
				60–70	26700
				70–80	26800
LA2FE-r115	—	f1 channel	350	80–90	27000
				90–100	27700
				0–10	32600
				10–20	31000
				20–30	27900
				30–40	25200
LA2FE-r116	—	f1	346	40–50	23600
				50–60	23200
				0–10	28000
				10–20	26300
				20–30	24300
LA2FE-r117	—	f1	350	30–40	22600
				40–50	21900
				0–10	26800
				10–20	27000
				20–30	25300
				30–40	24500
LA2FE-r118	—	f1	371	40–50	24100
				50–60	23500
				0–10	27500
				10–20	27900
				20–30	27000
				30–40	25800
				40–50	24500

Table B-1.0-2 (continued)

Fixed-Point Site	Location ID	Geomorphic Unit	Distance from Upstream End of Reach (m)	Depth (cm)	Shielded Gamma Radiation (cpm ^a)
LA2FE-r119	—	f1	383	0–10	29800
				10–20	31000
				20–30	27000
				30–40	24400
				40–50	23600
				50–60	23300
LA2FE-r120	—	f1	372	0–10	40500
				10–20	43200
				20–30	39300
				30–40	35500
				40–50	31500
				50–60	27900
				60–70	26000
				70–80	25300
LA2FE-r121	LA-10083	f1	403	0–10	34900
				10–20	36800
				20–30	35200
				30–40	31500
				40–50	28600
				50–70	26900
LA2FE-r122	—	f1	412	0–10	30500
				10–20	32700
				20–30	32200
				30–40	30800
				40–50	29100
LA2FE-r123	—	c3a	365	0–10	49500
				10–20	54900
				20–30	54500
				30–40	45600
				40–50	38400
				50–60	31300
				60–70	28400
				70–80	27800
LA2FE-r124	LA-10084	c3a	355	0–10	43400
				10–20	53100
				20–30	54200
				30–40	47600
				40–50	39900
				50–60	33300
				60–70	31800
				70–80	30500
LA2FE-r125	LA-10078	f1? (c3?)	287	0–10	35100
				10–20	33900
				20–30	32000
				30–40	29400
				40–50	27000
				50–60	25500
				60–70	25300

Table B-1.0-2 (continued)

Fixed-Point Site	Location ID	Geomorphic Unit	Distance from Upstream End of Reach (m)	Depth (cm)	Shielded Gamma Radiation (cpm ^a)
LA2FE-r126	—	f1 swale	313	0–10	25000
				10–20	24700
				20–30	24000
				30–40	24500
				40–50	24400
				50–60	24700

^a cpm = Counts per minute.

^b — = No location ID.

Table B-1.0-3
Field Radiological Data Obtained from Reach LA-3 West

Fixed-Point Site	Location ID	Geomorphic Unit	Distance from Upstream End of Reach (m)	Depth (cm)	Shielded Gamma Radiation (cpm ^a)
LA3W-r1	— ^b	c3	50	0–10	19720
				10–20	21400
				20–30	24000
				30–40	25400
				40–50	27500
				50–60	28400
				60–70	28800
				70–80	29100
LA3W-r2	—	c2	50	0–10	17960
				10–20	19590
				20–30	21700
				30–40	22800
				40–50	23000
				50–60	24100
LA3W-r3	—	c3	55	0–10	19710
				10–20	22700
				20–30	24500
				30–40	25500
				40–50	25800
				50–60	25100
				60–70	23400
LA3W-r4	—	f1? (f2?)	60	0–10	15860
				10–20	16410
LA3W-r5	—	f1? (f2?)	60	0–10	15480
				10–20	15960
LA3W-r6	—	c2	109	0–10	14260
				10–20	15200
LA3W-r7	—	c2	109	0–10	14510
				10–20	15170
				20–30	15660

Table B-1.0-3 (continued)

Fixed-Point Site	Location ID	Geomorphic Unit	Distance from Upstream End of Reach (m)	Depth (cm)	Shielded Gamma Radiation (cpm ^a)
LA3W-r8	LA-10099	c3	105	0-10	21000
				10-20	24400
				20-30	25000
				30-40	23500
				40-50	23800
				50-60	22800
LA3W-r9	—	f1? (f2?)	105	0-10	17700
				10-20	19060
				20-30	19960
				30-40	20000
				40-50	20500
LA3W-r10	—	c3	130	0-10	24100
				10-20	28000
				20-30	29900
				30-40	29400
LA3W-r11	—	c2	152	0-10	17640
				10-20	20600
				20-30	22600
				30-40	23200
				40-50	24700
				50-60	25900
				60-70	26600
				70-80	26900
LA3W-r12	—	c2	200	0-10	17550
				10-20	20200
				20-30	21400
LA3W-r13	—	c3	202	0-10	18690
				10-20	22200
				20-30	25000
				30-40	26000
				40-50	26100
LA3W-r14	LA-10100	f1? (f2?)	194	0-10	15450
				10-20	16540
LA3W-r15	—	f2? (Qt?)	205	0-10	14500
				10-20	15890
LA3W-r16	LA-10102	c2	250	0-10	14400
				10-20	15280
				20-30	15810
LA3W-r17	—	c2	252	0-10	16100
				10-20	16710
				20-30	15110
				30-40	16230
LA3W-r18	LA-10101	c3	248	0-10	23300
				10-20	28400
				20-30	32800
				30-40	35900
				40-50	34900

Table B-1.0-3 (continued)

LA3W-r19	—	f1	249	0-10	15580
				10-20	16540
				20-30	18010
				30-40	18740
LA3W-r20	—	f2? (Qt?)	254	0-10	15280
				10-20	16800
				20-30	17120
LA3W-r21	—	f2? (Qt?)	252	0-10	14890
				10-20	15930
				20-30	17660
LA3W-r22	—	c2	299	0-10	17550
				10-20	18630
				20-30	20400
				30-40	21100
LA3W-r23	—	c2	300	0-10	19030
				10-20	20800
				20-30	20600
				30-40	18090
LA3W-r24	LA-10103	f1	299	0-10	16200
				10-20	17090
				20-30	18510
LA3W-r25	—	Qt? (f2?)	300	0-10	15120
				10-20	17290
				20-30	18770
				30-40	19520
LA3W-r26	LA-10104	f2? (Qt?) swale	300	0-10	15150
				10-20	16600
LA3W-r27	—	c2	348	0-10	17650
				10-20	19600
				20-50	20600
				50-60	20700
				60-70	18520
LA3W-r28	—	c3	336	0-10	17110
				10-20	18600
				20-30	19270
				30-40	20800
LA3W-r29	—	c2	350	0-10	17540
				10-20	18390
				20-30	17910
				30-40	17770
LA3W-r30	—	Qt? (f2?)	350	0-10	14120
LA3W-r31	—	c2	400	0-10	16610
				10-20	18640
				20-30	18760
LA3W-r32	—	c2	400	0-10	17490
				10-20	18870
				20-30	19290
LA3W-r33	—	c3	394	0-10	22700
				10-20	24900
				20-30	25900
LA3W-r34	LA-10106	Qt? (f2?)	394	0-10	18220

Table B-1.0-3 (continued)

LA3W-r35	—	c3	443	0-10	22300
				10-20	24200
				20-30	24900
				30-40	24300
				40-50	22700
				50-60	22400
LA3W-r36	LA-10107	f1	441	0-10	17930
				10-20	18830
				20-30	19740
				30-40	19430
				40-50	19580
LA3W-r37	—	c2	443	0-10	16990
				10-20	18540
				20-30	19020
LA3W-r38	—	c2	447	0-10	16510
				10-20	17450
				20-30	17510
LA3W-r39	—	c2	494	0-10	19350
				10-20	21500
				20-30	24600
				30-40	25400
				40-50	25900
				50-60	26000
LA3W-r40	—	f1	493	0-10	16220
				10-20	17450
				20-30	18530
				30-40	19480
				40-50	20300
LA3W-r41	—	c2	499	0-10	20200
				10-20	22200
				20-30	23100
				30-40	24400
				40-50	24800
LA3W-r42	LA-10105	c2	365	0-10	17910
				10-20	19630
				20-30	21800

^a cpm = Counts per minute.

^b — = No location ID.

Table B-1.0-4
Sediment Thickness Measurements from Reach LA-2 Far East

Distance from Upstream End of Reach (m)	Side of Channel	Geomorphic Unit	Fine Facies Thickness (cm)	Coarse Facies Thickness (cm)	Fixed-Point Site	Location ID
0	S	c2	28	>12	LA2FE-r1	
0	S	f2? (c3?)	9	27	LA2FE-r2	
8	N	c2	25	>37	LA2FE-r4	
8	N	f2? (c3?)	20	0	LA2FE-r5	LA-10138
50	N	c2	56	>10	LA2FE-r6	
50	N	f2? (Qt?)	31	0	LA2FE-r7	
50	S	f2	27	59	LA2FE-r8	
100	N	c2	43	>45	LA2FE-r11	
100	S	c2	46	>29	LA2FE-r9	
100	S	f2? (Qt?)	32	0	LA2FE-r10	
120	N	c2	24	>10	LA2FE-r13	LA-10142
150	S	c2	31	>55	LA2FE-r14	
150	S	c3	10	15	LA2FE-r15	LA-10143
150	S	f2	28	12	LA2FE-r17	
186	S	c3	13	30	LA2FE-r96	
188	S	c3	14	36	LA2FE-r97	LA-10144
200	N	c2	18	>37	LA2FE-r19	
200	N	c3	57	18	LA2FE-r20	
200	S	f2	5	0	LA2FE-r23	LA-10145
205	S	c2	12	>64	LA2FE-r21	
210	S	c3	21	24	LA2FE-r22	
219	N	c3	0	35	LA2FE-r105	
224	S	f1	13	0	LA2FE-r98	
227	S	c3	0	22	LA2FE-r100	
228	S	c3	14	14	LA2FE-r99	
238	N	c3a	33	48	LA2FE-r104	LA-10076
240	S	c3	48	12	LA2FE-r24	LA-10075
241	S	c3	6	37	LA2FE-r101	
245	N	c3	25	8	LA2FE-r108	
249	S	c3	18	34	LA2FE-r102	
250	N	c2	32	>43	LA2FE-r25	
255	N	c3a	34	22	LA2FE-r26	LA-10077
258	N	c3	0	6	LA2FE-r106	
262	S	c3	15	17	LA2FE-r103	
269	N	c3	0	60	LA2FE-r110	
274	N	c3	8	24	LA2FE-r109	
287	N	f1	39	0	LA2FE-r107	
287	S	f1	34	0	LA2FE-r125	LA-10078

Table B-1.0-4 (continued)

Distance from Upstream End of Reach (m)	Side of Channel	Geomorphic Unit	Fine Facies Thickness (cm)	Coarse Facies Thickness (cm)	Fixed-Point Site	Location ID
290	N	c3	4	17	LA2FE-r111	LA-10079
295	S	f1	29	31	LA2FE-r27	
297	N	c3	10	100	LA2FE-r114	LA-10080
300	S	c2	21	>54	LA2FE-r28	
310	N	c3a	120	>40	LA2FE-r30	LA-10081
310	N	f1	34	0	LA2FE-r29	
310	N	f1	23	0	LA2FE-r31	
313	S	f1	27	9	LA2FE-r126	
318	N	f1	39	0	LA2FE-r113	
330	N	f1	7	0	LA2FE-r35	
330	N	f1	11	19	LA2FE-r34	
331	N	c3	33	>22	LA2FE-r112	
335	N	c3a	103	>16	LA2FE-r32	
340	N	c2	18	>42	LA2FE-r36	
340	N	f1	28	0	LA2FE-r33	LA-10082
346	N	f1	18	0	LA2FE-r116	
350	NA	c1	0	>48		
350	N	f1	35	0	LA2FE-r115	
350	N	f1	32	0	LA2FE-r117	
355	S	c3a	68	>24	LA2FE-r124	LA-10084
355	N	f1	24	3	LA2FE-r39	
360	S	c3	35	23	LA2FE-r40	LA-10085
360	N	f1	34	0	LA2FE-r42	
360	S	f1	14	0	LA2FE-r41	
365	S	c3a	71	>9	LA2FE-r123	
371	N	f1	32	12	LA2FE-r118	
372	N	f1	55	10	LA2FE-r120	
383	N	f1	33	9	LA2FE-r119	
390	N	f1	54	16	LA2FE-r46	
390	S	f2? (Qt?)	11	0	LA2FE-r45	LA-10186
403	N	f1	67	0	LA2FE-r121	LA-10083
405	S	c2	22	>38	LA2FE-r43	
410	N	f1	13	0	LA2FE-r47	
412	N	f1	32	0	LA2FE-r122	
450	NA	c1	0	>7		
450	S	c2	24	>26	LA2FE-r49	
450	S	f2? (Qt?)	23	0	LA2FE-r52	
455	N	c2	36	>16	LA2FE-r51	
455	N	f2? (Qt?)	32	0	LA2FE-r50	
500	N	c2	67	>21	LA2FE-r53	

Table B-1.0-4 (continued)

Distance from Upstream End of Reach (m)	Side of Channel	Geomorphic Unit	Fine Facies Thickness (cm)	Coarse Facies Thickness (cm)	Fixed-Point Site	Location ID
500	S	c2	53	>17	LA2FE-r54	
505	S	f2	14	0	LA2FE-r55	
550	N	c2	34	>38	LA2FE-r56	
550	N	f2? (f1?)	9	0	LA2FE-r57	
555	S	c2	53	>8	LA2FE-r58	
560	S	f1	14	0	LA2FE-r60	
588	N	f2? (f1?)	12	0	LA2FE-r62	
594	N	c2	30	>47	LA2FE-r61	LA-10087
600	S	c2	38	>31	LA2FE-r63	
600	S	f2? (Qt?)	7	0	LA2FE-r64	LA-10088
648	N	c2	42	>22	LA2FE-r65	
660	N	f2? (Qt?)	17	0	LA2FE-r67	LA-10092
660	S	f2? (Qt?)	7	0	LA2FE-r68	LA-10089
695	S	c2	28	>34	LA2FE-r69	
700	N	c2	37	>43	LA2FE-r70	
705	N	f2	11	0	LA2FE-r72	
710	S	f2? (f1?)	8	0	LA2FE-r74	
740	S	f1	19	0	LA2FE-r75	LA-10093
750	N	c2	58	>18	LA2FE-r76	
750	N	f1	8	0	LA2FE-r77	
800	N	c2	40	>30	LA2FE-r79	
800	S	f1	19	0	LA2FE-r80	LA-10094
800	N	f2? (Qt?)	5	5	LA2FE-r81	
800	N	f2	15	0	LA2FE-r82	LA-10095
840	N	f1	16	0	LA2FE-r83	LA-10096
855	N	c2	20	>15	LA2FE-r84	LA-10097
860	S	f1	45	0	LA2FE-r85	
865	S	c2? (c3?)	26	10	LA2FE-r86	
900	N	c2	38	>32	LA2FE-r87	
900	N	c3	14	9	LA2FE-r88	
910	S	f2	4	0	LA2FE-r89	
930	S	f1	35	0	LA2FE-r90	
955	N	c2	34	>32	LA2FE-r91	
995	S	c2	46	>29	LA2FE-r92	
995	S	c3	9	20	LA2FE-r93	
995	N	c3	21	>49	LA2FE-r94	

Table B-1.0-5
Sediment Thickness Measurements from Reach LA-3 West

Distance from Upstream End of Reach (m)	Side of Channel	Geomorphic Unit	Fine Facies Thickness (cm)	Coarse Facies Thickness (cm)	Fixed-Point Site	Location ID
50	N	c2	15	>60	LA3W-r2	
50	S	c3	72	>11	LA3W-r1	
55	N	c3	40	>34	LA3W-r3	
60	N	f1? (f2?)	5	0	LA3W-r4	
60	S	f1? (f2?)	5	0	LA3W-r5	
105	N	c3	15	>53	LA3W-r8	LA-10099
105	N	f1? (f2?)	36	19	LA3W-r9	
109	N	c2	30	>7	LA3W-6	
109	S	c2	11	>21	LA3W-7	
130	N	c3? (f1?)	56	0	LA3W-r10	
152	N	c2	38	>52	LA3W-11	
194	N	f1? (f2?)	4	5	LA3W-r14	LA-10100
200	N	c2	49	>7	LA3W-12	
202	N	c3	33	>22	LA3W-r13	
205	N	f2? (Qt?)	0	8	LA3W-r15	
248	N	c3	50	0	LA3W-r18	LA-10101
249	S	f1	23	5	LA3W-r19	
250	S	c2	56	>1	LA3W-16	LA-10102
252	N	c2	74	>1	LA3W-17	
252	N	f2? (Qt?)	0	7	LA3W-r21	
254	S	f2? (Qt?)	18	0	LA3W-r20	
299	N	c2	48	>1	LA3W-22	
299	N	f1	10	0	LA3W-r24	LA-10103
300	S	c2	30	>20	LA3W-23	
300	S	f2? (Qt?)	7	0	LA3W-r26	
336	N	c3	39	0	LA3W-r28	
348	S	c2	19	>45	LA3W-27	
350	N	c2	16	>29	LA3W-29	
365	S	c2	34	>1	LA3W-42	LA-10105
394	S	c3	23	>1	LA3W-r33	
400	S	c2	62	>1	LA3W-31	
400	N	c2	25	>10	LA3W-32	
441	N	f1	28	0	LA3W-r36	LA-10107
443	N	c2	30	>6	LA3W-37	
443	N	c3	27	>39	LA3W-r35	
447	S	c2	21	>9	LA3W-38	
493	N	f1	8	0	LA3W-r40	
494	S	c2	41	>22	LA3W-39	
499	N	c2	37	>12	LA3W-41	

Table B-1.0-6
Particle-Size and Organic-Matter Data from Reaches LA-2 Far East and LA-3 West

Sample ID	Reach	Gravel (> 2 mm) (wt %)	Very Coarse Sand (2-1 mm) (wt %)	Coarse Sand (1-0.5 mm) (wt %)	Medium Sand (0.5-0.25 mm) (wt %)	Fine Sand (0.25-0.125 mm) (wt %)	Very Fine Sand (0.125-0.0625 mm) (wt %)	Coarse Silt (62.5-15 µm) (wt %)	Fine Silt (15-2 µm) (wt %)	Clay (<2 µm) (wt %)	Median Particle Size Class*	Total Silt + Clay (wt %)	Organic Matter (wt %)
CALA-01-0067	LA-2FE	0.3	0.0	0.2	1.1	4.0	13.9	44.8	20.2	15.7	csi	80.7	4.0
CALA-01-0068	LA-2FE	3.1	3.6	6.7	15.8	22.1	17.2	18.0	7.8	8.6	vfs	34.4	2.3
CALA-01-0069	LA-3W	0.9	0.0	1.1	2.8	9.1	23.4	40.6	10.8	11.7	csi	63.1	4.0
CALA-01-0070	LA-3W	2.5	1.7	7.4	18.7	22.0	16.4	21.3	2.8	9.4	vfs	33.5	3.7
CALA-01-0071	LA-2FE	2.0	0.5	2.4	11.4	18.4	20.1	26.3	8.6	12.1	vfs	47.0	4.4
CALA-01-0072	LA-2FE	2.8	3.8	3.4	9.3	24.8	23.2	21.7	3.7	9.8	vfs	35.3	2.0
CALA-01-0073	LA-2FE	2.9	0.3	1.0	6.2	15.3	21.6	36.1	9.0	10.4	csi	55.5	6.6
CALA-01-0074	LA-2FE	0.6	0.4	0.7	5.3	19.8	26.0	32.0	5.8	10.0	vfs	47.8	3.4
CALA-01-0075	LA-3W	1.4	0.6	2.6	7.7	13.2	18.4	35.7	10.0	11.7	csi	57.4	3.7
CALA-01-0076	LA-3W	2.5	0.4	1.5	9.9	19.2	22.5	28.0	7.4	10.8	vfs	46.3	3.6
CALA-01-0077	LA-3W	2.1	1.8	4.9	12.9	15.3	15.4	26.1	12.2	11.3	vfs	49.6	3.5
CALA-01-0078	LA-3W	4.2	5.7	12.7	20.6	19.1	14.7	14.1	5.2	7.7	fs	27.1	2.2
CALA-01-0080	LA-2FE	1.0	0.9	2.6	7.3	10.7	14.5	34.2	17.7	12.1	csi	64.0	4.8
CALA-01-0083	LA-2FE	2.2	2.4	3.9	11.6	15.5	17.0	32.8	8.4	8.3	vfs	49.6	3.2
CALA-01-0084	LA-2FE	3.0	6.3	21.8	28.3	14.3	9.0	11.7	4.0	4.5	ms	20.2	2.3
CALA-01-0085	LA-2FE	4.3	6.5	11.3	18.4	18.3	13.5	19.4	6.3	6.2	fs	31.9	2.4
CALA-01-0086	LA-2FE	2.5	4.4	8.4	14.7	17.0	17.9	23.6	7.3	6.6	vfs	37.5	2.5
CALA-01-0087	LA-2FE	1.9	5.8	7.3	15.4	24.5	16.9	19.9	4.9	5.2	fs	30.0	1.9
CALA-01-0088	LA-2FE	8.4	28.8	41.0	21.1	3.1	1.4	2.7	1.0	0.9	cs	4.6	0.6
CALA-01-0089	LA-2FE	3.8	4.3	6.6	10.6	16.6	17.0	29.9	7.9	7.0	vfs	44.8	3.8
CALA-01-0090	LA-2FE	0.6	1.0	1.8	3.7	16.8	28.4	35.5	6.5	6.2	vfs	48.2	3.0
CALA-01-0091	LA-2FE	10.8	29.1	22.9	19.3	13.2	5.9	5.7	0.9	2.9	cs	9.4	0.9
CALA-01-0092	LA-2FE	1.2	1.1	2.6	15.7	32.6	21.4	18.2	3.3	5.1	fs	26.6	2.3
CALA-01-0093	LA-2FE	1.5	0.4	1.5	5.8	10.3	16.3	44.0	11.3	10.4	csi	65.7	4.1
CALA-01-0094	LA-2FE	0.4	0.6	2.0	7.0	17.8	22.4	31.9	8.8	9.4	csi	50.1	2.7
CALA-01-0095	LA-2FE	13.6	29.5	39.8	23.0	4.0	0.9	0.0	0.1	2.6	cs	2.6	0.5
CALA-01-0096	LA-2FE	0.5	1.2	2.0	6.6	17.4	23.8	32.5	7.4	9.2	vfs	49.1	2.2
CALA-01-0097	LA-2FE	0.8	1.0	2.2	6.7	13.2	20.5	36.5	10.4	9.2	csi	56.1	2.3
CALA-01-0098	LA-2FE	4.2	4.8	6.0	16.3	24.3	18.4	18.5	5.8	5.7	fs	30.0	2.3
CALA-01-0099	LA-2FE	5.1	9.3	24.7	32.5	14.9	5.9	5.0	3.5	4.1	ms	12.5	5.6
CALA-01-0100	LA-2FE	9.6	5.2	2.3	5.2	14.5	24.5	33.4	9.2	5.8	vfs	48.3	2.5
CALA-01-0101	LA-2FE	1.2	0.2	0.6	1.2	5.0	24.0	54.7	5.0	9.3	csi	69.0	2.7
CALA-01-0102	LA-2FE	7.2	7.5	8.8	7.6	11.7	16.0	29.5	10.0	8.6	vfs	48.1	3.0
CALA-01-0103	LA-2FE	1.2	4.8	6.0	5.9	12.4	19.1	35.7	5.4	10.7	csi	51.8	2.4
CALA-01-0104	LA-2FE	26.8	29.4	35.0	17.9	5.8	2.8	3.8	5.2	0.1	cs	9.0	0.8
CALA-01-0105	LA-2FE	35.9	41.9	32.9	12.9	3.4	1.6	1.0	2.0	4.4	cs	7.4	0.9
CALA-01-0106	LA-2FE	2.5	1.6	2.3	3.2	7.1	16.3	41.9	15.0	12.5	csi	69.4	7.4

Table B-1.0-6 (continued)

Sample ID	Reach	Gravel (> 2 mm) (wt %)	Very Coarse Sand (2–1 mm) (wt %)	Coarse Sand (1–0.5 mm) (wt %)	Medium Sand (0.5–0.25 mm) (wt %)	Fine Sand (0.25–0.125 mm) (wt %)	Very Fine Sand (0.125–0.0625 mm) (wt %)	Coarse Silt (62.5–15 µm) (wt %)	Fine Silt (15–2 µm) (wt %)	Clay (<2 µm) (wt %)	Median Particle Size Class*	Total Silt + Clay (wt %)	Organic Matter (wt %)
CALA-01-0107	LA-2FE	5.5	19.7	31.7	23.8	7.6	4.0	3.9	4.8	4.5	cs	13.2	0.9
CALA-01-0108	LA-2FE	3.1	0.2	0.6	2.2	8.7	17.5	39.2	16.1	14.3	csi	69.6	5.7
CALA-01-0109	LA-2FE	1.1	0.0	0.5	1.2	3.8	10.4	44.5	23.2	16.2	csi	83.9	4.8
CALA-01-0110	LA-2FE	3.5	4.0	5.4	10.1	17.6	19.6	26.0	9.5	7.6	vfs	43.1	2.4
CALA-01-0111	LA-2FE	4.5	3.2	3.5	6.2	12.9	18.8	34.5	10.9	10.0	csi	55.4	2.4
CALA-01-0112	LA-2FE	8.9	9.0	9.3	12.2	18.8	19.3	21.4	3.7	6.4	vfs	31.5	1.8
CALA-01-0113	LA-2FE	1.9	2.1	6.7	20.4	21.0	15.8	19.8	6.2	7.8	vfs	33.8	3.9
CALA-01-0114	LA-2FE	1.2	0.6	1.8	7.2	20.7	26.6	30.0	4.3	8.9	vfs	43.2	2.5
CALA-01-0115	LA-2FE	4.1	4.6	13.8	27.7	19.6	12.1	11.9	4.7	5.6	fs	22.1	1.6
CALA-01-0116	LA-2FE	1.0	1.8	4.8	16.0	18.3	17.0	25.9	9.4	6.5	vfs	41.9	2.8
CALA-01-0117	LA-2FE	6.2	5.9	8.7	15.6	19.2	14.0	21.3	9.7	5.6	vfs	36.6	2.3
CALA-01-0118	LA-2FE	0.3	1.9	5.8	13.0	22.4	21.5	25.4	5.7	4.2	vfs	35.3	2.2
CALA-01-0119	LA-2FE	2.1	10.8	46.7	32.9	4.1	1.3	1.7	3.3	0.0	cs	5.0	0.5
CALA-01-0120	LA-2FE	15.9	9.3	8.4	11.6	13.7	13.3	27.6	8.3	7.7	vfs	43.5	6.3
CALA-01-0121	LA-2FE	12.0	17.9	25.4	16.2	9.1	6.4	13.6	6.3	4.9	ms	24.9	1.7
CALA-01-0122	LA-2FE	18.1	18.3	20.8	15.6	10.4	8.9	11.7	10.8	3.4	ms	26.0	1.7
CALA-01-0123	LA-2FE	44.8	40.0	33.9	15.5	4.6	1.0	2.3	1.3	1.3	cs	4.9	0.6
CALA-01-0124	LA-2FE	1.6	1.0	1.4	8.1	24.3	27.6	26.2	7.5	4.0	vfs	37.7	2.0
CALA-01-0125	LA-2FE	1.1	0.5	2.8	12.5	20.1	22.2	28.6	6.5	6.7	vfs	41.8	3.3
CALA-01-0126	LA-2FE	4.6	4.0	8.5	13.6	13.6	15.1	27.4	12.8	4.9	vfs	45.1	3.4
CALA-01-0127	LA-2FE	0.5	0.3	1.0	13.6	22.2	19.2	26.3	9.1	8.1	vfs	43.5	5.0
CALA-01-0128	LA-2FE	0.9	1.2	3.6	23.3	24.2	16.9	21.0	6.6	3.1	fs	30.8	2.1
CALA-01-0129	LA-2FE	2.2	2.3	5.6	12.0	18.2	18.4	29.5	8.6	5.3	vfs	43.4	2.7
CALA-01-0130	LA-2FE	1.1	1.7	5.1	14.8	18.6	18.8	24.3	6.9	9.7	vfs	40.9	2.8
CALA-01-0131	LA-3W	4.2	6.8	18.2	23.9	17.3	12.3	9.9	4.4	7.1	fs	21.4	1.9
CALA-01-0132	LA-3W	8.7	12.7	23.3	27.3	13.2	7.6	6.8	2.9	6.0	ms	15.7	1.2
CALA-01-0133	LA-3W	15.1	18.6	25.6	16.2	7.7	5.8	13.9	5.7	6.4	ms	26.1	1.7
CALA-01-0134	LA-3W	1.5	0.6	2.2	6.1	11.3	17.8	34.8	14.5	12.6	csi	62.0	5.3
CALA-01-0135	LA-3W	3.7	3.0	7.8	11.3	11.4	18.1	29.4	8.0	10.7	vfs	48.1	6.2
CALA-01-0137	LA-3W	10.1	8.8	14.3	14.8	14.9	14.3	19.2	5.9	8.0	fs	33.2	2.9
CALA-01-0138	LA-3W	2.5	3.3	7.7	15.2	16.2	15.2	25.2	8.2	8.9	vfs	42.3	3.1
CALA-01-0139	LA-3W	7.0	0.6	2.0	7.4	17.4	28.8	30.0	7.0	6.7	vfs	43.8	3.2
CALA-01-0140	LA-3W	0.9	7.5	11.2	21.6	20.1	14.1	12.8	4.4	8.1	fs	25.4	2.1

*cs = coarse sand; csi = coarse silt; fs = fine sand; fsi = fine silt; ms = medium sand; vfs = very fine sand.

Table B-1.0-7
Summary of Particle-Size and Organic-Matter Data from Reaches LA-2 Far East and LA-3 West

Reach	Geomorphic Unit	Sediment Facies	Number of Analyses	Gravel (>2 mm) (wt %)	Very Coarse Sand (2-1 mm) (wt %)	Coarse Sand (1-0.5 mm) (wt %)	Medium Sand (0.5-0.25 mm) (wt %)	Fine Sand (0.25-0.125 mm) (wt %)	Very Fine Sand (0.125-0.0625 mm) (wt %)	Coarse Silt (62.5-15 µm) (wt %)	Fine Silt (15-2 µm) (wt %)	Clay (<2 µm) (wt %)	Median Particle Size Class*	Total Silt + Clay (wt %)	Organic Matter (wt %)
LA-2FE	c1	Coarse	1	44.8	40.0	33.9	15.5	4.6	1.0	2.3	1.3	1.3	cs	4.9	0.6
	c2	Coarse	1	2.1	10.8	46.7	32.9	4.1	1.3	1.7	3.3	0.0	cs	5.0	0.5
	c3	Coarse	4	20.5	32.3	33.0	17.8	6.4	2.9	3.3	2.2	2.1	cs	7.6	0.8
	c3a	Coarse	3	8.1	19.5	32.0	26.4	8.9	3.6	3.0	2.8	3.7	cs	9.4	2.3
	c1	Fine	1	1.6	1.0	1.4	8.1	24.3	27.6	26.2	7.5	4.0	vfs	37.7	2.0
	c2	Fine	4	1.4	2.0	5.1	15.6	20.5	19.1	24.1	7.0	6.5	vfs	37.6	2.8
	c3	Fine	7	1.4	2.1	3.3	10.4	20.7	20.8	28.2	6.8	7.5	vfs	42.5	2.7
	c3a	Fine	12	2.3	1.5	2.3	6.6	12.5	18.8	35.8	11.7	10.6	csi	58.1	3.7
	f1	Fine	8	3.3	3.1	4.6	10.5	17.8	19.9	28.3	7.7	8.1	vfs	44.0	3.1
	f1a	Fine	2	3.3	3.8	6.1	13.0	19.8	18.4	22.0	8.7	8.1	vfs	38.8	2.4
	f2	Fine	2	4.2	4.2	7.6	12.1	15.1	16.1	28.6	10.3	6.0	vfs	44.9	3.6
LA-3W	c3	Coarse	1	8.7	12.7	23.3	27.3	13.2	7.6	6.8	2.9	6.0	ms	15.7	1.2
	c2	Fine	4	2.8	2.8	6.7	14.6	17.5	17.0	23.4	8.3	9.7	vfs	41.3	3.1
	c3	Fine	5	2.1	2.0	6.3	11.8	14.6	17.7	28.4	8.5	10.5	vfs	47.5	3.7
	f1	Fine	2	2.3	5.2	9.5	16.5	15.7	16.1	21.1	6.2	9.4	vfs	36.8	4.1

Note: Average values, excluding samples that are inferred to be of largely pre-1943 sediment.

*cs = coarse sand; csi = coarse silt; ms = medium sand; vfs = very fine sand.

Table B-1.0-8
Dendrochronological Analyses from Reaches LA-2 Far East and LA-3 West

Reach	Core ID	Channel Distance (m)	Geomorphic Unit	Depth of Burial (cm)	Fixed-Point Measurement Site	Location ID	Species	Date of Pith Ring
LA-2FE	LA-2FE-001A	186	c3	43	LA2FE-r96	— ^a	Ponderosa pine	1964
	LA-2FE-001B							1964
	LA-2FE-002B	188	c3	50	LA2FE-r97	LA-10144	Ponderosa pine	1960 ^b
	LA-2FE-002C							1960
	LA-2FE-003B	210	c3	85	LA2FE-r22	—	Ponderosa pine	1893–1895
	LA-2FE-004B	240	c3	56	LA2FE-r24	—	Ponderosa pine	1900 ^b
	LA-2FE-005A	255	c3a	56	LA2FE-r26	LA-10077	Ponderosa pine	1960 ^b
	LA-2FE-005B							1960 ^b
	LA-2FE-005C						Ponderosa pine	1958 ^b
	LA-2FE-006A	330	f1	7	LA2FE-r35	—	Ponderosa pine	1936
	LA-2FE-006B							1938
	LA-2FE-007C	330	f1	11	LA2FE-r34	—	Ponderosa pine	1960
	LA-2FE-007D							1960
	LA-2FE-008A	410	f1	13	LA2FE-r47	—	Ponderosa pine	1943 ^b
	LA-2FE-009A	150	c3	25	LA2FE-r15	LA-10143	Ponderosa pine	1951
	LA-2FE-009B							1950
	LA-2FE-010A	150	Qt	5	LA2FE-r16	—	Ponderosa pine	1964
	LA-2FE-010B							1964
	LA-2FE-011B	8	Qt	9	LA2FE-r3	LA-10139	Ponderosa pine	1918
	LA-2FE-012	24	c2	40	LA2FE-r24	LA-10140	Ponderosa pine	1981 ^c
	LA-2FE-013A	100	Qt	13	LA2FE-r95	LA-10141	Ponderosa pine	1909 ^b
	LA-2FE-013B							1909 ^b
	LA-2FE-014B	100	Qt	5			Douglas fir	1913 ^b
	LA-2FE-015A	120	c2	34	LA2FE-r13	LA-10142	Ponderosa pine	1980
	LA-2FE-015B							1980
	LA-2FE-016A	660	f2? (Qt?)	0	LA2FE-r68	LA-10089	Ponderosa pine	1986
	LA-2FE-016B							1986
	LA-2FE-017E	740	f1	19	LA2FE-r75	LA-10093	Douglas fir	1946? ^b
	LA-2FE-017F							1946? ^b
	LA-2FE-018C	705	Qt	3	LA2FE-r71	—	Ponderosa pine	1948 ^b
	LA-2FE-018D							1948 ^b
	LA-2FE-019B	750	f1	8	LA2FE-r77	—	Piñon pine	1928
	LA-2FE-019C							1928
	LA-2FE-020A	800	f1	19	LA2FE-r80	—	Ponderosa pine	1928
	LA-2FE-020B							1928

Table B-1.0-8 (continued)

Reach	Core ID	Channel Distance (m)	Geomorphic Unit	Depth of Burial (cm)	Fixed-Point Measurement Site	Location ID	Species	Date of Pith Ring
LA-2FE	LA-2FE-021A	882	f1	10	—	—	Rocky Mountain juniper	1932 ^b
	LA-2FE-021B							1933 ^b
	LA-2FE-022A	938	f1	14	—	—	Ponderosa pine	1936
	LA-2FE-022B							1937
	LA-2FE-023A	938	f1	12	—	—	Rocky Mountain juniper	1968
	LA-2FE-023B							1968
	LA-2FE-023D							1968
	LA-2FE-024A	258	c3	6 or 42	LA2FE-r106	—	Ponderosa pine	1936
	LA-2FE-024B							1939
LA-3W	LA3W-001A	365	c2	28	LA3W-r42	LA-10105	Ponderosa pine	1980
	LA3W-001B							1980
	LA3W-002A	336	c3	39	LA3W-r28	—	Ponderosa pine	1943 ^b
	LA3W-002B							1943 ^b
	LA3W-003B	299	f1	10	LA3W-r24	—	Piñon pine	1919
	LA3W-004B	248	c3	50	LA3W-r18	—	Ponderosa pine	1943
	LA3W-004C							1943

^a — = No fixed-point measurement site or location ID.

^b Pith not encountered, age estimated.

^c Age estimate based on whorl count.

Table B-1.0-9

Physical Characteristics of Post-1942 Geomorphic Units in Reaches LA-0 and LA-1 Far West

Reach	Geomorphic Unit	Average Unit Width (m)*	Sediment Facies	Estimated Average Sediment Thickness (m)	Typical Median Particle Size Class (<2 mm fraction)	Notes
LA-0	c1	1.7	Coarse	0.5	Coarse sand	Active channel
	c2	0.9	Fine	0.32	Unknown	Abandoned channel
			Coarse	0.5	Coarse sand	
	f1	9.6	Fine	0.23	Unknown	Post-1942 floodplain
	Total	12.3				
LA-1 Far West	c1	1.8	Coarse	0.5	Coarse sand	Active channel
	c2	2.9	Fine	0.41	Fine sand	Low abandoned channel
			Coarse	0.5	Coarse sand	
	c3	1.5	Fine	Unknown	Coarse silt	High abandoned channel
			Coarse	0.5	Coarse sand	
	f1	4.3	Fine	Unknown	Unknown	Post-1942 floodplain
	f2	2.5	Fine	Unknown	Unknown	Possible post-1942 floodplain
	Total	13.1				

*Average unit width is total area of unit in reach divided by reach length.

Table B-1.0-10
Sediment Thickness Measurements from Reaches LA-0 and LA-1 Far West

Reach	Distance Along Reach (m)	Side of Channel	Geomorphic Unit	Fine Facies Thickness (cm)	Coarse Facies Thickness (cm)	Location ID
LA-0	9	S	c2	14	>5	—*
	24	S	c2	42	0	LA-00222
	53	S	f1	16	0	LA-00223
	71	S	f1	≥30	unknown	LA-00224
	114	N	c2	40	>5	LA-00225
LA-1 Far West	13	N	c2	≥48	unknown	LA-00226
	17	S	c2	36	>5	LA-00227
	47	N	c2	43	>5	LA-00228
	80	N	c2	54	>5	—
	91	S	c2	24	16	LA-00230

*— = No fixed-point measurement site or location ID.

Table B-1.0-11
Physical Characteristics of
Post-1942 Geomorphic Units in Reaches P-1 Far West, P-1 West, and Walnut Canyon

Reach	Geomorphic Unit	Average Unit Width (m) ^a	Sediment Facies	Estimated Average Sediment Thickness (m)	Typical Median Particle Size Class (<2 mm fraction)	Notes
P-1FW	c1	3.9	Coarse	0.5	Very coarse sand	Active channel
	c2	2.8	Fine	0.24	Very fine sand	Abandoned channel
			Coarse	0.5	Very coarse sand?	
	f1	0.1	Fine	0.15	Very fine sand?	Post-1942 floodplain
	Total	7.1				
P-1W	c1	2.0	Coarse	0.5	Coarse sand	Active channel
	c2	3.1	Fine	0.24	Fine sand	Abandoned channel
			Coarse	0.5	Coarse sand	
	f1	0.4	Fine	0.2?	Fine sand	Post-1942 floodplain
	f2	0.9	Fine	<0.05	na ^b	Possible post-1942 floodplain
	Total	5.5				
WC	c1	3.3	Coarse	0.5	Coarse sand	Active channel
	c2	1.5	Fine	0.15	Fine sand	Abandoned channel
			Coarse	0.5	Coarse sand	
	f1	2.9	Fine	0.08	Fine sand	Post-1942 floodplain
			Coarse	0.03	Coarse sand	
	f2	5.5	Fine	<0.05	na	Possible post-1942 floodplain
	Total	13.2				

^a Average unit width is total area of unit in reach divided by reach length.

^b na = Not available.

Table B-1.0-12
Sediment Thickness Measurements from Reaches P-1 Far West, P-1 West, and Walnut Canyon

Reach	Distance Along Reach (m)	Side of Channel	Geomorphic Unit	Fine Facies Thickness (cm)	Coarse Facies Thickness (cm)	Location ID
P-1 Far West	1	N	c2	≥23	>20	PU-10056
	7	N	f1	15	0	—*
	36	Mid	c2	11	0	—
	37	S	c2	67	>5	PU-10058
	44	Mid	c2	30	>12	—
	45	S	c2	41	>16	—
	47	N	c2	30	10	PU-10059
	50	S	c2	16	8	—
	53	N	c2	32	>15	—
	56	N	c2	0	>40	—
	58	N	c2	22	>42	—
	64	N	c2	≥19	>7	PU-10061
	72	S	c2	0	>37	—
P-1 West	10	S	c2	48	>6	—
	25	S	c2	29	>28	—
	26	N	c2	10	>21	PU-10062
	37	N	c2	17	>10	PU-10063
	39	N	c2	29	0	—
	65	N	c2	26	>5	PU-10064
	74	S	c2	0	>49	—
	79	N	c2	23	>5	PU-10065
	89	S	c2	7	>22	—
	94	N	c2	>62	≥33	—
	122	N	c2	12	>53	—
Walnut Canyon	17	W	c2	15	>12	—
	18	E	c2	7	>7	PU-10050
	18	E	f1	8	0	PU-10051
	20	E	f1	7	6	—
	33	E	c2	28	>5	PU-10052
	36	W	c2	31	>12	—
	40	W	c2	19	>14	PU-10054
	54	E	c2	8	>15	PU-10055
	56	W	c2	0	>19	—

*— = No location ID.

Table B-1.0-13
Particle-Size and Organic-Matter Data from Reaches P-1 Far West, P-1 West, and Walnut Canyon

Sample ID	Reach	Gravel (>2 mm) (wt %)	Very Coarse Sand (2–1 mm) (wt %)	Coarse Sand (1–0.5 mm) (wt %)	Medium Sand (0.5–0.25 mm) (wt %)	Fine Sand (0.25–0.125 mm) (wt %)	Very Fine Sand (0.125–0.0625 mm) (wt %)	Coarse Silt (62.5–15 µm) (wt %)	Fine Silt (15–2 µm) (wt %)	Clay (<2 µm) (wt %)	Median Particle Size Class ^a	Total Silt + Clay (wt %)	Organic Matter (wt %)
04PU-96-0123	P-1W	6.3	6.8	24.5	22.9	14.0	5.3	19.8	3.8	3.0	ms	26.6	0.8
04PU-97-0081	P-1W	7.0	15.6	26.7	21.7	10.8	6.4	9.6	4.7	4.5	ms	18.8	1.7
04PU-97-0082	P-1W	9.7	3.3	8.9	19.3	17.8	15.5	21.5	6.6	7.2	vfs	35.3	2.4
CAPU-99-0003	WC	5.9	23.6	29.8	16.6	8.9	5.8	6.2	4.5	4.5	cs	15.2	NA ^b
CAPU-99-0004	WC	0.7	3.9	9.2	11.6	12.4	15.2	26.3	13.3	8.0	vfs	47.5	NA
CAPU-99-0005	WC	20.3	43.1	31.4	9.8	3.2	2.1	3.0	3.5	4.1	cs	10.6	NA
CAPU-99-0006	WC	2.0	1.9	3.7	7.0	12.0	19.5	33.7	11.7	10.4	csi	55.9	NA
CAPU-99-0007	WC	2.4	7.3	15.0	15.9	11.5	11.4	22.8	8.6	7.6	vfs	38.9	NA
CAPU-99-0008	WC	1.6	3.8	6.2	9.9	16.0	21.6	28.1	7.0	7.3	vfs	42.3	NA
CAPU-99-0009	P-1FW	1.0	3.0	4.4	5.2	5.0	13.9	43.1	11.0	13.7	csi	67.8	NA
CAPU-99-0010	P-1FW	0.0	0.1	0.4	0.3	1.1	15.1	58.8	10.6	13.3	csi	82.7	NA
CAPU-99-0011	P-1FW	50.3	51.9	28.3	7.7	2.1	1.2	1.9	3.7	3.0	vcs	8.7	NA
CAPU-99-0012	P-1FW	0.3	1.9	5.0	11.0	9.1	12.4	32.8	16.0	11.6	csi	60.4	NA
CAPU-99-0013	P-1FW	7.6	14.6	18.0	13.5	7.3	7.2	16.9	12.7	9.1	fs	38.6	NA
CAPU-99-0014	P-1FW	10.6	9.5	22.4	25.0	10.6	6.4	11.7	7.6	6.6	ms	25.9	NA
CAPU-99-0015	P-1W	21.1	21.7	27.7	20.4	8.4	5.1	7.3	4.2	4.9	ms	16.5	NA
CAPU-99-0016	P-1W	7.3	9.1	16.3	18.6	12.1	9.4	16.4	10.2	7.5	fs	34.1	NA
CAPU-99-0017	P-1W	3.9	4.9	17.0	19.3	12.2	9.6	16.5	10.2	9.3	fs	36.1	NA
CAPU-99-0018	P-1W	12.0	14.9	15.7	11.8	9.2	10.0	19.8	9.3	8.7	fs	37.9	NA
CAPU-99-0019	P-1W	16.2	33.3	46.4	15.4	1.3	0.4	-0.1	1.3	1.9	cs	3.1	NA

^a cs = coarse sand; csi = coarse silt; fs = fine sand; ms = medium sand; vcs = very coarse sand; vfs = very fine sand.

^b NA = Not analyzed.

Table B-1.0-14
Summary of Particle Size and
Organic-Matter Data from Reaches P-1 Far West, P-1 West, and Walnut Canyon

Reach	Geomorphic Unit	Sediment Facies	Number of Analyses	Gravel (> 2 mm) (wt %)	Very Coarse Sand (2–1 mm) (wt %)	Coarse Sand (1–0.5 mm) (wt %)	Medium Sand (0.5–0.25 mm) (wt %)	Fine Sand (0.25–0.125 mm) (wt %)	Very Fine Sand (0.125–0.0625 mm) (wt %)	Coarse Silt (62.5–15 µm) (wt %)	Fine Silt (15–2 µm) (wt %)	Clay (<2 µm) (wt %)	Median Particle Size Class ^a	Total Silt + Clay (wt %)	Organic Matter (wt %)
P-1FW	c1	Coarse	1	50.3	51.9	28.3	7.7	2.1	1.2	1.9	3.7	3.0	vcs	8.7	NA ^b
	c2	Fine	4	4.9	7.3	12.4	13.7	8.0	10.0	26.1	11.8	10.3	vfs	48.2	NA
	f1	Fine	1	0.0	0.1	0.4	0.3	1.1	15.1	58.8	10.6	13.3	csi	82.7	NA
P-1W	c1	Coarse	1	16.2	33.3	46.4	15.4	1.3	0.4	-0.1	1.3	1.9	cs	3.1	NA
	c2	Fine	7	9.6	10.9	19.5	19.1	12.1	8.8	15.8	7.0	6.4	fs	29.3	1.6
WC	c1	Coarse	1	20.3	43.1	31.4	9.8	3.2	2.1	3.0	3.5	4.1	cs	10.6	NA
	c2	Coarse	1	5.9	23.6	29.8	16.6	8.9	5.8	6.2	4.5	4.5	cs	15.2	NA
	c2	Fine	3	1.4	3.2	6.4	9.5	13.5	18.8	29.4	10.7	8.6	vfs	48.6	NA
	f1	Fine	1	2.4	7.3	15.0	15.9	11.5	11.4	22.8	8.6	7.6	vfs	38.9	NA

Note: Average values, excluding samples that are inferred to be of largely pre-1943 sediment.

^a cs = coarse sand; csi = coarse silt; ms = medium sand; vfs = very fine sand.

^b NA = Not analyzed.

Table B-1.0-15
Physical Characteristics of Post-1942 Geomorphic Units in Acid Canyon Reaches

Reach	Geomorphic Unit	Average Unit Width (m) ^a	Sediment Facies	Estimated Average Sediment Thickness (m)	Typical Median Particle Size Class (<2 mm fraction)	Notes
AC-1	c1	1.5	Coarse	0.3	Coarse sand	Active channel
	c2	0.6	Fine	0.65	Fine sand	Inset abandoned channel
			Coarse	0.3	Coarse sand	
	f1+c3	6.4	Fine	0.63	Coarse silt	High abandoned channel and post-1942 floodplain
			Coarse	0.15	Coarse sand	
	Total	8.4				
AC-2	c1	1.9	Coarse	0.25	Coarse sand	Active channel
	c1b	0.1	Fine	0.1	Very fine sand	Area of fine-grained sediment deposition along active channel
			Coarse	0.3	Coarse sand	
	c2	0.6	Fine	0.49	Very fine sand	Inset abandoned channel
			Coarse	0.25	Coarse sand	
	c3+f1	3.5	Fine	0.47	Very fine sand	High abandoned channel and post-1942 floodplain
			Coarse	0.2	Coarse sand	
	Total	6.0				
AC-3	c1	3.2	Coarse	0.5	Coarse sand	Active channel
	c2	1.6	Fine	0.32	Fine sand	Abandoned channel
			Coarse	0.5	Coarse sand	
	f1	0.9	Fine	0.18	Coarse silt	Post-1942 floodplain
			Coarse	0.02	Medium sand?	
	f2	0.8	Fine	0.05	Fine sand	Possible post-1942 floodplain
	Total	6.5				
ACS, pre-1A	c1	1.4	Coarse	0.5	Coarse sand	Active channel
	c1b	0.1	Fine	0.09	Fine sand	Area of fine-grained sediment deposition along active channel
			Coarse	0.5	Very fine sand	
	c2	1.0	Fine	0.33	Very fine sand	Young abandoned channel with relatively low plutonium-239,240
			Coarse	0.5	Coarse sand	
	c2a	0.3	Fine	0.42	Very fine sand	Old abandoned channel with intermediate plutonium-239,240
			Coarse	0.5	Coarse sand	
	c3	0.1	Fine	0.36	Very fine sand	Old abandoned channel with relatively high plutonium-239,240
			Coarse	0.5	Coarse sand	
	f1	0.5	Fine	0.35	Very fine sand	Post-1942 floodplain with relatively low plutonium-239,240
			Coarse	0.02	Coarse sand	
	f1a	0.3	Fine	0.39	Coarse silt	Post-1942 floodplain with relatively high plutonium-239,240
			Coarse	0.08	Coarse sand	
	f1b	0.2	Fine	0.34	Very fine sand	Post-1942 floodplain with intermediate plutonium-239,240
			Coarse	0.11	Coarse sand	
	Total	3.8				

Table B-1.0-15 (continued)

Reach	Geomorphic Unit	Average Unit Width (m) ^a	Sediment Facies	Estimated Average Sediment Thickness (m)	Typical Median Particle Size Class (<2 mm fraction)	Notes
ACS, post-IA	c1	0.8	Coarse	0.5	Coarse sand	Active channel
	c1b	0.1	Fine	0.09	Fine sand	Area of fine-grained sediment deposition along active channel
			Coarse	0.5	Very fine sand	
	c2	0.4	Fine	0.33	Very fine sand	Young abandoned channel with relatively low plutonium-239,240
			Coarse	0.5	Coarse sand	
	f1	0.4	Fine	0.35	Very fine sand	Post-1942 floodplain with relatively low plutonium-239,240
			Coarse	0.02	Coarse sand	
	c.a.	2.1	n/a ^b	0.25	n/a	IA cleanup area
	Total	3.8				
0-030(g) Drainage	c1	0.9	Fine	0.13	Coarse silt	Active channel
			Coarse	0.29	Coarse sand	
	c1b	0.3	Fine	0.07	Coarse silt	Recent sand and gravel lobe
			Coarse	0.43	Coarse sand	
	c1w	0.3	Fine	0.23	Coarse silt	Ponded area above dirt road with high water table
			Coarse	0.22	Coarse sand	
	c2a	2.2	Fine	0.22	Coarse silt	Lower abandoned channel in upper basin
			Coarse	0.32	Coarse sand	
	c2b	1.0	Fine	0.19	Coarse silt	Abandoned channel in middle basin
			Coarse	0.19	Coarse sand	
	c2c	3.6	Fine	0.16	Coarse silt	Abandoned channel in lower basin
			Coarse	0.06	Coarse sand	
	c3 + c2	0.1	Fine	0.15	Coarse silt	Higher abandoned channel in upper basin
			Coarse	0.15	Coarse sand	

^a Average unit width is total area of unit in reach divided by reach length.^b n/a = Not applicable.

Table B-1.0-16
Field Radiological Data Obtained from Reach AC-1

Location ID	Geomorphic Unit	Distance from Upstream End of Reach (m)	Depth (cm)	Alpha Radiation (cpm*)
PU-10240	c2	5	0-47	6
				7
			47-70	9
				4
PU-10241	f1+c3	12	0-14	11
				11
			14-36	18
				6
PU-10242	c1	25	0-5	6
				6
PU-10013	c2	29	0-43	5
				9

*cpm = Counts per minute.

Table B-1.0-17
Field Radiological Data Obtained from Reach AC-2

Location ID	Geomorphic Unit	Distance from Downstream End of Reach (m)	Depth (cm)	Alpha Radiation (cpm ^a)	Shielded Beta/Gamma Radiation (dpm ^b)	Shielded Gamma Radiation (cpm)
— ^c	c1	44	Surface	10	190	6828
				—	410	—
	f1	43	0–10	3	196	6493
				—	397	—
			10–20	6	172	6454
				—	457	—
PU-10014	c2	40	0–10	1	208	6601
				—	466	—
			10–20	3	194	6711
				—	457	—
			20–30	6	186	1708
				—	475	—
PU-10015	c2	29	0–10	4	218	7188
				—	419	—
			10–20	5	190	6324
				—	457	—
			20–30	7	194	6702
				—	419	—
—	c1	32	Surface	4	184	7035
				—	457	—
—	c1	12	Surface	0	210	7012
				—	526	—
PU-10016	f1	9	0–10	3	200	7503
				—	462	—
			10–20	8	204	6776
				—	337	—
			20–30	4	231	6955
				—	466	—
—	c1	12	Surface	6	216	6923
				—	479	—

^a cpm = Counts per minute.^b dpm = Disintegrations per minute.^c — = No location ID or no measurements.

Table B-1.0-18
Field Radiological Data Obtained from Reach AC-3

Fixed-Point Site	Location ID	Geomorphic Unit	Distance from Upstream End of Reach (m)	Depth (cm)	Alpha Radiation (cpm ^a)	Shielded Beta/Gamma Radiation (dpm ^b)	Shielded Gamma Radiation (cpm)
AC3-1	— ^c	f1	38	0–10	6	354	—
				10–20	11	453	—
				20–30	12	470	—
				30–40	7	414	—
				40–50	9	401	—
				50–60	10	539	—
				60–70	6	367	—
				70–80	12	363	—
AC3-2	PU-10017	f1	41	0–10	19	811	—
				10–20	6	1900	—
				20–30	9	397	—
				30–40	9	488	—
				40–50	5	457	—
AC3-3	—	f2? (f1?)	61	0–10	13	363	—
				10–20	9	401	—
				20–30	8	432	—
				30–40	4	453	—
AC3-4	—	f1	71	0–10	25	470	—
				10–20	11	453	—
				20–30	6	406	—
				30–40	9	539	—
				40–50	7	526	—
AC3-5	—	c2	80	0–7	13	401	—
				7–17	5	440	—
				17–25	16	479	—
AC3-6	PU-10018	c2	92	0–10	7	384	—
				10–20	5	380	—
				20–30	9	539	—
				30–40	6	488	—
				40–50	14	388	—
AC3-7	—	f2	91	0–10	0	453	—
				10–20	1	462	—
				20–30	3	375	—
				30–40	4	345	—
AC3-8	PU-10102	c2	116	0–10	11	501	—
				10–20	14	388	—
				20–30	12	393	—
				30–40	9	496	—
				40–50	9	490	—

Table B-1.0-18 (continued)

Fixed-Point Site	Location ID	Geomorphic Unit	Distance from Upstream End of Reach (m)	Depth (cm)	Alpha Radiation (cpm ^a)	Shielded Beta/Gamma Radiation (dpm ^b)	Shielded Gamma Radiation (cpm)
AC3-9	—	c2	129	0–10	0	462	7093
				10–20	11	466	7069
				20–30	28	536	7270
				30–40	16	462	7653
AC3-10	—	c2	129	0–10	6	405	7008
				10–20	8	528	6776
				20–30	13	368	6548
				30–40	20	446	6499
				40–50	19	434	6739
				50–60	15	—	—
AC3-11	—	c2	143	0–10	10	430	7266
				10–20	11	503	7089
				20–30	12	397	7250
				30–40	6	376	7447
				40–50	15	372	7526
AC3-12	PU-10103	c2	143	0–10	7	413	6826
				10–20	5	405	6586
				20–30	7	479	6732
				30–40	4	323	6728
				40–50	11	421	6952
				50–60	10	450	7520
AC3-13	PU-10019	c2	155	0–10	13	409	8365
				10–20	20	458	9124
				20–30	33	749	10073
				30–40	16	565	9884
				40–50	18	454	9782
				50–60	30	536	9789
AC3-14	—	c2	155	0–10	6	462	7037
				10–20	11	479	7271
				20–30	10	458	7127
				30–40	14	454	7323
				40–50	10	466	7644
AC3-15	—	f1?	177	0–10	9	376	7787
				10–20	13	434	7713
				20–30	7	503	7639
				30–40	20	622	7926
				40–50	11	507	8418
				50–60	12	—	—
				60–70	11	—	—

Table B-1.0-18 (continued)

AC3-16	—	c2	178	0-10	5	397	7005
				10-20	6	364	7386
				20-30	7	340	7210
				30-40	11	466	7835
				40-50	7	475	8560
				50-60	3	462	10035
AC3-17	—	c2	186	0-10	10	454	6819
				10-20	15	466	6988
				20-30	8	405	7267
				30-40	11	470	7529
				40-50	13	438	7698
AC3-18	PU-10104	c2	198	0-10	—	352	6094
				10-20	8	364	6011
				20-30	6	315	6242
				30-40	9	385	6385
				40-50	6	393	6344
				50-60	5	331	6501
				60-70	12	393	7090
				70-80	11	352	7240
AC3-19	—	f1	200	0-10	7	372	7187
				10-20	7	462	6912
				20-30	11	515	7292
				30-40	6	397	7529
AC3-20	—	c2	210	0-10	0	393	6903
				10-20	5	450	6781
				20-30	4	454	7091
				30-40	13	475	7394
				40-50	23	438	7616
AC3-21	—	c2? (f1?)	214	0-10	8	421	6836
				10-20	11	434	6963
				20-30	9	454	7644
				30-40	14	495	7485
AC3-22	—	f2? (f1?)	247	0-10	7	470	6806
				10-20	5	413	7062
				20-30	5	420	7250
				30-40	3	447	7268
AC3-23	PU-10106	f2? (f1?)	250	0-10	2	424	6333
				10-20	5	470	6625
				20-30	7	401	7169
				30-40	5	489	7813
AC3-24	—	f1? (f2?)	273	0-10	4	420	5750
				10-20	13	390	6288
				20-30	12	401	6628

Table B-1.0-18 (continued)

				30-40	14	462	6682
AC3-25	—	c2	269	0-10	9	401	6336
				10-20	13	390	6288
				20-30	12	401	6628
				30-40	14	462	6682
AC3-26	—	f1? (f2?)	285	0-10	44	390	6999
					50	—	—
				10-20	34	485	7127
AC3-27	PU-10107	c2	298	0-10	4	386	6338
				10-20	5	374	6379
				20-30	9	382	6542
				30-40	6	439	6635
				40-50	8	397	6554
AC3-28	—	f1	386	0-10	8	443	6728
AC3-29	—	c2	378	0-10	10	420	8803
				10-20	42	535	9902
				20-30	122	733	9148
					62	—	—
				30-40	21	477	8424
				40-50	7	523	7675
				50-60	5	485	7432
				60-70	7	485	7432
				70-80	3	497	7561
AC3-30	—	c1	385	Surface	—	—	6837
AC3-31	PU-10110	c2	375	0-10	5	416	5928
				10-20	7	397	5840
				20-30	10	416	5823
				30-40	7	367	6222
				40-50	4	336	6571
AC3-32	—	c2	372	0-10	4	439	6289
				10-20	7	393	6035
				20-30	4	371	6010
				30-40	8	470	6112
				40-50	13	443	6672
AC3-33	—	c2	369	0-10	6	474	6557
				10-20	10	401	6348
				20-30	8	397	6585
				30-40	6	397	6867
				40-50	10	455	7060
AC3-34	—	f1? (c2?)	353	0-10	9	428	6447
				10-20	9	489	6434
				20-30	14	420	6668
				30-40	15	428	6987

Table B-1.0-18 (continued)

				40-50	12	584	4202
				50-60	18	485	7419
AC3-35	—	c2	351	0-10	2	355	6230
				10-20	5	317	5766
				20-30	6	359	5646
				30-40	13	405	5467
				40-50	5	371	5612
				50-60	10	393	5870
				60-70	—	—	5989
AC3-36	PU-10109	c2	330	0-10	5	336	5955
				10-20	11	413	5920
				20-30	7	439	4869
				30-40	7	401	5776
				40-50	8	451	6058
				50-60	4	382	6301
				60-70	8	363	6360
				70-80	6	477	6948
AC3-37	—	c2	323	0-10	6	351	6895
				10-20	11	363	6483
				20-30	15	435	7111
				30-40	6	413	7628
				40-50	53	477	9154
AC3-38	PU-10108	f1	314	0-10	53	443	6772
				10-20	111	447	6348
					85	—	—
				20-30	11	466	6213
				30-40	6	371	6206
				40-50	8	409	6488
AC3-39	PU-10105	c1	244	Surface	10	—	—

^a cpm = Counts per minute.

^b dpm = Disintegrations per minute.

^c — = No location ID or no measurements.

Table B-1.0-19
Field Radiological Data Obtained from Reach ACS Prior to Interim Action

Fixed-Point Site	Location ID	Geomorphic Unit	Distance from Upstream End of Reach (m)	Depth (cm)	Alpha Radiation (cpm ^a)	Shielded Beta/Gamma Radiation (dpm ^b)	Shielded Gamma Radiation (cpm)
ACS-1	— ^c	f1	289	0–10	36	206	7294
					19	—	—
					32	—	—
				10–20	8	186	7177
					11	—	—
				20–30	9	220	7239
				30–40	12	200	7128
				40–50	19	210	6783
				50–60	23	233	6725
				60–70	5	200	6574
				70–80	4	184	6151
				80–90	1	178	6183
ACS-2	—	c2	281	0–10	31	299	9800
				10–20	35	314	9214
				20–30	54	322	9382
				30–40	46	281	9082
				40–50	17	255	8847
ACS-3	—	f1 (c.a.)	272	0–10	29	475	7407
					48	—	—
				10–20	27	445	7706
					19	—	—
				20–30	20	535	7922
					28	—	—
					10	—	—
				30–40	3	531	8721
					6	—	—
				40–50	6	574	9395
					3	—	—
				50–60	5	479	10124
					6	—	—
				60–70	38	630	11182
					43	—	—
					37	—	—
				70–80	189	790	12707
					107	—	—
				80–90	155	846	13634
					174	—	—
					132	—	—
				90–100	56	1090	13844
					67	—	—
				100–110	58	660	12568
					44	—	—
				110–120	20	—	—
					43	—	—

Table B-1.0-19 (continued)

Fixed-Point Site	Location ID	Geomorphic Unit	Distance from Upstream End of Reach (m)	Depth (cm)	Alpha Radiation (cpm ^a)	Shielded Beta/Gamma Radiation (dpm ^b)	Shielded Gamma Radiation (cpm)
ACS-4	—	f1b (c.a.)	264.3	0–10	58	488	7748
					129	—	—
				10–20	472	544	7614
					38	—	—
					33	—	—
					24	—	—
				20–30	7	453	7798
					10	—	—
				30–40	10	561	7836
					20	—	—
				40–50	9	544	8025
					8	—	—
				50–60	11	570	7835
					10	—	—
				60–70	5	—	—
				70–80	9	—	—
				80–90	16	—	—
				90–100	8	—	—
ACS-5	—	c2a (c.a.)	262	0–10	25	613	—
					26	—	—
				10–20	42	682	—
					62	—	—
				20–30	75	794	—
					87	—	—
				30–40	178	820	—
					93	—	—
					132	—	—
					164	—	—
ACS-6	—	f1b (c.a.)	254	0–10	68	526	6325
					67	—	—
				10–20	150	445	6499
					150	—	—
					42	—	—
				20–30	16	470	7075
					15	—	—
				30–40	8	531	7527
					11	—	—
				40–50	10	535	7317
					11	—	—
				50–60	9	432	7608
					5	—	—
				60–70	6	531	7372

Table B-1.0-19 (continued)

Fixed-Point Site	Location ID	Geomorphic Unit	Distance from Upstream End of Reach (m)	Depth (cm)	Alpha Radiation (cpm ^a)	Shielded Beta/Gamma Radiation (dpm ^b)	Shielded Gamma Radiation (cpm)
					13	—	—
				70–80	13	526	7740
					9	—	—
				80–90	3	596	8360
					4	—	—
				90–100	22	539	8370
ACS-7	PU-10246	c2a (c.a.)	250	0–10	44	669	12385
					45	—	—
				10–20	86	837	13570
					93	—	—
				20–30	104	1210	13803
					85	—	—
				30–40	91	1020	13068
					59	—	—
				40–50	61	837	13040
					53	—	—
				50–60	140	863	13037
					110	—	—
ACS-8	—	c2a (c.a.)	245	0–10	100	466	7114
				10–20	89	449	7297
				20–30	27	505	7394
				30–40	—	419	7499
				40–50	32	479	7367
ACS-9	—	f1a (c.a.)	236	-10–0	74	—	—
				0–10	69	492	7122
					85	—	—
				10–20	377	539	7518
					392	—	—
					490	—	—
					442	—	—
				20–30	461	863	7937
					431	—	—
					389	—	—
					367	—	—
				30–40	833	734	7985
					778	—	—
					504	—	—
					510	—	—
				40–50	149	721	8051
					89	—	—
				50–60	60	514	8078
					89	—	—
				60–70	31	—	—

Table B-1.0-19 (continued)

Fixed-Point Site	Location ID	Geomorphic Unit	Distance from Upstream End of Reach (m)	Depth (cm)	Alpha Radiation (cpm ^a)	Shielded Beta/Gamma Radiation (dpm ^b)	Shielded Gamma Radiation (cpm)
ACS-10	PU-10101	c3 (c.a.)	233	70-80	38	—	—
				0-10	172	1130	12650
					76	—	—
				10-20	85	1640	14995
					166	—	—
				20-30	41	1240	17034
					31	—	—
				30-40	105	1180	21952
					58	—	—
				40-50	327	1530	21003
					184	—	—
				50-60	151	—	—
ACS-11	PU-10001	f1a (c.a.)	231	0-10	112	647	8484
					53	—	—
				10-20	256	993	9025
					276	—	—
					327	—	—
				20-30	326	1230	9366
					462	—	—
					691	—	—
				30-40	246	1020	3219
					184	—	—
				40-50	67	889	8742
					59	—	—
				50-60	90	932	8761
					56	—	—
				60-70	54	630	8500
					32	—	—
				70-80	41	755	8157
					22	—	—
ACS-12	PU-10242	c2 (c.a.)	231	0-10	57	772	9271
					58	—	—
				10-20	38	669	10199
					54	—	—
				20-30	23	583	11521
					27	—	—
				30-40	23	712	12898
					29	—	—
				40-50	25	850	14369
					26	—	—
				50-60	39	928	17207
					141	—	—
				60-70	25	1400	20158

Table B-1.0-19 (continued)

Fixed-Point Site	Location ID	Geomorphic Unit	Distance from Upstream End of Reach (m)	Depth (cm)	Alpha Radiation (cpm ^a)	Shielded Beta/Gamma Radiation (dpm ^b)	Shielded Gamma Radiation (cpm)
					50	—	—
				70–80	65	997	19467
					37	—	—
				80–90	9	824	18636
				90–100	16	—	—
ACS-13	PU-10241	c2a (c.a.)	230	0–10	31	617	11897
					46	—	—
					29	—	—
				10–20	100	919	13548
					26	—	—
					70	—	—
				20–30	58	941	14629
					69	—	—
					65	—	—
				30–40	47	583	13749
					189	—	—
					310	—	—
				40–50	61	483	11795
					51	—	—
					50	—	—
ACS-14	—	c2 (c.a.)	219	0–10	11	427	9669
					56	747	10740
				10–20	56	747	10740
				20–30	58	755	11244
				30–40	49	647	10081
				40–50	11	548	8702
				50–60	10	470	8423
				60–70	9	397	7768
ACS-15	PU-10002	f1 (c.a.)	200	70–80	11	475	7867
				0–10	20	466	6482
				10–20	9	630	7039
				20–30	8	462	7010
				30–40	5	440	7515
				40–50	11	557	7626
				50–60	9	492	7960
ACS-16	PU-10003	c3 (c.a.)	188	–10–0	23	—	—
				0–10	12	470	6251
					30	—	—
				10–20	58	505	6415
					135	—	—
				20–30	658	578	7004
					640	—	—
					433	—	—

Table B-1.0-19 (continued)

Fixed-Point Site	Location ID	Geomorphic Unit	Distance from Upstream End of Reach (m)	Depth (cm)	Alpha Radiation (cpm ^a)	Shielded Beta/Gamma Radiation (dpm ^b)	Shielded Gamma Radiation (cpm)
				30-40	139	548	7114
					71	—	—
				40-50	34	475	7413
					31	—	—
				50-60	22	578	7581
					30	—	—
ACS-17	—	c3 (c.a.)	185	0-10	31	501	6499
					28	—	—
				10-20	15	462	6617
					4	—	—
				20-30	31	483	7296
					37	—	—
				30-40	373	492	7749
					348	—	—
				40-50	220	665	7626
					344	—	—
				50-60	65	544	7934
					118	—	—
ACS-18	—	c2 (c.a.)	177	0-10	33	475	5917
					17	—	—
				10-20	26	457	6808
					11	—	—
					11	—	—
				20-30	15	445	7188
					26	—	—
				30-40	25	483	7664
					6	—	—
				40-50	35	514	7750
					31	—	—
				50-60	4	—	—
ACS-19	—	c2 (c.a.)	170	0-10	12	462	6206
				10-20	9	445	6347
				20-30	11	483	6645
				30-40	15	531	7329
				40-50	22	505	6660
ACS-20	—	c2 (c.a.)	159	0-10	18	406	7103
				10-20	20	496	8035
				20-30	25	552	8241
				30-40	28	501	8737
				40-50	41	518	8809
ACS-21	PU-10238	c2a (c.a.)	152	0-10	16	423	6163
					19	—	—

Table B-1.0-19 (continued)

Fixed-Point Site	Location ID	Geomorphic Unit	Distance from Upstream End of Reach (m)	Depth (cm)	Alpha Radiation (cpm ^a)	Shielded Beta/Gamma Radiation (dpm ^b)	Shielded Gamma Radiation (cpm)
				10–20	19	440	6509
					22	—	—
				20–30	21	518	6761
					24	—	—
				30–40	17	466	6976
					34	—	—
				40–50	40	470	7482
					74	—	—
				50–60	204	522	7521
					178	—	—
60–70	80	483	7816				
	70–80	—	492	7968			
ACS-22	PU-10219	c2 (c.a.)	148	0–10	16	427	6225
					8	—	—
				10–20	25	470	6679
					23	—	—
				20–30	13	440	6962
					9	—	—
				30–40	17	514	7329
					17	—	—
				40–50	15	457	7961
					24	—	—
ACS-23	PU-10005	c2a (c.a.)	143	0–10	44	738	13041
					52	—	—
					48	—	—
				10–20	114	659	17032
					103	—	—
					85	—	—
				20–30	16	816	23235
					41	—	—
				30–40	10	1300	29738
					44	—	—
				40–50	51	1700	32489
					76	—	—
				50–60	283	945	27249
					35	—	—
				60–70	291	936	22196
					77	—	—
				70–80	59	703	17587
					36	—	—
					27	—	—
				80–90	61	639	14731
					24	—	—

Table B-1.0-19 (continued)

Fixed-Point Site	Location ID	Geomorphic Unit	Distance from Upstream End of Reach (m)	Depth (cm)	Alpha Radiation (cpm ^a)	Shielded Beta/Gamma Radiation (dpm ^b)	Shielded Gamma Radiation (cpm)
ACS-24	PU-10220	c2 (c.a.)	134	0-10	14	457	6775
					32	—	—
				10-20	8	388	7548
					11	—	—
				20-30	26	509	8371
					25	—	—
				30-40	28	518	9115
					61	—	—
				40-50	88	514	9984
					61	—	—
				50-60	47	509	10276
					0	—	—
					7	—	—
				60-70	24	552	10267
					30	—	—
ACS-25	—	c2	96	0-10	10	406	6047
				10-20	14	509	6213
				20-30	22	505	6224
				30-40	11	440	6426
				40-50	12	544	6339
				50-60	9	505	6368
ACS-26	—	c2	66	0-10	12	457	6481
				10-20	14	375	6301
				20-30	8	427	6345
				30-40	21	401	6223
ACS-27	—	c2	103	0-10	15	492	5071
				10-20	4	393	5335
				20-30	14	427	5404
				30-40	13	479	5821
				40-50	12	406	6051
				50-60	16	427	6321
				60-70	11	—	—
ACS-27A	—	c1b	103	Surface	12	583	6076
ACS-28	—	c2 (c.a.)	117	0-10	14	440	7037
				10-20	35	445	7287
				20-30	19	462	7485
				30-40	25	488	7417
				40-50	17	518	7367
ACS-29	—	c1 (c.a.)	125	Surface	5	535	7204
ACS-30	—	c2	5	0-10	16	526	5891
				10-20	13	427	6210
				20-30	3	393	6304

Table B-1.0-19 (continued)

Fixed-Point Site	Location ID	Geomorphic Unit	Distance from Upstream End of Reach (m)	Depth (cm)	Alpha Radiation (cpm ^a)	Shielded Beta/Gamma Radiation (dpm ^b)	Shielded Gamma Radiation (cpm)
				30-40	7	479	6307
				40-50	128	544	6702
					9	—	—
				50-60	14	432	6972
ACS-31	PU-10223	c2	27	0-10	7	427	6181
				10-20	12	453	6081
				20-30	15	445	6334
				30-40	35	475	6557
				40-50	27	496	6680
				50-60	23	514	6853
				60-70	16	414	6894
ACS-32	—	c2	33	0-10	21	683	6614
				10-20	17	539	6803
				20-30	17	570	6663
				30-40	10	544	6945
ACS-33	PU-10009	c2	33	0-10	14	518	6429
				10-20	25	539	6307
				20-30	38	436	6776
				30-40	87	549	6940
ACS-34	—	c2	40	0-10	51	436	6333
				10-20	23	388	6642
				20-30	9	522	6748
				30-40	8	—	—
ACS-35	PU-10222	c1	49	Surface	2	496	5813
ACS-36	PU-10006	c1b (c.a.)	118	Surface	9	557	6890
ACS-37	PU-10004	f1	150	0-10	5	380	6381
				10-20	7	496	6696
				20-30	16	518	6876
				30-40	5	479	6925
				40-50	8	440	6815
				50-60	8	453	7285
				60-70	15	492	7300
ACS-38	—	c2 (c.a.)	155	0-10	24	496	6576
					13	—	—
				10-20	12	445	6893
					11	—	—
				20-30	17	613	7148
					17	—	—
				30-40	27	526	7603
					21	—	—
				40-50	109	552	7923
					72	—	—
				50-60	40	449	7858
					23	—	—

Table B-1.0-19 (continued)

Fixed-Point Site	Location ID	Geomorphic Unit	Distance from Upstream End of Reach (m)	Depth (cm)	Alpha Radiation (cpm ^a)	Shielded Beta/Gamma Radiation (dpm ^b)	Shielded Gamma Radiation (cpm)
ACS-39	PU-10218	c2 (c.a.)	200	0-10	15	479	6520
				10-20	13	470	6773
				20-30	16	436	7105
				30-40	17	380	7571
				40-50	—	501	8545
ACS-40	—	c1	214	Surface	10	384	6916
ACS-41	—	c1 (c.a.)	240	Surface	11	453	6205
ACS-42	PU-10243	f1a (c.a.)	238	0-10	14	565	6844
					17	—	—
				10-20	34	587	6991
					48	—	—
				20-30	100	496	7471
					191	—	—
				30-40	100	535	7836
					79	—	—
				40-50	10	505	8105
					13	—	—
				50-60	5	531	8479
					15	—	—
				60-70	7	591	9186
					5	—	—
				70-80	23	634	9120
					18	—	—
				80-90	13	613	9582
					31	—	—
ACS-43	PU-10245	c2a (c.a.)	242	0-10	12	544	6227
				10-20	26	462	6540
				20-30	8	596	6986
				30-40	7	509	7365
				40-50	45	479	7389
				50-60	0	535	7662
					17	—	—
					59	—	—
				60-70	54	470	6657
					53	—	—
				70-80	452	462	7132
					384	—	—
					96	—	—
				80-90	76	583	7793
					61	—	—
				90-100	57	496	7732
					37	—	—
				100-110	28	414	8023
				110-120	23	526	8069

Table B-1.0-19 (continued)

Fixed-Point Site	Location ID	Geomorphic Unit	Distance from Upstream End of Reach (m)	Depth (cm)	Alpha Radiation (cpm ^a)	Shielded Beta/Gamma Radiation (dpm ^b)	Shielded Gamma Radiation (cpm)
				120-130	24	462	—
				130-140	9	488	—
ACS-44	—	c2 (c.a.)	192	0-10	9	427	5886
				10-20	15	514	6601
				20-30	15	462	6927
				30-40	22	526	7590
ACS-45	—	c2 (c.a.)	185	0-10	9	436	6182
					10	—	—
				10-20	17	501	6507
					13	—	—
				20-30	18	419	6627
					9	—	—
				30-40	19	462	7352
					14	—	—
ACS-46	PU-10008	c2	50	0-10	6	328	5700
				10-20	4	384	5976
				20-30	3	457	6621
ACS-47	PU-10000	f1a (c.a.)	245	0-10	62	432	6817
					62	—	—
				10-20	255	522	7512
					102	—	—
				20-30	1538	721	8039
					1691	—	—
					317	—	—
					475	—	—
				30-40	424	626	8112
					354	—	—
					381	—	—
				40-50	80	712	8042
					912	—	—
					307	—	—
				50-60	163	535	7918
					108	—	—
				60-70	189	526	7550
					86	—	—
				70-80	112	673	7464
					75	—	—
				80-90	63	552	7594
					21	—	—
				90-100	39	522	7641
ACS-48	—	f1a (c.a.)	232	0-10	33	481	6504
				10-20	103	432	6657
					136	—	—
				20-30	348	493	7242

Table B-1.0-19 (continued)

Fixed-Point Site	Location ID	Geomorphic Unit	Distance from Upstream End of Reach (m)	Depth (cm)	Alpha Radiation (cpm ^a)	Shielded Beta/Gamma Radiation (dpm ^b)	Shielded Gamma Radiation (cpm)
ACS-49	—	f1a (c.a.)	247	0–10	311	—	—
					526	672	7960
					457	—	—
				10–20	1402	657	7799
					1662	—	—
				20–30	246	600	7536
					256	—	—
				30–40	43	497	7669
				40–50	88	519	7747
ACS-50	—	c3 (c.a.)	226	50–60	77	562	8020
				0–10	66	458	7046
					29	458	7146
					36	455	7638
				30–40	48	535	8468
				40–50	633	703	9288
					620	—	—
				50–60	187	814	10096
					214	—	—
				60–70	128	695	10825
					112	—	—
ACS-51	PU-10237	c2a (c.a.)	146	70–80	58	619	10825
				80–90	25	558	11080
				0–10	12	420	7224
					132	432	7218
					109	—	—
ACS-52	PU-10236	c2a (c.a.)	143	20–30	122	474	7409
					135	—	—
				0–10	35	481	8676
					73	695	9514
				10–20	27	649	11513
				20–30	52	657	12834
				30–40	99	1142	13188
					128	—	—
				40–50	87	1108	13306
					75	—	—
				50–60	97	642	12598
					100	—	—
				60–70	39	443	11775
				70–80	—	615	10800
ACS-53	—	c2 (c.a.)	139	80–90	—	573	10837
				90–100	—	573	10837
				0–10	13	367	6227
					87	474	6791
					16	527	6911
				20–30	7	462	7006
				30–40	7	462	7006

Table B-1.0-19 (continued)

Fixed-Point Site	Location ID	Geomorphic Unit	Distance from Upstream End of Reach (m)	Depth (cm)	Alpha Radiation (cpm ^a)	Shielded Beta/Gamma Radiation (dpm ^b)	Shielded Gamma Radiation (cpm)
				40–50	25	485	7306
				50–60	24	416	7348
				60–70	—	405	7401
				70–80	—	416	7444
ACS-54	PU-10221	c2 (c.a.)	130	0–10	14	500	6154
				10–20	22	401	6460
				20–30	16	416	7010
				30–40	27	409	7749
				40–50	5	512	9033
				50–60	62	539	10920
				60–70	188	1000	13105
					128	—	—
				70–80	56	672	12334
				80–90	37	455	11522
				90–100	—	535	10084
				100–110	—	424	9169
ACS-55	—	c2a (c.a.)	145	0–15	24	—	—
					35	—	—
					30	—	—
				15–30	26	—	—
					26	—	—
					17	—	—
				30–45	79	—	—
					100	—	—
					84	—	—
				45–60	338	—	—
					266	—	—
					488	—	—
				60–75	48	—	—
					43	—	—
					38	—	—
ACS-56	PU-10235	c2a (c.a.)	141	0–15	50	—	—
					62	—	—
					41	—	—
				15–30	65	—	—
					58	—	—
					50	—	—
				30–45	49	—	—
					63	—	—
					59	—	—
				45–60	104	—	—
					89	—	—
					110	—	—
				60–75	47	—	—

Table B-1.0-19 (continued)

Fixed-Point Site	Location ID	Geomorphic Unit	Distance from Upstream End of Reach (m)	Depth (cm)	Alpha Radiation (cpm ^a)	Shielded Beta/Gamma Radiation (dpm ^b)	Shielded Gamma Radiation (cpm)
					40	—	—
					30	—	—
				75–90	61	—	—
					65	—	—
					66	—	—
ACS-57	—	c2 (c.a.)	137	0–15	22	—	—
				15–30	22	—	—
				30–45	36	—	—
				45–60	35	—	—
				60–75	54	—	—
				75–90	24	—	—
ACS-58	PU-10234	c2a (c.a.)	141	0–15	33	—	—
					31	—	—
					47	—	—
				15–30	25	—	—
					25	—	—
					37	—	—
				30–45	146	—	—
					140	—	—
					215	—	—
				45–60	61	—	—
					51	—	—
					53	—	—
ACS-59	—	c2a (c.a.)	139	0–15	9	—	—
					8	—	—
					18	—	—
				15–30	24	—	—
					29	—	—
					40	—	—
				30–45	155	—	—
					127	—	—
					151	—	—
				45–60	92	—	—
					297	—	—
					100	—	—
				60–75	99	—	—
					96	—	—
					122	—	—
ACS-60	PU-10233	c2a (c.a.)	137	75–90	220	—	—
					239	—	—
					238	—	—
				0–15	25	—	—
				15–30	44	—	—
				30–45	145	—	—

Table B-1.0-19 (continued)

Fixed-Point Site	Location ID	Geomorphic Unit	Distance from Upstream End of Reach (m)	Depth (cm)	Alpha Radiation (cpm ^a)	Shielded Beta/Gamma Radiation (dpm ^b)	Shielded Gamma Radiation (cpm)
ACS-61	—	c2a (c.a.)	145	45–60	50	—	—
				60–75	11	—	—
				75–90	96	—	—
				0–15	58	—	—
					82	—	—
					69	—	—
				15–30	46	—	—
					58	—	—
					52	—	—
				30–45	143	—	—
					154	—	—
					119	—	—
				45–60	84	—	—
					104	—	—
					79	—	—
				60–75	48	—	—
					46	—	—
					49	—	—
				75–90	257	—	—
					230	—	—
					256	—	—
				90–105	72	—	—
				—	57	—	—
				—	60	—	—
ACS-62	—	c2a (c.a.)	146	0–15	57	—	—
					46	—	—
					44	—	—
				15–30	97	—	—
					95	—	—
					109	—	—
				30–45	31	—	—
					46	—	—
					43	—	—
				45–60	41	—	—
					40	—	—
					46	—	—
				60–75	69	—	—
					59	—	—
					87	—	—
				75–90	250	—	—
					216	—	—
					207	—	—
ACS-63	—	c2 (c.a.)	152	0–15	23	—	—
				15–30	13	—	—

Table B-1.0-19 (continued)

Fixed-Point Site	Location ID	Geomorphic Unit	Distance from Upstream End of Reach (m)	Depth (cm)	Alpha Radiation (cpm ^a)	Shielded Beta/Gamma Radiation (dpm ^b)	Shielded Gamma Radiation (cpm)
				30-45	19	—	—
				45-60	22	—	—
				60-75	46	—	—
				75-90	38	—	—
ACS-64	—	c2 (c.a.)	181	0-15	10	—	—
				15-30	12	—	—
				30-45	11	—	—
				45-60	11	—	—
ACS-65	—	f1b (c.a.)	185	0-15	33	—	—
					38	—	—
					27	—	—
				15-30	18	—	—
					14	—	—
					19	—	—
				30-45	43	—	—
					40	—	—
					35	—	—
				45-60	318	—	—
					274	—	—
					290	—	—
ACS-66	PU-10239	f1b (c.a.)	181	0-15	28	—	—
					20	—	—
					29	—	—
				15-30	13	—	—
					11	—	—
					12	—	—
				30-45	40	—	—
					28	—	—
					25	—	—
				45-60	112	—	—
					140	—	—
					178	—	—
				60-75	65	—	—
					66	—	—
					66	—	—
ACS-67	PU-10240	f1b (c.a.)	193	0-15	39	—	—
					35	—	—
					38	—	—
				15-30	117	—	—
					127	—	—
					131	—	—
				30-45	22	—	—
					64	—	—
					25	—	—

Table B-1.0-19 (continued)

Fixed-Point Site	Location ID	Geomorphic Unit	Distance from Upstream End of Reach (m)	Depth (cm)	Alpha Radiation (cpm ^a)	Shielded Beta/Gamma Radiation (dpm ^b)	Shielded Gamma Radiation (cpm)
				45-60	13	—	—
					7	—	—
					11	—	—
ACS-68	—	c2 (c.a.)	218	0-15	9	—	—
				15-30	14	—	—
				30-45	19	—	—
				45-60	11	—	—
ACS-69	—	f1b (c.a.)	230	0-15	53	—	—
					62	—	—
					60	—	—
				15-30	144	—	—
					196	—	—
					190	—	—
				30-45	99	—	—
					83	—	—
					92	—	—
				45-60	16	—	—
					24	—	—
					18	—	—
ACS-70	—	c2a (c.a.)	238	0-15	35	—	—
				15-30	32	—	—
				30-45	71	—	—
ACS-71	PU-10244	f1a (c.a.)	239	0-15	81	—	—
				15-30	76	—	—
				30-45	23	—	—
				45-60	13	—	—
				60-75	28	—	—
ACS-72	—	f1a (c.a.)	250	0-15	493	—	—
					341	—	—
					384	—	—
				15-30	1160	—	—
					1216	—	—
					1091	—	—
				30-45	159	—	—
					102	—	—
					130	—	—
				45-60	14	—	—
					15	—	—
					24	—	—
ACS-73	—	c2 (c.a.)	254	0-15	9	—	—
				15-30	18	—	—
				30-45	21	—	—
				45-60	14	—	—
ACS-74	—	f1a (c.a.)	256	0-15	339	—	—

Table B-1.0-19 (continued)

Fixed-Point Site	Location ID	Geomorphic Unit	Distance from Upstream End of Reach (m)	Depth (cm)	Alpha Radiation (cpm ^a)	Shielded Beta/Gamma Radiation (dpm ^b)	Shielded Gamma Radiation (cpm)
					292	—	—
					293	—	—
				15–30	84	—	—
					60	—	—
					113	—	—
				30–45	9	—	—
					7	—	—
					9	—	—
				45–60	8	—	—
				60–75	7	—	—
				75–90	7	—	—
ACS-75	—	f1a (c.a.)	259	0–15	270	—	—
					377	—	—
					228	—	—
				15–30	91	—	—
					156	—	—
					77	—	—
				30–45	31	—	—
					33	—	—
					40	—	—
				45–60	8	—	—
					11	—	—
					8	—	—
ACS-76	—	f1 (c.a.)	263	0–15	27	—	—
				15–30	9	—	—
				30–45	12	—	—
				45–60	17	—	—
ACS-77	—	c3 (c.a.)	243	0–15	32	—	—
					36	—	—
					34	—	—
				15–30	50	—	—
					48	—	—
					45	—	—
				30–45	45	—	—
					38	—	—
					38	—	—
				45–60	690	—	—
					692	—	—
					681	—	—
ACS-78	—	f1a (c.a.)	236	0–15	73	—	—
					84	—	—
					81	—	—
				15–30	188	—	—
					227	—	—

Table B-1.0-19 (continued)

Fixed-Point Site	Location ID	Geomorphic Unit	Distance from Upstream End of Reach (m)	Depth (cm)	Alpha Radiation (cpm ^a)	Shielded Beta/Gamma Radiation (dpm ^b)	Shielded Gamma Radiation (cpm)
				30–45	202	—	—
					545	—	—
					423	—	—
				45–60	479	—	—
					105	—	—
					93	—	—
					135	—	—
ACS-79	—	f1a (c.a.)	232	0–15	71	—	—
					80	—	—
					70	—	—
				15–30	226	—	—
					236	—	—
					238	—	—
				30–45	311	—	—
					352	—	—
					405	—	—
				45–60	162	—	—
125	—	—					
110	—	—					
ACS-80	—	f1	121	0–15	26	—	—
				15–30	27	—	—
ACS-81	—	f1	135	0–15	12	—	—
				15–30	13	—	—
				30–45	20	—	—
				45–60	34	—	—
ACS-82	—	c2 (c.a.)	159	0–15	16	—	—
				15–30	10	—	—
				30–45	14	—	—

^a cpm = Counts per minute.^b dpm = Disintegrations per minute.^c — = No location ID or no measurements.

Table B-1.0-20
Thickness Measurements from Reaches AC-1 and AC-2 and 0-030(g) Drainage

Reach	Distance from Upstream End of Reach (m)	Side of Channel	Geomorphic Unit	Fine Facies Thickness (cm)	Coarse Facies Thickness (cm)	Location ID
AC-1, Upstream from 0-030(g) Drainage	5	N	c2	80	35	00-10240
	5	S	f1+c3	62	0	— ^a
	12	S	f1+c3	70	18	00-10241
	12	N	f1	46	0	—
	13	N	f1	78	0	—
	16	S	c2	88	Unknown	—
	22	S	c3	74	7	—
	27	S	f1+c3	78	17	—
	29	N	c2	43	0	PU-10013
	34	N	c2	64	>16	—
AC-2, Downstream from 0-030(g) Drainage	47	S	c2?	66	Unknown	—
	52	N	c3	73+	Unknown	00-10243
	57	N	c3	83	Unknown	—
	65	N	c3	59	Unknown	—
	65	S	c3	63	Unknown	—
	73	N	c2	45	Unknown	—
	74	S	c3? (f1?)	39	Unknown	—
	78	N	c2	49	Unknown	00-10246
AC-2, Upstream from South Fork of Acid Canyon	40	N	c2	26	0	PU-10014
	29	N	c2	40	15	PU-10015
	42	S	f1	24	0	—
	9	N	f1	28	5	PU-10016
0-030(g) Drainage	19	na ^b	c2a	15	15	—
	27	na	c1b	7	43	—
	37	na	c2a	10	34	00-10232
	40	na	c2a	9	31	—
	49	na	c2a	16	12	—
	52	na	c2a	41	38	00-10233
	60	na	c2a	23	54	—
	70	na	c2a	51	31	—
	95	na	c2b? (c2c?)	23	0	—
	120	na	c2c	10	28	—
	150	na	c2c	14	8	—
	170	na	c1	19	14	—
	192	na	c2c	12	0	00-10237
	196	na	c2c	12	0	—
	197	na	c2c	6	0	—
	197	na	c2c	31	0	—
	225	na	c1w	45	0	00-10238

^a — = No location ID

^b na = Not available.

Table B-1.0-21
Thickness Measurements from Reach AC-3

Distance from Upstream End of Reach (m)	Side of Channel	Geomorphic Unit	Fine Facies Thickness (cm)	Coarse Facies Thickness (cm)	Fixed- Point Site	Location ID
38	N	f1	33	0	AC3-1	—*
41	S	f1	18	0	AC3-2	PU-10017
61	S	f1? (f2?)	26	0	AC3-3	—
71	S	f1	9	0	AC3-4	—
80	N	c2	10	≥15	AC3-5	—
91	S	f2	14	0	AC3-7	—
92	N	c2	26	>38	AC3-6	PU-10018
116	N	c2	19	>41	AC3-8	PU-10102
129	S	c2	33	>27	AC3-10	—
129	N	c2	19	>31	AC3-9	—
143	N	c2	35	>21	AC3-11	—
143	S	c2	17	>58	AC3-12	PU-10103
155	S	c2	44	>24	AC3-13	PU-10019
155	N	c2	26	>30	AC3-14	—
177	N	f1	48	15	AC3-15	—
178	S	c2	41	>32	AC3-16	—
186	S	c2	30	24	AC3-17	—
198	S	c2	81	>4	AC3-18	PU-10104
200	N	c2	29	13	AC3-19	—
210	N	c2? (f1?)	50	≥15	AC3-20	—
214	S	c2? (f1?)	38	6	AC3-21	—
247	W	f2? (f1?)	≥10	0	AC3-22	—
250	E	f2? (f1?)	≥6	0	AC3-23	PU-10106
269	W	c2	17	>23	AC3-25	—
273	W	f1	5	0	AC3-24	—
285	W	f1	8	0	AC3-26	—
298	W	c2	28	>22	AC3-27	PU-10107
314	W	f1	16	0	AC3-38	PU-10108
323	W	c2	42	8	AC3-37	—
330	E	c2	63	>23	AC3-36	PU-10109
351	W	c2	27	>60	AC3-35	—
353	W	f1? (c2?)	9	9	AC3-34	—
369	W	c2	15	>38	AC3-33	—
372	E	c2	27	23	AC3-32	—
375	mid	c2	25	>30	AC3-31	—
378	W	c2	21	23	AC3-29	PU-10110
386	W	f1	11	0	AC3-28	—

*— = No location ID

Table B-1.0-22
Thickness Measurements from Reach ACS

Distance from Upstream End of Reach (m)	Side of Channel	Geomorphic Unit	Fine Facies Thickness (cm)	Coarse Facies Thickness (cm)	Thickness of Pre-1942 Sediment (m)	Fixed Point Site	Location ID
5	E	c2	20	60	0	ACS-30	—*
27	W	c2	22	56	0	ACS-31	PU-10223
33	E	c2	7	21	0	ACS-32	—
33	W	c2	22	40	0	ACS-33	PU-10009
40	W	c2	29	5	0	ACS-34	—
50	E	c2	33	0	0	ACS-46	PU-10008
66	W	c2	27	>17	Unknown	ACS-26	—
96	W	c2	27	>46	Unknown	ACS-25	—
103	W	c1b	6	>0.2	Unknown	ACS-27A	—
103	E	c2	58	>8	Unknown	ACS-27	—
117	E	c2 (c.a.)	44	>5	Unknown	ACS-28	—
118	E	c1b (c.a.)	12	>0.2	Unknown	ACS-36	PU-10006
121	W	f1	24	0	>6	ACS-80	—
130	W	c2 (c.a.)	39	>68	Unknown	ACS-54	PU-10221
134	W	c2 (c.a.)	44	41	0	ACS-24	PU-10220
135	E	f1	25	0	>35	ACS-81	—
137	E	c2 (c.a.)	31	59	0	ACS-57	—
137	W	c2a (c.a.)	61	29	0	ACS-60	PU-10233
139	E	c2 (c.a.)	11	>80	Unknown	ACS-53	—
139	W	c2a (c.a.)	67	23	0	ACS-59	—
141	E	c2a (c.a.)	45	48	0	ACS-56	PU-10235
141	W	c2a (c.a.)	57	≥33	Unknown	ACS-58	PU-10234
143	E	c2a (c.a.)	28	>66	Unknown	ACS-23	PU-10005
143	E	c2a (c.a.)	60	≥43	Unknown	ACS-52	PU-10236
145	E	c2a (c.a.)	31	43	0	ACS-55	—
145	W	c2a (c.a.)	78	32	0	ACS-61	—
146	E	c2a (c.a.)	6	23	0	ACS-51	PU-10237
146	W	c2a (c.a.)	68	24	0	ACS-62	—
148	W	c2 (c.a.)	18	>48	Unknown	ACS-22	PU-10219
150	E	f1	42	0	33	ACS-37	PU-10004
152	E	c2a (c.a.)	63	>18	Unknown	ACS-21	PU-10238
152	W	c2 (c.a.)	40	51	0	ACS-63	—
155	E	c2 (c.a.)	50	18	0	ACS-38	—
159	W	c2 (c.a.)	51	5	0	ACS-20	—
159	E	c2 (c.a.)	30	20	0	ACS-82	—
170	W	c2 (c.a.)	37	15	0	ACS-19	—
177	E	c2 (c.a.)	56	>4	Unknown	ACS-18	—
181	E	c2 (c.a.)	57	5	0	ACS-64	—
181	W	f1b (c.a.)	>64	11	0	ACS-66	PU-10239
185	E	c3 (c.a.)	23	≥44	Unknown	ACS-17	—
185	W	c2 (c.a.)	43	7	0	ACS-45	—

Table B-1.0-22 (continued)

Distance from Upstream End of Reach (m)	Side of Channel	Geomorphic Unit	Fine Facies Thickness (cm)	Coarse Facies Thickness (cm)	Thickness of Pre-1942 Sediment (m)	Fixed Point Site	Location ID
185	W	f1b (c.a.)	59	4	0	ACS-65	—
188	W	c3 (c.a.)	56	13	0	ACS-16	PU-10003
192	W	c2 (c.a.)	31	≥15	Unknown	ACS-44	—
193	W	f1b (c.a.)	32	0	28	ACS-67	PU-10240
200	W	f1 (c.a.)	10	0	52	ACS-15	PU-10002
200	E	c2 (c.a.)	37	>17	Unknown	ACS-39	PU-10218
218	W	c2 (c.a.)	31	31	0	ACS-68	—
219	W	c2 (c.a.)	16	≥76	Unknown	ACS-14	—
226	E	c3 (c.a.)	27	51	0	ACS-50	—
230	E	c2a (c.a.)	20	37	0	ACS-13	PU-10241
230	W	f1b (c.a.)	25	19	>16	ACS-69	—
231	E	c2 (c.a.)	34	>86	Unknown	ACS-12	PU-10242
231	W	f1a (c.a.)	56	0	45	ACS-11	PU-10001
232	E	f1a (c.a.)	40	0	Unknown	ACS-48	—
232	W	f1a (c.a.)	51	14	Unknown	ACS-79	—
233	E	c3 (c.a.)	47	≥32	Unknown	ACS-10	—
236	W	f1a (c.a.)	73	5	≥20	ACS-9	—
236	W	f1a (c.a.)	65	0	0	ACS-78	—
238	E	f1a (c.a.)	46	8	31	ACS-42	PU-10243
238	E	c2 (c.a.)	37	≥15	Unknown	ACS-70	—
239	W	f1a (c.a.)	18	25	≥43	ACS-71	PU-10244
242	W	c2a (c.a.)	27	>116	Unknown	ACS-43	PU-10245
243	W	c3 (c.a.)	29	31	0	ACS-77	—
245	W	f1a (c.a.)	35	14	≥41	ACS-47	PU-10000
245	W	c2a (c.a.)	34	>36	Unknown	ACS-8	—
247	E	f1a (c.a.)	10	15	30	ACS-49	—
250	E	c2a (c.a.)	4	≥83	Unknown	ACS-7	PU-10246
250	W	f1a (c.a.)	39	0	24	ACS-72	—
254	W	f1b (c.a.)	12	20	>78	ACS-6	—
254	E	c2 (c.a.)	22	>40	Unknown	ACS-73	—
256	W	f1a (c.a.)	20	0	70	ACS-74	—
259	W	f1a (c.a.)	15	12	33	ACS-75	—
262	E	c2a (c.a.)	28	>24	Unknown	ACS-5	—
263	E	f1 (c.a.)	≥27	0	>35	ACS-76	—
264	W	f1b (c.a.)	14	11	>78	ACS-4	—
272	E	f1 (c.a.)	80	9	>70	ACS-3	—
281	W	c2	22	36	0	ACS-2	—
289	W	c2	24	62	0	ACS-1	—

*— = No location ID

Table B-1.0-23
Particle-Size and Organic-Matter Data from Acid Canyon Reaches

Sample ID	Reach	Gravel (>2 mm) (wt %)	Very Coarse Sand (2-1 mm) (wt %)	Coarse Sand (1-0.5 mm) (wt %)	Medium Sand (0.5-0.25 mm) (wt %)	Fine Sand (0.25-0.125 mm) (wt %)	Very Fine Sand (0.125-0.0625 mm) (wt %)	Coarse Silt (62.5-15 µm) (wt %)	Fine Silt (15-2 µm) (wt %)	Clay (<2 µm) (wt %)	Median Particle Size Class ^a	Total Silt + Clay (wt %)	Organic Matter (wt %)
04PU-96-0124	AC-3	12.1	17.2	36.0	24.7	11.3	5.7	3.3	1.1	0.7	cs	5.1	0.5
04PU-97-0079	AC-3	6.9	11.3	19.7	17.2	10.8	8.1	17.2	10.1	5.5	fs	32.8	4.4
04PU-97-0080	AC-3	27.6	5.9	11.4	10.3	7.5	15.8	38.3	5.5	5.3	ms	49.1	1.9
CAPU-00-0100	AC-3	7.6	2.6	6.9	8.3	6.9	14.6	33.5	13.3	13.9	csi	60.6	4.6
CAPU-00-0101	AC-3	2.7	9.4	15.9	14.0	10.0	11.2	17.8	11.6	9.8	vfs	39.2	3.3
CAPU-00-0102	AC-3	2.9	5.5	11.4	17.0	14.1	15.7	19.7	7.9	8.4	vfs	36.0	2.3
CAPU-00-0117	AC-3	4.3	7.9	16.2	20.0	14.2	10.9	14.6	8.4	7.7	fs	30.7	2.5
CAPU-00-0118	AC-3	62.0	53.6	20.7	8.3	2.7	1.6	3.4	4.9	4.7	vcs	13.0	NA ^b
CAPU-00-0119	AC-3	0.2	2.9	6.2	8.4	9.4	16.1	30.8	14.5	11.5	csi	56.8	4.8
CAPU-00-0120	AC-3	17.9	52.1	27.2	5.7	1.3	1.2	4.0	4.2	4.1	vcs	12.3	NA
CAPU-00-0121	AC-3	1.1	5.4	14.4	18.5	15.7	13.3	17.3	7.6	7.7	fs	32.5	3.5
CAPU-00-0122	AC-3	14.0	10.1	12.1	11.6	9.4	11.9	23.5	12.0	9.5	vfs	45.0	3.6
CAPU-00-0123	AC-3	15.3	52.7	32.6	9.8	1.6	0.4	0.3	1.0	1.6	vcs	2.9	NA
CAPU-00-0124	AC-3	1.0	6.0	19.1	17.8	8.5	8.3	21.4	10.3	8.4	fs	40.1	4.3
CAPU-00-0125	AC-3	14.2	14.2	29.9	26.5	13.4	5.1	4.9	2.6	3.3	ms	10.8	1.2
CAPU-00-0126	AC-3	5.5	12.7	19.9	19.2	12.6	10.4	12.6	6.1	6.7	ms	25.5	2.5
CAPU-01-0059	ACS	28.8	24.5	24.7	21.1	9.2	4.6	5.2	4.9	5.8	ms	15.8	1.70
CAPU-01-0060	ACS	16.5	26.0	27.1	19.6	7.3	3.6	3.5	6.2	6.7	cs	16.4	1.69
CAPU-01-0061	ACS	44.1	22.9	23.6	20.6	10.4	5.7	6.8	5.5	4.5	ms	16.7	1.60
CAPU-01-0062	ACS	58.3	37.4	25.0	9.5	4.2	2.7	4.7	7.6	7.9	cs	20.2	1.67
CAPU-01-0063	ACS	69.2	50.0	25.4	9.2	3.3	1.8	1.9	3.1	5.4	cs	10.3	0.78
CAPU-01-0065	ACS	40.3	48.7	30.3	10.9	2.5	1.4	2.4	1.3	2.4	cs	6.1	0.64

Table B-1.0-23 (continued)

Sample ID	Reach	Gravel (>2 mm) (wt %)	Very Coarse Sand (2-1 mm) (wt %)	Coarse Sand (1-0.5 mm) (wt %)	Medium Sand (0.5-0.25 mm) (wt %)	Fine Sand (0.25-0.125 mm) (wt %)	Very Fine Sand (0.125-0.0625 mm) (wt %)	Coarse Silt (62.5-15 µm) (wt %)	Fine Silt (15-2 µm) (wt %)	Clay (<2 µm) (wt %)	Median Particle Size Class ^a	Total Silt + Clay (wt %)	Organic Matter (wt %)
CAPU-01-0068	ACS	19.0	21.1	15.2	13.1	9.1	7.9	15.1	7.1	11.2	fs	33.3	3.41
CAPU-01-0069	ACS	0.4	1.2	3.3	8.4	17.5	17.9	28.9	13.3	9.4	csi	51.6	4.19
CAPU-01-0147	ACS	0.7	1.8	5.9	11.2	14.8	16.3	26.6	11.9	11.5	csi	50.1	4.44
CAPU-01-0148	ACS	7.9	11.5	9.8	7.0	9.1	12.4	24.0	12.5	13.1	vfs	49.7	3.08
CAPU-01-0149	ACS	22.3	15.8	24.9	25.1	10.4	5.2	10.5	5.0	3.1	ms	18.6	1.41
CAPU-01-0150	ACS	0.0	2.7	4.6	7.6	12.8	18.6	32.1	11.8	9.6	csi	53.5	3.15
CAPU-01-0151	ACS	9.3	9.4	13.7	9.9	7.8	11.5	27.4	9.5	11.0	vfs	47.9	3.15
CAPU-01-0152	ACS	3.5	7.6	9.4	8.4	9.9	13.9	29.8	11.0	9.9	csi	50.7	3.24
CAPU-01-0153	ACS	19.6	10.4	12.7	8.6	10.4	14.3	25.4	9.9	8.1	vfs	43.4	2.96
CAPU-01-0154	ACS	17.3	1.1	2.3	5.5	10.8	18.6	37.5	11.7	12.4	csi	61.6	0.91
CAPU-01-0155	ACS	1.0	1.6	3.6	6.4	11.7	18.0	38.6	11.8	8.2	csi	58.6	3.04
CAPU-01-0156	ACS	44.8	19.7	15.7	10.7	7.4	9.2	23.5	6.3	7.4	fs	37.2	1.77
CAPU-01-0157	ACS	18.3	42.1	22.4	8.8	3.7	2.9	9.0	5.9	5.1	cs	20.1	0.91
CAPU-01-0158	ACS	32.0	5.9	9.4	12.6	14.5	17.2	26.5	7.0	6.9	vfs	40.4	2.42
CAPU-01-0159	ACS	36.4	15.5	16.3	14.8	11.7	9.7	17.4	6.2	8.4	fs	32.0	3.00
CAPU-01-0160	ACS	2.3	5.2	9.5	22.2	21.1	12.9	14.6	8.6	5.8	fs	29.0	2.77
CAPU-01-0161	ACS	17.7	22.3	17.8	11.2	9.0	8.5	17.6	8.9	4.6	ms	31.2	2.59
CAPU-01-0162	ACS	0.6	2.3	7.7	9.8	9.5	12.9	30.6	15.1	12.1	csi	57.8	3.60
CAPU-01-0163	ACS	7.3	6.8	15.7	20.2	15.5	11.5	15.9	7.8	6.5	fs	30.1	3.05
CAPU-01-0164	ACS	23.7	23.8	28.9	15.6	7.1	4.9	9.9	5.8	3.9	cs	19.7	1.76
CAPU-01-0165	ACS	1.1	0.6	4.2	12.0	16.3	21.6	28.4	5.8	11.0	vfs	45.2	2.26
CAPU-01-0166	ACS	6.7	8.0	10.7	9.5	11.2	13.4	28.8	10.5	7.9	vfs	47.2	3.06
CAPU-01-0167	ACS	12.4	44.1	33.5	8.0	2.3	1.5	3.1	3.4	4.0	cs	10.5	0.83

Table B-1.0-23 (continued)

Sample ID	Reach	Gravel (>2 mm) (wt %)	Very Coarse Sand (2-1 mm) (wt %)	Coarse Sand (1-0.5 mm) (wt %)	Medium Sand (0.5-0.25 mm) (wt %)	Fine Sand (0.25-0.125 mm) (wt %)	Very Fine Sand (0.125-0.0625 mm) (wt %)	Coarse Silt (62.5-15 µm) (wt %)	Fine Silt (15-2 µm) (wt %)	Clay (<2 µm) (wt %)	Median Particle Size Class ^a	Total Silt + Clay (wt %)	Organic Matter (wt %)
CAPU-01-0168	ACS	0.6	1.5	4.7	10.1	13.0	15.3	30.8	13.7	10.7	csi	55.3	4.84
CAPU-01-0169	ACS	4.6	3.6	8.7	12.0	11.7	14.3	28.3	10.5	11.0	vfs	49.8	3.04
CAPU-01-0170	ACS	25.2	4.8	13.5	15.7	12.6	11.0	21.0	12.9	8.6	vfs	42.6	3.72
CAPU-01-0171	ACS	20.6	26.6	28.7	14.2	5.7	4.1	8.6	6.2	5.9	cs	20.7	1.60
CAPU-01-0172	ACS	5.5	15.3	15.7	8.3	6.5	9.9	25.4	10.7	8.0	vfs	44.1	2.17
CAPU-01-0173	ACS	6.0	9.7	23.5	23.8	12.6	7.9	11.1	5.6	5.9	ms	22.6	1.87
CAPU-01-0174	ACS	2.8	1.4	4.4	8.5	13.7	19.7	33.9	9.3	9.0	csi	52.3	2.60
CAPU-01-0175	ACS	16.6	31.7	31.5	11.6	5.0	3.6	7.1	4.4	5.9	cs	17.3	1.27
CAPU-01-0177	ACS	27.2	7.9	12.7	12.9	11.5	10.8	22.6	13.7	7.9	vfs	44.2	2.33
CAPU-01-0178	ACS	15.2	12.5	20.6	16.7	10.6	10.2	15.6	9.1	4.5	fs	29.3	1.90
CAPU-01-0180	ACS	30.3	28.1	24.6	12.3	6.7	4.6	10.6	9.3	3.8	cs	23.7	1.72
CAPU-01-0181	ACS	51.9	34.3	16.3	8.5	6.4	7.0	13.8	6.7	6.8	cs	27.4	1.65
CAPU-01-0182	ACS	68.0	31.4	24.3	10.8	4.6	3.9	11.7	7.5	5.8	cs	24.9	1.47
CAPU-01-0183	ACS	66.1	41.4	24.0	9.4	3.4	2.3	7.2	7.4	4.8	cs	19.4	1.39
CAPU-01-0184	ACS	23.8	18.2	29.2	18.1	8.1	5.3	9.7	6.5	4.9	ms	21.1	1.66
CAPU-01-0185	ACS	31.1	24.8	31.1	16.7	5.6	3.2	7.1	5.2	6.2	cs	18.5	1.82
CAPU-01-0186	ACS	68.2	39.6	27.8	8.3	2.9	2.0	5.9	8.7	4.9	cs	19.5	0.97
CAPU-99-1000	AC-3	0.4	1.6	3.0	3.4	4.9	10.5	46.3	16.6	13.6	csi	76.5	NA
CAPU-99-1001	AC-3	2.1	6.4	8.7	9.6	8.7	10.0	32.0	12.5	12.0	csi	56.5	NA
CAPU-99-1002	AC-3	3.1	11.1	19.7	25.1	14.6	8.1	12.4	5.0	3.9	ms	21.3	NA
CAPU-99-1003	AC-3	9.6	16.2	20.4	18.1	9.9	6.5	15.9	6.8	6.0	ms	28.6	NA
CAPU-99-1004	AC-3	7.1	20.4	27.6	16.2	6.9	5.3	12.4	5.6	5.7	ms	23.7	NA
CAPU-99-1005	ACS	0.4	1.3	1.2	1.6	5.3	20.1	47.3	10.9	12.1	csi	70.4	NA

Table B-1.0-23 (continued)

Sample ID	Reach	Gravel (>2 mm) (wt %)	Very Coarse Sand (2-1 mm) (wt %)	Coarse Sand (1-0.5 mm) (wt %)	Medium Sand (0.5-0.25 mm) (wt %)	Fine Sand (0.25-0.125 mm) (wt %)	Very Fine Sand (0.125-0.0625 mm) (wt %)	Coarse Silt (62.5-15 µm) (wt %)	Fine Silt (15-2 µm) (wt %)	Clay (<2 µm) (wt %)	Median Particle Size Class ^a	Total Silt + Clay (wt %)	Organic Matter (wt %)
CAPU-99-1006	ACS	1.2	3.7	14.9	23.1	19.0	12.2	16.5	5.1	5.3	fs	27.0	NA
CAPU-99-1007	ACS	2.4	3.6	7.3	11.0	13.2	15.7	30.7	8.2	10.3	vfs	49.1	NA
CAPU-99-1008	ACS	1.5	4.1	6.8	6.6	12.1	20.7	34.7	9.6	5.1	vfs	49.3	NA
CAPU-99-1009	ACS	0.9	2.0	6.9	21.9	28.0	18.4	16.0	3.9	2.9	fs	22.7	NA
CAPU-99-1010	ACS	40.7	46.1	30.1	13.3	4.1	1.3	3.2	1.1	0.7	cs	5.1	NA
CAPU-99-1011	AC-1	2.0	6.9	13.1	16.2	12.2	10.5	23.7	9.2	8.0	vfs	41.0	NA
CAPU-99-1012	AC-1	0.1	1.0	3.8	8.9	11.5	20.2	33.9	8.8	11.5	csi	54.2	NA
CAPU-99-1013	AC-1	0.9	3.1	9.1	15.0	15.3	14.5	24.6	10.0	8.1	vfs	42.7	NA
CAPU-99-1014	AC-2	1.5	7.5	15.0	12.3	10.7	12.5	22.4	10.0	9.5	vfs	41.9	NA
CAPU-99-1015	AC-2	0.6	5.1	11.0	11.0	9.4	9.9	26.0	14.5	12.9	csi	53.3	NA
CAPU-99-1016	AC-2	6.2	9.6	17.5	15.9	8.9	9.7	18.7	8.0	11.3	fs	38.1	NA
CAPU-99-1023	ACS	5.8	9.8	11.2	12.5	12.0	12.1	24.2	10.5	7.7	vfs	42.4	NA
CAPU-99-1024	ACS	2.6	2.7	5.7	8.3	9.8	14.9	34.6	12.7	11.2	csi	58.6	NA
CAPU-99-1025	ACS	9.0	16.8	24.5	18.1	7.9	6.5	12.4	6.7	7.0	ms	26.0	NA
CAPU-99-1026	ACS	18.8	45.6	29.7	10.2	3.0	1.3	2.4	4.2	3.6	cs	10.3	NA
CAPU-99-1027	ACS	3.1	3.7	8.9	10.9	10.7	13.9	28.7	13.6	9.6	csi	51.9	NA
CAPU-99-1028	ACS	1.1	1.1	1.9	2.2	5.4	13.5	49.1	16.6	9.9	csi	75.6	NA
CAPU-99-1029	ACS	25.4	20.0	20.3	13.1	7.9	7.0	16.2	9.7	5.5	ms	31.4	NA
CAPU-99-1030	ACS	2.7	4.6	11.4	13.4	14.1	13.6	23.1	10.7	8.8	vfs	42.7	NA
CAPU-99-1031	ACS	16.0	17.6	19.1	13.7	10.1	9.0	15.2	8.1	7.1	ms	30.4	NA
CAPU-99-1032	ACS	4.2	3.4	10.0	17.0	19.2	15.9	19.2	7.0	8.1	vfs	34.3	NA
CAPU-99-1033	ACS	13.9	41.0	29.4	7.9	2.7	2.2	6.5	5.3	4.6	cs	16.4	NA
CAPU-99-1034	ACS	6.4	9.2	9.4	10.2	11.3	12.3	24.7	12.4	10.2	vfs	47.3	NA

Table B-1.0-23 (continued)

Sample ID	Reach	Gravel (>2 mm) (wt %)	Very Coarse Sand (2-1 mm) (wt %)	Coarse Sand (1-0.5 mm) (wt %)	Medium Sand (0.5-0.25 mm) (wt %)	Fine Sand (0.25-0.125 mm) (wt %)	Very Fine Sand (0.125-0.0625 mm) (wt %)	Coarse Silt (62.5-15 µm) (wt %)	Fine Silt (15-2 µm) (wt %)	Clay (<2 µm) (wt %)	Median Particle Size Class ^a	Total Silt + Clay (wt %)	Organic Matter (wt %)
CAPU-99-1035	ACS	0.4	3.1	7.6	11.2	13.6	15.1	26.2	12.7	10.1	vfs	49.1	NA
CAPU-99-1036	ACS	6.5	19.5	17.9	7.9	5.5	6.6	22.1	12.5	8.1	fs	42.8	NA
CAPU-99-1037	ACS	2.0	7.8	12.1	9.5	9.1	12.5	28.2	12.9	7.9	vfs	48.9	NA
CAPU-99-1038	ACS	12.3	35.5	33.5	14.4	4.5	2.5	3.8	3.3	2.5	cs	9.5	NA
CAPU-99-1039	ACS	32.2	53.8	22.5	6.2	2.7	2.3	5.2	4.8	2.5	vcs	12.4	NA
CAPU-99-1040	ACS	8.1	18.8	15.3	13.3	13.2	11.3	15.1	5.6	7.4	fs	28.1	NA
CAPU-99-1041	ACS	36.6	36.8	29.7	16.6	4.6	1.8	4.1	3.2	3.1	cs	10.4	NA
CAPU-99-1042	ACS	5.0	10.5	22.1	21.6	13.0	8.4	12.3	6.9	5.1	ms	24.3	NA
CAPU-99-1043	ACS	1.5	3.6	7.3	10.5	14.1	16.0	26.3	13.6	8.6	vfs	48.5	NA
CAPU-99-1044	ACS	2.1	5.1	8.0	9.3	10.6	12.9	29.5	14.0	10.5	csi	54.0	NA
CAPU-99-1045	ACS	20.1	42.0	28.0	7.1	2.1	1.9	6.2	6.3	6.2	cs	18.7	NA
CAPU-99-1046	ACS	9.8	21.1	16.0	8.4	5.5	6.6	20.8	16.0	5.6	fs	42.4	NA
CAPU-99-1047	ACS	33.6	18.3	19.2	11.7	7.8	8.1	19.6	10.2	5.0	fs	34.9	NA
RE00-99-0173	AC-1	5.4	6.2	16.3	23.6	15.4	10.2	15.6	5.6	7.2	fs	28.5	2.51
RE00-99-0174	AC-1	8.4	0.3	1.9	3.2	7.0	14.1	45.3	14.0	13.8	csi	73.1	7.02
RE00-99-0175	AC-1	38.1	39.9	28.5	16.6	4.0	1.3	3.4	3.5	2.9	cs	9.7	0.72
RE00-99-0176	AC-2	3.0	4.6	12.2	17.9	12.6	13.3	22.7	7.7	9.0	vfs	39.4	2.73
RE00-99-0177	AC-2	5.0	5.3	12.8	17.4	13.5	13.6	21.9	6.8	8.7	vfs	37.4	2.83
RE00-99-0178	AC-2	22.1	47.5	30.3	13.2	2.6	0.8	2.0	1.8	1.8	cs	5.6	0.51
RE00-99-0179	AC-2	7.3	3.7	10.3	17.4	13.7	12.4	23.2	8.9	10.3	vfs	42.4	3.55

^a cs = coarse sand; csi = coarse silt; fs = fine sand; fsi = fine silt; ms = medium sand; vcs = very coarse sand; vfs = very fine sand.

^b NA = Not analyzed.

Table B-1.0-24
Summary of Particle-Size and Organic-Matter Data from Acid Canyon Reaches

Reach	Geomorphic Unit	Sediment Facies	Number of Analyses	Gravel (>2 mm) (wt %)	Very Coarse Sand (2–1 mm) (wt %)	Coarse Sand (1–0.5 mm) (wt %)	Medium Sand (0.5–0.25 mm) (wt %)	Fine Sand (0.25–0.125 mm) (wt %)	Very Fine Sand (0.125–0.0625 mm) (wt %)	Coarse Silt (62.5–15 µm) (wt %)	Fine Silt (15–2 µm) (wt %)	Clay (<2 µm) (wt %)	Median Particle Size Class ^b	Total Silt + Clay (wt %)	Organic Matter (wt %)
AC-1	c1	Coarse	1	38.1	39.9	28.5	16.6	4.0	1.3	3.4	3.5	2.9	cs	9.7	0.7
	c2	Fine	3	2.7	5.4	12.8	18.3	14.3	11.7	21.3	8.3	7.8	fs	37.4	2.5
	f1+c3	Fine	2	4.3	0.7	2.8	6.0	9.3	17.2	39.6	11.4	12.6	csi	63.7	7.0
AC-2	c1	Coarse	1	22.1	47.5	30.3	13.2	2.6	0.8	2.0	1.8	1.8	cs	5.6	0.5
	c2	Fine	3	3.1	5.4	12.1	13.6	11.3	11.6	23.9	11.1	10.9	vfs	45.9	3.5
	c3+f1	Fine	2	4.6	7.1	14.9	16.9	10.7	11.5	20.7	7.9	10.2	vfs	38.7	2.7
AC-3	c1	Coarse	2	13.7	35.0	34.3	17.2	6.4	3.1	1.8	1.0	1.1	cs	4.0	0.5
	c2	Coarse	3	31.3	40.0	25.9	13.5	5.8	2.6	4.1	3.9	4.0	cs	12.0	1.2
	c2	Fine	10	5.0	10.2	16.4	16.8	11.7	10.9	17.7	8.6	7.7	fs	33.9	3.2
	f1	Fine	5	4.9	7.8	12.1	10.3	7.6	9.9	29.5	12.3	10.3	csi	52.1	3.2
	f2	Fine	1	1.0	6.0	19.1	17.8	8.5	8.3	21.4	10.3	8.4	fs	40.1	4.3
ACS	c1	Coarse	3	39.2	43.9	30.0	13.6	3.7	1.5	3.3	1.9	2.1	cs	7.2	0.6
	c2	Coarse	8	32.4	30.5	26.1	15.3	6.8	4.0	5.8	5.4	6.0	cs	17.3	1.5
	c2a	Coarse	12	36.0	32.1	25.2	12.7	5.6	4.1	9.2	6.3	4.8	cs	20.3	1.5
	c3	Coarse	1	13.9	41.0	29.4	7.9	2.7	2.2	6.5	5.3	4.6	cs	16.4	NA ^b
	f1a	Coarse	3	17.7	27.4	24.8	13.8	6.3	5.0	10.3	6.8	5.4	cs	22.6	NA
	f1b	Coarse	2	18.0	34.0	31.2	11.8	4.7	3.2	6.5	4.6	4.0	cs	15.1	1.3
	c1b	Fine	1	0.9	2.0	6.9	21.9	28.0	18.4	16.0	3.9	2.9	fs	22.7	NA
	c2	Fine	6	5.1	7.1	10.1	11.9	13.0	13.8	24.3	10.7	9.0	vfs	44.0	3.4
	c2a	Fine	18	12.1	8.1	10.2	10.4	11.4	13.9	26.6	10.3	9.0	vfs	45.8	2.9
	c3	Fine	3	4.3	5.4	8.9	12.7	14.6	14.6	24.8	9.2	9.5	vfs	43.6	NA
	f1	Fine	2	0.8	3.4	11.2	17.2	16.3	13.7	21.3	8.9	7.7	vfs	38.0	NA
	f1a	Fine	7	7.9	5.6	8.9	9.3	9.3	13.6	31.7	12.4	9.0	csi	53.2	2.1
	f1b	Fine	5	4.0	4.1	8.8	12.8	13.5	15.2	26.4	9.7	9.4	vfs	45.5	3.2

Note: Average values, excluding samples that are inferred to be of largely pre-1943 sediment.

^a cs = coarse sand; csi = coarse silt; ms = medium sand; vfs = very fine sand.

^b NA = Not analyzed.

Table B-1.0-25
Crosswalk Between Sample ID for Particle-Size and
Organic-Matter Data and Sample ID for Other Analyses from Reach ACS

Sample ID for Particle Size and Organic Matter Analyses	Sample ID for Other Analyses
CAPU-01-0147	CAPU-01-0105
CAPU-01-0148	CAPU-01-0106
CAPU-01-0149	CAPU-01-0107
CAPU-01-0150	CAPU-01-0108
CAPU-01-0151	CAPU-01-0109
CAPU-01-0152	CAPU-01-0110
CAPU-01-0153	CAPU-01-0111
CAPU-01-0154	CAPU-01-0112
CAPU-01-0155	CAPU-01-0113
CAPU-01-0156	CAPU-01-0114
CAPU-01-0157	CAPU-01-0115
CAPU-01-0158	CAPU-01-0116
CAPU-01-0159	CAPU-01-0117
CAPU-01-0160	CAPU-01-0118
CAPU-01-0161	CAPU-01-0119
CAPU-01-0162	CAPU-01-0120
CAPU-01-0163	CAPU-01-0122
CAPU-01-0164	CAPU-01-0123
CAPU-01-0165	CAPU-01-0124
CAPU-01-0166	CAPU-01-0125
CAPU-01-0167	CAPU-01-0126
CAPU-01-0168	CAPU-01-0127
CAPU-01-0169	CAPU-01-0128
CAPU-01-0170	CAPU-01-0129
CAPU-01-0171	CAPU-01-0130
CAPU-01-0172	CAPU-01-0131
CAPU-01-0173	CAPU-01-0132
CAPU-01-0174	CAPU-01-0133
CAPU-01-0175	CAPU-01-0134
CAPU-01-0177	CAPU-01-0137
CAPU-01-0178	CAPU-01-0138
CAPU-01-0180	CAPU-01-0140
CAPU-01-0181	CAPU-01-0141
CAPU-01-0182	CAPU-01-0142
CAPU-01-0183	CAPU-01-0143
CAPU-01-0184	CAPU-01-0144
CAPU-01-0185	CAPU-01-0145
CAPU-01-0186	CAPU-01-0146

Table B-2.1-1
Surface Water Field Parameters for Los Alamos Canyon

Sample ID	Location ID	Sample Location	Date Collected	Filtered/ Unfiltered	pH	Specific Conductance ($\mu\text{S}/\text{cm}^a$)	Temp. ($^{\circ}\text{C}$)	Turbidity (NTU^b)
Upper Los Alamos Canyon								
CALA-01-0520	LA-10126	LA Creek upstream of LA Reservoir	11/2/2001	Filtered	8.13	149	8.3	0.93
CALA-01-0522	LA-10126	LA Creek upstream of LA Reservoir	11/2/2001	Filtered	8.13	149	8.3	0.93
CALA-01-0521	LA-10126	LA Creek upstream of LA Reservoir	11/2/2001	Unfiltered	8.13	149	8.3	0.93
CABG-00-0113	LA-10033	LA Reservoir	9/6/2000	Filtered	7.21	320	19.6	19.30
CABG-00-0112	LA-10033	LA Reservoir	9/6/2000	Unfiltered	7.21	320	19.6	19.30
GF01041WRAL	LA-10033	LA Reservoir	5/1/2001	Filtered	8.07	117	10.1	6.30
GU01041WRAL	LA-10033	LA Reservoir	5/1/2001	Unfiltered	8.07	117	10.1	6.30
CALA-01-0254	LA-10033	LA Reservoir	6/18/2001	Filtered	7.03	293	19.4	14.30
CALA-01-0256	LA-10033	LA Reservoir	6/18/2001	Filtered	7.03	293	19.4	14.30
CALA-01-0255	LA-10033	LA Reservoir	6/18/2001	Unfiltered	7.03	293	19.4	14.30
CABG-00-0111	LA-10034	Los Alamos Creek below LA Reservoir	9/6/2000	Filtered	7.4	290	16.4	4.90
CABG-00-0110	LA-10034	Los Alamos Creek below LA Reservoir	9/6/2000	Unfiltered	7.4	290	16.4	4.90
CALA-02-45014	LA-10034	Los Alamos Creek below LA Reservoir	5/30/2002	Filtered	7.93	128	11.4	2.93
CALA-02-45015	LA-10034	Los Alamos Creek below LA Reservoir	5/30/2002	Unfiltered	7.93	128	11.4	2.93
CALA-00-0101	LA-10006	Reach LA-Bkgd SW	7/24/2000	Filtered	6.54	210	19.8	4.58
CALA-00-0100	LA-10006	Reach LA-Bkgd SW	7/24/2000	Unfiltered	6.54	210	19.8	4.58
CALA-00-0166	LA-10006	Reach LA-Bkgd SW	10/5/2000	Filtered	6.13	210	11.6	2.50
CALA-00-0165	LA-10006	Reach LA-Bkgd SW	10/5/2000	Unfiltered	6.13	210	11.6	2.50
CALA-01-0020	LA-10040	SW at E026	8/30/2001	Filtered	8.54	237	14.3	NA
CALA-01-0019	LA-10040	SW at E026	8/30/2001	Unfiltered	8.54	237	14.3	NA
CALA-01-0061	LA-10064	Reach LA-1W SW	3/30/2001	Filtered	7.9	243	8.2	117.00
CALA-01-0062	LA-10064	Reach LA-1W SW	3/30/2001	Unfiltered	7.9	243	8.2	117.00
CALA-01-0244	LA-10064	Reach LA-1W SW	6/18/2001	Filtered	8.03	218	11.5	63.90
CALA-01-0245	LA-10064	Reach LA-1W SW	6/18/2001	Unfiltered	8.03	218	11.5	63.90
CALA-01-0510	LA-10064	Reach LA-1W SW	11/5/2001	Filtered	8.13	268	10.2	352.00
CALA-01-0511	LA-10064	Reach LA-1W SW	11/5/2001	Unfiltered	8.13	268	10.2	352.00
CALA-00-0024	LA-10005	SW at LAO-0.6	6/22/2000	Filtered	6.06	330	12.9	2.50
CALA-00-0023	LA-10005	SW at LAO-0.6	6/22/2000	Unfiltered	6.06	330	12.9	2.50
CALA-00-0099	LA-10005	SW at LAO-0.6	7/24/2000	Filtered	6.99	160	25.4	8.97
CALA-00-0098	LA-10005	SW at LAO-0.6	7/24/2000	Unfiltered	6.99	160	25.4	8.97
CALA-00-0168	LA-10005	SW at LAO-0.6	10/5/2000	Filtered	6.75	380	9.3	3.20
CALA-00-0167	LA-10005	SW at LAO-0.6	10/5/2000	Unfiltered	6.75	380	9.3	3.20
CALA-01-0063	LA-10065	Reach LA-1C SW	3/30/2001	Filtered	7.89	240	7.5	115.00
CALA-01-0064	LA-10065	Reach LA-1C SW	3/30/2001	Unfiltered	7.89	240	7.5	115.00
CALA-01-0246	LA-10065	Reach LA-1C SW	6/18/2001	Filtered	7.94	286	17.6	5.78
CALA-01-0247	LA-10065	Reach LA-1C SW	6/18/2001	Unfiltered	7.94	286	17.6	5.78
CALA-01-0512	LA-10065	Reach LA-1C SW	11/5/2001	Filtered	7.78	253	6.6	>1000
CALA-01-0513	LA-10065	Reach LA-1C SW	11/5/2001	Unfiltered	7.78	253	6.6	>1000
GF01031WGUL	LA-10036	SW at E030	3/26/2001	Filtered	7.45	235	7.8	44.70
CALA-01-0036	LA-10036	SW at E030	3/26/2001	Unfiltered	7.45	235	7.8	44.70

Table B-2.1-1 (continued)

Sample ID	Location ID	Sample Location	Date Collected	Filtered/Unfiltered	pH	Specific Conductance ($\mu\text{S}/\text{cm}^a$)	Temp. ($^{\circ}\text{C}$)	Turbidity (NTU ^b)
GU01031WGUL	LA-10036	SW at E030	3/26/2001	Unfiltered	7.45	235	7.8	44.70
GF01031W4SL	LA-10038	SW at E042	3/26/2001	Filtered	7.95	236	9.0	68.30
CALA-01-0035	LA-10038	SW at E042	3/26/2001	Unfiltered	7.95	236	9.0	68.30
GU01031W4SL	LA-10038	SW at E042	3/26/2001	Unfiltered	7.95	236	9.0	68.30
DP Canyon								
CA21-01-0005	21-10929	Reach DP-1W SW	4/2/2001	Filtered	8.97	481	7.2	21.70
CA21-01-0006	21-10929	Reach DP-1W SW	4/2/2001	Unfiltered	8.97	481	7.2	21.70
CA21-01-0011	21-10929	Reach DP-1W SW	6/20/2001	Filtered	7.23	437	16.5	17.20
CA21-01-0012	21-10929	Reach DP-1W SW	6/20/2001	Unfiltered	7.23	437	16.5	17.20
CA21-01-0021	21-10929	Reach DP-1W SW	6/28/2001	Filtered	7.37	372	17.5	12.20
CA21-01-0023	21-10929	Reach DP-1W SW	7/23/2001	Unfiltered	7.65	349	18.4	7.72
CA21-01-0029	21-10929	Reach DP-1W SW	11/12/2001	Filtered	8.51	564	9.2	13.40
CA21-01-0030	21-10929	Reach DP-1W SW	11/12/2001	Unfiltered	8.51	564	9.2	13.40
CA21-02-45264	21-10929	Reach DP-1W SW	5/21/2002	Filtered	9.19	531	16.3	12.80
CA21-02-45265	21-10929	Reach DP-1W SW	5/21/2002	Unfiltered	9.19	531	16.3	12.80
CA21-01-0003	21-11226	Reach DP-1C SW	4/2/2001	Filtered	6.92	629	4.4	6.24
CA21-01-0004	21-11226	Reach DP-1C SW	4/2/2001	Unfiltered	6.92	629	4.4	6.24
CA21-01-0009	21-11226	Reach DP-1C SW	6/20/2001	Filtered	6.87	218	15.0	13.20
CA21-01-0010	21-11226	Reach DP-1C SW	6/20/2001	Unfiltered	6.87	218	15.0	13.20
CA21-01-0019	21-11226	Reach DP-1C SW	6/28/2001	Filtered	6.6	263	16.9	8.60
CA21-01-0020	21-11226	Reach DP-1C SW	6/28/2001	Unfiltered	6.6	263	16.9	8.60
CA21-01-0022	21-11226	Reach DP-1C SW	7/23/2001	Unfiltered	6.72	253	17.3	7.47
CA21-01-0027	21-11226	Reach DP-1C SW	11/12/2001	Filtered	6.52	370	5.7	5.12
CA21-01-0028	21-11226	Reach DP-1C SW	11/12/2001	Unfiltered	6.52	370	5.7	5.12
CA21-02-45266	21-11226	Reach DP-1C SW	5/21/2002	Filtered	6.96	582	12.8	49.40
CA21-02-45267	21-11226	Reach DP-1C SW	5/21/2002	Unfiltered	6.96	582	12.8	49.40
GF01031W1PD	21-11269	Reach DP-2 SW	3/28/2001	Filtered	6.51	116	8.1	8.20
GU01031W1PD	21-11269	Reach DP-2 SW	3/28/2001	Unfiltered	6.51	116	8.1	8.20
0121-97-1401	21-01854	DP Spring	8/21/1997	Filtered	7.85	219	11.6	NA ^c
0121-97-1400	21-01854	DP Spring	8/21/1997	Unfiltered	7.85	219	11.6	NA
0121-97-1422	21-01854	DP Spring	10/15/1997	Unfiltered	NA	NA	NA	NA
CA21-98-0006	21-01854	DP Spring	5/6/1998	Filtered	6.18	486	12.0	NA
CA21-98-0005	21-01854	DP Spring	5/6/1998	Unfiltered	6.18	486	12.0	NA
CA21-98-0012	21-01854	DP Spring	9/16/1998	Filtered	8.16	308	16.7	NA
CA21-98-0011	21-01854	DP Spring	9/16/1998	Unfiltered	8.16	308	16.7	NA
CA21-98-0043	21-01854	DP Spring	10/6/1998	Unfiltered	7.84	219	12.4	NA
GF01031GSDP	21-01854	DP Spring	4/3/2001	Filtered	7.81	367	9.6	2.85
GU01031GSDP	21-01854	DP Spring	4/3/2001	Unfiltered	7.81	367	9.6	2.85
CA21-01-0017	21-01854	DP Spring	6/22/2001	Filtered	8.44	407	20.8	3.21
CA21-01-0018	21-01854	DP Spring	6/22/2001	Unfiltered	8.44	407	20.8	3.21
CADP-03-50373	21-01854	DP Spring	1/15/2003	Filtered	6.36	236	6.3	NA
Lower Los Alamos Canyon								
CALA-00-0028	LA-00219	Basalt Spring	6/27/2000	Filtered	6.35	290	9.3	NA
CALA-00-0027	LA-00219	Basalt Spring	6/27/2000	Unfiltered	6.35	290	9.3	NA
CALA-00-0105	LA-00219	Basalt Spring	7/26/2000	Filtered	6.09	290	7.4	1.80
CALA-00-0104	LA-00219	Basalt Spring	7/26/2000	Unfiltered	6.09	290	7.4	1.80
CALA-00-0158	LA-00219	Basalt Spring	9/1/2000	Filtered	6.64	340	9.7	0.77
CALA-00-0157	LA-00219	Basalt Spring	9/1/2000	Unfiltered	6.64	340	9.7	0.77

Table B-2.1-1 (continued)

Sample ID	Location ID	Sample Location	Date Collected	Filtered/Unfiltered	pH	Specific Conductance ($\mu\text{S}/\text{cm}^a$)	Temp. ($^{\circ}\text{C}$)	Turbidity (NTU^b)
CALA-00-0172	LA-00219	Basalt Spring	10/6/2000	Filtered	6.16	290	9.4	1.10
CALA-00-0171	LA-00219	Basalt Spring	10/6/2000	Unfiltered	6.16	290	9.4	1.10
CALA-01-0026	LA-00219	Basalt Spring	3/15/2001	Filtered	6	527	5.9	0.45
CALA-01-0025	LA-00219	Basalt Spring	3/15/2001	Unfiltered	6	527	5.9	0.45
CALA-01-0248	LA-00219	Basalt Spring	7/27/2001	Filtered	6.77	418	9.3	11.10
CALA-01-0249	LA-00219	Basalt Spring	7/27/2001	Unfiltered	6.77	418	9.3	11.10
CALA-01-0506	LA-00219	Basalt Spring	11/1/2001	Filtered	6.67	533	11.7	1.39
CALA-01-0507	LA-00219	Basalt Spring	11/1/2001	Unfiltered	6.67	533	11.7	1.39
CALA-02-45012	LA-00219	Basalt Spring	5/29/2002	Filtered	7.01	310	10.5	1.12
CALA-02-45013	LA-00219	Basalt Spring	5/29/2002	Unfiltered	7.01	310	10.5	1.12
CALA-00-0022	LA-00218	Reach LA-4 SW	6/27/2000	Filtered	7.64	270	22.3	6.40
CALA-00-0021	LA-00218	Reach LA-4 SW	6/27/2000	Unfiltered	7.64	270	22.3	6.40
CALA-00-0103	LA-00218	Reach LA-4 SW	7/26/2000	Filtered	7.31	350	16.6	2.20
CALA-00-0102	LA-00218	Reach LA-4 SW	7/26/2000	Unfiltered	7.31	350	16.6	2.20
CALA-00-0156	LA-00218	Reach LA-4 SW	9/1/2000	Filtered	8.35	330	13.1	0.89
CALA-00-0155	LA-00218	Reach LA-4 SW	9/1/2000	Unfiltered	8.35	330	13.1	0.89
CALA-00-0170	LA-00218	Reach LA-4 SW	10/6/2000	Filtered	6.84	310	10.7	11.70
CALA-00-0169	LA-00218	Reach LA-4 SW	10/6/2000	Unfiltered	6.84	310	10.7	11.70
CALA-01-0024	LA-00218	Reach LA-4 SW	3/15/2001	Filtered	6	460	6.7	18.32
CALA-01-0023	LA-00218	Reach LA-4 SW	3/15/2001	Unfiltered	6	460	6.7	18.32
CALA-01-0059	LA-00218	Reach LA-4 SW	3/30/2001	Filtered	8.17	314	5.8	52.50
CALA-01-0066	LA-00218	Reach LA-4 SW	3/30/2001	Filtered	8.17	314	5.8	52.50
CALA-01-0060	LA-00218	Reach LA-4 SW	3/30/2001	Unfiltered	8.17	314	5.8	52.50
CALA-01-0508	LA-00218	Reach LA-4 SW	11/1/2001	Filtered	8.26	503	10.6	7.00
CALA-01-0509	LA-00218	Reach LA-4 SW	11/1/2001	Unfiltered	8.26	503	10.6	7.00
CALA-02-45010	LA-00218	Reach LA-4 SW	5/29/2002	Filtered	7.6	358	12.7	2.06
CALA-02-45011	LA-00218	Reach LA-4 SW	5/29/2002	Unfiltered	7.6	358	12.7	2.06
CAGU-01-0002	GU-10004	Guaje at LA Confluence	3/15/2001	Filtered	7	451	12.6	1.05
CAGU-01-0001	GU-10004	Guaje at LA Confluence	3/15/2001	Unfiltered	7	451	12.6	1.05
CAGU-01-0023	GU-10004	Guaje at LA Confluence	9/13/2001	Filtered	7.05	245	16.1	2.60
CAGU-01-0022	GU-10004	Guaje at LA Confluence	9/13/2001	Unfiltered	7.05	245	16.1	2.60
CALA-01-0028	LA-10057	Upper Reach LA-5 SW	3/15/2001	Filtered	6	447	8.3	32.80
CALA-01-0027	LA-10057	Upper Reach LA-5 SW	3/15/2001	Unfiltered	6	447	8.3	32.80
CALA-01-0470	LA-10057	Upper Reach LA-5 SW	9/13/2001	Filtered	7.48	131	17.7	5.15
CALA-01-0469	LA-10057	Upper Reach LA-5 SW	9/13/2001	Unfiltered	7.48	131	17.7	5.15
CALA-01-0030	LA-10058	Lower Reach LA-5 SW	3/15/2001	Filtered	6.5	443	13.0	75.50
CALA-01-0029	LA-10058	Lower Reach LA-5 SW	3/15/2001	Unfiltered	6.5	443	13.0	75.50
GF01031WGRL	LA-10058	Lower Reach LA-5 SW	3/26/2001	Filtered	7.52	333	13.9	74.50
CALA-01-0037	LA-10058	Lower Reach LA-5 SW	3/26/2001	Unfiltered	7.52	333	13.9	74.50
GU01031WGRL	LA-10058	Lower Reach LA-5 SW	3/26/2001	Unfiltered	7.52	333	13.9	74.50
CALA-01-0518	LA-10179	Otowi Spring	11/2/2001	Filtered	7.1	277	14.6	1.36
CALA-01-0519	LA-10179	Otowi Spring	11/2/2001	Unfiltered	7.1	277	14.6	1.36
CALA-01-0516	BG-00081	LA Spring	11/20/2001	Filtered	7.36	339	12.6	0.13
CALA-01-0517	BG-00081	LA Spring	11/20/2001	Unfiltered	7.38	340	9.6	0.13

^a $\mu\text{S}/\text{cm}$ = microSiemens per centimeter.^b NTU = Nephelometric turbidity unit.^c NA = Parameter not collected.

Table B-2.1-2
Surface Water Field Parameters for Pueblo Canyon

Sample ID	Location ID	Sample Location	Date Collected	Filtered/ Unfiltered	pH	Specific Conductance ($\mu\text{S}/\text{cm}^a$)	Temp. ($^{\circ}\text{C}$)	Turbidity (NTU^b)
Acid Canyon								
CAPU-00-0136	00-10241	Reach AC-2 SW	10/10/2000	Filtered	6.42	100	6.6	28.30
CAPU-00-0135	00-10241	Reach AC-2 SW	10/10/2000	Unfiltered	6.42	100	6.6	28.30
CAPU-01-0013	00-10241	Reach AC-2 SW	4/3/2001	Filtered	5.9	788	5.8	8.53
CAPU-01-0014	00-10241	Reach AC-2 SW	4/3/2001	Unfiltered	5.9	788	5.8	8.53
CAPU-01-0009	PU-10175	Upper S. Fork Acid Canyon SW	4/3/2001	Filtered	6.72	347	6.0	11.40
CAPU-01-0015	PU-10175	Upper S. Fork Acid Canyon SW	4/3/2001	Filtered	6.72	347	6.0	11.40
CAPU-01-0010	PU-10175	Upper S. Fork Acid Canyon SW	4/3/2001	Unfiltered	6.72	347	6.0	11.40
CAPU-01-0090	PU-10175	Upper S. Fork Acid Canyon SW	6/20/2001	Filtered	7.49	130	13.5	8.32
CAPU-01-0091	PU-10175	Upper S. Fork Acid Canyon SW	6/20/2001	Unfiltered	7.49	130	13.5	8.32
CAPU-01-0104	PU-10175	Upper S. Fork Acid Canyon SW	6/28/2001	Filtered	7.27	317	16.3	3.20
CAPU-01-0103	PU-10175	Upper S. Fork Acid Canyon SW	6/28/2001	Unfiltered	7.27	317	16.3	3.20
CAPU-00-0138	PU-10176	Lower S. Fork Acid Canyon SW	10/10/2000	Filtered	6	300	6.8	9.90
CAPU-00-0137	PU-10176	Lower S. Fork Acid Canyon SW	10/10/2000	Unfiltered	6	300	6.8	9.90
CAPU-01-0011	PU-10176	Lower S. Fork Acid Canyon SW	4/3/2001	Filtered	6.35	344	4.4	10.20
CAPU-01-0012	PU-10176	Lower S. Fork Acid Canyon SW	4/3/2001	Unfiltered	6.35	344	4.4	10.20
CAPU-00-0134	PU-10155	Lower Reach AC-3 SW (near Acid Weir)	9/6/2000	Filtered	6.29	180	14.0	1.95
CAPU-00-0133	PU-10155	Lower Reach AC-3 SW (near Acid Weir)	9/6/2000	Unfiltered	6.29	180	14.0	1.95
CAPU-00-0140	PU-10155	Lower Reach AC-3 SW (near Acid Weir)	10/10/2000	Filtered	6.32	3000	9.5	4.20
CAPU-00-0139	PU-10155	Lower Reach AC-3 SW (near Acid Weir)	10/10/2000	Unfiltered	6.32	3000	9.5	4.20
GF01041WPWA	PU-10155	Lower Reach AC-3 SW (near Acid Weir)	4/11/2001	Filtered	6.96	625	6.5	8.80
GU01041WPWA	PU-10155	Lower Reach AC-3 SW (near Acid Weir)	4/11/2001	Unfiltered	6.96	625	6.5	8.80
CAPU-01-0100	PU-10155	Lower Reach AC-3 SW (near Acid Weir)	7/3/2001	Filtered	7.29	379	22.4	78.80
CAPU-01-0101	PU-10155	Lower Reach AC-3 SW (near Acid Weir)	7/3/2001	Unfiltered	7.29	379	22.4	78.80
Pueblo Canyon								
CAPU-00-0005	PU-10068	Reach P-1 Far West SW	6/17/2000	Filtered	7.01	190	12.3	3.01
CAPU-00-0001	PU-10068	Reach P-1 Far West SW	6/17/2000	Unfiltered	7.01	190	12.3	3.01
CAPU-00-0037	PU-10068	Reach P-1 Far West SW	7/27/2000	Filtered	6.47	320	13.0	15.90
CAPU-00-0032	PU-10068	Reach P-1 Far West SW	7/27/2000	Unfiltered	6.47	320	13.0	15.90
CAPU-00-0076	PU-10068	Reach P-1 Far West SW	8/30/2000	Filtered	6.32	270	14.5	1.17
CAPU-00-0075	PU-10068	Reach P-1 Far West SW	8/30/2000	Unfiltered	6.32	270	14.5	1.17
CAPU-00-0166	PU-10068	Reach P-1 Far West SW	10/3/2000	Filtered	6.35	290	NA ^c	77.10
CAPU-00-0165	PU-10068	Reach P-1 Far West SW	10/3/2000	Unfiltered	6.35	290	NA	77.10
CAPU-00-0006	PU-10069	Upper Reach P-1W SW	6/17/2000	Filtered	7.05	210	14.3	3.60
CAPU-00-0002	PU-10069	Upper Reach P-1W SW	6/17/2000	Unfiltered	7.05	210	14.3	3.60
CAPU-00-0035	PU-10069	Upper Reach P-1W SW	7/27/2000	Filtered	6.64	320	14.3	26.80
CAPU-00-0034	PU-10069	Upper Reach P-1W SW	7/27/2000	Unfiltered	6.64	320	14.3	26.80
CAPU-00-0078	PU-10069	Upper Reach P-1W SW	8/30/2000	Filtered	6.73	300	16.8	2.45
CAPU-00-0077	PU-10069	Upper Reach P-1W SW	8/30/2000	Unfiltered	6.73	300	16.8	2.45

Table B-2.1-2 (continued)

Sample ID	Location ID	Sample Location	Date Collected	Filtered/Unfiltered	pH	Specific Conductance ($\mu\text{S}/\text{cm}^a$)	Temp. ($^{\circ}\text{C}$)	Turbidity (NTU^b)
CAPU-00-0168	PU-10069	Upper Reach P-1W SW	10/3/2000	Filtered	6.43	290	NA	23.80
CAPU-00-0167	PU-10069	Upper Reach P-1W SW	10/3/2000	Unfiltered	6.43	290	NA	23.80
CAPU-00-0007	PU-10070	Lower Reach P-1W SW	6/17/2000	Filtered	6.96	240	17.6	1.75
CAPU-00-0003	PU-10070	Lower Reach P-1W SW	6/17/2000	Unfiltered	6.96	240	17.6	1.75
CAPU-00-0033	PU-10070	Lower Reach P-1W SW	7/27/2000	Filtered	7.01	170	17.8	17.10
CAPU-00-0036	PU-10070	Lower Reach P-1W SW	7/27/2000	Unfiltered	7.01	170	17.8	17.10
CAPU-00-0080	PU-10070	Lower Reach P-1W SW	8/30/2000	Filtered	6.87	320	20.5	2.07
CAPU-00-0079	PU-10070	Lower Reach P-1W SW	8/30/2000	Unfiltered	6.87	320	20.5	2.07
CAPU-00-0170	PU-10070	Lower Reach P-1W SW	10/3/2000	Filtered	6.19	310	NA	4.50
CAPU-00-0169	PU-10070	Lower Reach P-1W SW	10/3/2000	Unfiltered	6.19	310	NA	4.50
GF01041WR1P	PU-10070	Lower Reach P-1W SW	4/11/2001	Filtered	7.36	282	6.6	11.60
GU01041WR1P	PU-10070	Lower Reach P-1W SW	4/11/2001	Unfiltered	7.36	282	6.6	11.60
CAPU-01-0098	PU-10070	Lower Reach P-1W SW	7/5/2001	Filtered	6.83	449	14.6	6.43
CAPU-01-0099	PU-10070	Lower Reach P-1W SW	7/5/2001	Unfiltered	6.83	449	14.6	6.43
CAPU-00-0008	PU-10071	Upper Reach P-1E SW	6/17/2000	Filtered	6.96	200	16.8	3.27
CAPU-00-0004	PU-10071	Upper Reach P-1E SW	6/17/2000	Unfiltered	6.96	200	16.8	3.27
CAPU-00-0039	PU-10071	Upper Reach P-1E SW	7/27/2000	Filtered	7.1	230	16.2	13.50
CAPU-00-0038	PU-10071	Upper Reach P-1E SW	7/27/2000	Unfiltered	7.1	230	16.2	13.50
CAPU-00-0082	PU-10071	Upper Reach P-1E SW	8/30/2000	Filtered	7.01	230	16.3	2.65
CAPU-00-0081	PU-10071	Upper Reach P-1E SW	8/30/2000	Unfiltered	7.01	230	16.3	2.65
CAPU-00-0172	PU-10071	Upper Reach P-1E SW	10/3/2000	Filtered	6.73	290	NA	109.00
CAPU-00-0171	PU-10071	Upper Reach P-1E SW	10/3/2000	Unfiltered	6.73	290	NA	109.00
GF01041W2LP	PU-10231	Pueblo 2	4/3/2001	Filtered	8.08	357	16.8	18.10
GU01041W2LP	PU-10231	Pueblo 2	4/3/2001	Unfiltered	8.08	357	16.8	18.10
GF01041W3LP	PU-10230	Pueblo 3	4/3/2001	Filtered	7.55	615	17.2	14.80
GU01041W3LP	PU-10230	Pueblo 3	4/3/2001	Unfiltered	7.55	615	17.2	14.80
CAPU-01-0094	PU-10230	Pueblo 3	6/21/2001	Filtered	7.16	642	23.0	7.55
CAPU-01-0095	PU-10230	Pueblo 3	6/21/2001	Unfiltered	7.16	642	23.0	7.55
CAPU-01-0220	PU-10230	Pueblo 3	10/31/2001	Filtered	7.46	565	18.1	25.10
CAPU-01-0221	PU-10230	Pueblo 3	10/31/2001	Unfiltered	7.46	565	18.1	25.10
CAPU-02-45081	PU-10230	Pueblo 3	5/23/2002	Filtered	7.44	576	19.2	10.70
CAPU-02-45082	PU-10230	Pueblo 3	5/23/2002	Unfiltered	7.44	576	19.2	10.70
GF01041W5SP	PU-10229	Pueblo at SR-502	4/3/2001	Filtered	7.42	523	10.8	12.70
GF01042W5SP	PU-10229	Pueblo at SR-502	4/3/2001	Filtered	7.42	523	10.8	12.70
GU01041W5SP	PU-10229	Pueblo at SR-502	4/3/2001	Unfiltered	7.42	523	10.8	12.70
GU01042W5SP	PU-10229	Pueblo at SR-502	4/3/2001	Unfiltered	7.42	523	10.8	12.70
CAPU-01-0092	PU-10229	Pueblo at SR-502	7/3/2001	Filtered	7.48	534	26.3	914.00
CAPU-01-0093	PU-10229	Pueblo at SR-502	7/3/2001	Unfiltered	7.48	534	26.3	914.00
CAPU-01-0218	PU-10229	Pueblo at SR-502	10/31/2001	Filtered	6.89	529	15.4	9.13
CAPU-01-0219	PU-10229	Pueblo at SR-502	10/31/2001	Unfiltered	6.89	529	15.4	9.13
CAPU-02-45083	PU-10229	Pueblo at SR-502	5/23/2002	Filtered	6.7	596	17.4	3.46
CAPU-02-45084	PU-10229	Pueblo at SR-502	5/23/2002	Unfiltered	6.7	596	17.4	3.46

^a $\mu\text{S}/\text{cm}$ = microSiemens per centimeter.^b NTU = Nephelometric turbidity unit.^c NA = Parameter not collected.

Table B-2.1-3
Alluvial Groundwater Field Parameters and Water Levels for Los Alamos Canyon

Sample ID	Location ID	Sample Location	Date Collected	Filtered/ Unfiltered	pH	Specific Conductance ($\mu\text{S}/\text{cm}^a$)	Temp. ($^{\circ}\text{C}$)	Turbidity (NTU ^b)	Water Level (ft TOC ^c)	Water Level (ft bgs ^d)	Water Level (ft asl ^e)
Upper Los Alamos Canyon											
CABG-00-0021	41-01045	LAO-B	1/10/2000	Filtered	7.57	110	5.7	4.80	9.00	6.54	7316.03
CABG-00-0046	41-01045	LAO-B	3/24/2000	Filtered	6.93	78	3.5	3.00	8.52	6.06	7316.51
CABG-00-0028	41-01045	LAO-B	3/24/2000	Unfiltered	6.93	78	3.5	3.00	8.52	6.06	7316.51
CALA-00-0030	41-01045	LAO-B	6/21/2000	Filtered	6.52	70	8.3	4.00	10.11	7.65	7314.92
CALA-00-0029	41-01045	LAO-B	6/21/2000	Unfiltered	6.52	70	8.3	4.00	10.11	7.65	7314.92
CALA-00-0049	41-01045	LAO-B	6/22/2000	Unfiltered	6.52	70	8.3	4.00	10.11	7.65	7314.92
CALA-00-0080	41-01045	LAO-B	7/24/2000	Filtered	6.21	140	9.2	2.20	9.13	6.67	7315.90
CALA-00-0079	41-01045	LAO-B	7/24/2000	Unfiltered	6.21	140	9.2	2.20	9.13	6.67	7315.90
CALA-00-0132	41-01045	LAO-B	9/5/2000	Filtered	6.15	140	11.1	0.40	10.49	8.03	7314.54
CALA-00-0131	41-01045	LAO-B	9/5/2000	Unfiltered	6.15	140	11.1	0.40	10.49	8.03	7314.54
CALA-00-0176	41-01045	LAO-B	10/5/2000	Filtered	6.14	160	11.1	0.90	9.92	7.46	7315.11
CALA-00-0175	41-01045	LAO-B	10/5/2000	Unfiltered	6.14	160	11.1	0.90	9.92	7.46	7315.11
CALA-01-0049	41-01045	LAO-B	3/29/2001	Filtered	6.83	149	3.8	1.30	8.06	5.60	7316.97
CALA-01-0050	41-01045	LAO-B	3/29/2001	Unfiltered	6.83	149	3.8	1.30	8.06	5.60	7316.97
CALA-01-0215	41-01045	LAO-B	6/18/2001	Filtered	6.49	160	8.1	0.70	8.65	6.19	7316.38
CALA-01-0216	41-01045	LAO-B	6/18/2001	Unfiltered	6.49	160	8.1	0.70	8.65	6.19	7316.38
CALA-01-0257	41-01045	LAO-B	6/28/2001	Unfiltered	6.45	162	8.9	0.60	8.74	6.28	7316.29
CALA-01-0471	41-01045	LAO-B	11/7/2001	Filtered	6.78	214	11.1	0.30	10.35	7.89	7314.68
CALA-01-0497	41-01045	LAO-B	11/7/2001	Filtered	6.78	214	11.1	0.30	na	na	na
CALA-01-0472	41-01045	LAO-B	11/7/2001	Unfiltered	6.78	214	11.1	0.30	10.35	7.89	7314.68
CALA-02-45277	41-01045	LAO-B	3/26/2002	Filtered	6.86	182	4.8	0.40	8.98	6.52	7316.05
CALA-02-45281	41-01045	LAO-B	3/26/2002	Filtered	6.86	182	4.8	0.40	na	na	na
CALA-02-45278	41-01045	LAO-B	3/26/2002	Unfiltered	6.86	182	4.8	0.40	8.98	6.52	7316.05
CALA-02-45029	41-01045	LAO-B	5/30/2002	Filtered	6.86	199	6.2	0.30	9.48	7.02	7315.55
CALA-02-45041	41-01045	LAO-B	5/30/2002	Filtered	6.86	199	6.2	0.30	na	na	na
CALA-02-45030	41-01045	LAO-B	5/30/2002	Unfiltered	6.86	199	6.2	0.30	9.48	7.02	7315.55
GF01031GCOL	41-01004	LAO-C	4/3/2001	Filtered	6.89	356	3.5	15.40	na	na	na
GU01031GCOL	41-01004	LAO-C	4/3/2001	Unfiltered	6.89	356	3.5	15.40	na	na	na

Table B-2.1-3 (continued)

Sample ID	Location ID	Sample Location	Date Collected	Filtered/ Unfiltered	pH	Specific Conductance ($\mu\text{S}/\text{cm}^a$)	Temp. ($^{\circ}\text{C}$)	Turbidity (NTU ^b)	Water Level (ft TOC ^c)	Water Level (ft bgs ^d)	Water Level (ft asl ^e)
CALA-01-0038	41-01004	LAO-C	4/4/2001	Unfiltered	6.89	356	3.5	15.40	3.85	2.35	7047.65
CALA-01-0239	41-01004	LAO-C	6/25/2001	Filtered	6.96	271	14.8	5.90	4.30	2.80	7047.20
CALA-01-0240	41-01004	LAO-C	6/25/2001	Unfiltered	6.96	271	14.8	5.90	4.30	2.80	7047.20
CALA-01-0481	41-01004	LAO-C	11/5/2001	Filtered	7.1	389	9.2	4.00	5.01	3.51	7046.49
CALA-01-0482	41-01004	LAO-C	11/5/2001	Unfiltered	7.1	389	9.2	4.00	5.01	3.51	7046.49
CALA-02-45037	41-01004	LAO-C	6/4/2002	Filtered	7.12	509	11.5	2.30	4.64	3.14	7046.86
CALA-02-45038	41-01004	LAO-C	6/4/2002	Unfiltered	7.12	509	11.5	2.30	4.64	3.14	7046.86
CALA-00-0032	41-01003	LAO-0.3	6/22/2000	Filtered	6.1	320	10.7	22.10	10.38	7.95	6959.87
CALA-00-0031	41-01003	LAO-0.3	6/22/2000	Unfiltered	6.1	320	10.7	22.10	10.38	7.95	6959.87
CALA-00-0082	41-01003	LAO-0.3	7/24/2000	Filtered	6.33	330	12.2	9.10	10.53	8.10	6959.72
CALA-00-0081	41-01003	LAO-0.3	7/24/2000	Unfiltered	6.33	330	12.2	9.10	10.53	8.10	6959.72
CALA-00-0134	41-01003	LAO-0.3	8/31/2000	Filtered	6.49	270	12.8	2.40	11.36	8.93	6958.89
CALA-00-0133	41-01003	LAO-0.3	8/31/2000	Unfiltered	6.49	270	12.8	2.40	11.36	8.93	6958.89
CALA-00-0178	41-01003	LAO-0.3	10/5/2000	Filtered	6.32	300	12.4	1.70	11.18	8.75	6959.07
CALA-00-0177	41-01003	LAO-0.3	10/5/2000	Unfiltered	6.32	300	12.4	1.70	11.18	8.75	6959.07
CALA-01-0051	41-01003	LAO-0.3	3/29/2001	Filtered	6.83	412	3.2	3.90	7.89	5.46	6962.36
CALA-01-0052	41-01003	LAO-0.3	3/29/2001	Unfiltered	6.83	412	3.2	3.90	7.89	5.46	6962.36
CALA-01-0217	41-01003	LAO-0.3	6/18/2001	Filtered	6.52	324	11.7	6.70	8.94	6.51	6961.31
CALA-01-0218	41-01003	LAO-0.3	6/18/2001	Unfiltered	6.52	324	11.7	6.70	8.94	6.51	6961.31
CALA-01-0258	41-01003	LAO-0.3	6/28/2001	Unfiltered	6.42	313	12.1	3.60	9.01	6.58	6961.24
CALA-01-0473	41-01003	LAO-0.3	11/8/2001	Filtered	6.81	312	12.8	9.10	10.72	8.29	6959.53
CALA-01-0474	41-01003	LAO-0.3	11/8/2001	Unfiltered	6.81	312	12.8	9.10	10.72	8.29	6959.53
CALA-02-45027	41-01003	LAO-0.3	5/28/2002	Filtered	6.84	476	8.6	4.20	10.68	8.25	6959.57
CALA-02-45028	41-01003	LAO-0.3	5/28/2002	Unfiltered	6.84	476	8.6	4.20	10.68	8.25	6959.57
CALA-00-0034	41-01002	LAO-0.6	6/21/2000	Filtered	6.45	250	13.8	32.20	15.77	13.23	6897.11
CALA-00-0033	41-01002	LAO-0.6	6/21/2000	Unfiltered	6.45	250	13.8	32.20	15.77	13.23	6897.11
CALA-00-0084	41-01002	LAO-0.6	7/24/2000	Filtered	6.43	340	14.1	43.20	9.13	6.59	6903.75
CALA-00-0083	41-01002	LAO-0.6	7/24/2000	Unfiltered	6.43	340	14.1	43.20	9.13	6.59	6903.75
CALA-00-0136	41-01002	LAO-0.6	8/31/2000	Filtered	6.78	420	15.6	8.60	8.48	5.94	6904.40

Table B-2.1-3 (continued)

Sample ID	Location ID	Sample Location	Date Collected	Filtered/ Unfiltered	pH	Specific Conductance ($\mu\text{S}/\text{cm}^a$)	Temp. ($^{\circ}\text{C}$)	Turbidity (NTU ^b)	Water Level (ft TOC ^c)	Water Level (ft bgs ^d)	Water Level (ft asl ^e)
CALA-00-0135	41-01002	LAO-0.6	8/31/2000	Unfiltered	6.78	420	15.6	8.60	8.48	5.94	6904.40
CALA-00-0180	41-01002	LAO-0.6	10/5/2000	Filtered	6.58	420	15.4	2.10	8.37	5.83	6904.51
CALA-00-0179	41-01002	LAO-0.6	10/5/2000	Unfiltered	6.58	420	15.4	2.10	8.37	5.83	6904.51
GF01031G7OL	LA-10066	LAO-0.7	3/29/2001	Filtered	7.05	357	5.2	22.40	12.38	9.88	6897.52
CALA-01-0039	LA-10066	LAO-0.7	3/29/2001	Unfiltered	7.05	357	5.2	22.40	12.38	9.88	6897.52
GU01031G7OL	LA-10066	LAO-0.7	3/29/2001	Unfiltered	7.05	357	5.2	22.40	12.38	9.88	6897.52
CALA-01-0225	LA-10066	LAO-0.7	6/25/2001	Filtered	6.86	345	16.3	4.70	13.32	10.82	6896.58
CALA-01-0226	LA-10066	LAO-0.7	6/25/2001	Unfiltered	6.86	345	16.3	4.70	13.32	10.82	6896.58
CALA-01-0483	LA-10066	LAO-0.7	11/5/2001	Filtered	6.82	368	13.2	5.60	14.15	11.65	6895.75
CALA-01-0484	LA-10066	LAO-0.7	11/5/2001	Unfiltered	6.82	368	13.2	5.60	14.15	11.65	6895.75
CALA-02-45045	LA-10066	LAO-0.7	6/4/2002	Filtered	6.84	413	9.0	4.00	14.38	11.88	6895.52
CALA-02-45046	LA-10066	LAO-0.7	6/4/2002	Unfiltered	6.84	413	9.0	4.00	14.38	11.88	6895.52
CALA-00-0036	02-01022	LAO-0.91	6/22/2000	Filtered	6.26	200	14.1	1.90	14.50	10.87	6850.29
CALA-00-0035	02-01022	LAO-0.91	6/22/2000	Unfiltered	6.26	200	14.1	1.90	14.50	10.87	6850.29
GF01031G1OL	02-01076	LAO-1	4/5/2001	Filtered	6.86	433	7.0	3.10	6.58	4.58	6831.72
CALA-01-0040	02-01076	LAO-1	4/5/2001	Unfiltered	6.86	433	7.0	3.10	6.58	4.58	6831.72
GU01031G1OL	02-01076	LAO-1	4/5/2001	Unfiltered	6.86	433	7.0	3.10	6.58	4.58	6831.72
CALA-01-0227	02-01076	LAO-1	6/25/2001	Filtered	6.65	331	14.2	3.00	8.68	6.68	6829.62
CALA-01-0228	02-01076	LAO-1	6/25/2001	Unfiltered	6.65	331	14.2	3.00	8.68	6.68	6829.62
CALA-01-0485	02-01076	LAO-1	11/5/2001	Filtered	7.19	331	11.4	5.90	11.50	9.50	6826.80
CALA-01-0486	02-01076	LAO-1	11/5/2001	Unfiltered	7.19	331	11.4	5.90	11.50	9.50	6826.80
CALA-00-0088	LA-10008	LAO-1.2	7/25/2000	Filtered	6.58	150	15.4	9.40	7.97	7.77	6712.23
CALA-00-0087	LA-10008	LAO-1.2	7/25/2000	Unfiltered	6.58	150	15.4	9.40	7.97	7.77	6712.23
04LA-97-0002	LA-00001	LAO-1.6g	4/10/1997	Filtered	6.3	259	10.0	0.00	9.12	6.24	6651.44
04LA-97-0001	LA-00001	LAO-1.6g	4/10/1997	Unfiltered	6.3	259	10.0	0.00	9.12	6.24	6651.44
CALA-00-0040	LA-00001	LAO-1.6g	6/23/2000	Filtered	6.18	180	9.8	4.50	15.65	12.77	6644.91
CALA-00-0048	LA-00001	LAO-1.6g	6/23/2000	Filtered	6.18	180	9.8	4.50	na	na	na
CALA-00-0039	LA-00001	LAO-1.6g	6/23/2000	Unfiltered	6.18	180	9.8	4.50	15.65	12.77	6644.91
CALA-00-0047	LA-00001	LAO-1.6g	6/23/2000	Unfiltered	6.18	180	9.8	4.50	na	na	na
CALA-00-0090	LA-00001	LAO-1.6g	7/25/2000	Filtered	6.36	190	10.6	5.90	17.21	14.33	6643.35

Table B-2.1-3 (continued)

Sample ID	Location ID	Sample Location	Date Collected	Filtered/ Unfiltered	pH	Specific Conductance ($\mu\text{S}/\text{cm}^a$)	Temp. ($^{\circ}\text{C}$)	Turbidity (NTU ^b)	Water Level (ft TOC ^c)	Water Level (ft bgs ^d)	Water Level (ft asl ^e)
CALA-00-0089	LA-00001	LAO-1.6g	7/25/2000	Unfiltered	6.36	190	10.6	5.90	17.21	14.33	6643.35
CALA-00-0142	LA-00001	LAO-1.6g	9/5/2000	Filtered	6.6	200	11.6	4.10	18.47	15.59	6642.09
CALA-00-0141	LA-00001	LAO-1.6g	9/5/2000	Unfiltered	6.6	200	11.6	4.10	18.47	15.59	6642.09
CALA-00-0186	LA-00001	LAO-1.6g	10/5/2000	Filtered	6.13	200	12.0	3.00	16.93	14.05	6643.63
CALA-00-0193	LA-00001	LAO-1.6g	10/5/2000	Filtered	6.13	200	12.0	3.00	na	na	na
CALA-00-0185	LA-00001	LAO-1.6g	10/5/2000	Unfiltered	6.13	200	12.0	3.00	16.93	14.05	6643.63
CALA-01-0053	LA-00001	LAO-1.6g	3/29/2001	Filtered	6.23	330	9.0	1.20	8.51	5.63	6652.05
CALA-01-0054	LA-00001	LAO-1.6g	3/29/2001	Unfiltered	6.23	330	9.0	1.20	8.51	5.63	6652.05
CALA-01-0219	LA-00001	LAO-1.6g	6/19/2001	Filtered	6.44	290	8.8	1.40	13.45	10.57	6647.11
CALA-01-0241	LA-00001	LAO-1.6g	6/19/2001	Filtered	6.44	290	8.8	1.40	na	na	na
CALA-01-0220	LA-00001	LAO-1.6g	6/19/2001	Unfiltered	6.44	290	8.8	1.40	13.45	10.57	6647.11
CALA-01-0475	LA-00001	LAO-1.6g	11/8/2001	Filtered	6.47	321	12.4	13.80	19.01	16.13	6641.55
CALA-01-0476	LA-00001	LAO-1.6g	11/8/2001	Unfiltered	6.47	321	12.4	13.80	19.01	16.13	6641.55
GF01031G2OL	LA-10067	LAO-2	3/29/2001	Filtered	6.66	429	9.8	1.30	13.00	11.50	6581.50
CALA-01-0041	LA-10067	LAO-2	3/29/2001	Unfiltered	6.66	429	9.8	1.30	13.00	11.50	6581.50
GU01031G2OL	LA-10067	LAO-2	3/29/2001	Unfiltered	6.66	429	9.8	1.30	13.00	11.50	6581.50
CALA-01-0229	LA-10067	LAO-2	6/26/2001	Filtered	6.74	354	12.7	1.50	16.40	14.90	6578.10
CALA-01-0230	LA-10067	LAO-2	6/26/2001	Unfiltered	6.74	354	12.7	1.50	16.40	14.90	6578.10
CALA-01-0263	LA-10067	LAO-2	7/11/2001	Filtered	6.56	347	11.9	4.30	17.00	15.50	6577.50
CALA-01-0264	LA-10067	LAO-2	7/11/2001	Unfiltered	6.56	347	11.9	4.30	17.00	15.50	6577.50
CALA-00-0199	LA-10035	LAO-3a	10/11/2000	Filtered	6.62	250	12.0	4.30	na	na	na
CALA-00-0198	LA-10035	LAO-3a	10/11/2000	Unfiltered	6.62	250	12.0	4.30	na	na	na
GF01031GA3L	LA-10035	LAO-3a	3/28/2001	Filtered	6.83	420	8.2	2.60	10.79	9.96	6569.04
GF01032GA3L	LA-10035	LAO-3a	3/28/2001	Filtered	6.83	420	8.2	2.60	na	na	na
GU01031GA3L	LA-10035	LAO-3a	3/28/2001	Unfiltered	6.83	420	8.2	2.60	10.79	9.96	6569.04
GU01032GA3L	LA-10035	LAO-3a	3/28/2001	Unfiltered	6.83	420	8.2	2.60	na	na	na
CALA-01-0042	LA-10035	LAO-3a	3/29/2001	Unfiltered	6.83	420	8.2	2.60	10.79	9.96	6569.04
CALA-01-0231	LA-10035	LAO-3a	6/26/2001	Filtered	6.77	343	12.2	1.60	8.95	8.12	6570.88
CALA-01-0232	LA-10035	LAO-3a	6/26/2001	Unfiltered	6.77	343	12.2	1.60	8.95	8.12	6570.88
CALA-01-0265	LA-10035	LAO-3a	7/11/2001	Filtered	6.61	352	11.3	2.60	na	na	na

Table B-2.1-3 (continued)

Sample ID	Location ID	Sample Location	Date Collected	Filtered/ Unfiltered	pH	Specific Conductance ($\mu\text{S}/\text{cm}^a$)	Temp. ($^{\circ}\text{C}$)	Turbidity (NTU ^b)	Water Level (ft TOC ^c)	Water Level (ft bgs ^d)	Water Level (ft asl ^e)
CALA-01-0266	LA-10035	LAO-3a	7/11/2001	Unfiltered	6.61	352	11.3	2.60	na	na	na
CALA-02-45043	LA-10035	LAO-3a	6/5/2002	Filtered	7.09	274	12.3	2.20	10.06	9.23	6569.77
CALA-02-45044	LA-10035	LAO-3a	6/5/2002	Unfiltered	7.09	274	12.3	2.20	10.06	9.23	6569.77
GF01031G4OL	LA-10068	LAO-4	4/5/2001	Filtered	7.2	329	8.5	1.50	9.65	8.23	6510.57
CALA-01-0043	LA-10068	LAO-4	4/5/2001	Unfiltered	7.2	329	8.5	1.50	9.65	8.23	6510.57
GU01031G4OL	LA-10068	LAO-4	4/5/2001	Unfiltered	7.2	329	8.5	1.50	9.65	8.23	6510.57
CALA-01-0233	LA-10068	LAO-4	6/27/2001	Filtered	6.78	310	9.8	0.80	13.52	12.10	6506.70
CALA-01-0234	LA-10068	LAO-4	6/27/2001	Unfiltered	6.78	310	9.8	0.80	13.52	12.10	6506.70
CALA-01-0491	LA-10068	LAO-4	11/6/2001	Filtered	7.04	340	11.8	0.90	13.80	12.38	6506.42
CALA-01-0492	LA-10068	LAO-4	11/6/2001	Unfiltered	7.04	340	11.8	0.90	13.80	12.38	6506.42
GF01031GC54	LA-10069	LAO-4.5c	3/28/2001	Filtered	7	318	8.6	1.40	8.79	6.71	6451.29
CALA-01-0044	LA-10069	LAO-4.5c	3/28/2001	Unfiltered	7	318	8.6	1.40	8.79	6.71	6451.29
GU01031GC54	LA-10069	LAO-4.5c	3/28/2001	Unfiltered	7	318	8.6	1.40	8.79	6.71	6451.29
CALA-01-0235	LA-10069	LAO-4.5c	6/26/2001	Filtered	6.67	298	10.2	0.90	12.95	10.87	6447.13
CALA-01-0236	LA-10069	LAO-4.5c	6/26/2001	Unfiltered	6.67	298	10.2	0.90	12.95	10.87	6447.13
CALA-01-0267	LA-10069	LAO-4.5c	7/11/2001	Filtered	6.43	316	10.0	0.60	12.58	10.50	6447.50
CALA-01-0268	LA-10069	LAO-4.5c	7/11/2001	Unfiltered	6.43	316	10.0	0.60	12.58	10.50	6447.50
CALA-01-0493	LA-10069	LAO-4.5c	11/6/2001	Filtered	6.7	315	11.7	4.40	13.39	11.31	6446.69
CALA-01-0494	LA-10069	LAO-4.5c	11/6/2001	Unfiltered	6.7	315	11.7	4.40	13.39	11.31	6446.69
GF01031GA6L	LA-10070	LAO-6a	3/28/2001	Filtered	7.52	312	7.2	1.40	10.77	9.44	6386.56
CALA-01-0045	LA-10070	LAO-6a	3/28/2001	Unfiltered	7.52	312	7.2	1.40	10.77	9.44	6386.56
GU01031GA6L	LA-10070	LAO-6a	3/28/2001	Unfiltered	7.52	312	7.2	1.40	10.77	9.44	6386.56
DP Canyon											
0121-97-1397	21-01811	LAUZ-1	8/20/1997	Filtered	7.17	245	18.2	5.00	5.05	2.50	7029.90
0121-97-1396	21-01811	LAUZ-1	8/20/1997	Unfiltered	7.17	245	18.2	5.00	5.05	2.50	7029.90
0121-97-1428	21-01811	LAUZ-1	12/4/1997	Filtered	7.11	802	5.5	1.00	4.87	2.32	7030.08
0121-97-1430	21-01811	LAUZ-1	12/4/1997	Filtered	7.11	802	5.5	1.00	na	na	na
0121-97-1424	21-01811	LAUZ-1	12/4/1997	Unfiltered	7.11	802	5.5	1.00	4.87	2.32	7030.08
0121-97-1426	21-01811	LAUZ-1	12/4/1997	Unfiltered	7.11	802	5.5	1.00	na	na	na
CA21-98-0002	21-01811	LAUZ-1	5/5/1998	Filtered	7.16	726	7.6	0.00	6.35	3.80	7028.60

Table B-2.1-3 (continued)

Sample ID	Location ID	Sample Location	Date Collected	Filtered/ Unfiltered	pH	Specific Conductance ($\mu\text{S}/\text{cm}^2$)	Temp. ($^{\circ}\text{C}$)	Turbidity (NTU ^b)	Water Level (ft TOC ^c)	Water Level (ft bgs ^d)	Water Level (ft asl ^e)
CA21-98-0001	21-01811	LAUZ-1	5/5/1998	Unfiltered	7.16	726	7.6	0.00	6.35	3.80	7028.60
CA21-98-0008	21-01811	LAUZ-1	9/17/1998	Filtered	7.27	337	17.6	3.00	5.96	3.41	7028.99
CA21-98-0007	21-01811	LAUZ-1	9/17/1998	Unfiltered	7.27	337	17.6	3.00	5.96	3.41	7028.99
CA21-98-0041	21-01811	LAUZ-1	10/20/1998	Unfiltered	6.7	246	13.8	4.00	6.40	3.85	7028.55
CA21-01-0001	21-01811	LAUZ-1	4/2/2001	Filtered	7	1146	4.0	4.20	5.13	2.58	7029.82
CA21-01-0002	21-01811	LAUZ-1	4/2/2001	Unfiltered	7	1146	4.0	4.20	5.13	2.58	7029.82
CA21-01-0007	21-01811	LAUZ-1	6/19/2001	Filtered	6.9	844	12.9	59.60	6.52	3.97	7028.43
CA21-01-0008	21-01811	LAUZ-1	6/19/2001	Unfiltered	6.9	844	12.9	59.60	6.52	3.97	7028.43
CA21-01-0024	21-01811	LAUZ-1	11/13/2001	Filtered	7.18	432	12.0	248.00	7.81	5.26	7027.14
CA21-01-0025	21-01811	LAUZ-1	11/13/2001	Unfiltered	7.18	432	12.0	248.00	7.81	5.26	7027.14
CA21-02-45300	21-01811	LAUZ-1	3/26/2002	Filtered	7.2	538	7.3	68.00	7.11	4.56	7027.84
CA21-02-45301	21-01811	LAUZ-1	3/26/2002	Unfiltered	7.2	538	7.3	68.00	7.11	4.56	7027.84
CA21-02-45090	21-01811	LAUZ-1	5/22/2002	Filtered	6.93	928	10.8	2.60	7.30	4.75	7027.65
CA21-02-45091	21-01811	LAUZ-1	5/22/2002	Unfiltered	6.93	928	10.8	2.60	7.30	4.75	7027.65
0121-97-1399	21-01812	LAUZ-2	8/20/1997	Filtered	7.41	420	19.1	1.00	6.16	3.72	7022.98
0121-97-1398	21-01812	LAUZ-2	8/20/1997	Unfiltered	7.41	420	19.1	1.00	6.16	3.72	7022.98
0121-97-1429	21-01812	LAUZ-2	12/4/1997	Filtered	7.43	545	7.3	3.00	6.67	4.23	7022.47
0121-97-1425	21-01812	LAUZ-2	12/4/1997	Unfiltered	7.43	545	7.3	3.00	6.67	4.23	7022.47
CA21-98-0004	21-01812	LAUZ-2	5/5/1998	Filtered	7.92	701	8.2	4.00	6.52	4.08	7022.62
CA21-98-0003	21-01812	LAUZ-2	5/5/1998	Unfiltered	7.92	701	8.2	4.00	6.52	4.08	7022.62
CA21-98-0010	21-01812	LAUZ-2	9/17/1998	Filtered	7.33	462	17.7	2.00	6.17	3.73	7022.97
CA21-98-0009	21-01812	LAUZ-2	9/17/1998	Unfiltered	7.33	462	17.7	2.00	6.17	3.73	7022.97
CA21-98-0042	21-01812	LAUZ-2	10/7/1998	Unfiltered	6.75	422	16.0	3.30	6.12	3.68	7023.02
Lower Los Alamos Canyon											
CALA-99-0002	LA-00215	LLAO-1	2/8/1999	Filtered	7.12	1392	10.2	2.00	11.82	9.19	5839.65
CALA-99-0001	LA-00215	LLAO-1	2/8/1999	Unfiltered	7.12	1392	10.2	2.00	11.82	9.19	5839.65
CALA-00-0042	LA-00215	LLAO-1	6/27/2000	Filtered	7.01	260	12.1	20.30	22.14	19.51	5829.33
CALA-00-0041	LA-00215	LLAO-1	6/27/2000	Unfiltered	7.01	260	12.1	20.30	22.14	19.51	5829.33
CALA-00-0092	LA-00215	LLAO-1	7/26/2000	Filtered	6.74	320	12.3	3.90	15.81	13.18	5835.66
CALA-00-0091	LA-00215	LLAO-1	7/26/2000	Unfiltered	6.74	320	12.3	3.90	15.81	13.18	5835.66

Table B-2.1-3 (continued)

Sample ID	Location ID	Sample Location	Date Collected	Filtered/ Unfiltered	pH	Specific Conductance ($\mu\text{S}/\text{cm}^a$)	Temp. ($^{\circ}\text{C}$)	Turbidity (NTU ^b)	Water Level (ft TOC ^c)	Water Level (ft bgs ^d)	Water Level (ft asl ^e)
CALA-00-0144	LA-00215	LLAO-1	9/1/2000	Filtered	7.01	370	13.9	2.50	14.77	12.14	5836.70
CALA-00-0143	LA-00215	LLAO-1	9/1/2000	Unfiltered	7.01	370	13.9	2.50	14.77	12.14	5836.70
CALA-00-0188	LA-00215	LLAO-1	10/6/2000	Filtered	6.79	360	13.8	3.90	21.38	18.75	5830.09
CALA-00-0187	LA-00215	LLAO-1	10/6/2000	Unfiltered	6.79	360	13.8	3.90	21.38	18.75	5830.09
CALA-01-0055	LA-00215	LLAO-1	3/30/2001	Filtered	6.99	463	9.4	0.60	10.54	7.91	5840.93
CALA-01-0065	LA-00215	LLAO-1	3/30/2001	Filtered	6.99	463	9.4	0.60	na	na	na
CALA-01-0056	LA-00215	LLAO-1	3/30/2001	Unfiltered	6.99	463	9.4	0.60	10.54	7.91	5840.93
CALA-01-0221	LA-00215	LLAO-1	6/26/2001	Filtered	7.12	385	11.7	3.00	18.90	16.27	5832.57
CALA-01-0222	LA-00215	LLAO-1	6/26/2001	Unfiltered	7.12	385	11.7	3.00	18.90	16.27	5832.57
CALA-01-0259	LA-00215	LLAO-1	7/12/2001	Filtered	6.88	379	11.9	3.30	18.70	16.07	5832.77
CALA-01-0260	LA-00215	LLAO-1	7/12/2001	Unfiltered	6.88	379	11.9	3.30	18.70	16.07	5832.77
CALA-01-0477	LA-00215	LLAO-1	11/1/2001	Filtered	6.86	432	13.2	1.60	22.13	19.50	5829.34
CALA-01-0478	LA-00215	LLAO-1	11/1/2001	Unfiltered	6.86	432	13.2	1.60	22.13	19.50	5829.34
CALA-02-45035	LA-00215	LLAO-1	5/29/2002	Filtered	6.87	495	12.3	1.50	22.91	20.28	5828.56
CALA-02-45036	LA-00215	LLAO-1	5/29/2002	Unfiltered	6.87	495	12.3	1.50	22.91	20.28	5828.56
04LA-97-0006	LA-00045	LLAO-2	5/5/1997	Filtered	7.31	469	13.9	1.00	23.81	22.25	5749.93
04LA-97-0005	LA-00045	LLAO-2	5/5/1997	Unfiltered	7.31	469	13.9	1.00	23.81	22.25	5749.93
04LA-97-0008	LA-00046	LLAO-4	5/7/1997	Filtered	6.87	424	12.2	2.00	4.54	3.38	5511.83
04LA-97-0007	LA-00046	LLAO-4	5/7/1997	Unfiltered	6.87	424	12.2	2.00	4.54	3.38	5511.83
CALA-00-0044	LA-00046	LLAO-4	6/27/2000	Filtered	6.68	310	14.8	0.50	8.46	7.30	5507.91
CALA-00-0043	LA-00046	LLAO-4	6/27/2000	Unfiltered	6.68	310	14.8	0.50	8.46	7.30	5507.91
CALA-00-0094	LA-00046	LLAO-4	7/26/2000	Filtered	6.84	300	16.2	0.30	8.14	6.98	5508.23
CALA-00-0097	LA-00046	LLAO-4	7/26/2000	Filtered	6.84	300	16.2	0.30	na	na	na
CALA-00-0093	LA-00046	LLAO-4	7/26/2000	Unfiltered	6.84	300	16.2	0.30	8.14	6.98	5508.23
CALA-00-0146	LA-00046	LLAO-4	9/1/2000	Filtered	6.99	340	17.0	0.20	7.81	6.65	5508.56
CALA-00-0149	LA-00046	LLAO-4	9/1/2000	Filtered	6.99	340	17.0	0.20	na	na	na
CALA-00-0145	LA-00046	LLAO-4	9/1/2000	Unfiltered	6.99	340	17.0	0.20	7.81	6.65	5508.56
CALA-00-0190	LA-00046	LLAO-4	10/6/2000	Filtered	6.87	320	17.5	1.40	8.41	7.25	5507.96
CALA-00-0189	LA-00046	LLAO-4	10/6/2000	Unfiltered	6.87	320	17.5	1.40	8.41	7.25	5507.96
04LA-97-0010	LA-00002	LLAO-5	5/6/1997	Filtered	6.51	808	16.1	1.00	11.50	12.00	5492.71

Table B-2.1-3 (continued)

Sample ID	Location ID	Sample Location	Date Collected	Filtered/ Unfiltered	pH	Specific Conductance ($\mu\text{S}/\text{cm}^a$)	Temp. ($^{\circ}\text{C}$)	Turbidity (NTU ^b)	Water Level (ft TOC ^c)	Water Level (ft bgs ^d)	Water Level (ft asl ^e)
04LA-97-0009	LA-00002	LLAO-5	5/6/1997	Unfiltered	6.51	808	16.1	1.00	12.47	12.97	5491.74
CALA-00-0046	LA-00002	LLAO-5	6/27/2000	Filtered	6.78	460	16.6	2.20	14.21	14.71	5490.00
CALA-00-0045	LA-00002	LLAO-5	6/27/2000	Unfiltered	6.78	460	16.6	2.20	14.21	14.71	5490.00
CALA-00-0096	LA-00002	LLAO-5	7/26/2000	Filtered	6.84	460	16.0	2.70	14.29	14.79	5489.92
CALA-00-0095	LA-00002	LLAO-5	7/26/2000	Unfiltered	6.84	460	16.0	2.70	14.29	14.79	5489.92
CALA-00-0148	LA-00002	LLAO-5	9/1/2000	Filtered	7.11	480	16.6	0.60	14.28	14.78	5489.93
CALA-00-0147	LA-00002	LLAO-5	9/1/2000	Unfiltered	7.11	480	16.6	0.60	14.28	14.78	5489.93
CALA-00-0192	LA-00002	LLAO-5	10/6/2000	Filtered	6.85	440	17.3	4.40	14.82	15.32	5489.39
CALA-00-0191	LA-00002	LLAO-5	10/6/2000	Unfiltered	6.85	440	17.3	4.40	14.82	15.32	5489.39
CALA-01-0057	LA-00002	LLAO-5	3/30/2001	Filtered	6.89	1023	15.2	2.10	12.49	12.99	5491.72
CALA-01-0058	LA-00002	LLAO-5	3/30/2001	Unfiltered	6.89	1023	15.2	2.10	12.49	12.99	5491.72
CALA-01-0223	LA-00002	LLAO-5	6/26/2001	Filtered	7.05	860	16.4	2.60	13.73	14.23	5490.48
CALA-01-0224	LA-00002	LLAO-5	6/26/2001	Unfiltered	7.05	860	16.4	2.60	13.73	14.23	5490.48
CALA-01-0261	LA-00002	LLAO-5	7/12/2001	Filtered	6.77	789	16.4	4.60	14.15	14.65	5490.06
CALA-01-0262	LA-00002	LLAO-5	7/12/2001	Unfiltered	6.77	789	16.4	4.60	14.15	14.65	5490.06
CALA-01-0479	LA-00002	LLAO-5	11/1/2001	Filtered	6.77	802	17.0	0.40	14.47	14.97	5489.74
CALA-01-0480	LA-00002	LLAO-5	11/1/2001	Unfiltered	6.77	802	17.0	0.40	14.47	14.97	5489.74
CALA-02-45033	LA-00002	LLAO-5	5/29/2002	Filtered	6.84	716	16.0	2.10	13.96	14.46	5490.25
CALA-02-45034	LA-00002	LLAO-5	5/29/2002	Unfiltered	6.84	716	16.0	2.10	13.96	14.46	5490.25

^a $\mu\text{S}/\text{cm}$ = microSiemens per centimeter.^b NTU = Nephelometric turbidity unit.^c ft toc = Feet below top of casing.^d ft bgs = Feet below ground surface.^e ft asl = Feet above sea level.^f na = Water-level data not available.

Table B-2.1-4
Alluvial Groundwater Field Parameters and Water Levels for Pueblo Canyon

Sample ID	Location ID	Sample Location	Date Collected	Filtered/ Unfiltered	pH	Specific Conductance ($\mu\text{S}/\text{cm}^a$)	Temp. ($^{\circ}\text{C}$)	Turbidity (NTU) ^b	Water Level (ft TOC ^c)	Water Level (ft bgs ^d)	Water Level (ft asl ^e)
CAPU-00-0015	PU-00178	PAO-1	6/17/2000	Filtered	6.38	260	13.1	4.59	8.20	5.33	6949.14
CAPU-00-0009	PU-00178	PAO-1	6/17/2000	Unfiltered	6.38	260	13.1	4.59	8.20	5.33	6949.14
CAPU-00-0023	PU-00178	PAO-1	7/27/2000	Filtered	6.72	240	15.4	1.26	10.63	7.76	6946.71
CAPU-00-0022	PU-00178	PAO-1	7/27/2000	Unfiltered	6.72	240	15.4	1.26	10.63	7.76	6946.71
CAPU-00-0066	PU-00178	PAO-1	8/30/2000	Filtered	6.65	280	15.1	1.08	10.80	7.93	6946.54
CAPU-00-0065	PU-00178	PAO-1	8/30/2000	Unfiltered	6.65	280	15.1	1.08	10.80	7.93	6946.54
CAPU-00-0157	PU-00178	PAO-1	10/3/2000	Filtered	6.47	350	NA ^f	1.10	11.91	9.04	6945.43
CAPU-00-0156	PU-00178	PAO-1	10/3/2000	Unfiltered	6.47	350	NA	1.10	11.91	9.04	6945.43
CAPU-01-0001	PU-00178	PAO-1	4/4/2001	Filtered	6.74	408	3.5	1.68	10.45	7.58	6946.89
CAPU-01-0002	PU-00178	PAO-1	4/4/2001	Unfiltered	6.74	408	3.5	1.68	10.45	7.58	6946.89
CAPU-01-0075	PU-00178	PAO-1	6/21/2001	Filtered	6.47	462	11.9	0.69	11.74	8.87	6945.60
CAPU-01-0076	PU-00178	PAO-1	6/21/2001	Unfiltered	6.47	462	11.9	0.69	11.74	8.87	6945.60
CAPU-01-0199	PU-00178	PAO-1	10/30/2001	Filtered	6.91	614	14.9	0.55	11.68	8.81	6945.66
CAPU-01-0209	PU-00178	PAO-1	10/30/2001	Filtered	6.91	614	14.9	0.55	NA	NA	NA
CAPU-01-0200	PU-00178	PAO-1	10/30/2001	Unfiltered	6.91	614	14.9	0.55	11.68	8.81	6945.66
CAPU-02-45061	PU-00178	PAO-1	5/28/2002	Filtered	6.24	579	9.7	0.89	12.38	9.51	6944.96
CAPU-02-45062	PU-00178	PAO-1	5/28/2002	Unfiltered	6.24	579	9.7	0.89	12.38	9.51	6944.96
CAPU-01-0078	PU-10174	PAO-2	6/21/2001	Unfiltered	6.57	482	20.9	0.50	14.07	11.38	6919.05
CAPU-01-0202	PU-10174	PAO-2	10/30/2001	Unfiltered	6.53	510	14.6	0.77	14.06	11.37	6919.06
CAPU-01-0005	PU-00181	PAO-3	4/4/2001	Filtered	7.03	346	6.7	8.25	7.37	4.27	6574.31
CAPU-01-0006	PU-00181	PAO-3	4/4/2001	Unfiltered	7.03	346	6.7	8.25	7.37	4.27	6574.31
CAPU-01-0079	PU-00181	PAO-3	6/21/2001	Filtered	6.63	401	21.2	11.90	13.61	10.51	6568.07
CAPU-01-0080	PU-00181	PAO-3	6/21/2001	Unfiltered	6.63	401	21.2	11.90	13.61	10.51	6568.07
CAPU-01-0204	PU-00181	PAO-3	10/31/2001	Unfiltered	6.83	406	14.7	13.80	13.61	10.51	6568.07
CAPU-98-0041	PU-00182	PAO-4	9/22/1998	Filtered	7	502	18.0	2.85	5.63	3.12	6433.92

Table B-2.1-4 (continued)

Sample ID	Location ID	Sample Location	Date Collected	Filtered/Unfiltered	pH	Specific Conductance ($\mu\text{S}/\text{cm}^a$)	Temp. ($^{\circ}\text{C}$)	Turbidity (NTU) ^b	Water Level (ft TOC ^c)	Water Level (ft bgs ^d)	Water Level (ft asl ^e)
CAPU-98-0040	PU-00182	PAO-4	9/22/1998	Unfiltered	7	502	18.0	2.85	5.63	3.12	6433.92
CAPU-00-0018	PU-00182	PAO-4	6/19/2000	Filtered	6.78	440	16.0	1.10	5.11	2.60	6434.44
CAPU-00-0012	PU-00182	PAO-4	6/19/2000	Unfiltered	6.78	440	16.0	1.10	5.11	2.60	6434.44
CAPU-00-0027	PU-00182	PAO-4	7/28/2000	Filtered	6.7	440	17.1	1.30	5.34	2.83	6434.21
CAPU-00-0030	PU-00182	PAO-4	7/28/2000	Filtered	6.7	440	17.1	1.30	NA	NA	NA
CAPU-00-0026	PU-00182	PAO-4	7/28/2000	Unfiltered	6.7	440	17.1	1.30	5.34	2.83	6434.21
CAPU-00-0070	PU-00182	PAO-4	8/31/2000	Filtered	6.87	520	17.4	2.90	5.63	3.12	6433.92
CAPU-00-0073	PU-00182	PAO-4	8/31/2000	Filtered	6.87	520	17.4	2.90	NA	NA	NA
CAPU-00-0069	PU-00182	PAO-4	8/31/2000	Unfiltered	6.87	520	17.4	2.90	5.63	3.12	6433.92
CAPU-00-0161	PU-00182	PAO-4	10/4/2000	Filtered	6.66	400	15.5	2.20	5.58	3.07	6433.97
CAPU-00-0160	PU-00182	PAO-4	10/4/2000	Unfiltered	6.66	400	15.5	2.20	5.58	3.07	6433.97
CAPU-01-0007	PU-00182	PAO-4	4/4/2001	Filtered	7.13	689	9.1	1.20	5.52	3.01	6434.03
CAPU-01-0016	PU-00182	PAO-4	4/4/2001	Filtered	7.13	689	9.1	1.20	NA	NA	NA
CAPU-01-0008	PU-00182	PAO-4	4/4/2001	Unfiltered	7.13	689	9.1	1.20	5.52	3.01	6434.03
CAPU-01-0081	PU-00182	PAO-4	6/21/2001	Filtered	6.86	658	14.8	2.26	5.83	3.32	6433.72
CAPU-01-0085	PU-00182	PAO-4	6/21/2001	Filtered	6.86	658	14.8	2.26	NA	NA	NA
CAPU-01-0082	PU-00182	PAO-4	6/21/2001	Unfiltered	6.86	658	14.8	2.26	5.83	3.32	6433.72
CAPU-01-0205	PU-00182	PAO-4	10/31/2001	Filtered	6.9	618	14.9	1.59	5.98	3.47	6433.57
CAPU-01-0206	PU-00182	PAO-4	10/31/2001	Unfiltered	6.9	618	14.9	1.59	5.98	3.47	6433.57
CAPU-02-45060	PU-00182	PAO-4	5/23/2002	Filtered	6.94	734	11.9	1.10	NA	NA	NA
CAPU-02-45065	PU-00182	PAO-4	5/23/2002	Filtered	6.94	734	11.9	1.10	6.36	3.85	6433.19
CAPU-02-45066	PU-00182	PAO-4	5/23/2002	Unfiltered	6.94	734	11.9	1.10	6.36	3.85	6433.19
CAPU-99-0002	PU-00177	PAO-5N	2/11/1999	Filtered	7.38	364	4.2	3.31	9.95	7.03	6362.76
CAPU-99-0001	PU-00177	PAO-5N	2/11/1999	Unfiltered	7.38	364	4.2	3.31	9.95	7.03	6362.76
CAPU-00-0020	PU-00177	PAO-5N	6/19/2000	Filtered	6.66	370	13.4	3.50	10.28	7.36	6362.43
CAPU-00-0014	PU-00177	PAO-5N	6/19/2000	Unfiltered	6.66	370	13.4	3.50	10.28	7.36	6362.43

Table B-2.1-4 (continued)

Sample ID	Location ID	Sample Location	Date Collected	Filtered/ Unfiltered	pH	Specific Conductance ($\mu\text{S}/\text{cm}^a$)	Temp. ($^{\circ}\text{C}$)	Turbidity (NTU) ^b	Water Level (ft TOC ^c)	Water Level (ft bgs ^d)	Water Level (ft asl ^e)
CAPU-00-0029	PU-00177	PAO-5N	7/28/2000	Filtered	6.88	450	16.0	1.10	9.41	6.49	6363.30
CAPU-00-0028	PU-00177	PAO-5N	7/28/2000	Unfiltered	6.88	450	16.0	1.10	9.41	6.49	6363.30
CAPU-00-0072	PU-00177	PAO-5N	8/31/2000	Filtered	7.08	410	16.5	0.74	10.47	7.55	6362.24
CAPU-00-0071	PU-00177	PAO-5N	8/31/2000	Unfiltered	7.08	410	16.5	0.74	10.47	7.55	6362.24
CAPU-00-0163	PU-00177	PAO-5N	10/4/2000	Filtered	6.92	370	15.4	3.50	10.95	8.03	6361.76
CAPU-00-0164	PU-00177	PAO-5N	10/4/2000	Filtered	6.92	370	15.4	3.50	NA	NA	NA
CAPU-00-0162	PU-00177	PAO-5N	10/4/2000	Unfiltered	6.92	370	15.4	3.50	10.95	8.03	6361.76
CAPU-02-45069	PU-00177	PAO-5N	6/11/2002	Filtered	6.92	598	11.6	0.85	11.63	8.71	6361.08
CAPU-02-45070	PU-00177	PAO-5N	6/11/2002	Unfiltered	6.92	598	11.6	0.85	11.63	8.71	6361.08
GF01041G1PA	PU-10228	APCO-1	4/3/2001	Filtered	7.14	597	7.9	4.70	5.90	4.15	6363.38
GU01041G1PA	PU-10228	APCO-1	4/3/2001	Unfiltered	7.14	597	7.9	4.70	5.90	4.15	6363.38
CAPU-01-0083	PU-10228	APCO-1	6/27/2001	Filtered	6.2	538	13.4	1.70	6.60	4.85	6362.68
CAPU-01-0084	PU-10228	APCO-1	6/27/2001	Unfiltered	6.2	538	13.4	1.70	6.60	4.85	6362.68
CAPU-01-0207	PU-10228	APCO-1	11/7/2001	Filtered	6.73	604	11.7	3.80	7.01	5.26	6362.27
CAPU-01-0208	PU-10228	APCO-1	11/7/2001	Unfiltered	6.73	604	11.7	3.80	7.01	5.26	6362.27

^a $\mu\text{S}/\text{cm}$ = microSiemens per centimeter.^b NTU = Nephelometric turbidity unit.^c ft toc = Feet below top of casing.^d ft bgs = Feet below ground surface.^e ft asl = Feet above sea level.^f NA = Data or parameter not collected.

Table B-3.0-1
Characteristics of Sediment in
Composite Samples from Small Mammal Trapping Arrays in Reach AC-3

Sub-Sample Number	Trap Number	Geomorphic Unit	Thickness Fine Facies Sediment (cm)	Thickness Coarse Facies Sediment (cm)	Thickness Post-Fire Sediment (cm)	Thickness Post-1942 Pre-Fire Sediment (cm)	Thickness Pre-1943 Sediment or Colluvium (cm)	Thickness Other (fill or disturbed material) (cm)
Sample CAPU-02-47846, Location ID PU-02-20866, Lower Array, Lower 1/3								
1	C4	Qc	5	10	0	0	15	0
2	C6	Qc	0	15	0	0	15	0
3	C7	Qc	10	5	0	0	15	0
4	A1	c2	15	0	15	0	0	0
5	A5	c2	5	10	0	15	0	0
6	B4	c2	3	12	0	15	0	0
7	B5	c1	0	15	0	15	0	0
8	A7	c2	15	0	0	15	0	0
9	B7	c2	8	7	0	15	0	0
Average			6.8	8.2	1.7	8.3	5.0	0.0
Percent of total			45.2%	54.8%	11.1%	55.6%	33.3%	0.0%
Sample CAPU-02-47847, Location ID PU-02-20867, Lower Array, Middle 1/3								
1	A8	c1	9	6	0	15	0	0
2	A10	f1	15	0	0	15	0	0
3	B10	c2	5	10	0	15	0	0
4	A12	c2	9	6	0	15	0	0
5	B13	c1	0	15	0	15	0	0
6	B14	Qc	15	0	0	0	15	0
7	C12	Qc	10	5	0	0	15	0
8	C11	Qc	12	3	0	0	15	0
9	C10	Qc	15	0	0	0	15	0
Average			10.0	5.0	0.0	8.3	6.7	0.0
Percent of total			66.7%	33.3%	0.0%	55.6%	44.4%	0.0%
Sample CAPU-02-47848, Location ID PU-02-20868, Lower Array, Upper 1/3								
1	A15	f1	15	0	0	15	0	0
2	A16	f1	9	6	0	15	0	0
3	B17	Qc	15	0	0	0	15	0
4	A17	f1	13	2	0	13	2	0
5	B18	c2	13	2	0	15	0	0
6	A20	c2	15	0	0	15	0	0
7	C19	Qc	6	9	0	0	15	0
8	C20	Qc	5	10	0	0	15	0
9	C17	Qc	7	8	0	0	15	0
Average			10.9	4.1	0.0	8.1	6.9	0.0
Percent of total			72.6%	27.4%	0.0%	54.1%	45.9%	0.0%

Table B-3.0-1 (continued)

Sub-Sample Number	Trap Number	Geomorphic Unit	Thickness Fine Facies Sediment (cm)	Thickness Coarse Facies Sediment (cm)	Thickness Post-Fire Sediment (cm)	Thickness Post-1942 Pre-Fire Sediment (cm)	Thickness Pre-1943 Sediment or Colluvium (cm)	Thickness Other (fill or disturbed material) (cm)
Sample CAPU-03-49805 Location ID PU-03-21412, Upper Array, Lower 1/2								
1	21B	Qc	15	0	0	0	15	0
2	23A	c2	0	15	0	15	0	0
3	23B	Qc	10	5	0	0	15	0
4	24A	c1	11	4	0	15	0	0
5	26A	Qc/c2	15	0	0	2	13	0
6	26B	Qc	15	0	0	0	15	0
7	27A	Qc	13	2	0	0	15	0
8	27B	f1	15	0	0	15	0	0
Average			11.8	3.3	0.0	5.9	9.1	0.0
Percent of total			78.3%	21.7%	0.0%	39.2%	60.8%	0.0%
Sample CAPU-03-49806 Location ID PU-03-21413, Upper Array, Upper 1/2								
1	28A	c2	11	4	0	15	0	0
2	28B	Qc	12	3	0	0	15	0
3	29B	Qc	5	10	0	0	15	0
4	29A	c2	15	0	0	15	0	0
5	30B	Qc	15	0	0	0	15	0
6	33B	Qc	15	0	0	0	15	0
7	33A	Qc	10	5	0	0	15	0
8	34A	c2	15	0	0	15	0	0
Average			12.3	2.8	0.0	5.6	9.4	0.0
Percent of total			81.7%	18.3%	0.0%	37.5%	62.5%	0.0%

Table B-3.0-2
Characteristics of Sediment in
Composite Samples From Small Mammal Trapping Arrays in Reach LA-1C

Sub-Sample Number	Trap Number	Geomorphic Unit	Thickness Fine Facies Sediment (cm)	Thickness Coarse Facies Sediment (cm)	Thickness Post-Fire Sediment (cm)	Thickness Post-1942 Pre-Fire Sediment (cm)	Thickness Pre-1943 Sediment or Colluvium (cm)	Thickness Other (fill or disturbed material) (cm)
Sample CALA-02-47839, Location ID LA-02-20860, Upper Array, Upper 1/3								
1	1	c3	5	10	0	15	0	0
2	81	Fill	10	5	0	0	0	15
3	62	Fill	0	15	0	0	15	0
4	63	Qc	15	0	0	0	15	0
5	24	f1	15	0	0	15	0	0
6	83	Qt	15	0	0	0	15	0
7	85	Qt	15	0	0	0	15	0
8	44	Disturbed	7	8	0	0	15	0
9	45	Disturbed	7	8	0	0	15	0
10	65	Disturbed	10	5	0	0	15	0
11	26	c2	15	0	0	15	0	0
12	46	f1	4	11	0	4	11	0
13	6	Qc	7	8	0	0	15	0
14	27	Qt	15	0	0	0	15	0
15	7	Qc	15	0	0	0	15	0
Average			10.3	4.7	0.0	3.3	10.7	1.0
Percent of total			68.9%	31.1%	0.0%	21.8%	71.6%	6.7%
Sample CALA-02-47840, Location ID LA-02-20861, Upper Array, Middle 1/3								
1	88	Disturbed	6	9	0	0	0	15
2	68	Disturbed	0	15	0	0	0	15
3	48	f1	15	0	0	15	0	0
4	89	Qc	15	0	0	0	15	0
5	69	Qt	5	10	0	0	15	0
6	10	Qt	5	10	0	0	15	0
7	51	f1	13	2	0	7	8	0
8	70	Qt	12	3	0	0	15	0
9	11	Qt	8	7	0	0	15	0
10	52	c3	5	10	0	15	0	0
11	32	f1	4	11	4	0	11	0
12	33	Qt	15	0	0	0	15	0
13	91	Qc	15	0	0	0	15	0
14	13	Qt	15	0	0	0	15	0
15	34	f1	6	9	0	4	11	0
Average			9.3	5.7	0.3	2.7	10.0	2.0
Percent of total			61.8%	38.2%	1.8%	18.2%	66.7%	13.3%

Table B-3.0-2 (continued)

Sub-Sample Number	Trap Number	Geomorphic Unit	Thickness Fine Facies Sediment (cm)	Thickness Coarse Facies Sediment (cm)	Thickness Post-Fire Sediment (cm)	Thickness Post-1942 Pre-Fire Sediment (cm)	Thickness Pre-1943 Sediment or Colluvium (cm)	Thickness Other (fill or disturbed material) (cm)
Sample CALA-02-47841, Location ID LA-02-20862, Upper Array, Lower 1/3								
1	15	Qt	12	3	0	0	15	0
2	35	Disturbed	0	15	0	0	0	15
3	55	f1	15	0	0	15	0	0
4	16	Qt	15	0	0	0	15	0
5	56	c2	10	5	0	15	0	0
6	37	f1/disturbed	15	0	0	6	0	9
7	17	Qt	10	5	0	0	15	0
8	79	f1	3	12	0	3	12	0
9	96	Qc	3	12	0	0	15	0
10	98	Qc	15	0	0	0	15	0
11	99	Qc	15	0	0	0	15	0
12	39	f1	15	0	0	15	0	0
13	60	f1	15	0	0	15	0	0
14	80	f1	12	3	0	15	0	0
15	77	Qc	9	6	0	0	15	0
Average			10.9	4.1	0.0	5.6	7.8	1.6
Percent of total			72.9%	27.1%	0.0%	37.3%	52.0%	10.7%
Sample CALA-02-47842, Location ID LA-02-20863, Lower Array, Upper 1/3								
1	1	Qc	15	0	0	0	15	0
2	2	Qc	2	13	0	0	15	0
3	21	c3	15	0	0	15	0	0
4	41	Qt	7	8	0	0	15	0
5	23	c3	15	0	0	15	0	0
6	42	Qt	15	0	0	0	15	0
7	62	Qt	14	1	0	0	15	0
8	63	Qc	14	1	0	0	15	0
9	83	Qc	14	1	0	0	15	0
10	43	Disturbed	9	6	0	0	15	0
11	84	Qc	11	4	0	0	15	0
12	85	Qc	15	0	0	0	15	0
13	25	f1	15	0	0	15	0	0
14	7	Qc	14	1	0	0	15	0
15	67	Qc	10	5	0	0	15	0
Average			12.3	2.7	0.0	3.0	12.0	0.0
Percent of total			82.2%	17.8%	0.0%	20.0%	80.0%	0.0%

Table B-3.0-2 (continued)

Sub-Sample Number	Trap Number	Geomorphic Unit	Thickness Fine Facies Sediment (cm)	Thickness Coarse Facies Sediment (cm)	Thickness Post-Fire Sediment (cm)	Thickness Post-1942 Pre-Fire Sediment (cm)	Thickness Pre-1943 Sediment or Colluvium (cm)	Thickness Other (fill or disturbed material) (cm)
Sample CALA-02-47843, Location ID LA-02-20864, Lower Array, Middle 1/3								
1	8	Qc	13	2	0	0	15	0
2	29	c2	15	0	0	15	0	0
3	48	Disturbed	9	6	0	0	15	0
4	90	Qc	11	4	0	0	15	0
5	70	Qc	5	10	0	0	15	0
6	31	c2	2	13	0	15	0	0
7	71	Qc	10	5	0	0	15	0
8	91	Qc	15	0	0	0	15	0
9	72	Qc	13	2	0	0	15	0
10	32	c2	15	0	0	15	0	0
11	52	f1	15	0	0	8	7	0
12	13	Qc	15	0	0	0	15	0
13	92	Qc	12	3	0	0	15	0
14	53	f1	4	11	0	15	0	0
15	14	Qt	0	15	0	0	15	0
Average			10.3	4.7	0.0	4.5	10.5	0.0
Percent of total			68.4%	31.6%	0.0%	30.2%	69.8%	0.0%
Sample CALA-02-47844, Location ID LA-02-20865, Lower Array, Lower 1/3								
1	35	c2	5	10	0	15	0	0
2	56	Qt	15	0	0	0	15	0
3	16	c3(?)	15	0	0	15	0	0
4	76	Qc	11	4	0	0	15	0
5	57	Qt	10	5	0	0	15	0
6	17	c3	6	9	0	15	0	0
7	97	Qc	12	3	0	0	15	0
8	58	Qt	7	8	0	0	15	0
9	18	c3	13	2	0	15	0	0
10	99	Qc	15	0	0	0	15	0
11	37	c2	5	10	0	15	0	0
12	100	Qc	5	10	0	0	15	0
13	39	c2	15	0	0	15	0	0
14	80	Qc	13	2	0	0	15	0
15	79	Qc	5	10	0	0	15	0
Average			10.1	4.9	0.0	6.0	9.0	0.0
Percent of total			67.6%	32.4%	0.0%	40.0%	60.0%	0.0%

Table B-3.0-3
Characteristics of Sediment in
Composite Samples from Small Mammal Trapping Arrays in Reach P-3W

Sub-Sample Number	Trap Number	Geomorphic Unit	Thickness Fine Facies Sediment (cm)	Thickness Coarse Facies Sediment (cm)	Thickness Post-Fire Sediment (cm)	Thickness Post-1942 Pre-Fire Sediment (cm)	Thickness Pre-1943 Sediment or Colluvium (cm)	Thickness Other (fill or disturbed material) (cm)
Sample CAPU-02-47849, Location ID PU-02-20869, Upper Array, Upper 1/3								
1	81	Qc	15	0	0	0	15	0
2	62	Qt	13	2	0	0	15	0
3	41	f1	0	15	2	0	13	0
4	2	c2	15	0	15	0	0	0
5	42	f1	15	0	3	0	12	0
6	23	f1	6	9	2	0	13	0
7	3	f1	15	0	12	3	0	0
8	4	f1	15	0	5	10	0	0
9	26	f1	15	0	15	0	0	0
10	27	f1	15	0	15	0	0	0
11	84	Qt	15	0	0	0	15	0
12	65	Qt	15	0	0	0	15	0
13	86	Qt	10	5	0	0	15	0
14	47	Qt	15	0	0	0	15	0
15	67	Qt	15	0	0	0	15	0
Average			12.9	2.1	4.6	0.9	9.5	0.0
Percent of total			86.2%	13.8%	30.7%	5.8%	63.6%	0.0%
Sample CAPU-02-47850, Location ID PU-02-20870, Upper Array, Middle 1/3								
1	9	c2	15	0	15	0	0	0
2	68	Qt	15	0	0	0	15	0
3	49	Qt	15	0	0	0	15	0
4	89	Qt	15	0	0	0	15	0
5	70	Qt	15	0	0	0	15	0
6	10	c2	15	0	15	0	0	0
7	51	Qt	15	0	0	0	15	0
8	11	c2	15	0	10	5	0	0
9	72	Qt	15	0	0	0	15	0
10	52	Qt	15	0	0	0	15	0
11	33	f1	15	0	3	0	12	0
12	92	Qt	15	0	0	0	15	0
13	93	Qt	15	0	0	0	15	0
14	34	f1	15	0	3	0	12	0
15	32	f1	15	0	1	0	14	0
Average			15.0	0.0	3.1	0.3	11.5	0.0
Percent of total			100.0%	0.0%	20.9%	2.2%	76.9%	0.0%

Table B-3.0-3 (continued)

Sub-Sample Number	Trap Number	Geomorphic Unit	Thickness Fine Facies Sediment (cm)	Thickness Coarse Facies Sediment (cm)	Thickness Post-Fire Sediment (cm)	Thickness Post-1942 Pre-Fire Sediment (cm)	Thickness Pre-1943 Sediment or Colluvium (cm)	Thickness Other (fill or disturbed material) (cm)
Sample CAPU-02-47851, Location ID PU-02-20871 Upper Array, Lower 1/3								
1	16	f1	15	0	2	0	13	0
2	35	Qt	15	0	0	0	15	0
3	17	f1	15	0	9	0	6	0
4	18	f1	15	0	15	0	0	0
5	36	Qt	15	0	0	0	15	0
6	56	Qt	15	0	0	0	15	0
7	57	Qt	15	0	0	0	15	0
8	76	Qt	13	2	0	0	15	0
9	97	Qt	12	3	0	0	15	0
10	79	Qt	15	0	0	0	15	0
11	78	Qt	15	0	0	0	15	0
12	99	Qt	13	2	0	0	15	0
13	100	Qt	15	0	0	0	15	0
14	60	Qt	15	0	0	0	15	0
15	40	Qt	15	0	0	0	15	0
Average			14.5	0.5	1.7	0.0	13.3	0.0
Percent of total			96.9%	3.1%	11.6%	0.0%	88.4%	0.0%
Sample CAPU-03-49802 Location ID PU-03-21409, Uppermost Array, Lower 1/3								
1	21	Qt	15	0	0	0	15	0
2	61	c3	15	0	3	12	0	0
3	82	c3	8	7	4	11	0	0
4	42	c2	15	0	13	2	0	0
5	83	c3	9	6	2	13	0	0
6	23	f1	15	0	2	0	13	0
7	84	f1	15	0	7	8	0	0
8	4	Qt	15	0	0	0	15	0
9	44	c2	15	0	10	5	0	0
10	5	Qt	15	0	0	0	15	0
11	26	Qt	15	0	0	0	15	0
12	45	c2	15	0	12	3	0	0
13	66	c3	3	12	3	12	0	0
14	3	Qt	15	0	0	0	15	0
15	67	c2	15	0	7	8	0	0
Average			13.3	1.7	4.2	4.9	5.9	0.0
Percent of total			88.9%	11.1%	28.0%	32.9%	39.1%	0.0%

Table B-3.0-3 (continued)

Sub-Sample Number	Trap Number	Geomorphic Unit	Thickness Fine Facies Sediment (cm)	Thickness Coarse Facies Sediment (cm)	Thickness Post-Fire Sediment (cm)	Thickness Post-1942 Pre-Fire Sediment (cm)	Thickness Pre-1943 Sediment or Colluvium (cm)	Thickness Other (fill or disturbed material) (cm)
Sample CAPU-03-49803 Location ID PU-03-21410, Uppermost Array, Middle 1/3								
1	50	c2	15	0	15	0	0	0
2	91	Qt	15	0	0	0	15	0
3	70	Qt	15	0	0	0	15	0
4	92	Qt	15	0	0	0	15	0
5	51	c2	6	9	15	0	0	0
6	73	c2	15	0	15	0	0	0
7	8	c3	12	3	0	15	0	0
8	30	f1	15	0	1	0	14	0
9	53	c2	0	15	15	0	0	0
10	31	f1	15	0	6	0	9	0
11	12	Qt	5	10	0	0	15	0
12	13	Qt	13	2	0	0	15	0
13	94	Qt	15	0	0	0	15	0
14	74	c2	15	0	15	0	0	0
15	34	Qt	15	0	0	0	15	0
Average			12.4	2.6	5.5	1.0	8.5	0.0
Percent of total			82.7%	17.3%	36.4%	6.7%	56.9%	0.0%
Sample CAPU-03-49804 Location ID PU-03-21411, Uppermost Array, Upper 1/3								
1	55	c2	15	0	15	0	0	0
2	75	c2	15	0	15	0	0	0
3	35	Qt	13	2	0	0	15	0
4	95	Qt	10	5	0	0	15	0
5	16	Qt	15	0	0	0	15	0
6	36	Qt	13	2	0	0	15	0
7	76	c2	15	0	15	0	0	0
8	38	Qt	11	4	0	0	15	0
9	57	c2	5	10	15	0	0	0
10	18	Qt	15	0	0	0	15	0
11	98	Qt	15	0	0	0	15	0
12	19	Qt	13	2	0	0	15	0
13	60	c2	11	4	15	0	0	0
14	79	c2	9	6	15	0	0	0
15	99	Qt	15	0	0	0	15	0
Average			12.7	2.3	6.0	0.0	9.0	0.0
Percent of total			84.4%	15.6%	40.0%	0.0%	60.0%	0.0%

Table B-3.0-4
Characteristics of Sediment in
Composite Samples from Small Mammal Trapping Arrays in Guaje Canyon

Sub-Sample Number	Trap Number	Geomorphic Unit	Thickness Fine Facies Sediment (cm)	Thickness Coarse Facies Sediment (cm)	Thickness Post-Fire Sediment (cm)	Thickness Post-1942 Pre-Fire Sediment (cm)	Thickness Pre-1943 Sediment or Colluvium (cm)	Thickness Other (fill or disturbed material) (cm)
Sample CAGU-02-47864, Location ID GU-02-20902, Lower Array, Lower 1/3								
1	1	Qc	0	15	0	0	15	0
2	62	f1	15	0	4	11	0	0
3	82	f1	15	0	2	13	0	0
4	63	f1	15	0	7	8	0	0
5	44	f1	15	0	2	13	0	0
6	24	f1	15	0	15	0	0	0
7	4	Qc	0	15	0	0	15	0
8	5	Qc	0	15	0	0	15	0
9	25	f1	15	0	15	0	0	0
10	45	f1	15	0	4	11	0	0
11	85	Disturbed	15	0	0	0	0	15
12	66	f1	10	5	0	15	0	0
13	26	f1	0	15	15	0	0	0
14	47	f1	15	0	3	12	0	0
15	87	Disturbed	15	0	1	0	0	14
Average			10.7	4.3	4.5	5.5	3.0	1.9
Percent of total			71.1%	28.9%	30.2%	36.9%	20.0%	12.9%
Sample CAGU-02-47865, Location ID GU-02-20903, Lower Array, Middle 1/3								
1	28	f1	15	0	15	0	0	0
2	9	f1	12	3	8	7	0	0
3	49	f1	15	0	1	14	0	0
4	89	Disturbed	15	0	0	0	0	15
5	30	f1	15	0	2	13	0	0
6	11	Qc	0	15	0	0	15	0
7	51	f1	15	0	0	15	0	0
8	71	f1	15	0	0	15	0	0
9	92	Qt	15	0	0	0	15	0
10	73	f1	15	0	7	8	0	0
11	53	f1	15	0	3	12	0	0
12	14	Qc	0	15	0	0	15	0
13	34	f1	3	12	3	12	0	0
14	74	f1	15	0	2	13	0	0
15	94	Qt	15	0	0	0	15	0
Average			12.0	3.0	2.7	7.3	4.0	1.0
Percent of total			80.0%	20.0%	18.2%	48.4%	26.7%	6.7%

Table B-3.0-4 (continued)

Sub-Sample Number	Trap Number	Geomorphic Unit	Thickness Fine Facies Sediment (cm)	Thickness Coarse Facies Sediment (cm)	Thickness Post-Fire Sediment (cm)	Thickness Post-1942 Pre-Fire Sediment (cm)	Thickness Pre-1943 Sediment or Colluvium (cm)	Thickness Other (fill or disturbed material) (cm)
Sample CAGU-02-47866, Location ID GU-02-20904, Lower Array, Upper 1/3								
1	35	c3	15	0	0	15	0	0
2	56	f1	15	0	3	12	0	0
3	76	f1	15	0	2	13	0	0
4	96	Qt	15	0	1	0	14	0
5	97	Qt	5	10	0	0	15	0
6	57	f1	10	5	0	15	0	0
7	17	Qc	0	15	0	0	15	0
8	18	Qc	5	10	0	0	15	0
9	38	f1	5	10	0	15	0	0
10	78	f1	15	0	0	15	0	0
11	39	Qt	6	9	0	0	15	0
12	100	Qt	15	0	2	0	13	0
13	80	Qt	0	15	0	0	15	0
14	60	c3	15	0	9	6	0	0
15	20	Qc	12	3	0	0	15	0
Average			9.9	5.1	1.1	6.1	7.8	0.0
Percent of total			65.8%	34.2%	7.6%	40.4%	52.0%	0.0%
Sample CAGU-02-47922, -47923, -47924, Location ID GU-02-20907, Upper Array, Lower 1/3								
1	1	f1	1	14	1	14	0	0
2	42	c3?	15	0	15	0	0	0
3	2	Qc	1	14	1	0	14	0
4	43	c3	15	0	15	0	0	0
5	63	f1	15	0	0	15	0	0
6	83	f1	11	4	3	12	0	0
7	44	f1	7	8	7	8	0	0
8	85	c3	15	0	15	0	0	0
9	64	c3	3	12	3	12	0	0
10	25	Qc	15	0	0	0	15	0
11	66	c3	7	8	3	12	0	0
12	26	Qc	10	5	2	0	13	0
13	87	c3	7	8	14	1	0	0
14	27	Qc	9	6	1	0	14	0
15	7	Qc	8	7	0	0	15	0
Average			9.3	5.7	5.3	4.9	4.7	0.0
Percent of total			61.8%	38.2%	35.6%	32.9%	31.6%	0.0%

Table B-3.0-4 (continued)

Sub-Sample Number	Trap Number	Geomorphic Unit	Thickness Fine Facies Sediment (cm)	Thickness Coarse Facies Sediment (cm)	Thickness Post-Fire Sediment (cm)	Thickness Post-1942 Pre-Fire Sediment (cm)	Thickness Pre-1943 Sediment or Colluvium (cm)	Thickness Other (fill or disturbed material) (cm)
Sample CAGU-02-47867, Location ID GU-02-20905, Upper Array, Middle 1/3								
1	28	f1	15	0	1	14	0	0
2	68	c3	15	0	4	11	0	0
3	49	f1	15	0	15	0	0	0
4	89	f1	15	0	7	8	0	0
5	29	f1	2	13	2	13	0	0
6	9	Qc	4	11	1	0	14	0
7	11	f1	15	0	4	11	0	0
8	31	f1	15	0	15	0	0	0
9	71	f1	15	0	6	9	0	0
10	91	f1-road	15	0	3	12	0	0
11	72	f1	15	0	6	9	0	0
12	52	f1	15	0	15	0	0	0
13	93	Qc	15	0	0	0	15	0
14	53	f1	15	0	14	1	0	0
15	13	Qc	4	11	1	0	14	0
Average			12.7	2.3	6.3	5.9	2.9	0.0
Percent of total			84.4%	15.6%	41.8%	39.1%	19.1%	0.0%
Sample CAGU-02-47868, Location ID GU-02-20906, Upper Array, Upper 1/3								
1	75	Qc	15	0	0	0	15	0
2	15	f1	4	11	4	11	0	0
3	56	Qt	15	0	0	0	15	0
4	36	f1	15	0	2	13	0	0
5	76	Disturbed	6	9	0	15	0	0
6	96	Qt	15	0	2	0	13	0
7	98	Disturbed	3	12	0	0	0	15
8	37	f1	15	0	2	13	0	0
9	78	f1	15	0	9	6	0	0
10	99	Qc	6	9	2	0	13	0
11	18	Qc	0	15	0	0	15	0
12	58	f1	15	0	15	0	0	0
13	59	f1	15	0	8	7	0	0
14	20	f1	6	9	1	14	0	0
15	40	f1	15	0	15	0	0	0
Average			10.7	4.3	4.0	5.3	4.7	1.0
Percent of total			71.1%	28.9%	26.7%	35.1%	31.6%	6.7%

Table B-3.0-5
Summary of Characteristics of Sediment in Composite Samples from Small Mammal Trapping Arrays

Reach	Trapping Array	Sub-Array	Sample ID	Location ID	Percent Fine Facies Sediment	Percent Coarse Facies Sediment	Percent Post-Fire Sediment	Percent Post-1942 Pre-Fire Sediment	Percent Pre-1943 Sediment or Colluvium	Percent Other (fill or disturbed material)
AC-3	Lower	Lower 1/3	CAPU-02-47846	PU-02-20866	45.2	54.8	11.1	55.6	33.3	0
AC-3	Lower	Middle 1/3	CAPU-02-47847	PU-02-20867	66.7	33.3	0	55.6	44.4	0
AC-3	Lower	Upper 1/3	CAPU-02-47848	PU-02-20868	72.6	27.4	0	54.1	45.9	0
AC-3	Upper	Lower 1/2	CAPU-03-49805	PU-03-21412	78.3	21.7	0	39.2	60.8	0
AC-3	Upper	Upper 1/2	CAPU-03-49806	PU-03-21413	81.7	18.3	0	37.5	62.5	0
Average					68.9	31.1	2.2	48.4	49.4	0.0
LA-1C	Upper	Upper 1/3	CALA-02-47839	LA-02-20860	68.9	31.1	0	21.8	71.6	6.7
LA-1C	Upper	Middle 1/3	CALA-02-47840	LA-02-20861	61.8	38.2	1.8	18.2	66.7	13.3
LA-1C	Upper	Lower 1/3	CALA-02-47841	LA-02-20862	72.9	27.1	0	37.3	52	10.7
LA-1C	Lower	Upper 1/3	CALA-02-47842	LA-02-20863	82.2	17.8	0	20	80	0
LA-1C	Lower	Middle 1/3	CALA-02-47843	LA-02-20864	68.4	31.6	0	30.2	69.8	0
LA-1C	Lower	Lower 1/3	CALA-02-47844	LA-02-20865	67.6	32.4	0	40	60	0
Average					70.3	29.7	0.3	27.9	66.7	5.1
P-3W	Upper	Upper 1/3	CAPU-02-47849	PU-02-20869	86.2	13.8	30.7	5.8	63.6	0
P-3W	Upper	Middle 1/3	CAPU-02-47850	PU-02-20870	100	0	20.9	2.2	76.9	0
P-3W	Upper	Lower 1/3	CAPU-02-47851	PU-02-20871	96.9	3.1	11.6	0	88.4	0
P-3W	Uppermost	Lower 1/3	CAPU-03-49802	PU-03-21409	88.9	11.1	28	32.9	39.1	0
P-3W	Uppermost	Middle 1/3	CAPU-03-49803	PU-03-21410	82.7	17.3	36.4	6.7	56.9	0
P-3W	Uppermost	Upper 1/3	CAPU-03-49804	PU-03-21411	84.4	15.6	40	0	60	0
Average					89.9	10.2	27.9	7.9	64.2	0.0
Guaje	Lower	Lower 1/3	CAGU-02-47864	GU-02-20902	71.1	28.9	30.2	36.9	20	12.9
Guaje	Lower	Middle 1/3	CAGU-02-47865	GU-02-20903	80	20	18.2	48.4	26.7	6.7
Guaje	Lower	Upper 1/3	CAGU-02-47866	GU-02-20904	65.8	34.2	7.6	40.4	52	0
Guaje	Upper	Lower 1/3	CAGU-02-47922	GU-02-20907	61.8	38.2	35.6	32.9	31.6	0
Guaje	Upper	Middle 1/3	CAGU-02-47867	GU-02-20905	84.4	15.6	41.8	39.1	19.1	0
Guaje	Upper	Upper 1/3	CAGU-02-47868	GU-02-20906	71.1	28.9	26.7	35.1	31.6	6.7
Average					72.4	27.6	26.7	38.8	30.2	4.4

Table B-3.0-6
Small Mammals Submitted for Pesticides/PCBs,
Metals, Isotopic Plutonium, Gamma Scan, and Strontium-90 Laboratory Analyses

Sample ID	Ear Tag No.	Species Code	Canyon and Array
CAPU-02-49235	427	PEMA ^a	Upper Pueblo
CAPU-02-49236	399	PEMA	Upper Pueblo
CAPU-02-49237	320	PEMA	Upper Pueblo
CAPU-02-49238	301	PEMA	Upper Pueblo
CAPU-02-49239	324	PETR ^b	Upper Pueblo
CAPU-02-49240	381	PETR	Upper Pueblo
CAPU-02-49241	322	PEBO ^c	Upper Pueblo
CAPU-02-49242	383	PEBO	Acid
CAPU-02-49243	65	PEBO	Acid
CAPU-02-49244	338	PEBO	Acid
CAPU-02-49245	27	PEBO	Acid
CAPU-02-49246	64	PEBO	Acid
CAPU-02-49247	55	PEMA	Acid
CAPU-02-49248	58	PEMA	Acid
CAPU-02-49249	28	PEBO	Acid
CAPU-02-49250	76	PEMA	Acid
CAPU-02-49251	79	PEMA	Acid
CAGU-02-49185	4	PEBO	Lower Guaje
CAGU-02-49186	17	PEBO	Lower Guaje
CAGU-02-49187	45	PEBO	Upper Guaje
CAQC-03-50660	n/a ^d	SWWE ^e	n/a
CALA-02-49210	317	PEMA	Lower Los Alamos
CALA-02-49211	380	PEBO	Lower Los Alamos
CALA-02-49212	345	PEBO	Lower Los Alamos
CALA-02-49213	337	PEBO	Upper Los Alamos
CALA-02-49214	325	PEBO	Lower Los Alamos
CALA-02-49215	389	PEBO	Upper Los Alamos
CALA-02-49216	378	PEBO	Upper Los Alamos
CALA-02-49217	330	PEMA	Upper Los Alamos
CALA-02-49218	395	PEMA	Upper Los Alamos
CALA-02-49219	339	PEMA	Upper Los Alamos
CALA-02-49220	321	PETR	Upper Los Alamos
CAGU-02-49188	43	PEBO	Upper Guaje
CAGU-02-49189	73	PEBO	Lower Guaje
CAGU-02-49190	83	PEBO	Upper Guaje
CAGU-02-49191	448	PEMA	Upper Guaje

Table B-3.0-6 (continued)

Sample ID	Ear Tag No.	Species Code	Canyon and Array
CAGU-02-49192	60	PEMA	Upper Guaje
CAGU-02-49193	70	PEMA	Upper Guaje
CAGU-02-49194	5	PEMA	Upper Guaje
CAGU-02-49195	33	PEMA	Upper Guaje
CAGU-02-49196	37	PEMA	Upper Guaje
CAQC-03-50661	n/a	SWWE	n/a
CALA-02-49221	336	PETR	Lower Los Alamos
CALA-02-49222	391	PETR	Lower Los Alamos
CALA-02-49223	326	PEMA	Lower Los Alamos
CALA-02-49224	341	PEMA	Lower Los Alamos
CALA-02-49225	310	PETR	Lower Los Alamos
CAPU-03-50608	241	PEMA	Acid
CAPU-03-50609	243	PEMA	Acid
CAPU-03-50610	248	PEMA	Acid
CAPU-03-50611	247	PEMA	Acid
CAPU-03-50612	244	PEMA	Acid
CAPU-03-50613	245	PETR	Acid
CAPU-03-50614	275	PEBO	Acid
CAPU-03-50615	274	PEBO	Acid
CAPU-03-50616	272	PEBO	Acid
CAPU-03-50617	246	PEBO	Acid
CAPU-03-50618	238	PEBO	Acid
CAPU-03-50619	225	REME	Upper Pueblo
CAPU-03-50620	239	PEBO	Acid
CAPU-03-50621	221	REME ^f	Lower Pueblo
CAQC-03-50662	n/a	SWWE	n/a
CALA-03-50623	23	PEBO	Lower Los Alamos
CALA-03-50624	66	PEBO	Upper Los Alamos
CALA-03-50625	3882	PEBO	Upper Los Alamos
CALA-03-50626	14	PEBO	Lower Los Alamos
CALA-03-50627	46	PEBO	Lower Los Alamos
CALA-03-50628	3468	PEBO	Upper Los Alamos
CALA-03-50629	82	PEMA	Lower Los Alamos
CAGU-03-50640	67	PEBO	Upper Guaje
CAGU-03-50641	81	PEBO	Lower Guaje
CAGU-03-50642	3484	PEBO	Lower Guaje
CAGU-03-50643	13	PEMA	Lower Guaje
CAGU-03-50644	10	PEMA	Upper Guaje
CAGU-03-50645	257	PEBO	Upper Guaje

Table B-3.0-6 (continued)

Sample ID	Ear Tag No.	Species Code	Canyon and Array
CAGU-03-50646	262	PEBO	Lower Guaje
CAGU-03-50647	252	PEMA	Upper Guaje
CAGU-03-50648	251	PEMA	Upper Guaje
CAGU-03-50649	254	PEMA	Upper Guaje
CAGU-03-50650	261	PEMA	Upper Guaje
CAGU-03-50651	256	PEBO	Upper Guaje
CAGU-03-50652	263	REME	Lower Guaje
CAQC-03-50663	n/a	SWWE	n/a
CAPU-03-50588	229	REME	Upper Pueblo
CAPU-03-50589	214	PEMA	Upper Pueblo
CAPU-03-50590	217	PEBO	Lower Pueblo
CAPU-03-50591	211	PEMA	Upper Pueblo
CAPU-03-50592	206	PEMA	Lower Pueblo
CAPU-03-50593	204	PEBO	Lower Pueblo
CAPU-03-50594	220	PETR	Lower Pueblo
CAPU-03-50595	231	PEBO	Lower Pueblo
CAPU-03-50596	218	PETR	Lower Pueblo
CAPU-03-50597	353	PETR	Lower Pueblo
CAPU-03-50598	233	PETR	Lower Pueblo
CAPU-03-50599	228	PETR	Upper Pueblo
CAPU-03-50600	224	PEMA	Upper Pueblo
CAPU-03-50601	235	PEMA	Lower Pueblo
CAPU-03-50602	237	PETR	Upper Pueblo
CAPU-03-50603	210	PEMA	Upper Pueblo
CAPU-03-50604	215	PEBO	Upper Pueblo
CAPU-03-50605	207	PEBO	Lower Pueblo
CAPU-03-50606	216	PEBO	Upper Pueblo
CAPU-03-50607	250	PEMA	Acid
CAQC-03-50664	n/a	SWWE	n/a

^a PEMA = Deer mouse (*Peromyscus maniculatus*).

^b PETR = Pinyon mouse (*Peromyscus truei*).

^c PEBO = Brush mouse (*Peromyscus boylii*).

^d n/a = Not applicable (QC mouse).

^e SWWE = Swiss Webster mouse (QC mouse).

^f REME = Western harvest mouse (*Reithrodontomys megalotis*).

Table B-3.0-7
Sediment Submitted for Laboratory Analyses

Reach	Sample ID	Location ID	Sample Type	Depth (cm)	Date Collected	Analytical Suites	Notes
LA-1C	CALA-02-47839	LA-02-20860	Composite	0-15	7/29/02	Standard*	Array 1, 1st composite sample (upper/upper)
LA-1C	CALA-02-47840	LA-02-20861	Composite	0-15	7/29/02	Standard	Array 1, 2nd composite sample (upper/middle)
LA-1C	CALA-02-47841	LA-02-20862	Composite	0-15	7/29/02	Standard	Array 1, 3rd composite sample (upper/lower)
LA-1C	CALA-02-47842	LA-02-20863	Composite	0-15	7/29/02	Standard	Array 2, 1st composite sample (lower/upper)
LA-1C	CALA-02-47843	LA-02-20864	Composite	0-15	7/29/02	Standard	Array 2, 2nd composite sample (lower/middle)
LA-1C	CALA-02-47844	LA-02-20865	Composite	0-15	7/29/02	Standard	Array 2, 3rd composite sample (lower/lower)
P-3W	CAPU-02-47849	PU-02-20869	Composite	0-15	7/26/02	Standard	Array 1, 1st composite sample (upper 1/3)
P-3W	CAPU-02-47850	PU-02-20870	Composite	0-15	7/26/02	Standard	Array 1, 2nd composite sample (middle 1/3)
P-3W	CAPU-02-47851	PU-02-20871	Composite	0-15	7/26/02	Standard	Array 1, 3rd composite sample (lower 1/3)
AC-3	CAPU-02-47848	PU-02-20868	Composite	0-15	7/26/02	Standard	Array 1, 1st composite sample (upper 1/3)
AC-3	CAPU-02-47847	PU-02-20867	Composite	0-15	7/26/02	Standard	Array 1, 2nd composite sample (middle 1/3)
AC-3	CAPU-02-47846	PU-02-20866	Composite	0-15	7/26/02	Standard	Array 1, 3rd composite sample (lower 1/3)
Guaje	CAGU-02-47868	GU-02-20906	Composite	0-15	7/25/02	Standard	Array 1, 1st composite sample (upper/upper)
Guaje	CAGU-02-47867	GU-02-20905	Composite	0-15	7/25/02	Standard	Array 1, 2nd composite sample (upper/middle)
Guaje	CAGU-02-47922	GU-02-20907	Composite	0-15	7/25/02	Standard+PAH	Array 1, 3rd composite sample (upper/lower)
Guaje	CAGU-02-47866	GU-02-20904	Composite	0-15	7/25/02	Standard	Array 2, 1st composite sample (lower/upper)
Guaje	CAGU-02-47865	GU-02-20903	Composite	0-15	7/25/02	Standard	Array 2, 2nd composite sample (lower/middle)
Guaje	CAGU-02-47864	GU-02-20902	Composite	0-15	7/25/02	Standard	Array 2, 3rd composite sample (lower/lower)
Guaje	CAGU-02-47863	GU-02-20904	Composite	0-15	7/25/02	Standard	QA duplicate of CAGU-02-47866
DP-1W	CALA-02-47906	21-10931	Grab	0-22	7/31/02	Standard+PAH	None
DP-2	CALA-02-47900	21-05500	Grab	0-30	7/30/02	Standard+PAH	None
LA-0	CALA-02-47894	LA-00221	Grab	0-30	7/29/02	Standard+PAH	None
LA-1W	CALA-02-47891	LA-00146	Grab	0-30	7/29/02	Standard+PAH	None
LA-1C	CALA-02-47888	LA-00179	Grab	0-30	7/29/02	Standard+PAH	None
LA-2W	CALA-02-47885	LA-00041	Grab	0-30	7/29/02	Standard+PAH	None
LA-3E	CALA-02-47897	LA-10009	Grab	0-30	7/30/02	Standard+PAH	None
LA-3E	CALA-02-47909	LA-10009	Grab	0-30	7/30/02	Standard+PAH	QA duplicate of CALA-02-47897
AC-1	CAPU-02-47919	PU-10013	Grab	0-30	7/30/02	Standard+PAH	None
AC-3	CAPU-02-47910	PU-10110	Grab	0-30	7/26/02	Standard+PAH	None
P-3W	CAPU-02-47916	PU-02-20873	Grab	0-30	7/30/02	Standard+PAH	None
P-3E	CAPU-02-47913	PU-02-20872	Grab	0-30	7/30/02	Standard+PAH	None
LA-1W	CALA-03-49799	LA-00141	Grab	0-30	11/20/02	Standard+PAH	None
LA-1W	CALA-03-49800	LA-00143	Grab	0-30	11/20/02	Standard+PAH	None

*Standard = Pesticides/PCBs, target analyte list metals with cyanide, isotopic plutonium, gamma spectroscopy radionuclides, and strontium-90.

Table B-3.0-8
Crosswalk Among Sediment Sample IDs, Worm Sample IDs, Locations, and Dates

Reach	Location ID	Depth (cm)	Sediment Sample ID, Chemical Analysis	Sediment Sample ID, Earthworm Mortality Test	Soil Sample Collection Date	Worm Sample ID, Chemical Analysis	Toxicity Test Termination Date	Sediment Sample ID, Plant Germination Test
Guaje	GU-02-20907	0-15	CAGU-02-47922	CAGU-02-47923	7/25/02	CAGU-03-50168	9/17/02	CAGU-02-47924
LA-2W	LA-00041	0-30	CALA-02-47885	CALA-02-47886	7/29/02	CALA-03-50152	9/17/02	CALA-02-47887
LA-1C	LA-00179	0-30	CALA-02-47888	CALA-02-47889	7/29/02	CALA-03-50153	9/17/02	CALA-02-47890
LA-1W	LA-00146	0-30	CALA-02-47891	CALA-02-47892	7/29/02	CALA-03-50160	9/17/02	CALA-02-47893
LA-0	LA-00221	0-30	CALA-02-47894	CALA-02-47895	7/29/02	CALA-03-50154	9/17/02	CALA-02-47896
LA-3E	LA-10009	0-30	CALA-02-47897	CALA-02-47898	7/30/02	CALA-03-50155	9/17/02	CALA-02-47899
DP-2	21-05500	0-30	CALA-02-47900	CALA-02-47901	7/30/02	CALA-03-50156	9/17/02	CALA-02-47902
DP-1W	21-10931	0-22	CALA-02-47906	CALA-02-47907	7/31/02	CALA-03-50157	9/17/02	CALA-02-47905
AC-3	PU-10110	0-30	CAPU-02-47910	CAPU-02-47911	7/26/02	CAPU-03-50162	9/17/02	CAPU-02-47912
P-3E	PU-02-20872	0-30	CAPU-02-47913	CAPU-02-47914	7/30/02	CAPU-03-50163	9/17/02	CAPU-02-47915
P-3W	PU-00141	0-30	CAPU-02-47916	CAPU-02-47917	7/30/02	CAPU-03-50164	9/17/02	CAPU-02-47918
AC-1	PU-10013	0-30	CAPU-02-47919	CAPU-02-47920	7/30/02	CAPU-03-50165	9/17/02	CAPU-02-47921
n/a*	n/a	n/a	Negative Control	Negative Control	n/a	CALA-03-50161	9/17/02	n/a
LA-1W	LA-00141	0-30	CALA-03-49796	CALA-03-49799	11/20/02	CALA-03-50158	1/3/03	n/a
LA-1W	LA-00143	0-30	CALA-03-49797	CALA-03-49800	11/20/02	CALA-03-50159	1/3/03	n/a
n/a	n/a	n/a	Negative Control	Negative Control	n/a	CAPU-03-50166	1/3/03	n/a

*n/a = Not applicable.

Table B-3.0-9
Sediment and Surface Water Samples Submitted for Laboratory Analyses

Media	Reach	Sample ID	Location ID	Sample Type	Depth (cm)	Date Collected	Analytical Suites
c1 sediment	DP-1C	CALA-02-47937	LA-02-20913	Grab	0-5	7/31/02	Standard ^a
water	DP-1C	CALA-02-47947	LA-02-20913	Grab	n/a ^b	7/31/02	Standard
c1 sediment	LA-0	CALA-02-47939	LA-02-20914	Grab	0-5	7/30/02	Standard
water	LA-0	CALA-02-47949	LA-02-20914	Grab	n/a	7/30/02	Standard
c1 sediment	LA-1FW	CALA-02-47941	LA-02-20915	Grab	0-5	7/30/02	Standard
water	LA-1FW	CALA-02-47950	LA-02-20915	Grab	n/a	7/30/02	Standard
c1 sediment	LA-4W	CALA-02-47929	LA-02-20909	Grab	0-5	7/30/02	Standard
water	LA-4W	CALA-02-47946	LA-02-20909	Grab	n/a	7/30/02	Standard
c1 sediment	LA-5	CALA-02-47927	LA-02-20908	Grab	0-5	7/30/02	Standard
water	LA-5	CALA-02-47945	LA-02-20908	Grab	n/a	7/30/02	Standard
c1 sediment	P-3E	CAPU-02-47959	PU-02-20920	Grab	0-5	7/31/02	Standard
water	P-3E	CAPU-02-47961	PU-02-20920	Grab	n/a	7/31/02	Standard
c1 sediment	DP-4	CALA-02-47933	LA-02-20911	Grab	0-5	7/31/02	Standard
c1 sediment	LA-1W	CALA-02-47931	LA-02-20910	Grab	0-5	7/31/02	Standard
c1 sediment	LA-3W	CALA-02-47935	LA-02-20912	Grab	0-5	7/31/02	Standard
c1 sediment	AC-1	CAPU-02-47953	PU-02-20917	Grab	0-5	7/30/02	Standard
c1 sediment	AC-3	CAPU-02-47955	PU-02-20918	Grab	0-5	7/31/02	Standard
c1 sediment	P-1FW	CAPU-02-47957	PU-02-20919	Grab	0-5	7/31/02	Standard

^a Standard = Pesticides/PCBs, target analyte list metals with cyanide, isotopic plutonium, gamma spectroscopy radionuclides, strontium-90, americium-241, and PAHs.

^b n/a = Not applicable.

Table B-3.0-10
Crosswalk Between Sediment, Surface Water, and
***Chironomus tentans* Growth and Survival Toxicity Bioassay**

Reach	Location ID	Sediment Sample ID	Water Sample ID	EPA 100.2 Sample ID	Date Collected
DP-1C	LA-02-20913	CALA-02-47938	CALA-02-47966	CALA-02-47966	7/31/02
LA-0	LA-02-20914	CALA-02-47940	CALA-02-47964	CALA-02-47964	7/30/02
LA-1FW	LA-02-20915	CALA-02-47942	CALA-02-47965	CALA-02-47965	7/30/02
LA-4W	LA-02-20909	CALA-02-47930	CALA-02-47963	CALA-02-47963	7/30/02
LA-5	LA-02-20908	CALA-02-47928	CALA-02-47962	CALA-02-47962	7/30/02
P-3E	PU-02-20920	CAPU-02-47972	CAPU-02-47960	CAPU-02-47960	7/31/02
DP-4	LA-02-20911	CALA-02-47934	n/a *	CALA-02-47934	7/31/02
LA-1W	LA-02-20910	CALA-02-47932	n/a	CALA-02-47932	7/31/02
LA-3W	LA-02-20912	CALA-02-47936	n/a	CALA-02-47936	7/31/02
AC-1	PU-02-20917	CAPU-02-47954	n/a	CAPU-02-47954	7/30/02
AC-3	PU-02-20918	CAPU-02-47956	n/a	CAPU-02-47956	7/31/02
P-1FW	PU-02-20919	CAPU-02-47958	n/a	CAPU-02-47958	7/31/02

*n/a = Not applicable.

Table B-4.1-1
Ash Samples from the Cerro Grande Burn Area

Sample ID	Location ID	Watershed	Collection Date	Begin Depth (cm)	End Depth (cm)	Analytical Suite													
						Americium-241 (alpha spectroscopy)	Gamma Spectroscopy Radionuclides	Isotopic Plutonium	Isotopic Thorium	Isotopic Uranium	Stontium-90	Target Analyte List Metals	Uranium	Semivolatile Organic Compounds	Dioxins and Furans	Cyanide	Alkalinity	Anions	Total Organic Carbon
CABG-00-0066	BG-00014	Los Alamos Canyon	6/9/2000	0	6	x	x	x	x	x	x	x	x	x	x		x	x	
CABG-00-0067	BG-00015	Los Alamos Canyon	6/9/2000	0	6	x	x	x	x	x	x	x	x	x	x		x	x	
CABG-00-0068	BG-00016	Los Alamos Canyon	6/9/2000	0	6	x	x	x	x	x	x	x	x	x	x		x	x	
CABG-00-0070	BG-00018	Pueblo Canyon	6/9/2000	0	6	x	x	x	x	x	x	x	x	x	x		x	x	
CABG-00-0105	BG-00014	Los Alamos Canyon	6/9/2000	0	6														x
CABG-00-0106	BG-00015	Los Alamos Canyon	6/9/2000	0	6														x
CABG-00-0107	BG-00016	Los Alamos Canyon	6/9/2000	0	6														x
CABG-00-0109	BG-00018	Pueblo Canyon	6/9/2000	0	6														x
CABG-01-0002	BG-00037	Rendija Canyon	5/17/2001	0	1		x	x			x	x							
CABG-01-0003	BG-00038	Rendija Canyon	5/17/2001	0	2		x	x			x	x							
CABG-01-0004	BG-00039	Rendija Canyon	5/17/2001	0	1		x	x			x	x							
CABG-01-0005	BG-00040	Rendija Canyon	5/17/2001	0	1		x	x			x	x							
CABG-01-0006	BG-00041	Rendija Canyon	5/17/2001	0	2		x	x			x								
CABG-01-0010	BG-00042	Los Alamos Canyon	6/1/2001	0	2		x	x			x	x		x	x				
CABG-01-0013	BG-00043	Los Alamos Canyon	6/1/2001	0	3		x	x			x	x		x	x				
CABG-01-0016	BG-00044	Los Alamos Canyon	6/1/2001	0	1		x	x			x	x		x	x				
CABG-01-0021	BG-00046	Chupaderos Canyon	7/23/2001	0	2		x	x			x	x							
CABG-01-0022	BG-00047	Chupaderos Canyon	7/23/2001	0	2		x	x			x	x							
CABG-01-0094	BG-00125	Rendija Canyon	12/3/2001	0	2	x	x	x			x								
CABG-01-0095	BG-00126	Rendija Canyon	12/3/2001	0	2	x	x	x			x	x				x			
CABG-01-0096	BG-00127	Rendija Canyon	12/3/2001	0	2	x	x	x			x								

Note: A blank cell in the analytical suite columns indicates that the sample was not analyzed for that suite.

Table B-4.1-2
Baseline Sediment Samples Collected Within and Downstream from the Cerro Grande Burn Area

Sample ID	Location ID	Canyon, Area	Collection Date	Begin Depth (cm)	End Depth (cm)	Analytical Suite																		Sediment Texture*	Sediment Facies	Geomorphic Position
						Americium-241 (alpha spectroscopy)	Gamma Spectroscopy Radionuclides	Isotopic Plutonium	Isotopic Thorium	Isotopic Uranium	Stontium-90	Tritium	Target Analyte List Metals	Cyanide	Uranium	Dioxins and Furans	High Explosives	PCBs and Pesticides	Semivolatile Organic Compounds	Alkalinity	Anions	Total Organic Carbon	Particle Size and Organic Matter			
CA18-00-0042	18-10103	Pajarito, west of NM 501	6/29/2000	0	15	x	x	x		x			x	x	x		x	x	x					muck or silt	Fine	Puddle outside main channel
CABG-00-0064	BG-00012	Los Alamos, Reservoir	6/9/2000	0	6	x	x	x	x	x	x		x		x	x			x	x	x			csi (muck)	Fine	Reservoir bottom
CABG-00-0065	BG-00013	Pueblo, west of Diamond Drive	6/9/2000	0	6	x	x	x	x	x	x		x		x	x			x	x	x			csi (muck)	Fine	Ponded area behind road fill
CABG-00-0069	BG-00017	South Fork Pajarito, west of NM 501	6/9/2000	0	6	x	x	x	x	x	x		x		x	x	x		x	x	x			csi (muck)	Fine	Ponded area behind road fill
CABG-00-0081	BG-00019	Pueblo, west of Diamond Drive	8/3/2000	0	10		x	x		x	x	x			x							x		fsi (muck)	Fine	Ponded area behind road fill
CABG-00-0088	BG-00028	Garcia, west of NM 30	9/19/2000	0	7		x	x		x	x	x	x	x	x	x						x		fsi (muck)	Fine	Overbank
CABG-00-0089	BG-00029	Garcia, west of NM 30	9/19/2000	0	5		x	x		x	x	x	x	x	x	x						x		csi (muck)	Fine	Overbank
CABG-00-0090	BG-00029	Garcia, west of NM 30	9/19/2000	9	16		x	x		x	x	x	x	x	x	x						x		fsi	Fine	Overbank
CABG-00-0103	BG-00012	Los Alamos, Reservoir	6/9/2000	0	6																x	x		csi (muck)	Fine	Reservoir bottom
CABG-00-0104	BG-00013	Pueblo, west of Diamond Drive	6/9/2000	0	6																x	x		csi (muck)	Fine	Ponded area behind road fill
CABG-00-0108	BG-00017	South Fork Pajarito, west of NM 501	6/9/2000	0	6																x	x		csi (muck)	Fine	Ponded area behind road fill

Table B-4.1-2 (continued)

Sample ID	Location ID	Canyon, Area	Collection Date	Begin Depth (cm)	End Depth (cm)	Analytical Suite																Sediment Texture*	Sediment Facies	Geomorphic Position		
						Americium-241 (alpha spectroscopy)	Gamma Spectroscopy Radionuclides	Isotopic Plutonium	Isotopic Thorium	Isotopic Uranium	Strontium-90	Tritium	Target Analyte List Metals	Cyanide	Uranium	Dioxins and Furans	High Explosives	PCBs and Pesticides	Semivolatile Organic Compounds	Alkalinity	Anions				Total Organic Carbon	Particle Size and Organic Matter
CABG-02-0001	BG-00148	Los Alamos, Reservoir	10/28/2001	451	470	x	x	x			x		x								x	fsi (clayey silt)	Fine	Center of reservoir		
CABG-02-0002	BG-00148	Los Alamos, Reservoir	10/28/2001	406	432	x	x	x			x		x								x	fsi (silty muck)	Fine	Center of reservoir		
CABG-02-0003	BG-00148	Los Alamos, Reservoir	10/28/2001	370	388	x	x	x			x		x								x	csi (silty muck)	Fine	Center of reservoir		
CABG-02-0004	BG-00148	Los Alamos, Reservoir	10/28/2001	329	354	x	x	x			x		x								x	fs	Fine	Center of reservoir		
CABG-02-0005	BG-00148	Los Alamos, Reservoir	10/28/2001	354	370	x	x	x			x		x								x	ms	Fine	Center of reservoir		
CABG-02-0006	BG-00148	Los Alamos, Reservoir	10/28/2001	289	329	x	x	x			x		x								x	csi	Fine	Center of reservoir		
CABG-02-0007	BG-00148	Los Alamos, Reservoir	10/28/2001	231	289	x	x	x			x		x								x	fsi (muck)	Fine	Center of reservoir		
CABG-02-0008	BG-00148	Los Alamos, Reservoir	10/28/2001	173	193	x	x	x			x		x								x	csi (muck)	Fine	Center of reservoir		
CABG-02-0009	BG-00148	Los Alamos, Reservoir	10/28/2001	109	132	x	x	x			x		x								x	fsi (muck)	Fine	Center of reservoir		
CABG-02-0010	BG-00148	Los Alamos, Reservoir	10/28/2001	132	142	x	x	x			x		x								x	csi (muck)	Fine	Center of reservoir		
CABG-02-0011	BG-00148	Los Alamos, Reservoir	10/28/2001	3	27	x	x	x			x		x								x	fsi (muck)	Fine	Center of reservoir		
CABG-02-0012	BG-00148	Los Alamos, Reservoir	10/28/2001	27	39	x	x	x			x		x								x	csi	Fine	Center of reservoir		
CABG-02-0013	BG-00148	Los Alamos, Reservoir	10/28/2001	39	54	x	x	x			x		x								x	fs	Fine	Center of reservoir		

Table B-4.1-2 (continued)

Sample ID	Location ID	Canyon, Area	Collection Date	Begin Depth (cm)	End Depth (cm)	Analytical Suite																Sediment Texture*	Sediment Facies	Geomorphic Position
						Americium-241 (alpha spectroscopy)	Gamma Spectroscopy Radionuclides	Isotopic Plutonium	Isotopic Thorium	Isotopic Uranium	Stontium-90	Tritium	Target Analyte List Metals	Cyanide	Uranium	Dioxins and Furans	High Explosives	PCBs and Pesticides	Semivolatile Organic Compounds	Alkalinity	Anions			
CABG-02-0014	BG-00148	Los Alamos, Reservoir	10/28/2001	76	97	x	x	x			x		x							x	fsi (muck)	Fine	Center of reservoir	
CABG-02-0015	BG-00148	Los Alamos, Reservoir	10/28/2001	97	109	x	x	x			x		x							x	vfs	Fine	Center of reservoir	
CABG-02-0016	BG-00149	Los Alamos, Reservoir	11/1/2001	36	43	x	x	x			x		x							x	fs	Fine	North side of reservoir	
CABG-02-0017	BG-00149	Los Alamos, Reservoir	11/1/2001	87	102	x	x	x			x		x							x	ms	Coarse	North side of reservoir	
CABG-02-0018	BG-00150	Los Alamos, Reservoir	11/1/2001	78	137	x	x	x			x		x							x	cs (gravel)	Coarse	North side of reservoir	
CAGU-00-0001	GU-10000	Guaje, west of Forest Road 416	8/11/2000	0	5		x	x			x		x	x						x	cs	Coarse	Active channel	
CAGU-00-0002	GU-10001	Guaje, west of Forest Road 416	8/11/2000	0	12		x	x			x		x	x						x	vfs	Fine	Edge of channel, c2 unit	
CAGU-00-0003	GU-10001	Guaje, west of Forest Road 416	8/11/2000	50	59		x	x			x		x	x						x	csi (muck)	Fine	Edge of channel, c2 unit	
CAGU-00-0004	GU-10002	Guaje, west of Forest Road 416	8/11/2000	10	25		x	x			x		x	x						x	fsi (muck)	Fine	Slackwater area, floodplain	
CAGU-00-0005	GU-10003	Guaje, west of Forest Road 416	8/11/2000	0	23		x	x			x		x	x						x	ms (stratified)	Fine	Floodplain	
CARE-00-0001	RE-10000	Rendija, east of Sportsman's Club	8/11/2000	0	5		x	x			x		x	x						x	csi (organic rich)	Fine	c1b side channel	
CARE-00-0002	RE-10000	Rendija, east of Sportsman's Club	8/11/2000	8	18		x	x			x		x	x						x	fs	Fine	c1b side channel	

Table B-4.1-2 (continued)

Sample ID	Location ID	Canyon, Area	Collection Date	Begin Depth (cm)	End Depth (cm)	Analytical Suite																		Sediment Texture*	Sediment Facies	Geomorphic Position
						Americium-241 (alpha spectroscopy)	Gamma Spectroscopy Radionuclides	Isotopic Plutonium	Isotopic Thorium	Isotopic Uranium	Strontium-90	Tritium	Target Analyte List Metals	Cyanide	Uranium	Dioxins and Furans	High Explosives	PCBs and Pesticides	Semivolatile Organic Compounds	Alkalinity	Anions	Total Organic Carbon	Particle Size and Organic Matter			
CARE-00-0003	RE-10001	Rendija, east of Sportsman's Club	8/11/2000	0	16		x	x			x		x	x							x	ms (stratified)	Fine	Abandoned channel, c3 unit		
CARE-00-0004	RE-10002	Rendija, east of Sportsman's Club	8/11/2000	0	3		x	x			x		x	x							x	fsi (muck)	Fine	Scour hole in c1b unit		
CARE-00-0005	RE-10003	Rendija, east of Sportsman's Club	8/11/2000	7	20		x	x			x		x	x							x	vcs	Coarse	Active channel		
CARE-01-0001	RE-10005	Rendija, east of Sportsman's Club	7/30/2001	0	4		x	x			x		x						x		x	fsi (ashy silt)	Fine	Overbank		
CARE-01-0002	RE-10006	Rendija, east of Sportsman's Club	7/30/2001	0	4		x	x			x		x						x		x	fsi (ashy silt)	Fine	Overbank		
CAWA-00-0026	WA-10037	Water, west of NM 501	6/29/2000	0	6	x	x	x		x		x	x	x		x	x	x				muck or dark vfs	Fine	Ponded area behind road fill		

Note: A blank cell in the analytical suite columns indicates that the sample was not analyzed for that suite.

* Median particle size in <2 mm fraction shown where particle size data are available; cs = coarse sand; csi = coarse silt; fs = fine sand; fsi = fine silt; ms = medium sand; vcs = very coarse sand; vfs = very fine sand.

Table B-4.1-3
Post-Fire Sediment Samples in Los Alamos Canyon

Sample ID	Location ID	Reach	Geomorphic Unit or Location	Sediment Facies	Collection Date	Begin Depth (cm)	End Depth (cm)	Analytical Suite											Sediment Texture ^a	Notes
								Gamma Spectroscopy Radionuclides	Isotopic Plutonium	Isotopic Uranium	Strontium-90	Tritium	Target Analyte List Metals	Cyanide	Uranium	Dioxins and Furans	Semivolatile Organic Compounds	Particle Size and Organic Matter		
CALA-00-0106	LA-10000	LA-5E	c1b	Fine	9/15/2000	21	29	x	x	x	x	x	x	x	x	x		x	csi (silty muck)	With disseminated woody material, basal post-fire layer
CALA-00-0107	LA-10001	LA-5E	c1b	Fine	9/15/2000	0	14	x	x	x	x	x	x	x	x	x		x	fs (finely stratified)	— ^b
CALA-00-0108	LA-10002	LA-5E	c1	Coarse	9/15/2000	0	10	x	x	x	x	x	x	x	x	x		x	cs	—
CALA-00-0109	LA-10003	LA-5E	f1	Fine	9/15/2000	13	33	x	x	x	x	x	x	x	x	x		x	csi (silty to very fine sandy muck)	Basal post-fire layer
CALA-00-0110	LA-10004	LA-5E	f1	Fine	9/15/2000	0	14	x	x	x	x	x	x	x	x	x		x	csi with some muck	—
CALA-00-0111	LA-10009	LA-3FE	Behind weir	Fine	9/7/2000	0	12	x	x	x	x	x	x	x	x	x	x	x	fsi (clayey muck)	Slackwater deposit behind fill material in channel
CALA-00-0112	LA-10010	LA-3FE	Behind weir	Fine	9/7/2000	0	3	x	x	x	x	x	x	x	x	x	x	x	csi (silty muck)	—
CALA-00-0113	LA-10004	LA-5E	f1	Fine	9/15/2000	14	26	x	x	x	x	x	x	x	x	x		x	csi (silty muck)	Fining upwards; w/ disseminated woody debris
CALA-01-0004	LA-10042	LA-4FE	Overbank	Fine	3/6/2001	0	6	x	x		x		x					x	vfs (silty fs to ms with some muck)	—
CALA-01-0005	LA-10043	LA-4FE	Overbank	Fine	3/6/2001	0	2	x	x		x		x					x	csi (silty muck)	—
CALA-01-0006	LA-10044	LA-4FE	Overbank	Fine	3/6/2001	0	6	x	x		x		x					x	fsi (silty muck)	—
CALA-01-0007	LA-10045	LA-4FE	c2	Fine	3/6/2001	0	5	x	x		x		x					x	fsi (silty muck)	—
CALA-01-0008	LA-10046	LA-4FE	c2	Fine	3/6/2001	0	8	x	x		x		x					x	vfs	—
CALA-01-0009	LA-10048	LA-4FE	c1b or c2	Coarse	3/6/2001	2	5	x	x		x		x					x	ms plus muck	—
CALA-01-0010	LA-10049	LA-4FE	c2	Fine	3/6/2001	0	7	x	x		x		x					x	fs	—
CALA-01-0011	LA-10047	LA-4FE	Overbank	Fine	3/6/2001	0	9	x	x		x		x					x	vfs (silty fs to ms with some muck)	—
CALA-01-0012	LA-10047	LA-4FE	Overbank	Fine	3/6/2001	0	9	x	x		x								vfs (silty fs to ms with some muck)	Field duplicate of CALA-01-0011

Table B-4.1-3 (continued)

Sample ID	Location ID	Reach	Geomorphic Unit or Location	Sediment Facies	Collection Date	Begin Depth (cm)	End Depth (cm)	Analytical Suite										Sediment Texture ^a	Notes
								Gamma Spectroscopy Radionuclides	Isotopic Plutonium	Isotopic Uranium	Stontium-90	Tritium	Target Analyte List Metals	Cyanide	Uranium	Dioxins and Furans	Semivolatile Organic Compounds		
CALA-01-0193	LA-10108	LA-4FE	c3	Fine	9/27/2001	0	4	x	x		x	x					x	csi	—
CALA-01-0194	LA-10108	LA-4FE	c3	Fine	9/27/2001	4	10	x	x		x	x					x	fs (stratified, with ms)	Possibly pre-2001
CALA-01-0195	LA-10109	LA-4FE	c2 or c3	Fine	9/27/2001	0	3	x	x		x		x				x	csi (slightly ashy)	With some ms-sized pumice
CALA-01-0196	LA-10110	LA-4FE	f2	Fine	9/27/2001	0	2	x	x		x	x					x	csi (slightly ashy)	Slackwater deposit in side drainage
CALA-01-0197	LA-10111	LA-4FE	c3	Fine	9/27/2001	0	3	x	x		x	x					x	ms	—
CALA-01-0198	LA-10112	LA-4FE	c2	Fine	9/27/2001	0	5	x	x		x	x					x	csi (ashy, finely stratified)	—
CALA-01-0199	LA-10113	LA-4FE	c1	Coarse	9/27/2001	3	6	x	x		x	x					x	vcs	Bar in side channel
CALA-01-0200	LA-10114	LA-4FE	c2	Fine	9/27/2001	0	3	x	x		x	x					x	csi (ashy, finely stratified)	—
CALA-01-0201	LA-10115	LA-5E	c2	Fine	9/27/2001	0	5	x	x		x		x				x	csi (ashy, finely laminated)	—
CALA-01-0202	LA-10116	LA-5E	f1	Fine	9/27/2001	0	15	x	x		x	x					x	vfs	—
CALA-01-0203	LA-10116	LA-5E	f1	Fine	9/27/2001	16	23	x	x		x	x					x	vfs	—
CALA-01-0204	LA-10117	LA-5E	c1	Coarse	9/27/2001	0	15	x	x		x	x					x	cs (stratified)	—
CALA-01-0205	LA-10118	LA-5E	c1b	Fine	9/27/2001	0	5	x	x		x	x					x	csi	—
CALA-01-0206	LA-10119	LA-5E	c1b	Fine	9/27/2001	0	5	x	x		x	x					x	vfs	—
CALA-01-0207	LA-10120	LA-3FE	Behind weir	Fine	10/2/2001	19	23	x	x		x	x					x	csi	—
CALA-01-0208	LA-10120	LA-3FE	Behind weir	Coarse	10/2/2001	23	39	x	x		x	x					x	cs	—
CALA-01-0209	LA-10121	LA-3FE	Behind weir	Fine	10/2/2001	0	3	x	x		x	x					x	csi (stratified)	—
CALA-01-0210	LA-10122	LA-3FE	Behind weir	Coarse	10/2/2001	0	14	x	x		x	x					x	cs	—
CALA-01-0211	LA-10123	LA-3FE	Behind weir	Fine	10/2/2001	17	20	x	x		x	x					x	csi	—
CALA-01-0212	LA-10124	LA-3FE	Behind weir	Fine	10/2/2001	2	12	x	x		x	x					x	fsl (muck)	—
CALA-01-0213	LA-10116	LA-5E	f1	Fine	9/27/2001	0	15	x	x		x						vfs		Field duplicate of CALA-01-0202

Table B-4.1-3 (continued)

Sample ID	Location ID	Reach	Geomorphic Unit or Location	Sediment Facies	Collection Date	Begin Depth (cm)	End Depth (cm)	Analytical Suite											Sediment Texture ^a	Notes
								Gamma Spectroscopy Radionuclides	Isotopic Plutonium	Isotopic Uranium	Stontium-90	Tritium	Target Analyte List Metals	Cyanide	Uranium	Dioxins and Furans	Semivolatile Organic Compounds	Particle Size and Organic Matter		
CALA-01-0214	LA-10125	LA-3FE	Behind weir	Fine	10/2/2001	0	9	x	x		x							Moderately ashy silt	Upper deposit in backwater area	
CALA-01-0526	LA-10124	LA-3FE	Behind weir	Fine	10/2/2001	15	22	x	x		x		x				x	fsi (muck)	3 muck layers separated by 1–2 mm vfs	
CALA-01-0527	LA-10125	LA-3FE	Behind weir	Fine	10/2/2001	0	9	x	x		x		x				x	fsi (moderately ashy)	Upper deposit in backwater area	
CALA-01-0528	LA-10125	LA-3FE	Behind weir	Fine	10/2/2001	9	10	x	x		x		x				x	fsi (slightly ashy)	—	
CALA-02-44929	LA-10108	LA-4FE	c3	Fine	2/27/2002	0	4								x	x		csi	Resample of CALA-01-0193	
CALA-02-44930	LA-10108	LA-4FE	c3	Fine	2/27/2002	4	10								x	x		fs (stratified, with ms)	Resample of CALA-01-0194	
CALA-02-44932	LA-10110	LA-4FE	f2	Fine	2/27/2002	0	2								x	x		csi (slightly ashy)	Resample of CALA-01-0196	
CALA-02-44933	LA-10111	LA-4FE	c3	Fine	2/27/2002	0	3								x	x		ms	Resample of CALA-01-0197	
CALA-02-44934	LA-10112	LA-4FE	c2	Fine	2/27/2002	0	5								x	x		csi (ashy, finely stratified)	Resample of CALA-01-0198	
CALA-02-44935	LA-10113	LA-4FE	c1	Coarse	2/27/2002	3	6								x	x		vcs	Resample of CALA-01-0199	
CALA-02-44936	LA-10114	LA-4FE	c2	Fine	2/27/2002	0	3								x	x		csi (ashy, finely stratified)	Resample of CALA-01-0200	
CALA-02-44958	LA-02-19558	LA-4FE	f2	Fine	2/27/2002	0	6								x	x		ashy, silty vfs	Resample replacement for CALA-01-0195	
CALA-02-44960	LA-10111	LA-4FE	c3	fine	2/27/2002	0	3								x	x		ms	field duplicate of CALA-02-44933	

Note: A blank cell in the analytical suite columns indicates that the sample was not analyzed for that suite.

^a Median particle size in < 2 mm fraction shown where particle size data are available; cs = coarse sand; csi = coarse silt; fs = fine sand; fsi = fine silt; ms = medium sand; vcs = very coarse sand; vfs = very fine sand.

^b — = No note.

Table B-4.1-4
Post-Fire Sediment Samples in Pueblo Canyon

Sample ID	Location ID	Reach	Geomorphic Setting	Sediment Facies	Collection Date	Begin Depth (cm)	End Depth (cm)	Analytical Suite					Sediment Texture ^a	Notes
								Gamma Spectroscopy Radionuclides	Isotopic Plutonium	Stontium-90	Target Analyte List Metals	Particle Size and Organic Matter		
CAPU-01-0017	PU-10178	P-4E	Overbank	Fine	8/6/2001	0	2	x	x	x	x	x	csi (ashy)	— ^b
CAPU-01-0018	PU-10179	P-4E	Overbank	Fine	8/6/2001	0	1	x	x	x	x	x	fsi (ashy)	—
CAPU-01-0019	PU-10178	P-4E	Overbank	Coarse	8/6/2001	2	9	x	x	x	x	x	ms	—
CAPU-01-0020	PU-10180	P-4E	Overbank	Fine	8/6/2001	2	5	x	x	x	x	x	csi (moderately ashy)	—
CAPU-01-0021	PU-10181	P-4E	Overbank	Fine	8/6/2001	0	8	x	x	x	x	x	fsi (muck)	In large scour hole
CAPU-01-0022	PU-10182	P-4E	Channel	Coarse	8/6/2001	0	13	x	x	x	x	x	cs	—
CAPU-01-0023	PU-10183	P-4E	Overbank	Fine	8/6/2001	0	2	x	x	x	x	x	csi (moderately ashy)	—
CAPU-01-0024	PU-10184	P-4E	Overbank	Fine	8/6/2001	0	2	x	x	x	x	x	fsi (ashy)	—
CAPU-01-0025	PU-00152	P-3E	Overbank	Fine	8/6/2001	0	2	x	x	x	x	x	fsi (moderately ashy)	—
CAPU-01-0026	PU-10185	P-3E	Overbank	Fine	8/6/2001	0	1	x	x	x	x	x	fsi (ashy)	—
CAPU-01-0027	PU-10185	P-3E	Overbank	Fine	8/6/2001	1	3	x	x	x	x	x	csi (slightly ashy)	—
CAPU-01-0028	PU-10186	P-3E	Overbank	Fine	8/6/2001	0	2	x	x	x	x	x	fsi (moderately ashy)	—
CAPU-01-0029	PU-10187	P-3W	Channel	Coarse	8/6/2001	0	17	x	x	x	x	x	cs	—
CAPU-01-0030	PU-10188	P-3W	Overbank	Fine	8/6/2001	0	3	x	x	x	x	x	csi (moderately ashy)	—
CAPU-01-0031	PU-10189	P-3W	Overbank	Fine	8/6/2001	0	2	x	x	x	x	x	csi (ashy)	—
CAPU-01-0032	PU-10190	P-1W	Overbank	Fine	8/6/2001	0	8	x	x	x	x	x	csi (muck)	—
CAPU-01-0033	PU-10191	P-1W	Overbank	Fine	8/6/2001	1	2	x	x	x	x	x	csi (muck)	—
CAPU-01-0034	PU-10192	P-1W	Overbank	Fine	8/6/2001	0	18	x	x	x	x	x	fs	—
CAPU-01-0035	PU-10194	P-1W	Overbank	Fine	8/6/2001	0	1	x	x	x	x	x	csi (slightly ashy)	—
CAPU-01-0036	PU-10190	P-1W	Overbank	Fine	8/6/2001	8	16	x	x	x	x	x	csi (muck)	Possibly year 2000 deposit
CAPU-01-0037	PU-10193	P-1W	Overbank	Fine	8/6/2001	0	1	x	x	x	x	x	csi (w/ organic matter)	—
CAPU-01-0038	PU-10195	P-1E	Overbank	Fine	8/6/2001	0	2	x	x	x	x	x	csi (ashy)	—
CAPU-01-0039	PU-10196	P-1E	Overbank	Fine	8/6/2001	0	3	x	x	x	x	x	csi (slightly ashy)	—

Table B-4.1-4 (continued)

Sample ID	Location ID	Reach	Geomorphic Setting	Sediment Facies	Collection Date	Begin Depth (cm)	End Depth (cm)	Analytical Suite					Sediment Texture ^a	Notes
								Gamma Spectroscopy Radionuclides	Isotopic Plutonium	Strontium-90	Target Analyte List Metals	Particle Size and Organic Matter		
CAPU-01-0040	PU-10197	P-1E	Overbank	Fine	8/6/2001	0	2	x	x	x	x	x	fsi (ashy)	—
CAPU-01-0041	PU-10198	P-1E	Overbank	Fine	8/6/2001	0	7	x	x	x	x	x	fs	Contains little or no ash
CAPU-01-0042	PU-10197	P-1E	Overbank	Fine	8/6/2001	3	7	x	x	x	x	x	csi (ashy)	—
CAPU-01-0043	PU-10199	P-1E	Overbank	Fine	8/6/2001	0	2	x	x	x	x	x	csi (slightly ashy)	—
CAPU-01-0044	PU-00114	P-1E	Overbank	Fine	8/6/2001	3	7	x	x	x	x	x	fs	—
CAPU-01-0045	PU-10200	P-1E	Channel	Coarse	8/6/2001	0	8	x	x	x	x	x	cs	—
CAPU-01-0046	PU-10188	P-3W	Overbank	Fine	8/24/2001	1	5	x	x	x	x	x	csi (partly ashy)	Fining upward layer
CAPU-01-0047	PU-10188	P-3W	Overbank	Fine	8/24/2001	5	10	x	x	x	x	x	csi (partly ashy)	Fining upward layer
CAPU-01-0048	PU-10201	P-3W	Overbank	Fine	8/24/2001	0	1	x	x	x	x	x	csi	—
CAPU-01-0049	PU-10202	P-2W	Overbank	Fine	8/24/2001	0	10	x	x	x	x	x	vfs (slightly ashy)	—
CAPU-01-0050	PU-10203	P-2W	Overbank	Fine	8/24/2001	0	2	x	x	x	x	x	csi (moderately ashy)	—
CAPU-01-0051	PU-10203	P-2W	Overbank	Fine	8/24/2001	2	10	x	x	x	x	x	csi	—
CAPU-01-0052	PU-10204	P-2W	Overbank	Fine	8/24/2001	0	13	x	x	x	x	x	fsi	—
CAPU-01-0053	PU-10205	P-2W	Overbank	Fine	8/24/2001	0	2	x	x	x	x	x	vfs (moderately ashy)	—
CAPU-01-0054	PU-10206	P-2W	Channel	Coarse	8/24/2001	0	8	x	x	x	x	x	cs	—
CAPU-01-0055	PU-10207	P-2W	Overbank	Fine	8/24/2001	0	3	x	x	x	x	x	csi (moderately ashy)	—
CAPU-01-0056	PU-10208	P-2W	Overbank	Fine	8/24/2001	6	14	x	x	x	x	x	csi (slightly ashy)	—
CAPU-01-0057	PU-10188	P-3W	Overbank	Fine	8/6/2001	0	3	x	x	x			csi (moderately ashy)	Field duplicate of CAPU-01-0030
CAPU-01-0058	PU-10192	P-1W	Overbank	Fine	8/6/2001	0	18	x	x	x			fs	Field duplicate of CAPU-01-0034

Note: A blank cell in the analytical suite columns indicates that the sample was not analyzed for that suite.

^a Median particle size in < 2 mm fraction shown where particle size data are available; cs = coarse sand; csi = coarse silt; fs = fine sand; fsi = fine silt; ms = medium sand; vcs = very coarse sand; vfs = very fine sand.

^b — = No note.

Table B-4.1-5
Particle-Size and Organic-Matter Data from Fire-Affected Sediment Samples

Sample ID	Gravel (> 2 mm) (wt %)	Very Coarse Sand (2-1 mm) (wt %)	Coarse Sand (1-0.5 mm) (wt %)	Medium Sand (0.5-0.25 mm) (wt %)	Fine Sand (0.25-0.125 mm) (wt %)	Very Fine Sand (0.125-0.0625 mm) (wt %)	Coarse Silt (62.5-15 µm) (wt %)	Fine Silt (15-2 µm) (wt %)	Clay (<2 µm) (wt %)	Organic Matter (wt %)	Total Silt + Clay (wt %)	Median Particle Size Class ^a	Sediment Facies
CABG-00-0081	0.0	0.0	1.1	1.4	1.7	1.3	5.2	61.1	27.8	12.1	94.1	fsi	Fine
CABG-00-0088	18.0	0.7	0.9	2.0	3.6	2.2	29.2	37.0	24.2	15.8	90.4	fsi	Fine
CABG-00-0089	40.6	0.1	0.3	0.9	5.7	31.6	50.7	5.6	5.2	2.3	61.5	csi	Fine
CABG-00-0090	0.0	1.1	2.9	3.3	2.2	1.4	30.3	34.7	23.8	13.7	88.8	fsi	Fine
CABG-00-0103	0.0	0.0	0.9	1.5	1.1	1.4	89.7	2.6	2.6	na ^b	94.9	csi	Fine
CABG-00-0104	0.0	0.0	0.2	0.4	0.5	1.7	48.6	37.2	11.4	na	97.2	csi	Fine
CABG-00-0108	0.0	0.0	0.7	4.3	8.2	15.0	37.7	22.5	11.5	na	71.7	csi	Fine
CABG-02-0001	0.0	0.0	1.0	1.2	1.5	4.6	25.7	45.4	20.6	na	91.7	fsi	Fine
CABG-02-0002	0.1	0.2	1.7	3.1	3.4	3.3	35.7	39.2	13.4	na	88.3	fsi	Fine
CABG-02-0003	0.1	0.3	2.1	2.7	2.7	2.0	54.3	26.7	9.1	na	90.0	csi	Fine
CABG-02-0004	1.4	0.4	4.9	21.7	28.2	14.1	20.3	6.7	3.6	na	30.6	fs	Fine
CABG-02-0005	3.0	4.3	26.9	36.0	14.1	5.3	7.7	2.6	2.9	na	13.2	ms	Fine
CABG-02-0006	0.0	0.1	0.5	1.2	10.8	16.8	51.3	12.6	6.4	na	70.3	csi	Fine
CABG-02-0007	1.0	0.3	2.3	2.3	1.7	1.2	31.4	47.6	13.2	na	92.2	fsi	Fine
CABG-02-0008	0.3	0.2	1.1	1.3	1.8	4.8	42.3	36.8	11.8	na	90.9	csi	Fine
CABG-02-0009	0.2	0.3	2.4	3.2	1.6	1.2	29.4	45.8	16.2	na	91.3	fsi	Fine
CABG-02-0010	0.0	0.1	0.9	2.0	4.9	17.4	50.2	16.7	7.7	na	74.6	csi	Fine
CABG-02-0011	0.1	0.1	1.2	1.4	1.2	1.8	41.6	41.1	11.5	na	94.2	fsi	Fine
CABG-02-0012	0.0	0.0	0.2	0.9	8.6	22.3	42.1	16.6	9.1	na	67.8	csi	Fine
CABG-02-0013	0.4	1.0	3.8	29.8	35.0	13.5	10.7	2.9	3.3	na	16.8	fs	Fine
CABG-02-0014	0.1	0.0	0.1	0.4	0.5	2.1	33.5	44.8	18.6	na	96.9	fsi	Fine
CABG-02-0015	0.6	0.2	1.8	3.0	27.0	24.0	28.5	8.9	6.5	na	43.9	vfs	Fine
CABG-02-0016	1.6	0.5	2.6	10.3	51.0	16.9	11.0	4.1	3.5	na	18.6	fs	Fine
CABG-02-0017	0.6	2.4	33.1	40.6	9.7	3.4	5.2	2.5	3.1	na	10.8	ms	Coarse
CABG-02-0018	57.2	33.9	33.2	14.9	4.4	2.2	4.6	4.2	2.6	na	11.4	cs	Coarse
CAGU-00-0001	15.3	44.5	42.3	9.3	1.8	0.5	0.1	0.6	1.0	0.5	1.7	cs	Coarse
CAGU-00-0002	0.2	0.5	6.7	21.0	11.9	30.3	21.7	4.4	3.3	1.6	29.4	vfs	Fine
CAGU-00-0003	4.9	2.3	5.3	7.1	7.3	8.3	28.4	24.2	16.5	11.8	69.0	csi	Fine
CAGU-00-0004	3.8	0.1	2.3	2.4	1.5	1.4	28.3	48.8	15.3	10.5	92.4	fsi	Fine
CAGU-00-0005	1.8	6.8	22.1	35.7	18.7	6.4	5.7	1.2	3.5	1.3	10.4	ms	Fine
CALA-00-0106	2.9	1.1	2.3	3.2	3.7	6.9	36.5	30.5	15.5	8.6	82.5	csi	Fine
CALA-00-0107	0.4	0.5	7.1	28.8	28.7	15.2	13.1	2.9	3.6	1.5	19.6	fs	Fine
CALA-00-0108	1.9	20.3	50.3	22.5	4.5	0.7	0.3	0.3	1.1	na	1.7	cs	Coarse
CALA-00-0109	0.2	0.5	1.0	1.7	6.0	19.3	48.7	15.7	7.4	5.9	71.8	csi	Fine
CALA-00-0110	5.3	0.9	1.8	2.6	8.0	20.3	46.7	13.6	6.4	7.3	66.7	csi	Fine
CALA-00-0111	2.2	0.0	1.1	1.4	1.5	1.9	26.4	48.0	19.4	8.5	93.8	fsi	Fine
CALA-00-0112	2.4	0.0	0.4	0.5	0.4	0.6	48.6	35.0	14.4	7.6	98.0	csi	Fine
CALA-00-0113	1.1	0.5	0.5	2.8	7.3	15.9	40.7	19.6	12.5	8.3	72.8	csi	Fine
CALA-01-0004	9.1	1.5	6.4	15.5	20.8	15.6	17.2	11.6	11.5	2.8	40.2	vfs	Fine

Table B-4.1-5 (continued)

Sample ID	Gravel (> 2 mm) (wt %)	Very Coarse Sand (2-1 mm) (wt %)	Coarse Sand (1-0.5 mm) (wt %)	Medium Sand (0.5-0.25 mm) (wt %)	Fine Sand (0.25-0.125 mm) (wt %)	Very Fine Sand (0.125-0.0625 mm) (wt %)	Coarse Silt (62.5-15 µm) (wt %)	Fine Silt (15-2 µm) (wt %)	Clay (<2 µm) (wt %)	Organic Matter (wt %)	Total Silt + Clay (wt %)	Median Particle Size Class ^a	Sediment Facies
CALA-01-0005	6.5	0.2	0.3	0.7	1.9	9.9	46.9	25.5	14.7	4.2	87.1	csi	Fine
CALA-01-0006	14.1	0.9	1.7	2.7	4.6	7.0	32.5	31.6	18.9	7.1	82.9	fsi	Fine
CALA-01-0007	12.0	0.2	0.9	1.6	1.8	3.8	37.1	33.5	21.1	6.4	91.6	fsi	Fine
CALA-01-0008	22.5	6.9	10.2	12.8	15.7	9.8	13.4	16.6	14.7	4.0	44.7	vfs	Fine
CALA-01-0009	0.1	3.0	19.2	45.6	18.5	4.7	2.4	2.1	4.6	0.8	9.1	ms	Coarse
CALA-01-0010	17.5	3.6	11.3	18.8	20.2	13.7	14.2	7.1	11.0	2.0	32.2	fs	Fine
CALA-01-0011	9.4	0.6	4.3	19.4	17.5	9.7	21.2	13.6	13.5	2.4	48.3	vfs	Fine
CALA-01-0193	0.2	0.1	0.3	1.4	5.8	11.6	55.0	17.6	8.2	3.9	80.8	csi	Fine
CALA-01-0194	7.4	11.2	18.9	18.1	14.4	10.2	13.8	6.3	6.9	2.7	27.0	fs	Fine
CALA-01-0195	0.7	0.2	1.0	2.8	4.0	5.4	49.5	23.8	13.5	7.8	86.7	csi	Fine
CALA-01-0196	0.1	0.0	0.5	1.0	2.0	5.1	54.8	25.5	10.8	5.3	91.1	csi	Fine
CALA-01-0197	0.8	2.6	19.5	36.6	19.8	8.0	7.3	2.6	3.3	1.7	13.3	ms	Fine
CALA-01-0198	0.0	0.0	0.6	1.0	3.8	8.0	39.9	35.2	11.1	5.7	86.2	csi	Fine
CALA-01-0199	42.7	51.9	37.3	7.7	0.8	0.2	0.0	0.0	1.5	0.4	1.5	vcs	Coarse
CALA-01-0200	0.0	0.0	0.2	0.7	3.3	8.2	45.2	35.5	6.7	3.0	87.4	csi	Fine
CALA-01-0201	0.2	0.3	1.0	1.5	2.6	13.8	60.2	13.4	6.1	3.4	79.7	csi	Fine
CALA-01-0202	0.2	0.2	0.7	5.3	22.6	30.5	32.8	4.5	3.1	1.8	40.4	vfs	Fine
CALA-01-0203	0.2	0.2	0.8	11.0	32.1	26.9	22.5	2.8	3.4	1.5	28.8	vfs	Fine
CALA-01-0204	17.0	17.6	41.1	32.2	5.9	1.1	0.5	0.2	1.1	0.4	1.9	cs	Coarse
CALA-01-0205	0.1	0.0	0.7	3.9	12.3	29.3	44.2	5.9	3.5	1.6	53.6	csi	Fine
CALA-01-0206	0.1	0.2	2.2	17.6	29.8	22.0	22.2	3.2	2.8	1.2	28.1	vfs	Fine
CALA-01-0207	0.1	0.1	0.7	1.1	7.7	38.5	41.0	4.7	6.1	2.4	51.8	csi	Fine
CALA-01-0208	12.3	33.6	37.7	11.8	3.1	4.2	5.4	2.1	2.1	0.8	9.5	cs	Coarse
CALA-01-0209	0.0	0.0	1.1	4.2	9.6	13.3	46.3	16.3	8.9	5.6	71.5	csi	Fine
CALA-01-0210	9.9	25.2	37.8	24.5	5.8	1.3	1.8	1.3	2.4	0.9	5.5	cs	Coarse
CALA-01-0211	0.2	0.2	1.1	2.2	12.8	27.5	38.8	8.4	8.7	3.5	55.8	csi	Fine
CALA-01-0212	0.0	0.0	0.1	0.3	0.3	0.6	22.4	55.0	21.1	7.5	98.5	fsi	Fine
CALA-01-0526	0.0	0.0	0.2	0.3	0.3	1.0	20.0	57.5	20.7	6.7	98.2	fsi	Fine
CALA-01-0527	0.0	0.0	0.1	0.4	0.5	0.7	47.2	43.1	7.8	8.1	98.1	fsi	Fine
CALA-01-0528	0.0	0.0	0.2	0.3	0.3	0.8	16.1	61.4	21.0	6.3	98.5	fsi	Fine
CAPU-01-0017	0.1	0.0	0.4	1.3	1.4	4.3	56.0	24.7	11.9	5.2	92.6	csi	Fine
CAPU-01-0018	0.1	0.1	0.3	0.7	0.9	1.3	36.6	42.4	17.9	6.9	96.9	fsi	Fine
CAPU-01-0019	7.4	11.1	33.5	34.5	9.8	2.9	0.1	2.6	5.4	1.1	8.1	ms	Coarse
CAPU-01-0020	0.1	0.0	0.3	1.9	2.6	4.0	46.8	26.9	17.2	10.5	90.9	csi	Fine
CAPU-01-0021	0.0	0.0	0.2	0.4	0.5	0.6	0.0	65.0	33.4	8.7	98.2	fsi	Fine
CAPU-01-0022	6.2	39.3	45.3	10.0	0.9	0.1	0.0	2.1	3.9	0.6	4.4	cs	Coarse
CAPU-01-0023	0.1	0.0	0.2	0.8	1.3	7.1	54.6	23.1	12.8	6.7	90.5	csi	Fine
CAPU-01-0024	0.2	0.1	0.2	0.6	0.6	0.5	46.7	28.8	22.5	9.0	98.0	fsi	Fine
CAPU-01-0025	0.1	0.0	0.1	0.7	1.0	1.9	31.5	44.7	20.0	10.2	96.2	fsi	Fine
CAPU-01-0026	0.1	0.0	0.2	0.6	1.2	1.5	34.8	43.0	18.4	8.0	96.2	fsi	Fine

Table B-4.1-5 (continued)

Sample ID	Gravel (> 2 mm) (wt %)	Very Coarse Sand (2-1 mm) (wt %)	Coarse Sand (1-0.5 mm) (wt %)	Medium Sand (0.5-0.25 mm) (wt %)	Fine Sand (0.25-0.125 mm) (wt %)	Very Fine Sand (0.125-0.0625 mm) (wt %)	Coarse Silt (62.5-15 µm) (wt %)	Fine Silt (15-2 µm) (wt %)	Clay (<2 µm) (wt %)	Organic Matter (wt %)	Total Silt + Clay (wt %)	Median Particle Size Class ^a	Sediment Facies
CAPU-01-0027	0.3	0.1	0.6	0.7	1.5	12.6	61.6	14.1	8.6	2.9	84.3	csi	Fine
CAPU-01-0028	0.3	0.0	0.2	0.4	0.5	1.7	37.7	44.7	14.6	5.8	97.0	fsi	Fine
CAPU-01-0029	4.0	25.9	45.4	17.2	2.3	0.9	0.7	1.9	2.7	0.6	5.3	cs	Coarse
CAPU-01-0030	0.0	0.0	0.2	0.2	0.4	4.3	61.4	21.1	12.2	5.0	94.7	csi	Fine
CAPU-01-0031	0.0	0.1	0.4	0.9	1.0	1.6	53.7	29.0	13.3	6.9	96.0	csi	Fine
CAPU-01-0032	0.6	0.1	1.6	3.2	4.6	10.1	48.3	17.8	14.4	10.1	80.5	csi	Fine
CAPU-01-0033	0.1	0.0	0.3	0.8	1.6	6.4	46.1	32.7	11.8	5.1	90.6	csi	Fine
CAPU-01-0034	0.0	0.0	2.8	21.6	32.0	18.8	14.9	5.3	4.2	1.3	24.4	fs	Fine
CAPU-01-0035	0.8	0.0	0.7	1.7	3.3	15.6	51.4	15.8	11.1	6.1	78.3	csi	Fine
CAPU-01-0036	0.1	0.0	0.5	2.6	3.9	9.3	54.3	21.1	8.1	7.7	83.5	csi	Fine
CAPU-01-0037	0.2	0.0	0.2	1.2	8.2	27.2	47.4	9.6	6.0	3.1	63.0	csi	Fine
CAPU-01-0038	0.1	0.1	0.6	0.9	2.6	10.1	46.5	25.6	13.4	5.4	85.5	csi	Fine
CAPU-01-0039	0.1	0.0	0.3	0.6	2.3	19.1	59.4	10.2	7.7	3.2	77.3	csi	Fine
CAPU-01-0040	0.3	0.0	0.3	0.7	1.3	3.5	40.9	37.7	15.5	4.9	94.1	fsi	Fine
CAPU-01-0041	0.1	0.9	4.9	22.1	30.6	18.6	15.5	3.4	3.9	1.0	22.8	fs	Fine
CAPU-01-0042	0.2	0.1	0.5	1.2	1.5	3.7	46.9	33.4	12.8	5.1	93.1	csi	Fine
CAPU-01-0043	0.1	0.1	0.1	0.3	4.9	23.4	48.9	15.1	7.4	3.0	71.4	csi	Fine
CAPU-01-0044	0.1	3.8	18.8	15.6	19.1	16.6	18.3	4.0	3.8	1.2	26.1	fs	Fine
CAPU-01-0045	6.6	16.6	36.0	27.4	9.3	3.3	3.1	1.4	2.8	0.6	7.3	cs	Coarse
CAPU-01-0046	0.1	0.0	0.3	0.5	0.7	3.4	49.9	32.6	12.5	5.4	95.0	csi	Fine
CAPU-01-0047	0.1	0.0	0.2	0.2	0.7	4.1	55.3	26.6	12.6	4.9	94.5	csi	Fine
CAPU-01-0048	1.0	0.1	0.2	1.0	1.1	2.1	57.0	29.6	8.7	4.9	95.3	csi	Fine
CAPU-01-0049	0.0	0.0	0.1	1.4	18.3	32.8	34.9	7.5	4.8	2.1	47.2	vfs	Fine
CAPU-01-0050	5.6	1.4	3.9	3.7	2.5	1.7	43.4	26.2	16.9	13.3	86.5	csi	Fine
CAPU-01-0051	0.1	0.5	0.4	1.0	5.3	19.8	57.7	9.2	6.0	3.0	72.9	csi	Fine
CAPU-01-0052	3.9	0.3	0.7	0.8	0.6	1.1	27.1	53.0	16.3	7.1	96.4	fsi	Fine
CAPU-01-0053	0.2	1.1	1.5	4.6	20.9	27.3	31.0	7.5	6.1	4.1	44.6	vfs	Fine
CAPU-01-0054	41.2	32.3	32.6	19.4	7.9	2.5	1.0	0.7	3.3	0.6	5.0	cs	Coarse
CAPU-01-0055	0.2	0.4	0.4	0.5	0.8	1.1	47.7	35.1	13.9	6.4	96.7	csi	Fine
CAPU-01-0056	0.1	0.9	1.5	2.5	5.6	14.8	51.7	13.4	9.5	7.2	74.6	csi	Fine
CARE-00-0001	0.1	0.3	0.5	1.5	5.6	19.7	50.8	12.6	8.7	5.4	72.1	csi	Fine
CARE-00-0002	0.2	1.1	10.2	26.9	23.5	15.2	16.2	2.8	3.9	1.4	23.0	fs	Fine
CARE-00-0003	1.3	6.1	20.3	28.8	18.5	10.0	10.1	2.5	3.6	1.5	16.2	ms	Fine
CARE-00-0004	0.3	0.2	1.0	1.7	2.1	4.3	38.3	35.0	17.0	9.4	90.3	fsi	Fine
CARE-00-0005	49.7	52.4	22.3	9.0	3.8	2.6	4.5	2.9	2.4	0.9	9.9	vcs	Coarse
CARE-01-0001	0.2	0.1	0.1	0.4	0.7	0.7	0.7	67.0	30.0	13.3	97.7	fsi	Fine
CARE-01-0002	0.7	0.1	0.2	0.9	1.8	1.3	4.7	64.4	26.3	14.4	95.4	fsi	Fine

^a <2 mm fraction; cs = coarse sand; csi = coarse silt; fs = fine sand; fsi = fine silt; ms = medium sand; vcs = very coarse sand; vfs = very fine sand.

^b na = Not available.

Appendix C

Analytical Results

(CD on inside back cover of this report)

C-1.0 SUMMARY OF ANALYSES

Tables C-1.0-1 through C-1.0-19 present summaries of inorganic chemical, organic chemical, and radionuclide analyses for samples collected from the Los Alamos and Pueblo watershed during this investigation. Some samples collected from nearby areas that are relevant to this investigation are also included, including Cerro Grande ash samples and post-fire sediment samples from baseline areas. The summaries include analyses that were included in the screening assessments for sediment and water in Section 6, excluding certain analyses as described in Section 6.1. The summaries also include analyses of ash and biota samples that were not part of the screening assessments in Section 6. These tables show the number of samples, detection frequency, and concentration range for each analyte. Separate tables are included for inorganic chemicals, organic chemicals, and radionuclides. Tables C-1.0-1 through C-1.0-3 summarize results from sediment samples, excluding post-fire baseline samples. Tables C-1.0-4 through C-1.0-6 summarize results from post-fire baseline sediment samples. Tables C-1.0-7 through C-1.0-9 summarize results from ash samples. Tables C-1.0-10 through C-1.0-12 summarize results from surface water and spring samples. Tables C-1.0-13 through C-1.0-15 summarize results from alluvial groundwater samples. Tables C-1.0-16 through C-1.0-18 summarize results from small mammal samples. Table C-1.0-19 summarizes inorganic chemical results from earthworm samples (no analyses were obtained from earthworms for organic chemicals or radionuclides).

C-2.0 ANALYTICAL RESULTS

Tables C-2.0-1 through C-2.0-18 present analytical results for samples collected from the Los Alamos and Pueblo watershed during this investigation. Some samples collected from nearby areas that are relevant to this investigation are also included, including Cerro Grande ash samples and post-fire sediment samples from baseline areas. For sediment and water samples, these tables only include analytes identified as chemicals of potential concern (COPCs) in this investigation. For ash and biota samples, all analyses are included in these tables. These tables include some analyses for sediment and water that were excluded from the screening assessments in Section 6 (e.g., field duplicates). These tables also present additional information on each sample, including the reach, location ID, sample depth, geomorphic unit, sediment facies, field preparation method, and sample collection date. Separate tables are included for inorganic chemicals, organic chemicals, and radionuclides. Tables C-2.0-1 through C-2.0-3 present results from sediment samples, excluding post-fire baseline samples. Tables C-2.0-4 through C-2.0-6 present results from post-fire baseline sediment samples. Tables C-2.0-7 through C-2.0-9 present results from ash samples. Tables C-2.0-10 through C-2.0-12 present results from surface water and spring samples. Tables C-2.0-13 through C-2.0-15 present results from alluvial groundwater samples. Tables C-2.0-16 through C-2.0-18 present results from biota (small mammal and earthworm) samples. Data qualifiers presented in these tables are defined as follows.

- U: The analyte was analyzed for, but not detected. For inorganic chemical and organic chemical analyses, the reported value is the sample-specific estimated quantitation limit or detection limit. For radionuclide analyses, the reported value is the best estimate of the analyte concentration, even when that estimate is less than the detection limit. For statistical reasons, the estimates for radionuclides may sometimes be given as negative results.
- J: The reported value should be regarded as estimated.
- J+: The reported value should be regarded as estimated and biased high.
- J-: The reported value should be regarded as estimated and biased low.
- UJ: The analyte was analyzed for, but not detected. Reported value is an estimate of the sample-specific quantitation limit or detection limit.

- UJ+: The analyte was analyzed for, but not detected. Reported value is an estimate of the sample-specific quantitation limit or reporting limit with a high bias.
- UJ-: The analyte was analyzed for, but not detected. Reported value is an estimate of the sample-specific quantitation limit or reporting limit with a low bias.

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Appendix D

Contaminant Trends and Inventory

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D-1.0 SEDIMENT

This section presents information on contaminants in sediments in the Los Alamos and Pueblo watershed that supports the physical system conceptual model in Section 7 and the risk assessments in Sections 6 and 8. It includes information on spatial and temporal variations in the concentrations of chemicals of potential concern (COPCs) that helps identify contaminant sources and provide an understanding of the effects of sediment redistribution by floods on contaminant concentrations and potential exposure to receptors. Calculations of the inventory (amount) of radionuclide COPCs are included that also support a conceptual understanding of the current distribution of contaminants. This section also presents specific information on how sample results from different geomorphic units were grouped or binned for the purpose of calculating weighted-average concentrations in a reach. This binning is used in the human health risk assessment process discussed in Sections 6, 8.2, and E-5, and in the conceptual model in Section 7.

D-1.1 Spatial Variations in Sample Results for COPCs

Figure D-1.1-1 consists of plots showing sample results for all COPCs identified in sediment in the watershed plotted versus distance from the Rio Grande. These plots help to identify sources for the COPCs and show how concentrations change with distance from sources. Different colors on these plots are used for each subwatershed: Acid, DP, Pueblo, upper Los Alamos, and lower Los Alamos Canyons. Each sample is plotted at a location represented by the distance from the Rio Grande to the approximate mid-point of the reach. For inorganic and organic chemicals, nondetected sample results are shown by an open circle, and the detected sample results are represented by a filled circle. For radionuclides, detect status is not indicated because radionuclide sample results are not censored.

Results from sample locations removed during remediation activities are included in Figure D-1.1-1 to help indicate sources and support the conceptual model described in Section 7, although these results are excluded from evaluations of potential present-day human health or ecological risk described in Sections 6, 8, and E-5. Results from fire-affected samples are also included in these plots, which partially complicates identification of sources. Averages from fire-affected samples are shown separately in figures in Section 7.1.

It should be noted that the sample results in Figure D-1.1-1 are biased high as a result of biases accompanying sample collection, as discussed in Section B-1 of Appendix B. Specifically, samples were typically biased towards geomorphic units and sediment facies with higher concentrations of contaminants, and units and facies with low concentrations (e.g., coarse facies sediment in the active channels) are underrepresented.

Some COPCs in these plots have clearly defined source areas, with concentrations decreasing downstream from these sources. For example, americium-241 originates from both the South Fork of Acid Canyon and the solid waste management unit (SWMU) 21-011(k) outfall and decreases downstream in Pueblo and Los Alamos Canyons, respectively; plutonium-239,240 originates primarily in the South Fork of Acid Canyon and decreases downstream in Acid, Pueblo, and lower Los Alamos Canyons; and cesium-137 originates primarily at the SWMU 21-011(k) outfall and decreases downstream in DP and Los Alamos Canyons. Other COPCs have no clearly defined source areas or spatial trends, which suggests that the sample results primarily represent variations in background concentrations. Examples include antimony, arsenic, iron, and selenium.

D-1.2 Temporal Variations in Radionuclide COPCs at Surveillance Stations

Figures D-1.2-1 and D-1.2-2 consist of plots showing temporal variations in the concentrations of cesium-137 and plutonium-239,240 in sediment in the Los Alamos and Pueblo watershed as measured in

annual environmental surveillance samples from a series of active channel stations. These data are from the annual environmental surveillance reports (e.g., ESP 2002, 73876) supplemented by data presented in Stoker et al. (1981, 6059), and include all analyses from these studies through 2002. The current station name is shown first, followed by prior station names and the associated sediment investigation reach in parentheses. Data for cesium-137 and plutonium-239,240 are shown because these two COPCs are important in assessing potential human health risk. The plots of these two COPCs also indicate possible temporal trends downstream from the most important contaminant sources in the watershed, specifically the SWMU 21-011[k] outfall into DP Canyon and the former TA-1 and TA-45 outfalls into the South Fork of Acid Canyon. Relatively extensive data sets, dating back to 1968 at one station, are also available for these COPCs. The plots in Figures D-1.2-1 and D-1.2-2 help to show how contaminant concentrations have changed over time because of the redistribution of sediment by floods and help provide insight into likely future changes in contaminant concentrations.

Some plots indicate general overall decreases in contaminant concentrations over time (e.g., plutonium-239,240 at the Acid above Pueblo station, Figure D-1.2-2), whereas others indicate no apparent trends. Some of the scatter in these plots probably results from variations in the particle-size distribution of the samples. Although the samples probably consist primarily of coarse-grained sediment, which typifies sediment in active stream channels in these canyons, no data on particle-size variations are available for these surveillance samples. Some samples could include significant amounts of fine sediment, which generally have higher concentrations of radionuclides, introducing some variation in sample results. Additional temporal variations in these data may reflect variable contributions of sediment from different sources, especially near stream confluences. For example, backwater from large Pueblo Canyon floods can extend into Acid Canyon past the surveillance sampling station and deposit sediment with relatively low concentrations of plutonium-239,240. Similarly, floods from Acid Canyon can extend part way upstream into Pueblo Canyon. These processes may be responsible for anomalously low values of plutonium-239,240 reported in Acid Canyon and anomalously high values reported upstream in Pueblo Canyon in some years.

Other results cannot be explained in the context of known contamination in the watershed and may represent analytical errors or other problems (e.g., 21.54 pCi/g cesium-137 result at Pueblo 3 station in 1998, Figure D-1.2-1, when all other pre-fire sample results are ≤ 0.5 pCi/g at this station). In addition, the data shown on the plots for Los Alamos Above DP Canyon (Los Alamos at Upper GS or GS-1, in reach LA-2W) may include data from two separate stations and may not show representative time trends because at different times the name "GS-1" has been given to either the gaging station in Los Alamos Canyon upstream from DP Canyon, in reach LA-2W, or to the station in Los Alamos Canyon upstream from State Highway NM 4, in reach LA-3. It is not clear from the surveillance reports which samples apply to which location. However, based on other data from Los Alamos Canyon the relatively high cesium-137 values reported from GS-1 prior to 1990 probably were collected downstream from DP Canyon and not upstream.

D-1.3 Binning of Contaminant Results

The analytical data used in this investigation were examined to determine what grouping of samples in each reach was optimal for the combined purposes of defining geomorphic variations in contaminant concentration and statistically describing the variability in contaminant concentration. These grouped or binned data are used in the geomorphic assessments and the weighted averages used in the human health risk assessments in this report; therefore, the specific binning process is an important part of the data evaluation. The variability in contaminant concentrations within these bins was also used in the sample allocation process discussed in prior reports (Reneau et al. 1998, 59159; Reneau et al. 1998, 59160; Reneau et al. 1998, 59667; Katzman et al. 1999, 63915; Reneau et al. 2000, 66867; Rytí et al. 2004, 85206). The binning process generally follows the process used in the reports cited above and is

discussed here to document the specific rationale for combining samples into bins used in this investigation.

In reaches where either cesium-137 or plutonium-239,240 were identified as key COPCs (COPCs that are widely distributed and that have the largest contribution to potential dose), the data for these radionuclides in each reach were first examined after being binned by individual geomorphic units and sediment facies. In many cases, these subsets of data were combined into larger bins to increase sample size and allow better statistical evaluation. Coarse facies and fine facies samples were kept in separate bins in all reaches because maximum and average radionuclide concentrations were always higher in the fine-grained sediments than in related coarse-grained sediments. Samples within the same sediment facies (coarse or fine facies) in different geomorphic units were kept in separate bins if the variations in radionuclide concentration provided information on time-dependent trends in a reach (e.g., where c1 sediment in active channels had lower radionuclide concentrations than texturally similar c2 sediment in older, abandoned channel units). However, these subsets were combined when no such trends were apparent in the data. Combining results from different geomorphic units, when no differences in contaminant concentrations between units are evident, improves the estimates of summary statistics because the estimates are based on a larger data set.

Data from the reaches were generally kept separate in this binning process because of downstream trends in radionuclide concentration, although data from adjacent reaches were in some cases combined when no apparent differences in concentrations between reaches was identified. As mentioned above, combining sample results helps improve the estimates of summary statistics. Specifically, data from the following reaches were combined in the original reports, and these groupings are retained here: P-3W and P-3E, P-4W and P-4E, and LA-4W and LA-4E (Reneau et al. 1998, 59159; Reneau et al. 1998, 59667).

The specific binning of samples from previous reports (Reneau et al. 1998, 59159; Reneau et al. 1998, 59160; Reneau et al. 1998, 59667; Katzman et al. 1999, 63915; Reneau et al. 2000, 66867) was retained here with the exceptions noted below. In some cases, vertical subdivisions within a geomorphic unit had been defined, particularly by subdividing buried stratigraphic intervals with higher radionuclide concentrations from near surface sediments with lower concentrations. This subdivision was done to provide estimates of the sediment volume associated with the highest radionuclide concentrations in a reach, which were less than the entire volume in a unit. For example, the fine facies in the c2b unit in reach P-1E had been vertically subdivided into an upper section with lower plutonium concentrations and a lower section with higher concentrations (Reneau et al. 1998, 59159). For simplicity, these vertical subdivisions are not retained here in calculating representative concentrations for use in human health risk assessments.

Binning of data in unreported reaches with pervasive radionuclide COPCs (AC-3, LA-2FE, and LA-3W) was done using the same process as in the prior reports. Binning of data in reaches without pervasive radionuclide contamination (e.g., AC-1, AC-2, and DP-1) relied on distinguishing between coarse and fine facies sediment. In some reaches where human health risk assessments were conducted, the absence of data for some COPCs in some geomorphic units and/or sediment facies required slightly different binning than used for the key radionuclide COPCs. For example, if no data were available for some COPCs in the coarse facies of c2 and c3 units, then these sediments were assumed to contain the same concentrations as the coarse facies of the c1 unit.

The binning used in this report for the human health risk assessments is presented in Tables D-1.3-1 through D-1.3-4 for Acid, DP, Los Alamos, and Pueblo Canyons, respectively. These tables include notes on the rationale for the specific binning and other summary information on the size of sediment deposits in each geomorphic unit and present the fractions of reach area and sediment volume represented by each geomorphic unit in each reach. These fractions are the area-weightings and volume-weightings used in

the human health risk assessment in Section 8.2. The f2 unit is excluded from these fractions because contaminant concentrations are at or near background concentrations in this geomorphic unit, and including f2 would introduce a low bias in estimates of average contaminant concentrations in a reach.

D-1.4 Radionuclide Inventory

This section presents inventory estimates for key radionuclide COPCs in the Los Alamos and Pueblo watershed that have been updated from estimates presented in previous reports (Reneau et al. 1998, 59159; Reneau et al. 1998, 59160; Reneau et al. 1998, 59667; Katzman et al. 1999, 63915). The COPCs included here are five radionuclides that remained following the Tier 2 human health screen in Section 6 and have clearly defined sources at SWMUs or areas of concern ([AOCs] americium-241, cesium-137, plutonium-239,240, strontium-90, and uranium-234. The term inventory refers to the total amount of a COPC in a geomorphic unit, in a reach, or in a canyon. Inventory estimates provide basic information for understanding how contaminants have been redistributed in the environment, and hence for understanding the processes of contaminant transport. Inventory estimates are also useful in considering corrective action alternatives and as input into fate and transport models that predict future contaminant redistribution (e.g., Malmon 2002, 76038; Malmon et al 2002, 82604; Malmon et al. 2003, 82603; Malmon et al. 2004, 85526).

The inventory estimates are restricted to radionuclides because these are the only COPCs with both well-documented sources and pervasive results above background values or detection limits. The other important COPCs in sediments from the perspective of potential human health risk, polycyclic aromatic hydrocarbons (PAHs), have a very high frequency of nondetects that introduces considerable uncertainty into estimates of weighted-average concentrations and inventories. In addition, the spatial pattern of PAH concentrations indicates the primary sources are urbanized areas of the Los Alamos townsite, and not releases from Laboratory SWMUs or AOCs. In general, nonradionuclide COPCs released from SWMUs or AOCs and associated with sediment particles are expected to share the same trends in inventory as the radionuclides discussed here.

The updates to the radionuclide inventory estimates primarily utilize analytical data from reaches that have been investigated since completion of the prior reports. These reaches include LA-2FE and LA-3W in upper Los Alamos Canyon, and ACS, AC-2, AC-3, and the SWMU 0-030(g) drainage in Acid Canyon. The updates also include improved estimates in nonsampled reaches in lower Pueblo Canyon, as discussed below. Estimates of the inventory removed in excavations in reach LA-2E in 2000 (MK 2000, 70741), in reach ACS in 2001 (Reneau et al. 2002, 73660), and in reach DP-2 in 2003 (LANL 2003, 82260) are also included in this section. No other changes are made to the estimated inventories for previously characterized reaches. These updates do not include a detailed characterization of the effects of remobilization and deposition of sediment as a direct result of floods since the Cerro Grande fire because this was out of the scope of this investigation. Inventory estimates presented here utilize the same process that was used in previous reports (Reneau et al. 1998, 59159; Reneau et al. 1998, 59160; Reneau et al. 1998, 59667; Katzman et al. 1999, 63915). In these calculations, estimates of the average concentration of radionuclides in each sediment facies and each geomorphic unit in each reach are combined with estimates of sediment volume, sediment density, and gravel content. Sediment volume is calculated as unit area, as determined from digitized geomorphic maps, multiplied by average sediment thickness. Sediment density utilizes measurements made previously in Los Alamos and Pueblo Canyons (Reneau et al. 1998, 59159, Appendix B-4.0). Gravel content, as determined from particle size analyses, is used to adjust the effective volume of each unit because of the predominant association of contaminants with fine-grained particles (clay, silt, and sand).

D-1.4.1 Plutonium-239,240 Inventory in Acid and Pueblo Canyons

Tables D-1.4-1 to D-1.4-5 present detailed estimates of the inventories of plutonium-239,240 in ACS, AC-2, AC-3, and the SWMU 0-030(g) drainage, along with supporting data that were used in these calculations. Two tables (Tables D-1.4-1 and D-1.4-2) are presented for reach ACS, one pre-dating and one post-dating the interim action (IA) in 2001 (Reneau et al. 2002, 73660). In the ACS tables, inventory estimates are included for pre-1943 sediment deposits because samples from these deposits consistently showed above-background levels of plutonium-239,240, although concentrations in these deposits were much less than in overlying post-1942 sediment. No sediment facies are indicated for the pre-1943 sediments. The table for AC-2 (Table D-1.4-3) includes two separate mapping areas, and an average of these areas was used to estimate the inventory in the intervening nonmapped portion of Acid Canyon. Tables D-1.4-6 and D-1.4-7 present revised estimates of the plutonium-239,240 inventory in nonsampled parts of reaches P-3 and P-4 in lower Pueblo Canyon. These calculations assume the same plutonium-239,240 concentrations and the same sediment thicknesses as in the equivalent geomorphic units in adjoining reaches and utilize areas obtained from geomorphic maps of these nonsampled areas. Previous estimates (Reneau et al. 1998, 59159, Table 4.2-1, pp. 4-9 to 4-10) used a simpler extrapolation between sampled reaches without incorporating varying unit areas. Table D-1.4-8 presents a summary of the inventory for all reaches in Acid and Pueblo Canyons downstream from the outfalls into the South Fork of Acid Canyon and the SWMU 0-030(g) drainage prior to the IA. These tables present the basis for the inventory estimates that were included in Reneau et al. (2003, 79271), with the exception of revisions to the SWMU 0-030(g) and AC-2 inventories completed since that report was finalized. An estimated 83% (149 mCi) of the ACS plutonium-239,240 inventory was removed in the IA in 2001, constituting an estimated 14% of the total inventory in Acid and Pueblo Canyons prior to the IA (1075 mCi).

D-1.4.2 Key Radionuclide Inventory in DP and Upper Los Alamos Canyons

Tables D-1.4-9 and D-1.4-10 present detailed estimates of the inventory of americium-241, cesium-137, strontium-90, and plutonium-239,240 in LA-2FE and LA-3W, along with the underlying data used in these calculations. Table D-1.4-11 presents estimates of the inventory removed during remediation activities in LA-2E in 2000 (MK 2000, 70741) and in DP-2 in 2003 (LANL 2003, 82260). Table D-1.4-12 combines these estimates with previous estimates for upper Los Alamos and DP Canyons (Reneau et al. 1998, 59160; Katzman et al. 1999, 63915) to provide revised estimates of the inventory of key radionuclides in the Los Alamos Canyon watershed upcanyon from Pueblo Canyon.

Because of the relatively short half-lives of cesium-137 and strontium-90 (30.1 and 28.8 years, respectively; Parrington et al. 1996, 58682), the estimates of average concentration and inventory in the different reaches were adjusted for radioactive decay to provide more internally consistent estimates, removing the effects of this decay. The year 1997 was chosen for this adjustment because the largest number of upper Los Alamos Canyon samples were collected in 1997, and these results formed the basis for the first cesium-137 inventory estimates in the watershed (Reneau et al. 1998, 59160). Adjustment to 1997 also follows the convention used in prior contaminant transport modeling in this canyon (Malmon 2002, 76038; Malmon et al. 2004, 85526). The inventory estimates for LA-2FE and LA-3W were based on samples collected in 2001, and the adjustment for radioactive decay since 1997 increased the calculated LA-2FE and LA-3W inventories by a factor of 1.096 for cesium-137 and by a factor of 1.101 for strontium-90. Most DP Canyon samples were collected in 1998, and an adjustment for radioactive decay since 1997 increased the prior DP Canyon estimates (Katzman et al. 1999, 63915) by a factor of 1.023 for cesium-137 and by a factor of 1.024 for strontium-90. Table D-1.4-12 also presents summary estimates of the inventory of these key radionuclides adjusted for radioactive decay to 2004, the year of this report. Radioactive decay between 1997 and 2004 reduced the inventory of cesium-137 by a factor of 0.851 and of strontium-90 by a factor of 0.845 (about 15% lost by decay). In comparison, the sediment

removals in LA-2E and DP-2 included an estimated 4% of the cesium-137 and strontium-90 inventories and an estimated 1% of the americium-241 and plutonium-239,240 inventories.

D-1.5 Summary of Key Radionuclides in Los Alamos and Pueblo Watersheds

Tables D-1.5-1 through D-1.5-5 summarize the variations in concentrations and inventory of key radionuclide COPCs in the Los Alamos and Pueblo watershed. Estimated average concentrations and normalized inventories (units of mCi/km) are presented for americium-241, cesium-137, plutonium-239,240, strontium-90, and uranium-234 for coarse and fine facies in each reach in which they have been identified as COPCs. The average concentrations are volume-weighted values, where the estimated average concentration in a geomorphic unit is weighted by the volume of that unit. Normalized inventories are calculated by dividing the total estimated inventory in a reach by the reach length. These concentrations and inventories are not corrected for radioactive decay. Many of these values have been presented in previous reports (Reneau et al. 1998, 59159; Reneau et al. 1998, 59160; Reneau et al. 1998, 59667; Katzman et al. 1999, 63915). The values in this table, adjusted for radioactive decay as discussed in Section D-1.4.2, are used in the summary figures in Section 7.1.1.1.

D-1.6 Spatial Variations in Average Concentrations for Select Inorganic and Organic COPCs

This section presents information on the average concentrations of inorganic and organic COPCs in sediment in the Los Alamos and Pueblo watershed that are important for assessing potential ecological or human health risk, as identified in Section 6. This information supports the identification of sources for the COPCs and examination of how concentrations change with distance from sources and how they vary with sediment facies. Averages were calculated separately for fine facies sediment samples and coarse facies samples to highlight differences between concentrations in these facies. For simplicity in calculation, averages used in this section and in Sections 7.1.2 and 7.1.3 are not weighted by the volume of sediment in different geomorphic units, as done in previous sections for radionuclides, but instead are straight arithmetic averages of all results from each facies in a reach. This simpler calculation method is appropriate for identifying general spatial trends and sources for COPCs. Upper and lower bounds on average concentrations in this section are calculated by replacing the sample result for nondetects with either the detection limit or zero, respectively, and the mid-point or median of this range is also calculated by substituting one-half of the detection limit for nondetects. For some COPCs and some reaches, considerable uncertainty exists in average concentrations because of elevated detection limits, although for most COPCs and most reaches uncertainties related to nondetects do not obscure the general spatial trends in COPC concentration. If improved estimates of average concentrations were warranted, these estimates could be refined using the more robust nondetect replacement methods employed in Sections 6.3 and 8.2.

Tables D-1.6-1 through D-1.6-4 present average concentrations for inorganic and organic COPCs discussed in Sections 7.1.2 and 7.1.3. Figure D-1.6-1 shows spatial variations in these average concentrations for PAHs, which supplement plots for PAHs that are presented in Section 7.1.3.1.

D-1.7 Fire Effects on Inorganic and Radionuclide COPC Concentrations

Figure D-1.7-1 presents box plots comparing sample results for inorganic and radionuclide COPCs in ash and fire-affected baseline sediment samples to soil and sediment background sample results. The background data are from the data set used by Ryti et al. (1998, 59730), and the ash and fire-affected baseline data are included in Appendix C of this investigation report. These plots indicate which COPCs are elevated in ash and baseline sediment samples relative to pre-fire soil and sediment samples. The boxes indicate the interquartile range of the sample results, with the upper and lower ends defined by the 75th and 25th percentiles, respectively. The line within each box is the 50th percentile of the data or the median. Lines

above and below the boxes represent the 10th and 90th percentiles of the data. For inorganic chemicals, detected sample results are shown by filled circles and nondetect sample results by open circles. For radionuclides, detect status is not indicated because radionuclide sample results are not censored.

D-2.0 WATER

This section presents plots showing sample results for all COPCs identified in surface water, springs, and alluvial groundwater in the Los Alamos and Pueblo watershed, versus distance from the Rio Grande (Figures D-2.0-1 to D-2.0-42). These plots help to identify sources for the COPCs, show how concentrations change with distance from sources, and support the physical system conceptual model in Section 7 and the risk assessments in Sections 6 and 8. Different colors in these plots are used for each subwatershed: Acid, DP, Pueblo, upper Los Alamos, and lower Los Alamos Canyons. For inorganic and organic chemicals, nondetected sample results are shown by an open circle, and the detected sample results are represented by a filled circle. For radionuclides, detect status is not indicated because radionuclide sample results are not censored. Each analyte has four plots, one for each combination of field preparation (filtered and unfiltered) and media (surface water and alluvial groundwater; samples from springs are included with the surface water results). Some plots include only nondetect values because some analytes were not detected in all four of these combinations (e.g., they were detected in unfiltered samples but not filtered samples).

D-3.0 REFERENCES

The following list includes all documents cited in this report. Parenthetical information following each reference provides the author, publication date, and ER ID number. This information is also included in text citations. ER ID numbers are assigned by the RRES-RS Records Processing Facility (RPF) and are used to locate the document at the RPF and, where applicable, in the RRES-RS project reference set titled "Reference Set for Canyons Investigations."

Copies of the reference sets are maintained at the NMED Hazardous Waste Bureau; the DOE Los Alamos Site Office; US Environmental Protection Agency, Region 6; and RRES-RS project. The sets were developed to ensure that the administrative authority has all material needed to review this document, and they are updated periodically as needed. Documents previously submitted to the administrative authority are not included.

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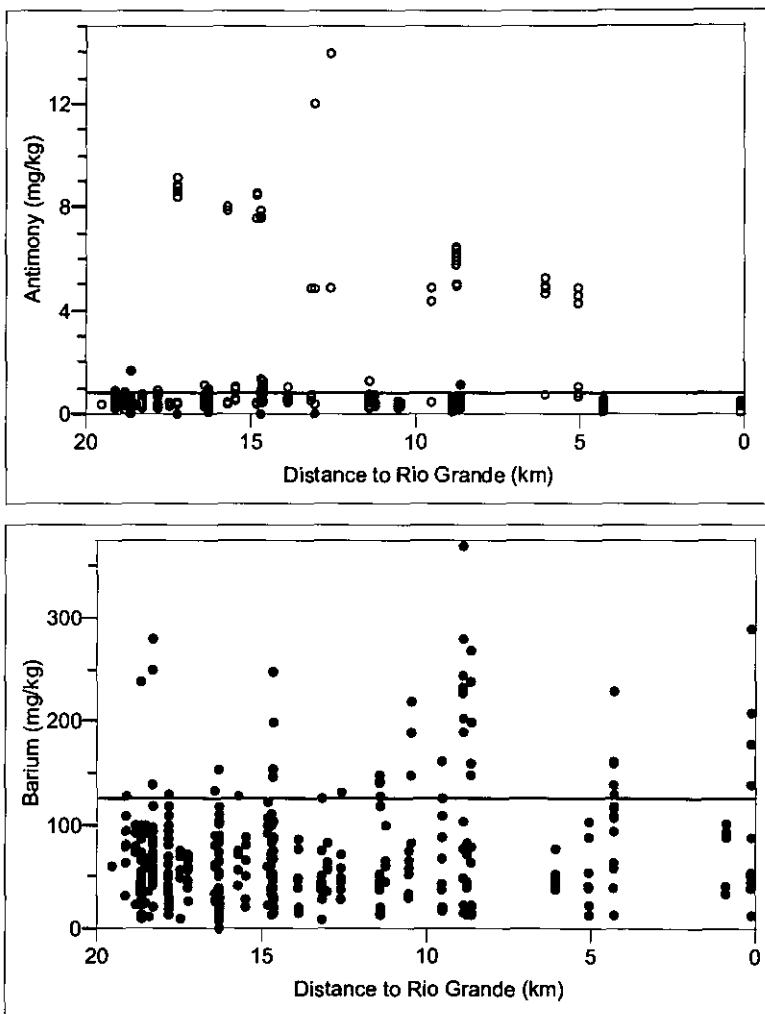
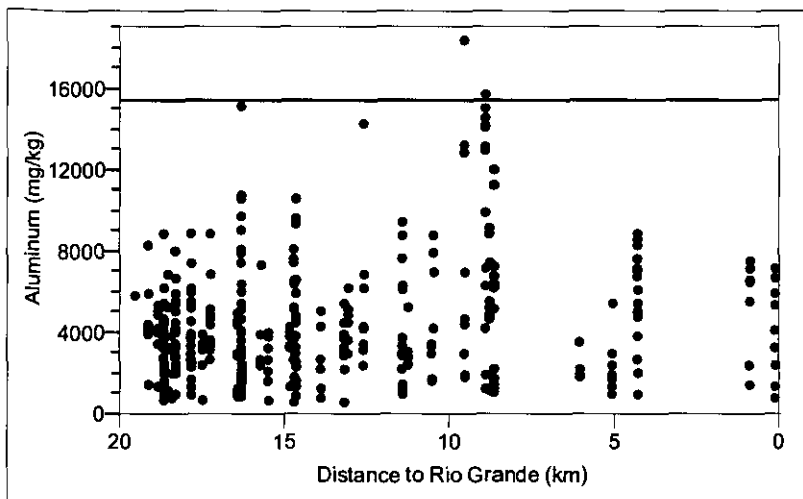
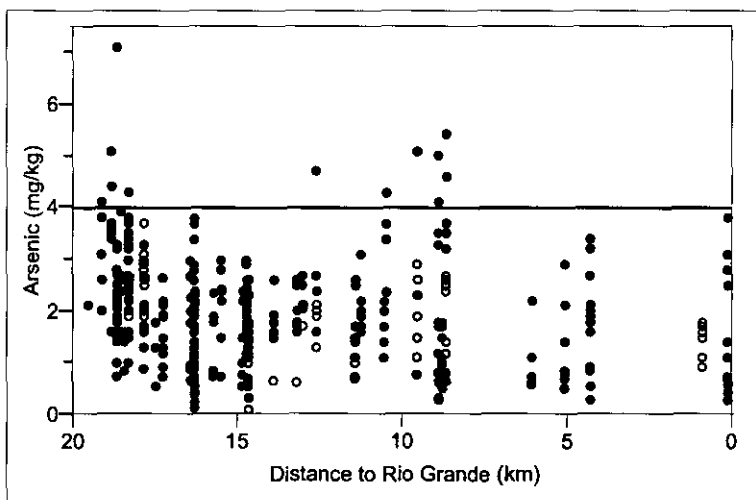
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Canyon		Detect Status	
● Acid	● Los Alamos	● Detect	○ Nondetect
● DP	● Pueblo		

Note: Horizontal line indicates BV.

Figure D-1.1-1. Plots of sample result versus distance from the Rio Grande for all COPCs identified in sediment in the Los Alamos and Pueblo watershed

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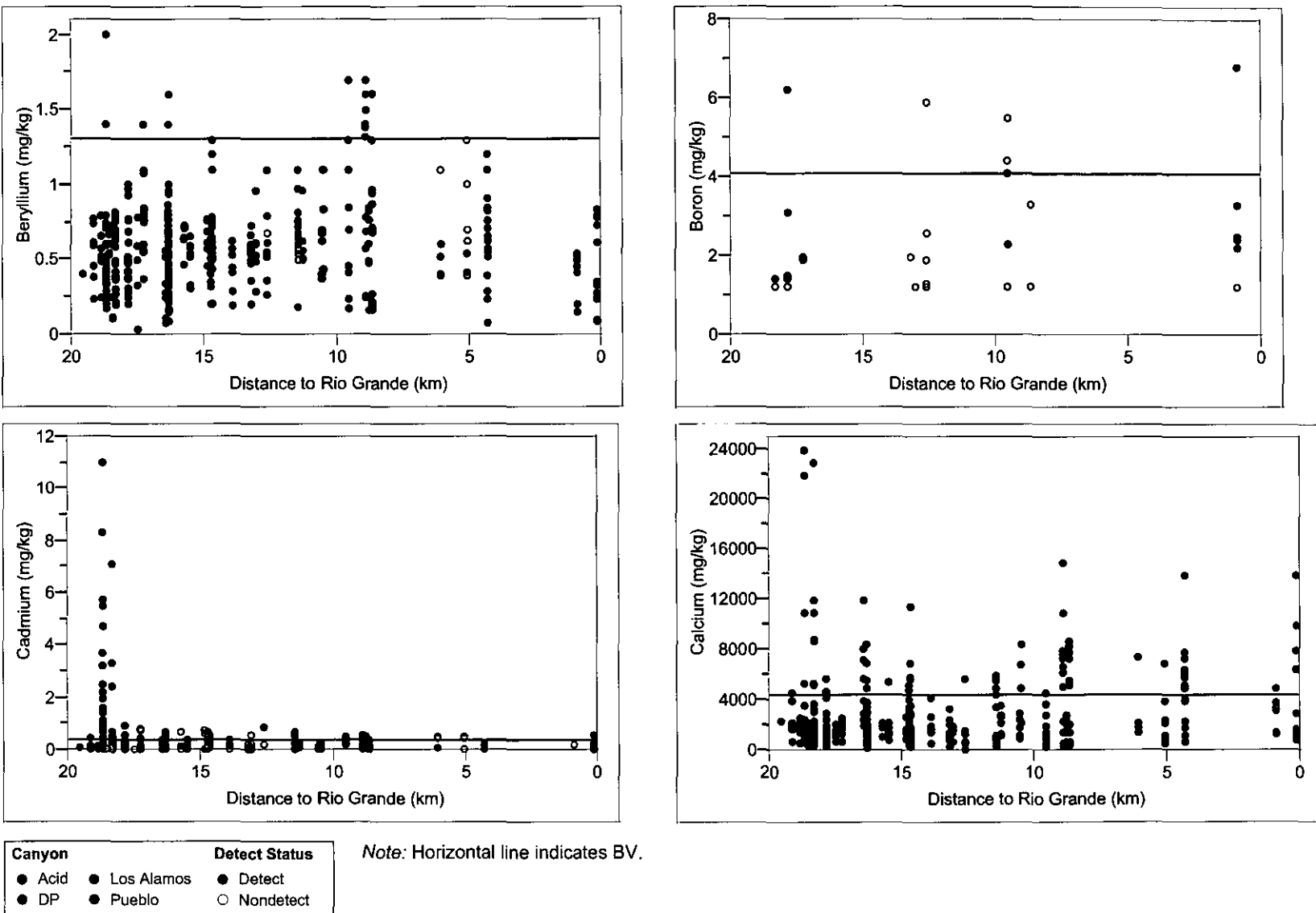
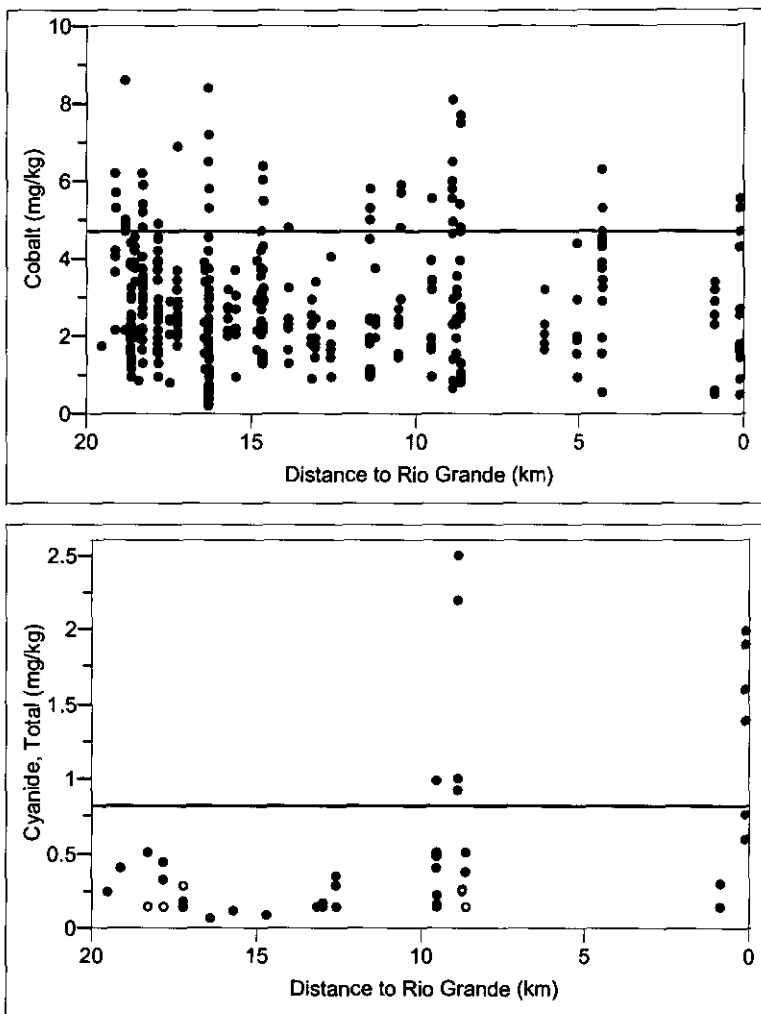
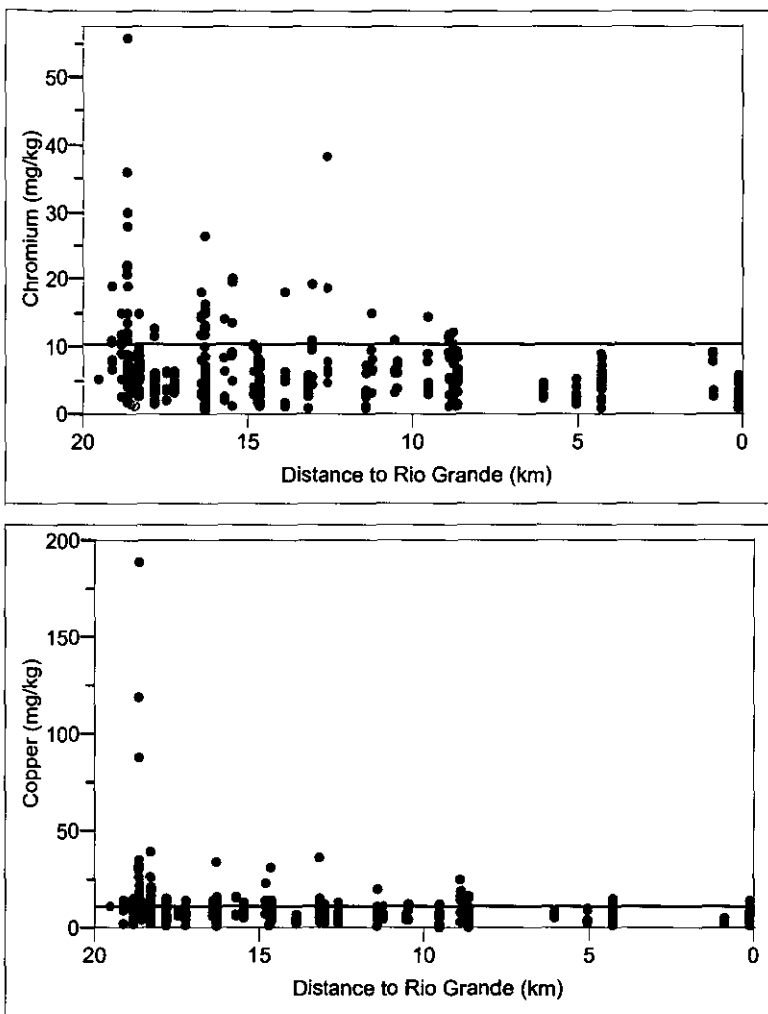


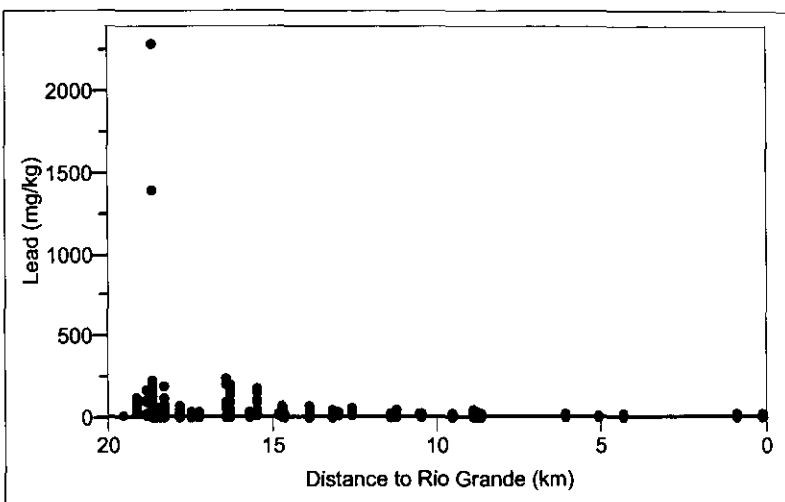
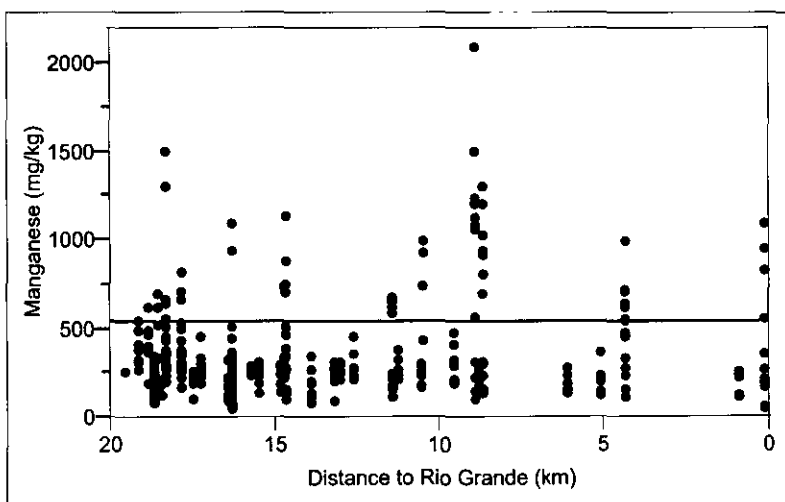
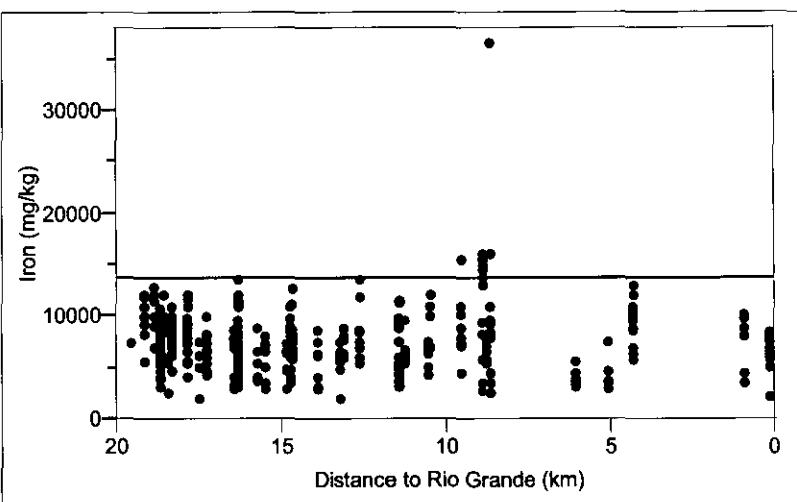
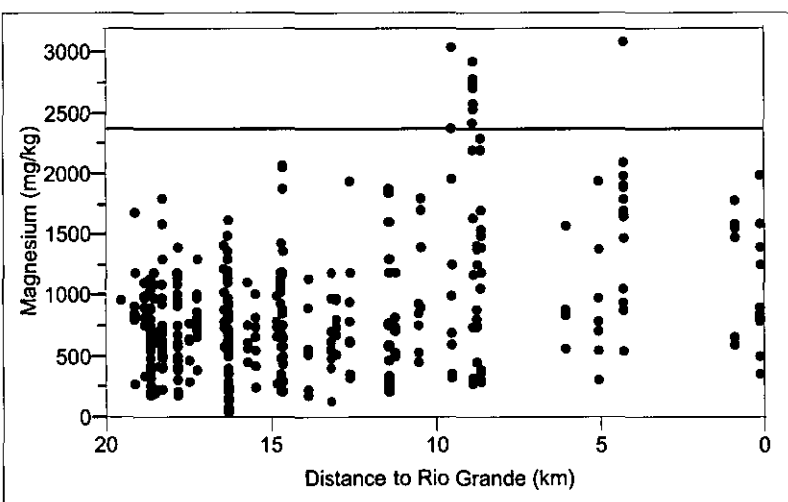
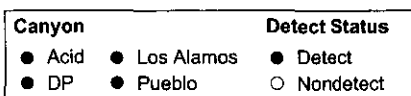
Figure D-1.1-1 (continued). Plots of sample result versus distance from the Rio Grande for all COPCs identified in sediment in the Los Alamos and Pueblo watershed



Canyon		Detect Status
● Acid	● Los Alamos	● Detect
● DP	● Pueblo	○ Nondetect

Note: Horizontal line indicates BV.

Figure D-1.1-1 (continued). Plots of sample result versus distance from the Rio Grande for all COPCs identified in sediment in the Los Alamos and Pueblo watershed



Note: Horizontal line indicates BV.

Figure D-1.1-1 (continued). Plots of sample result versus distance from the Rio Grande for all COPCs identified in sediment in the Los Alamos and Pueblo watershed

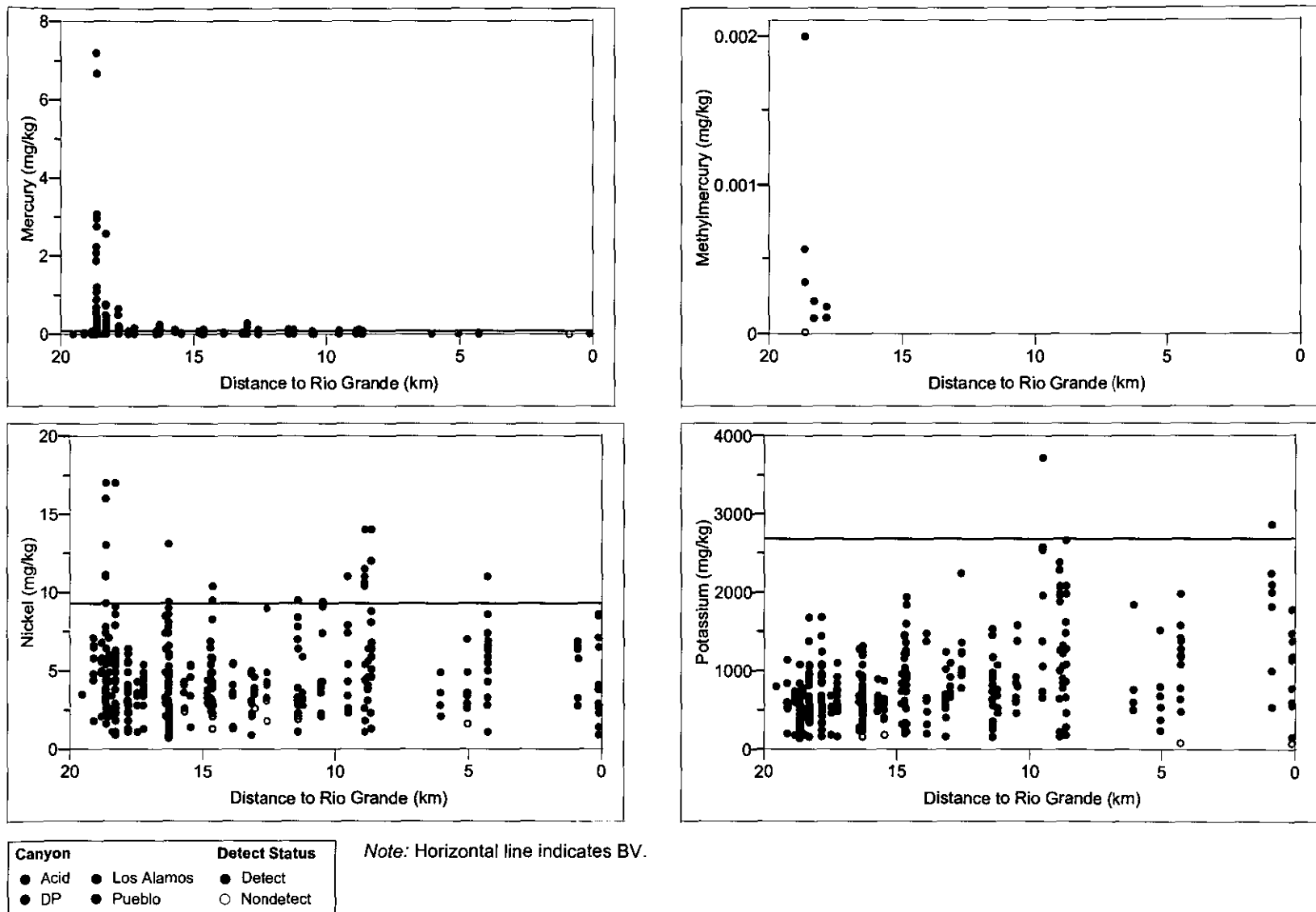
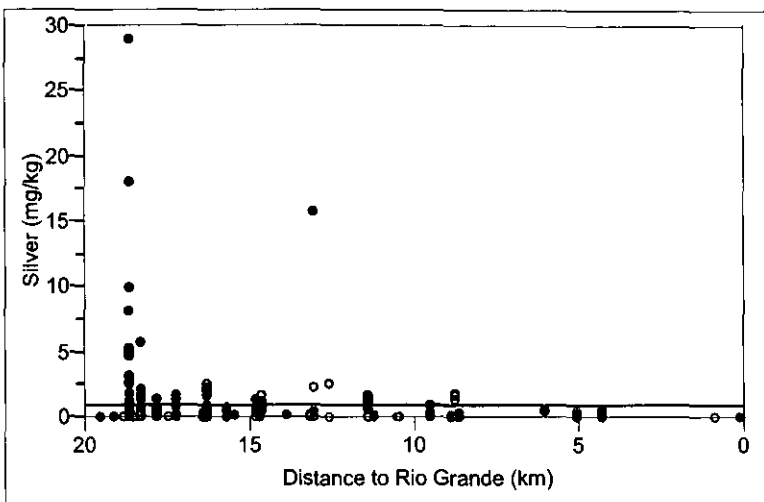
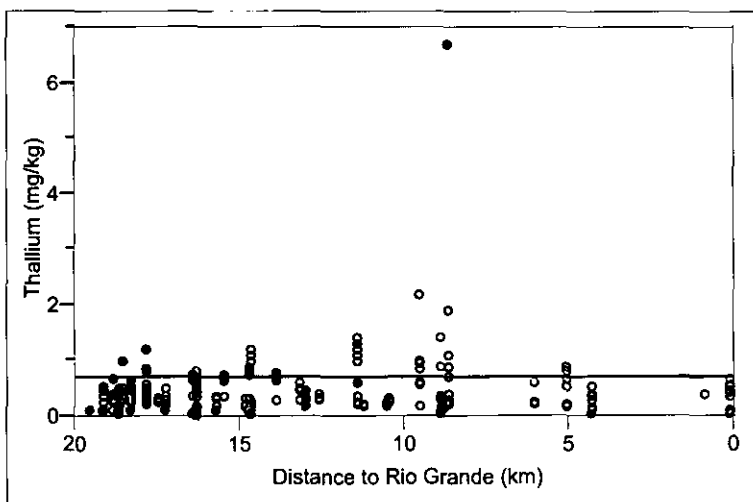
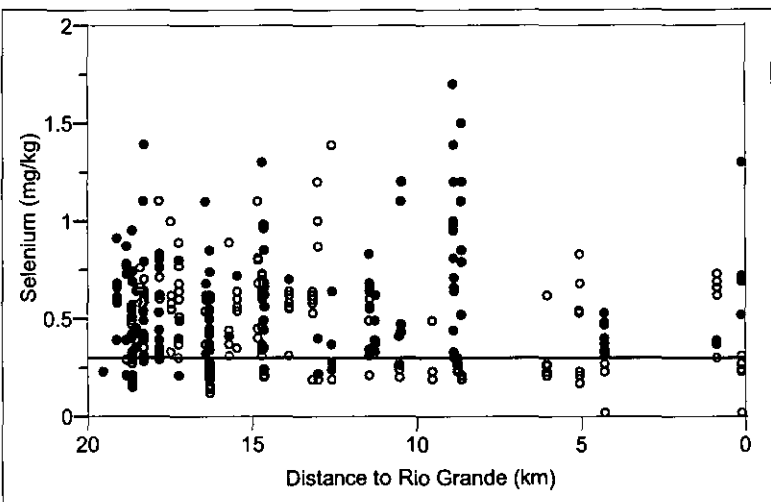
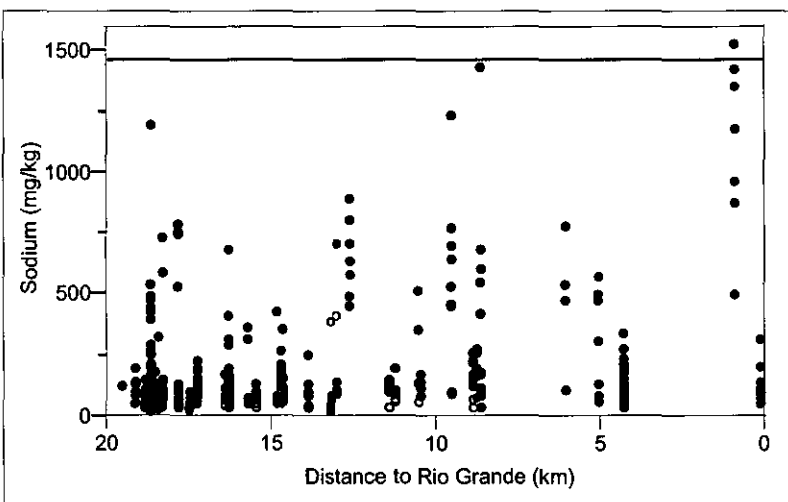
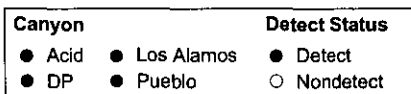


Figure D-1.1-1 (continued). Plots of sample result versus distance from the Rio Grande for all COPCs identified in sediment in the Los Alamos and Pueblo watershed

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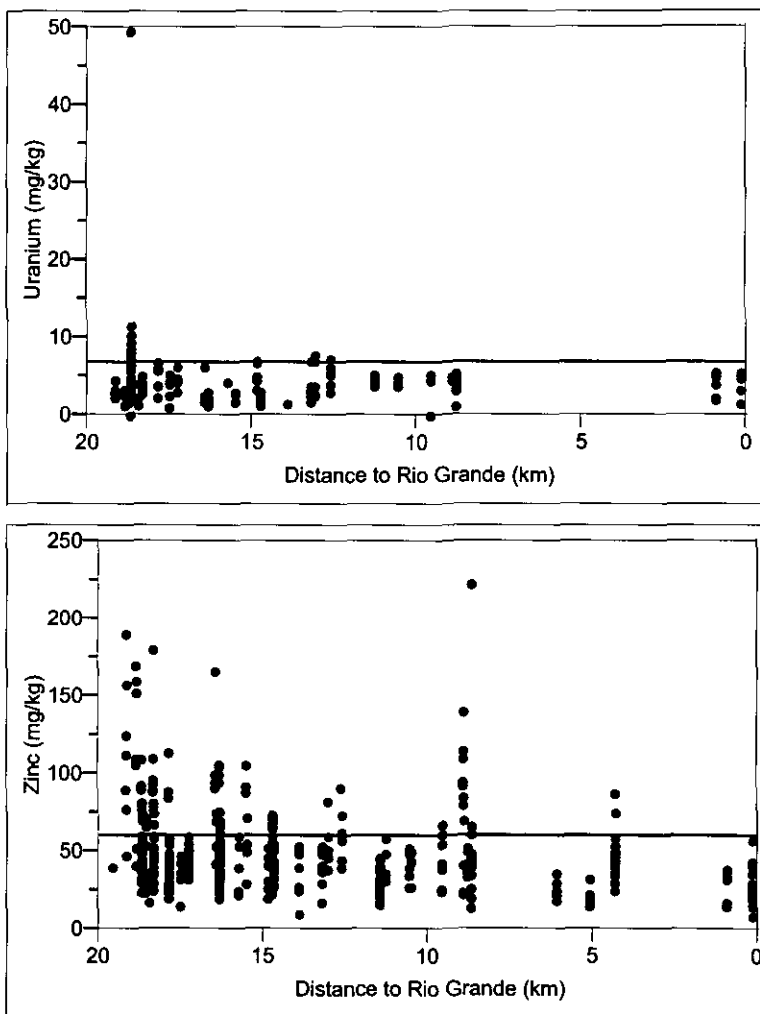
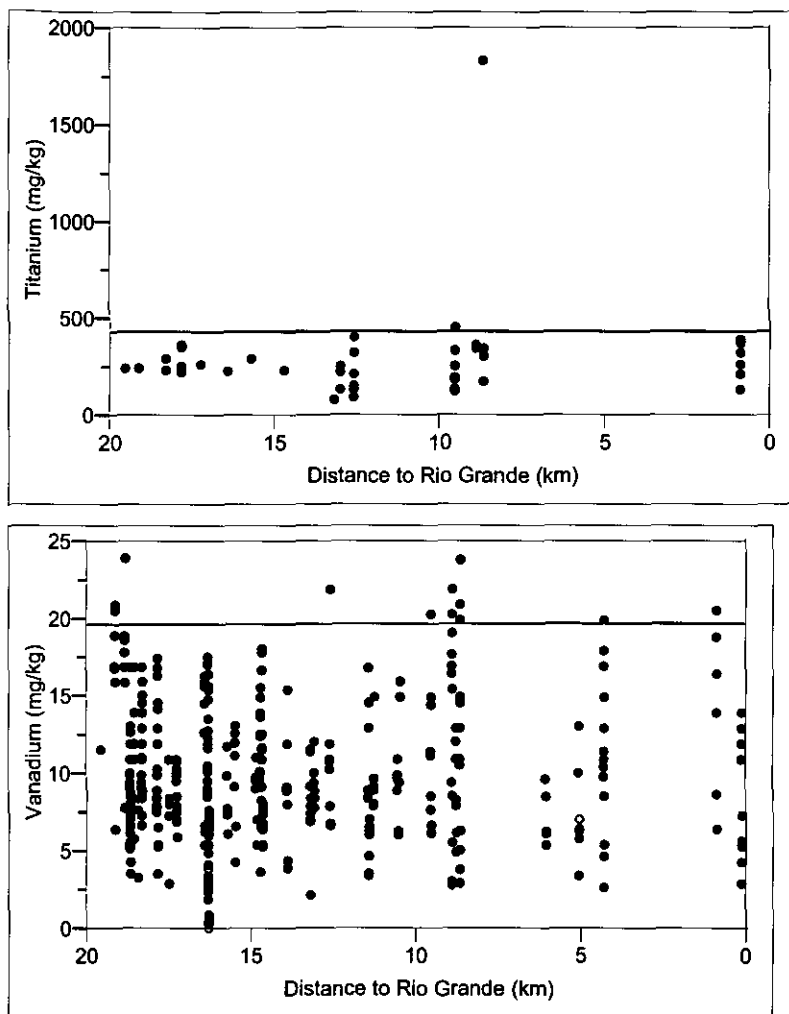
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Note: Horizontal line indicates BV.

Figure D-1.1-1 (continued). Plots of sample result versus distance from the Rio Grande for all COPCs identified in sediment in the Los Alamos and Pueblo watershed



Canyon		Detect Status
● Acid	● Los Alamos	● Detect
● DP	● Pueblo	○ Nondetect

Note: Horizontal line indicates BV.

Figure D-1.1-1 (continued). Plots of sample result versus distance from the Rio Grande for all COPCs identified in sediment in the Los Alamos and Pueblo watershed

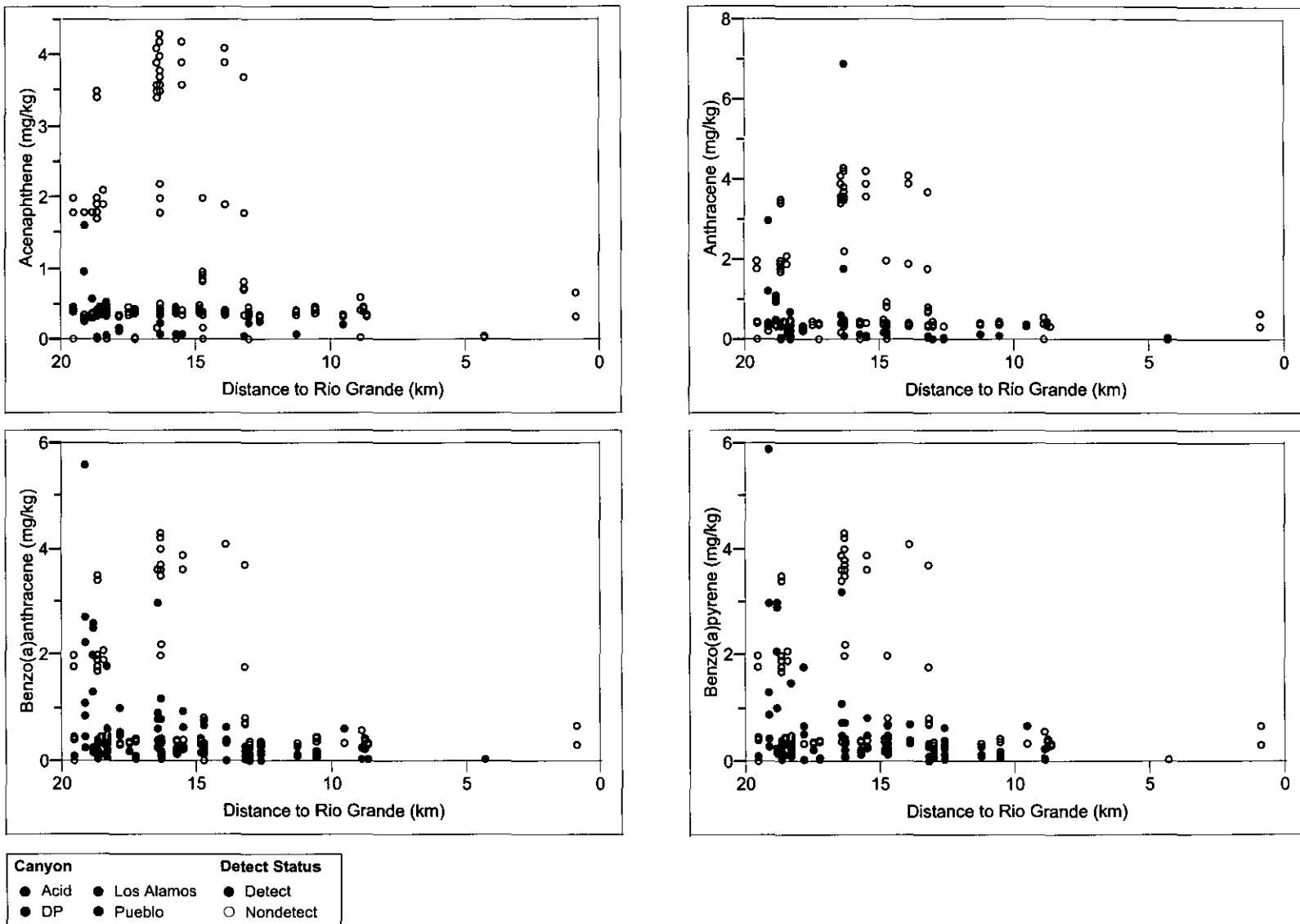


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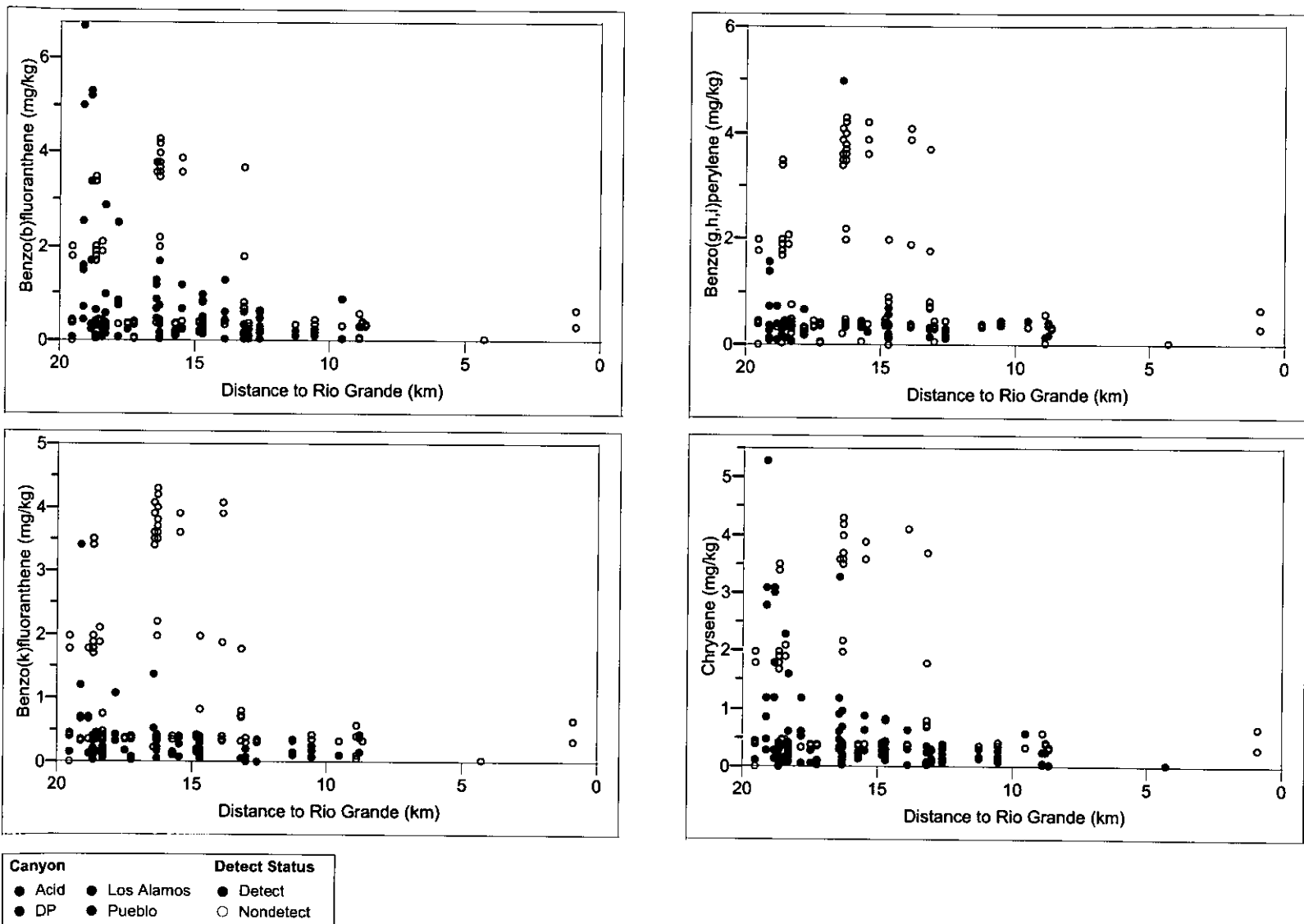


Figure D-1.1-1 (continued). Plots of sample result versus distance from the Rio Grande for all COPCs identified in sediment in the Los Alamos and Pueblo watershed

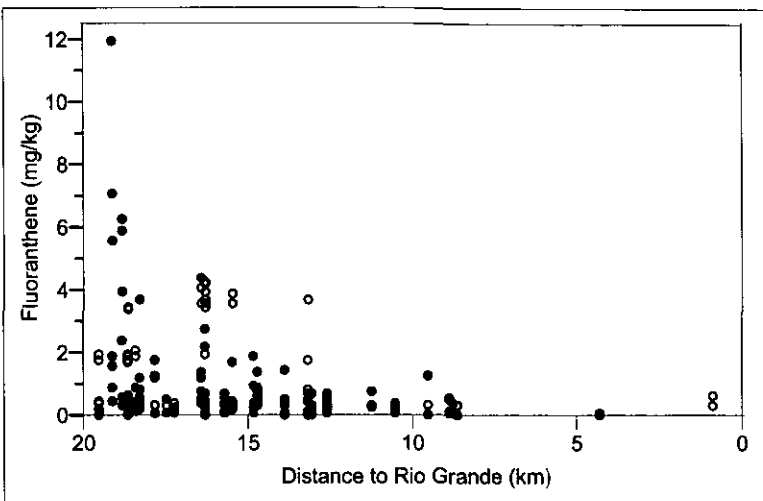
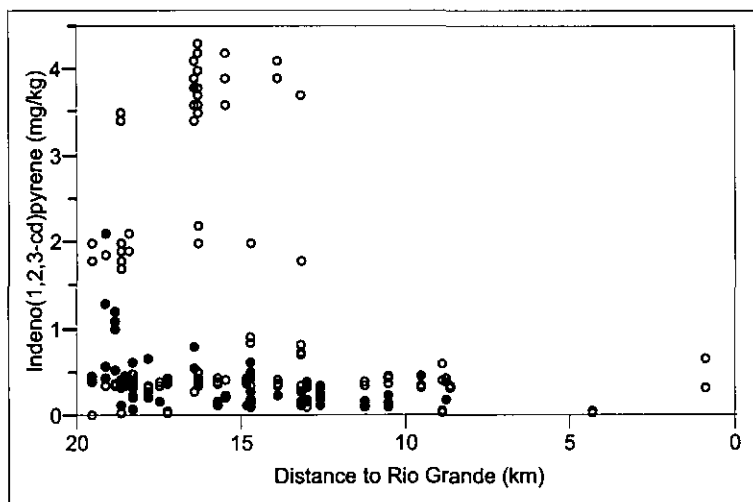
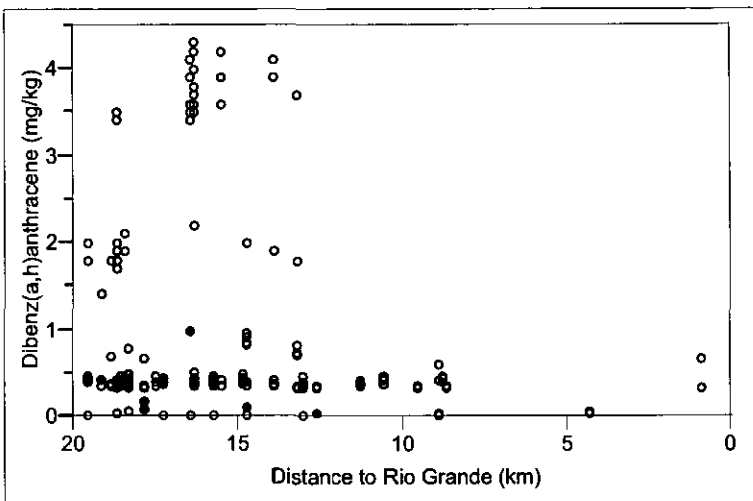
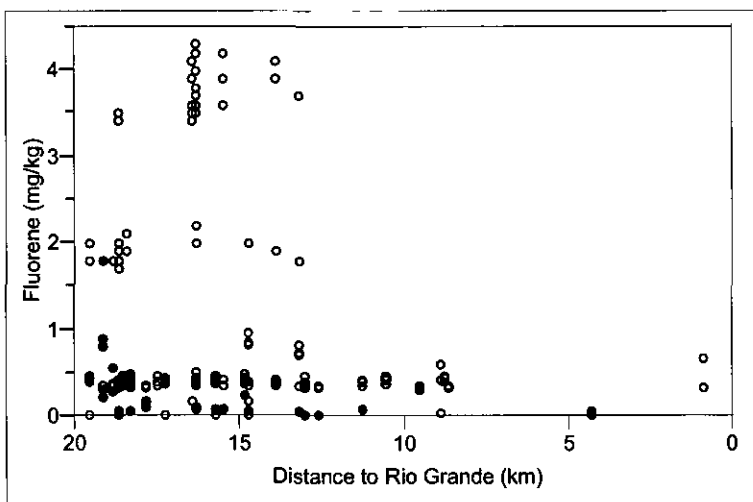
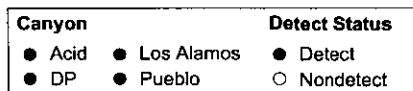


Figure D-1.1-1 (continued). Plots of sample result versus distance from the Rio Grande for all COPCs identified in sediment in the Los Alamos and Pueblo watershed

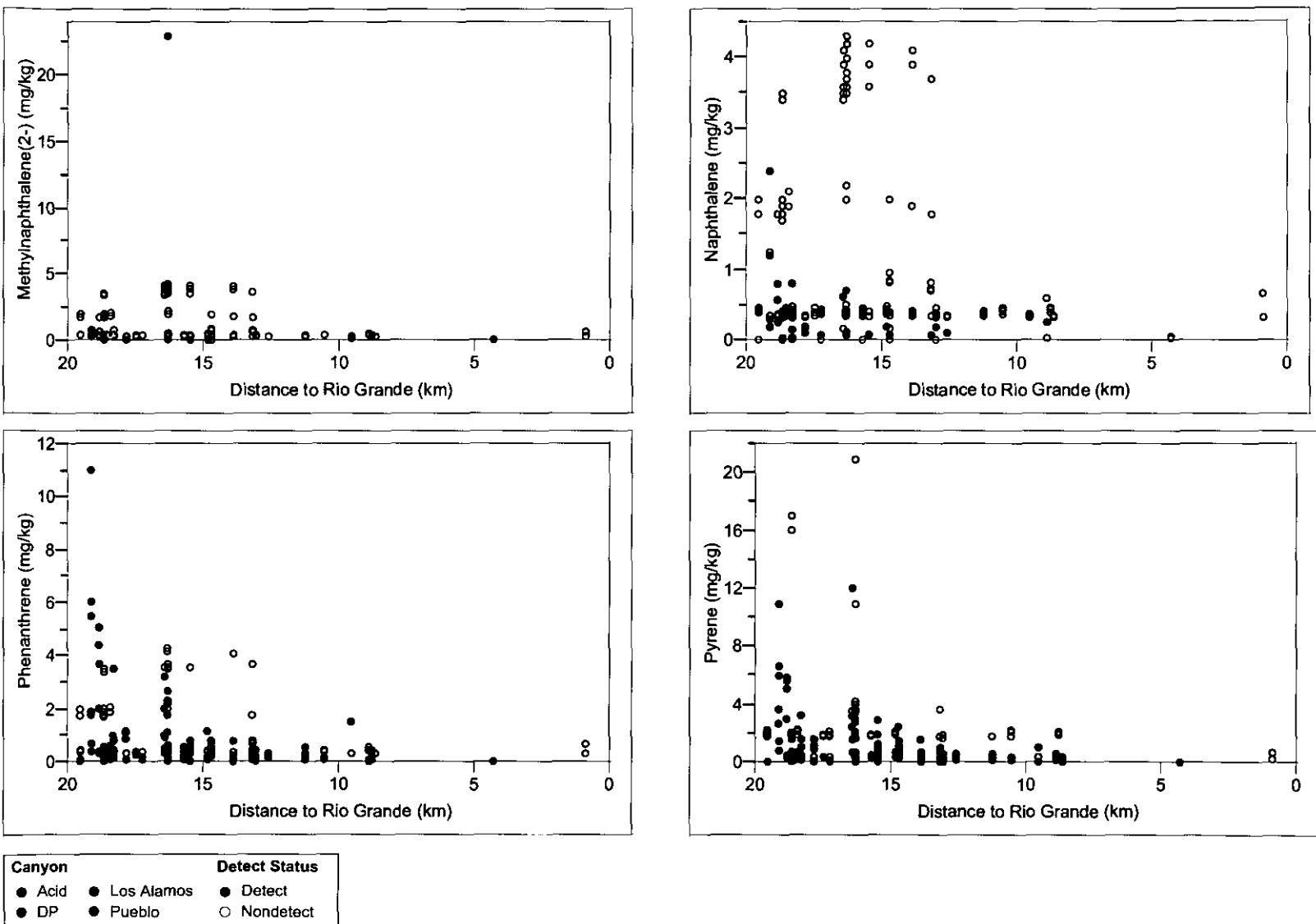


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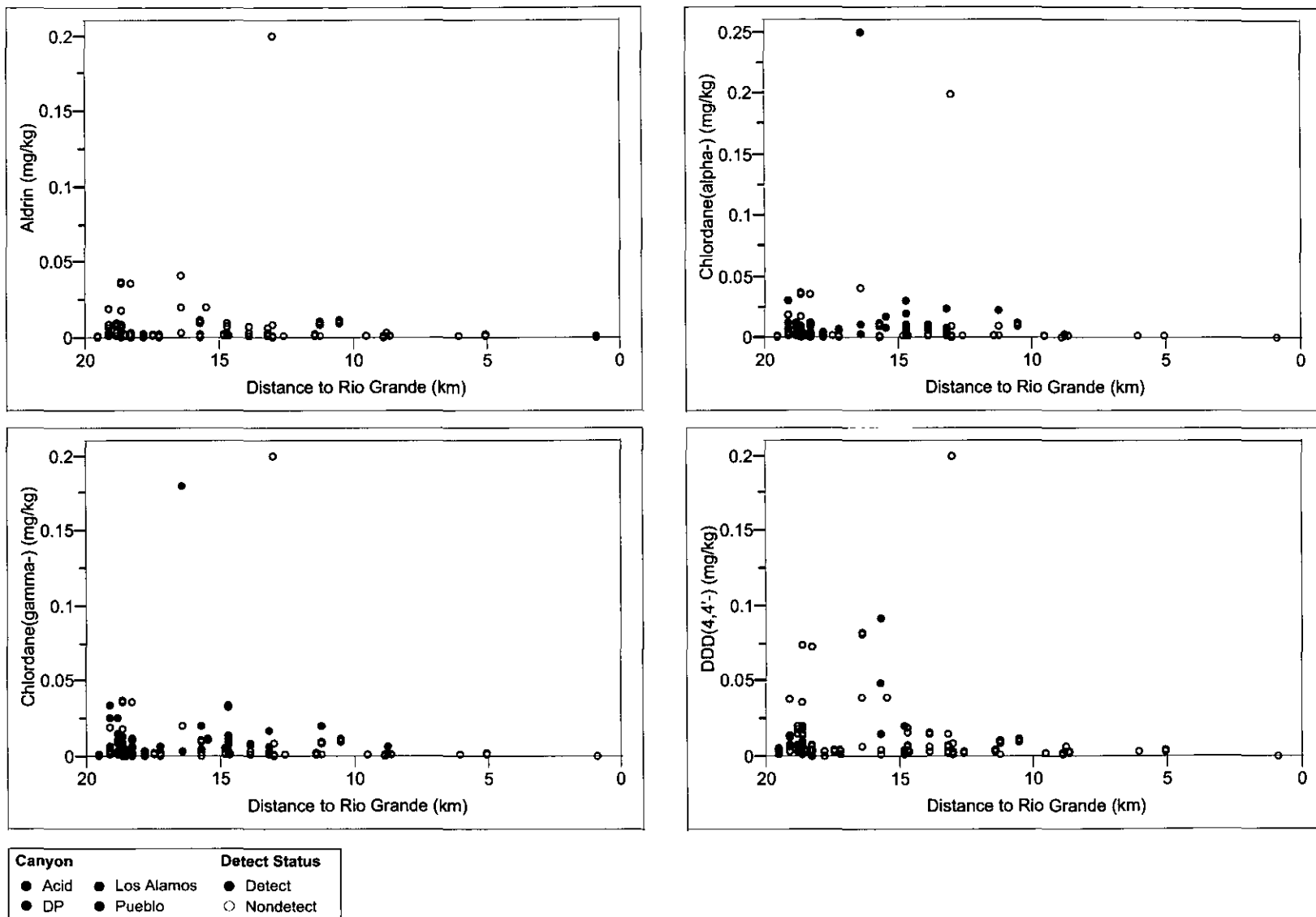


Figure D-1.1-1 (continued). Plots of sample result versus distance from the Rio Grande for all COPCs identified in sediment in the Los Alamos and Pueblo watershed

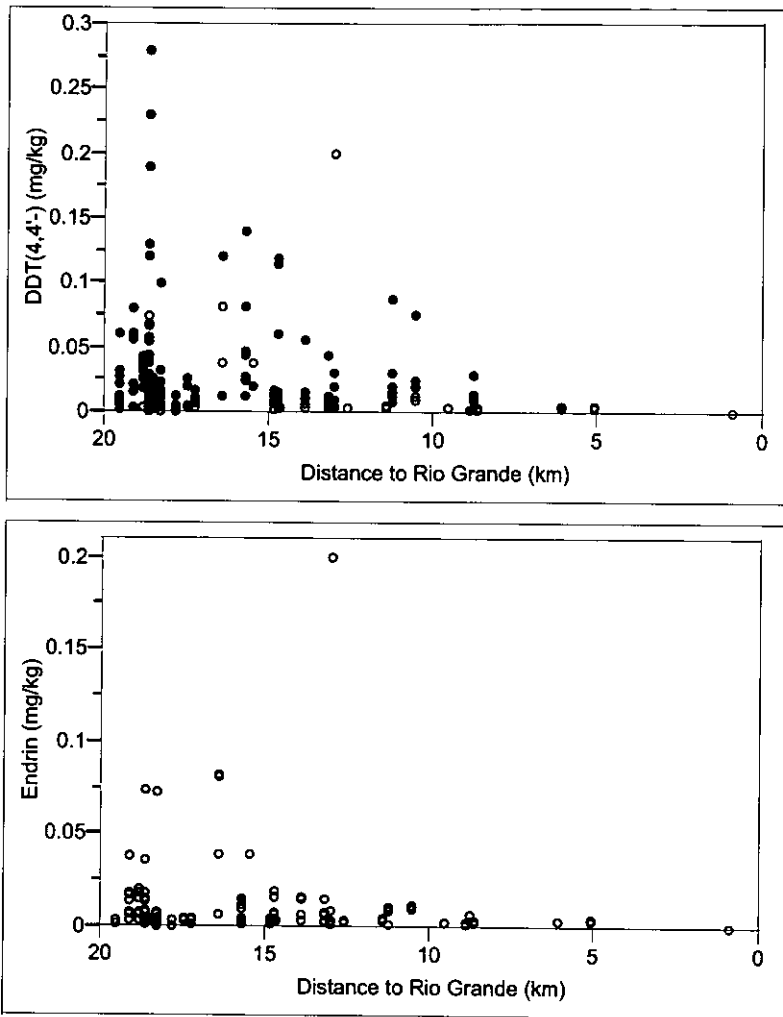
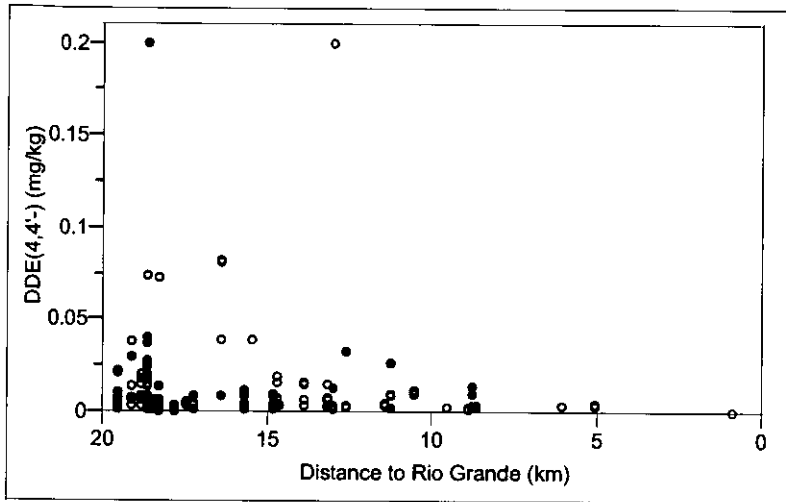
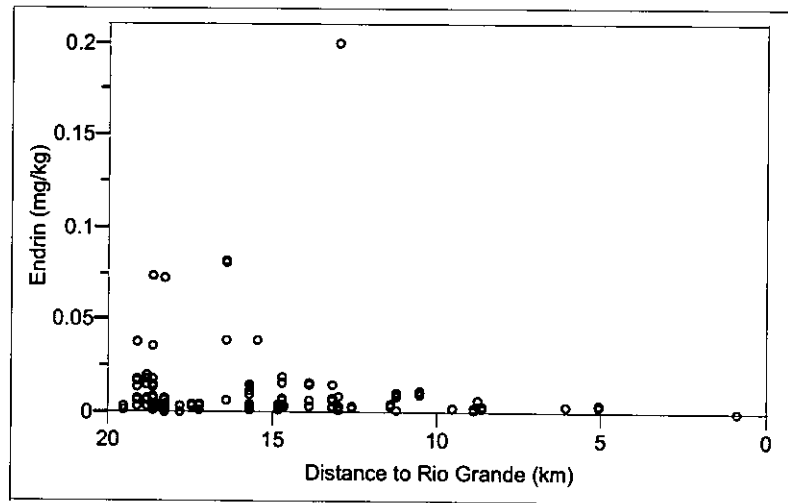
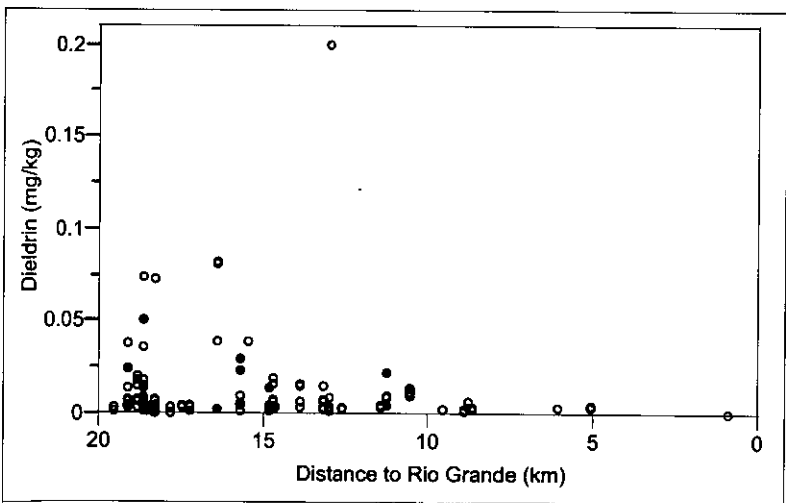
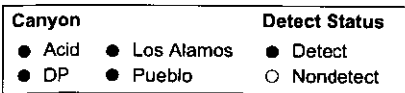


Figure D-1.1-1 (continued). Plots of sample result versus distance from the Rio Grande for all COPCs identified in sediment in the Los Alamos and Pueblo watershed

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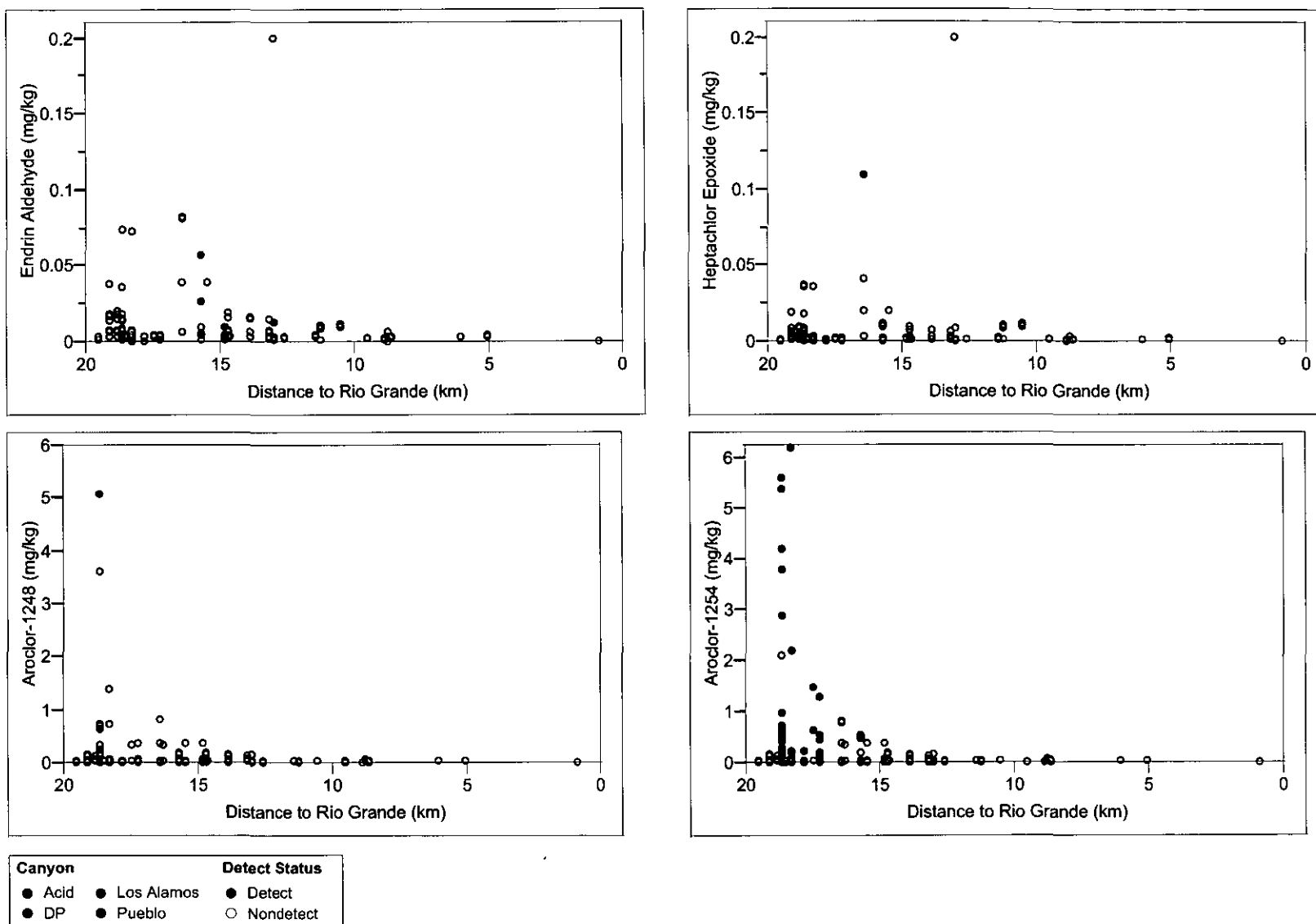


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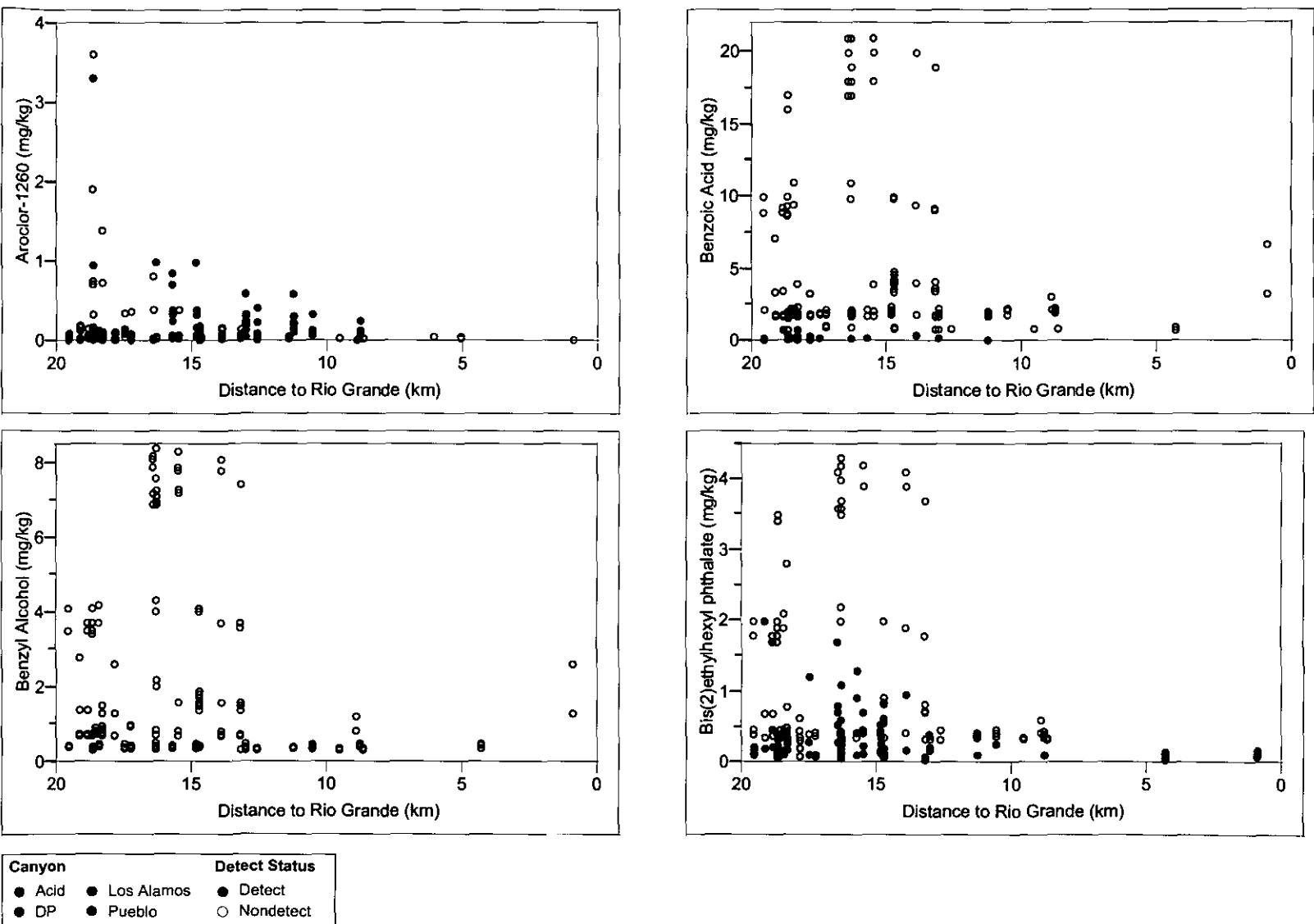


Figure D-1.1-1 (continued). Plots of sample result versus distance from the Rio Grande for all COPCs identified in sediment in the Los Alamos and Pueblo watershed

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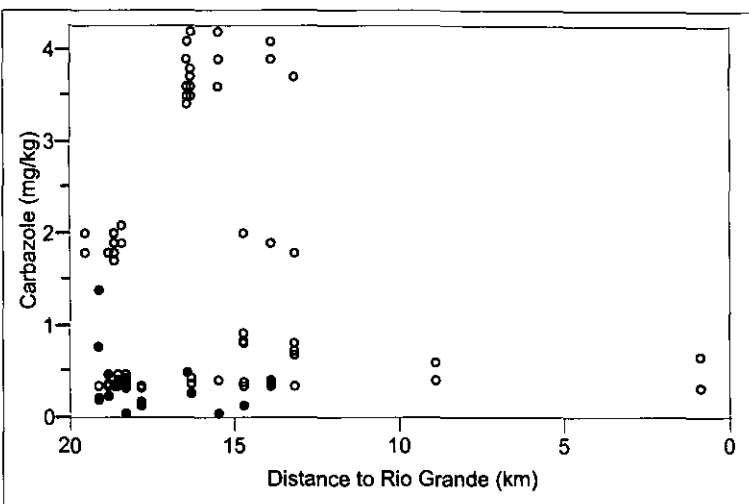
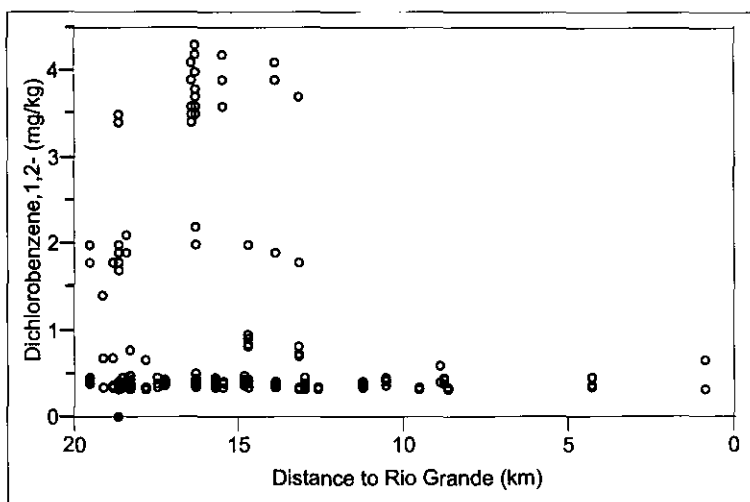
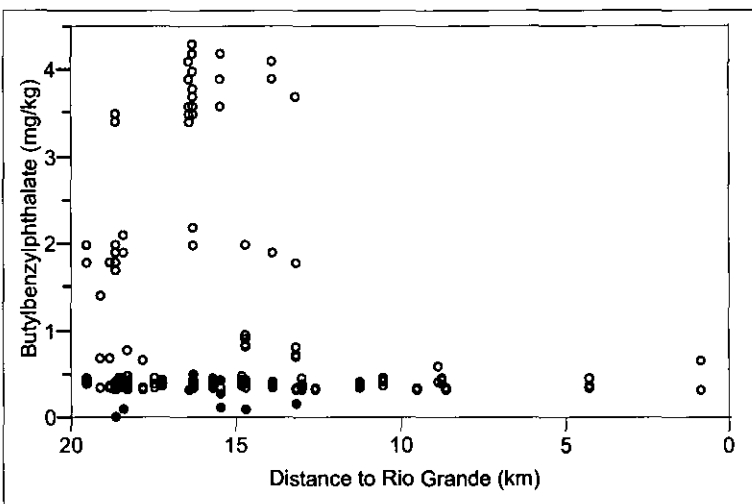
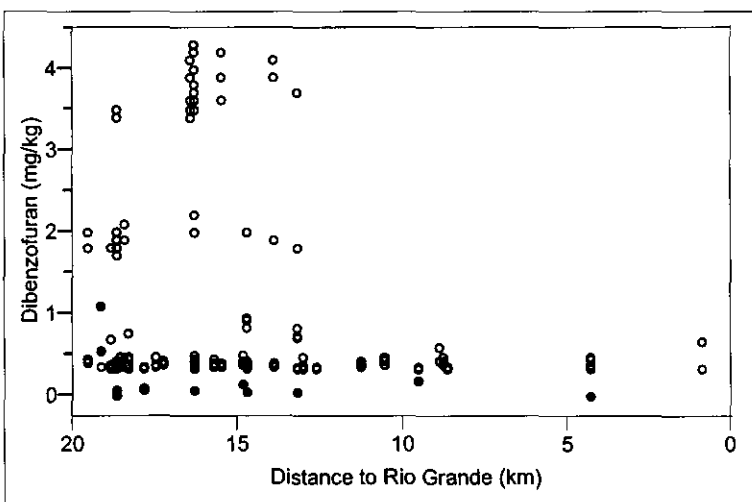
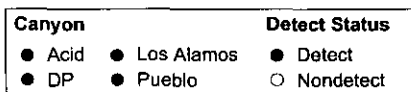


Figure D-1.1-1 (continued). Plots of sample result versus distance from the Rio Grande for all COPCs identified in sediment in the Los Alamos and Pueblo watershed

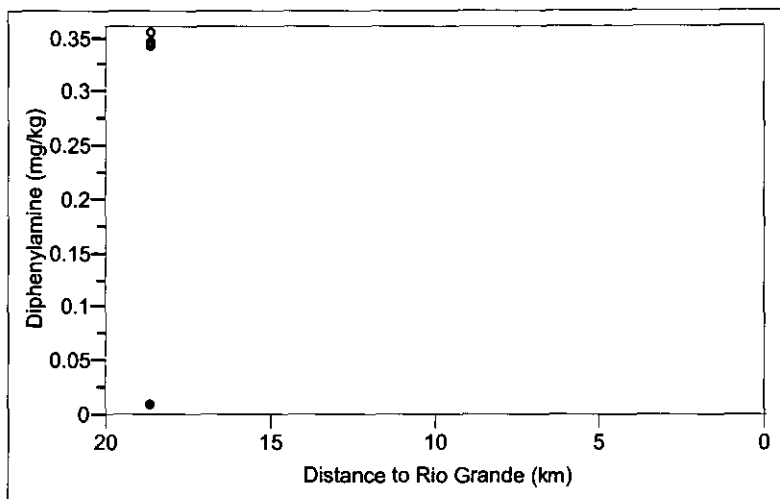
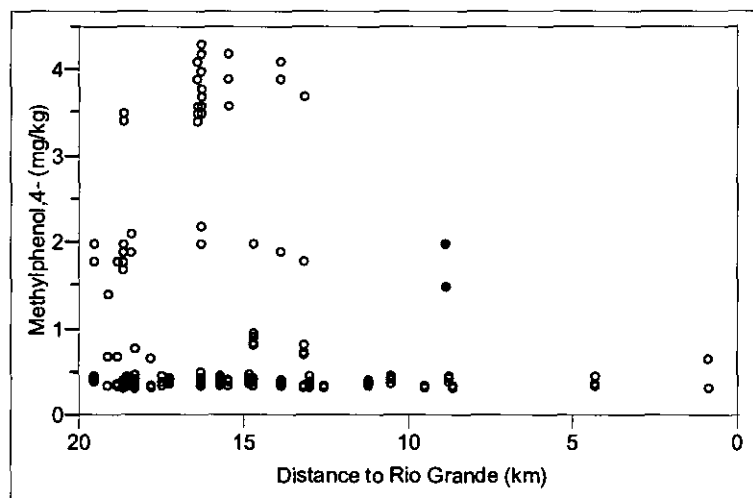
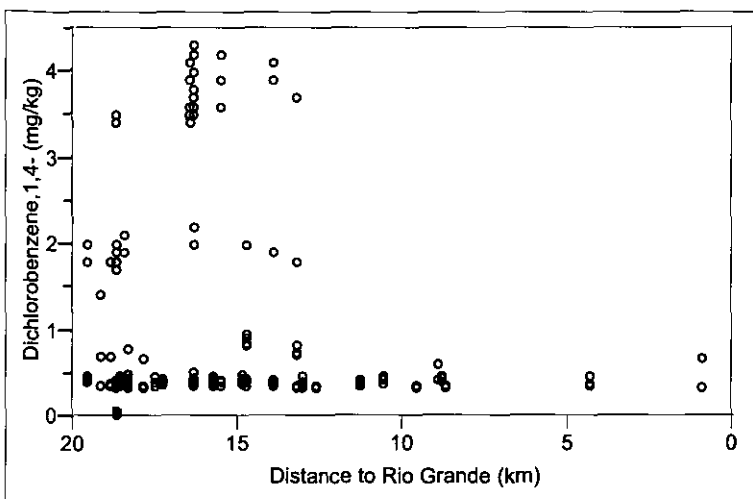
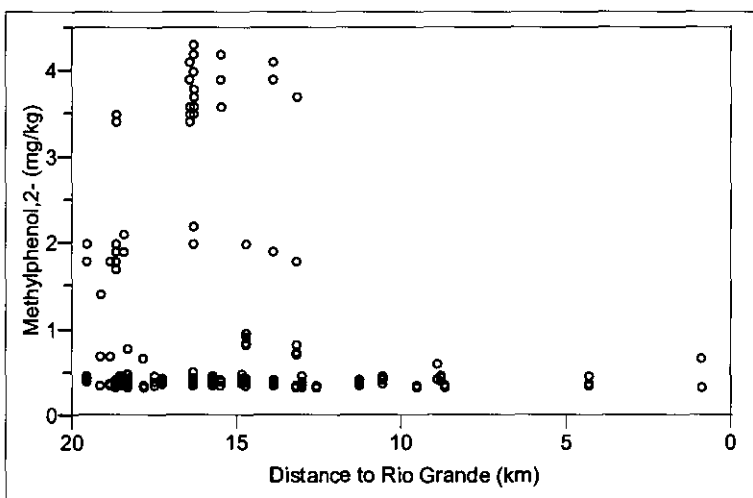
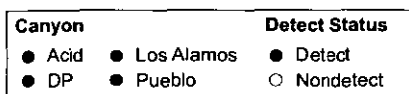


Figure D-1.1-1 (continued). Plots of sample result versus distance from the Rio Grande for all COPCs identified in sediment in the Los Alamos and Pueblo watershed

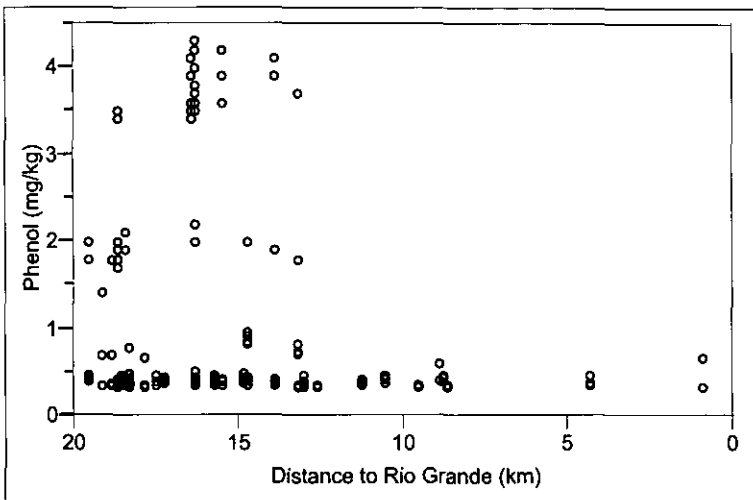
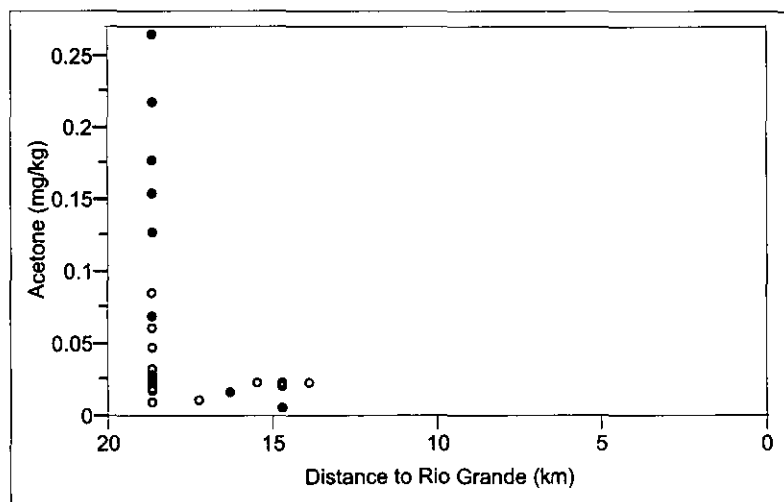
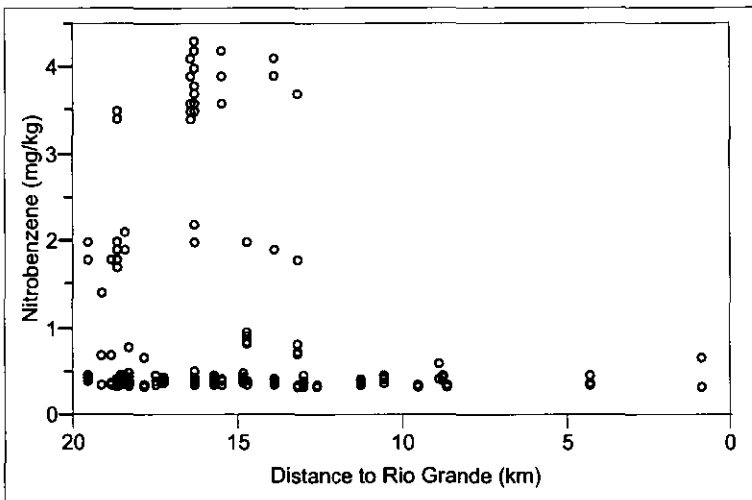
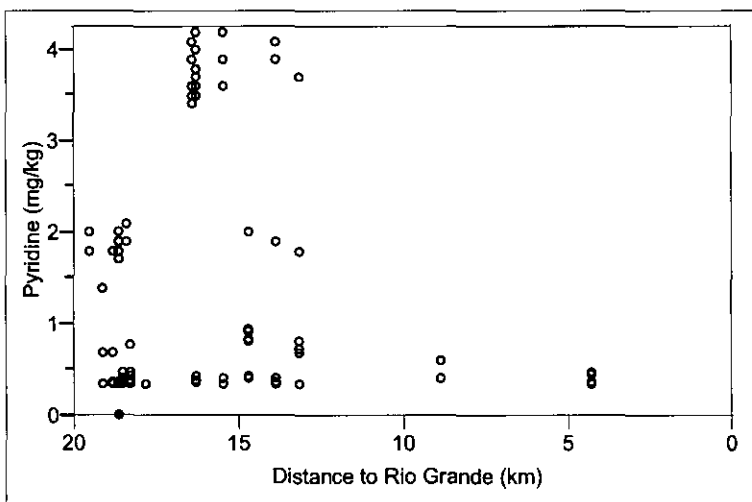
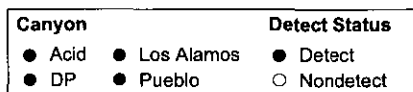


Figure D-1.1-1 (continued). Plots of sample result versus distance from the Rio Grande for all COPCs identified in sediment in the Los Alamos and Pueblo watershed

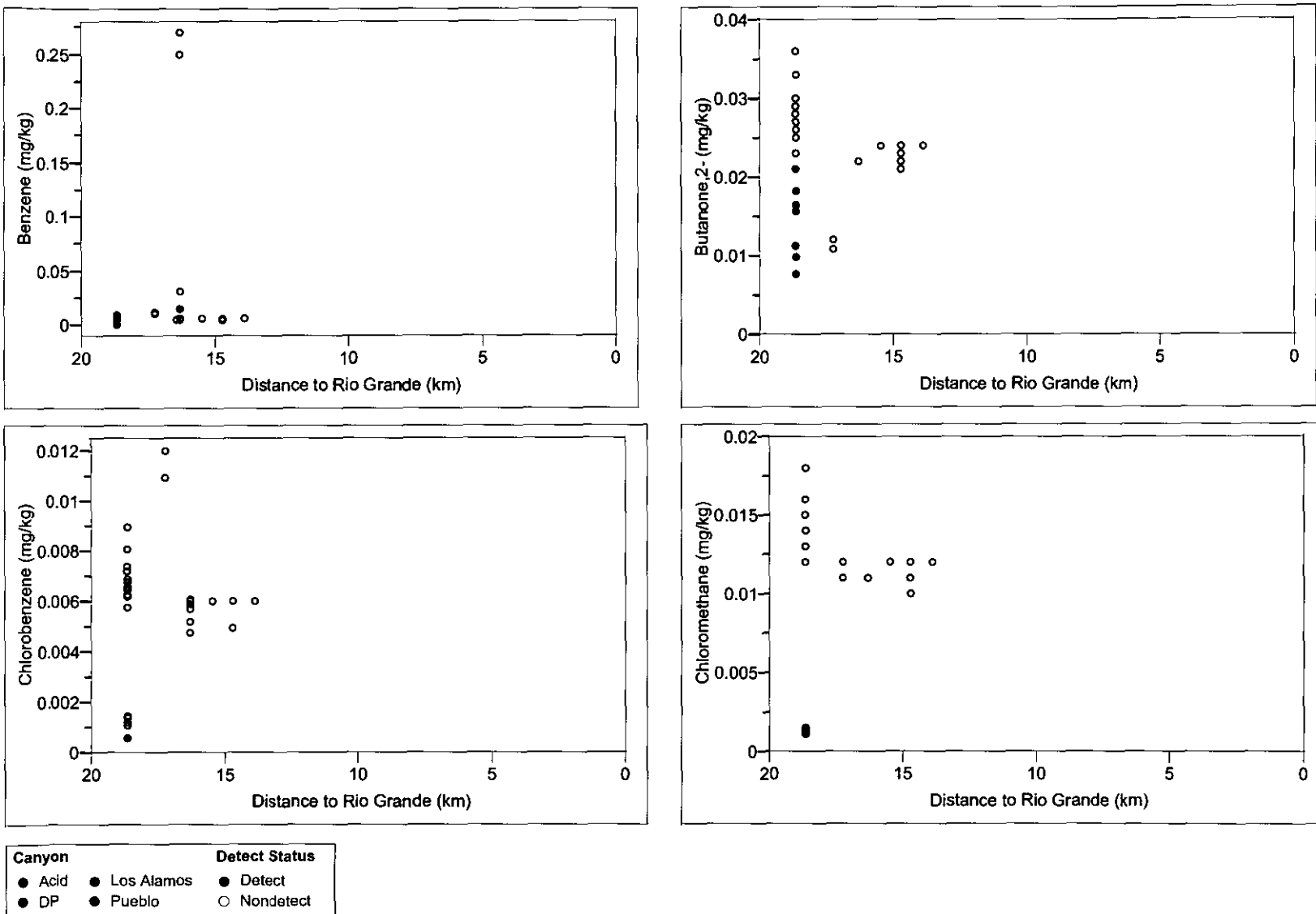


Figure D-1.1-1 (continued). Plots of sample result versus distance from the Rio Grande for all COPCs identified in sediment in the Los Alamos and Pueblo watershed

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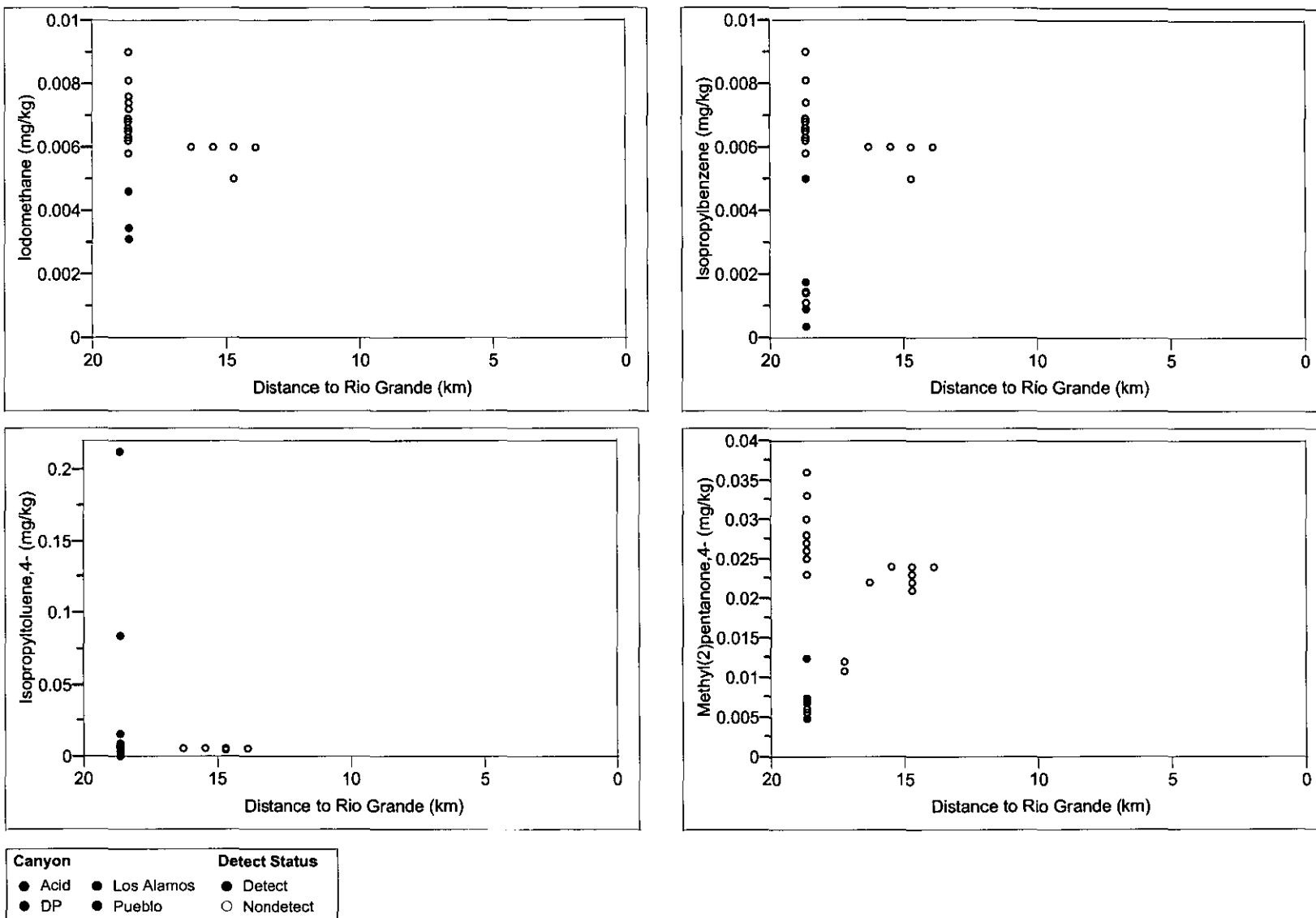


Figure D-1.1-1 (continued). Plots of sample result versus distance from the Rio Grande for all COPCs identified in sediment in the Los Alamos and Pueblo watershed

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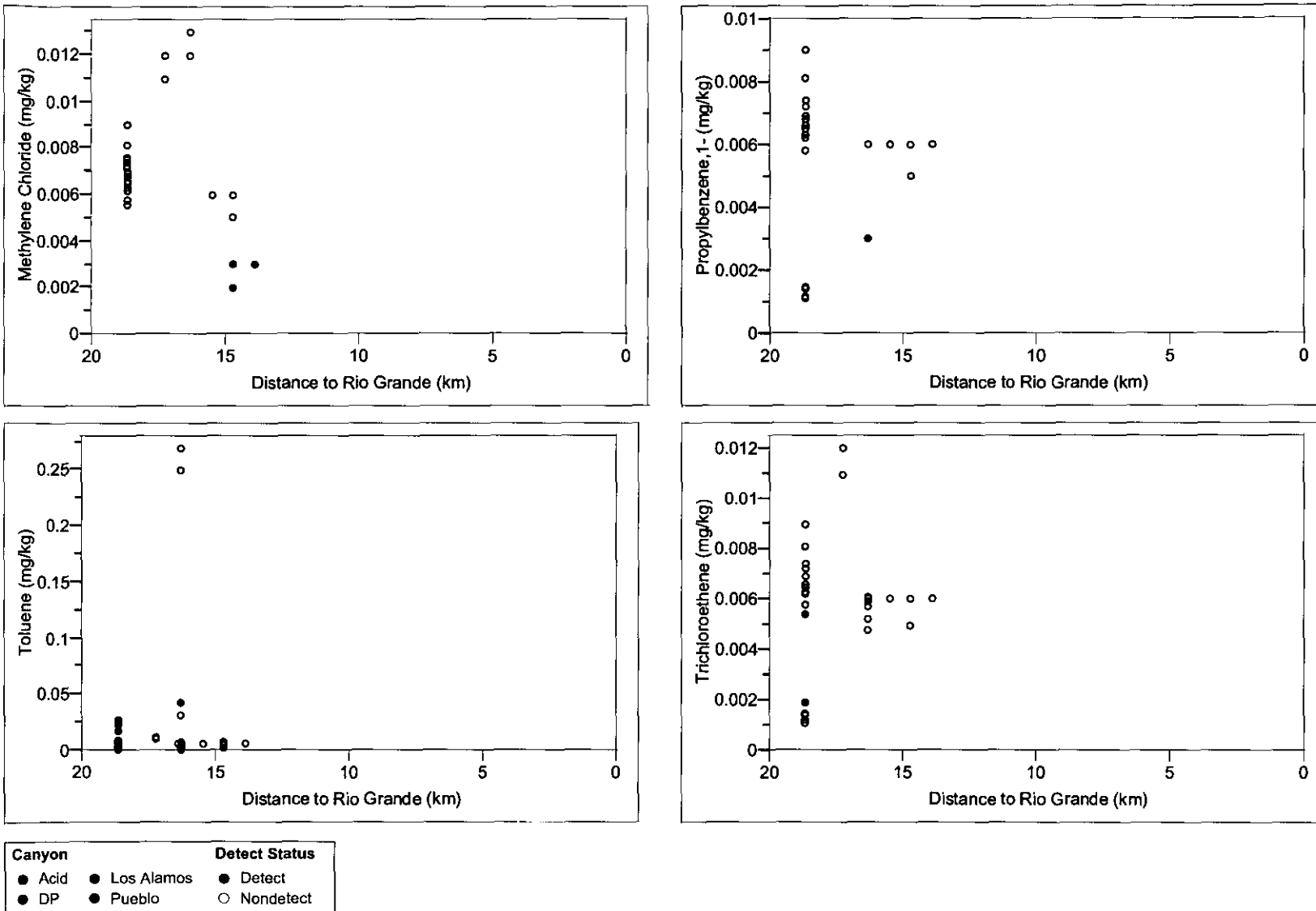


Figure D-1.1-1 (continued). Plots of sample result versus distance from the Rio Grande for all COPCs identified in sediment in the Los Alamos and Pueblo watershed

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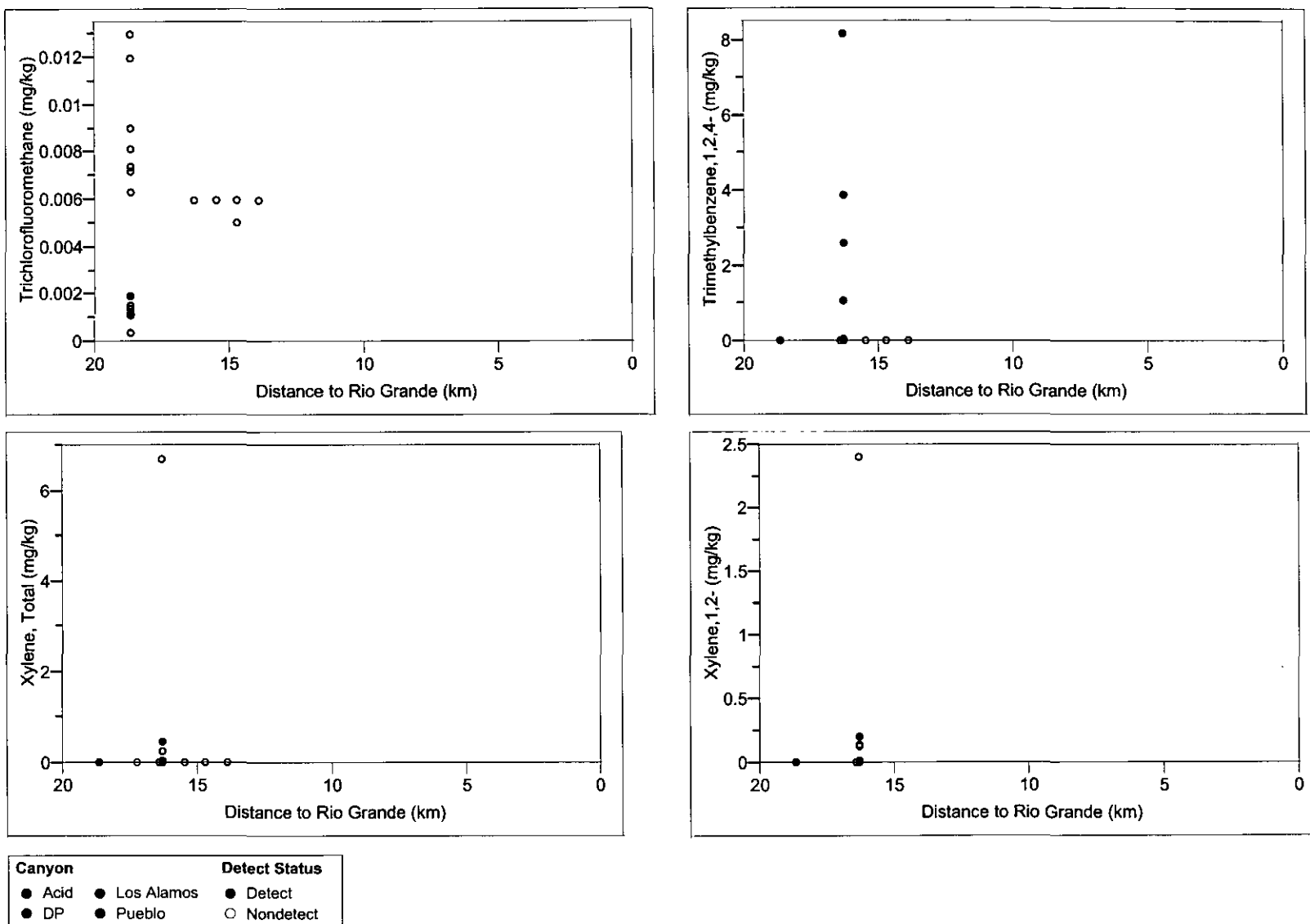


Figure D-1.1-1 (continued). Plots of sample result versus distance from the Rio Grande for all COPCs identified in sediment in the Los Alamos and Pueblo watershed

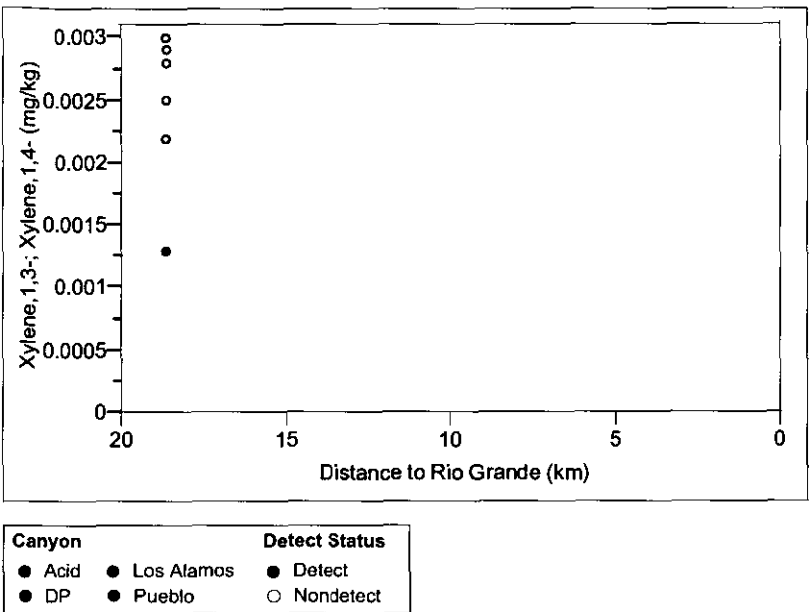


Figure D-1.1-1 (continued). Plots of sample result versus distance from the Rio Grande for all COPCs identified in sediment in the Los Alamos and Pueblo watershed

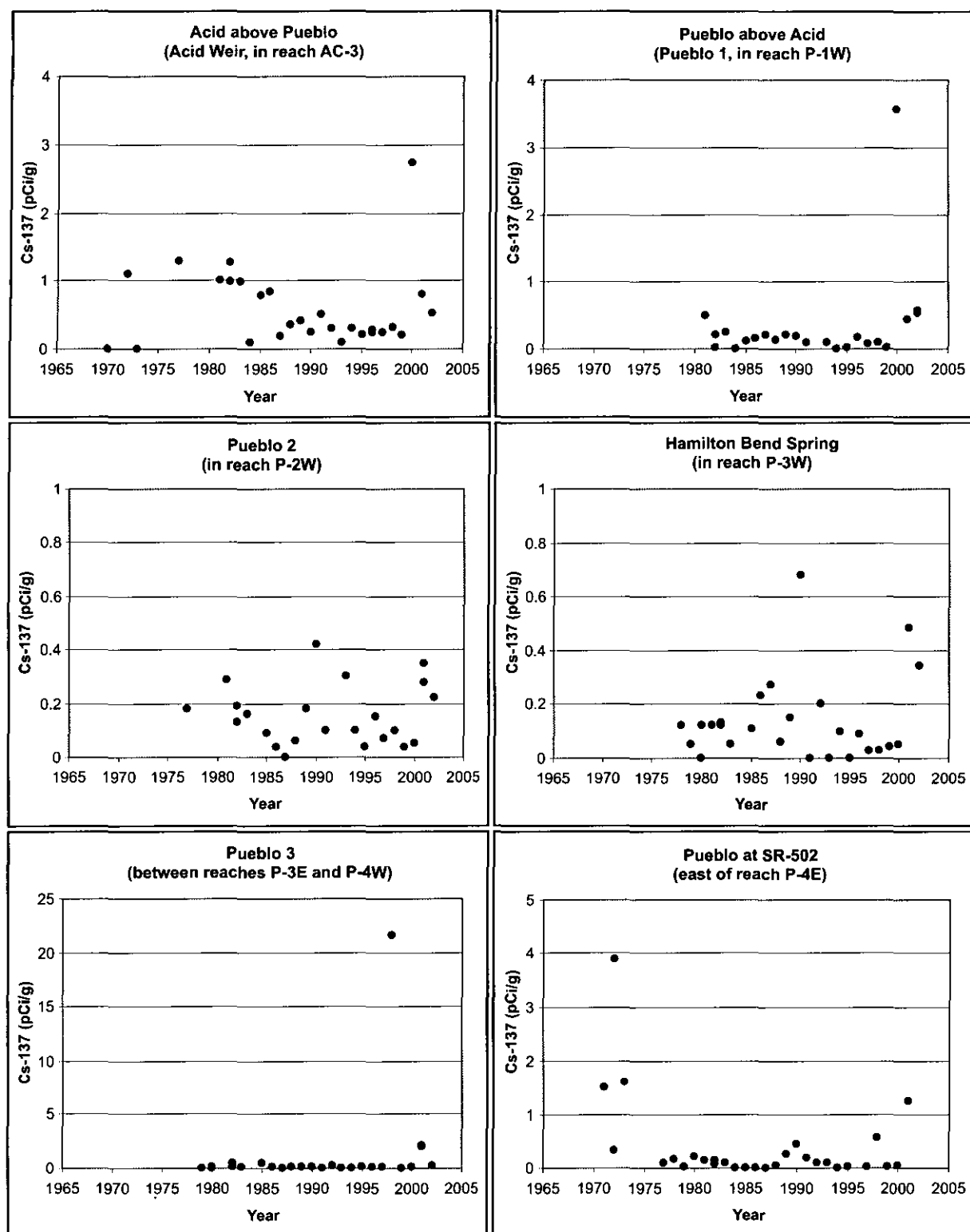


Figure D-1.2-1. Plots of sample results for cesium-137 in active channel samples from environmental surveillance sampling stations in the Los Alamos and Pueblo watershed

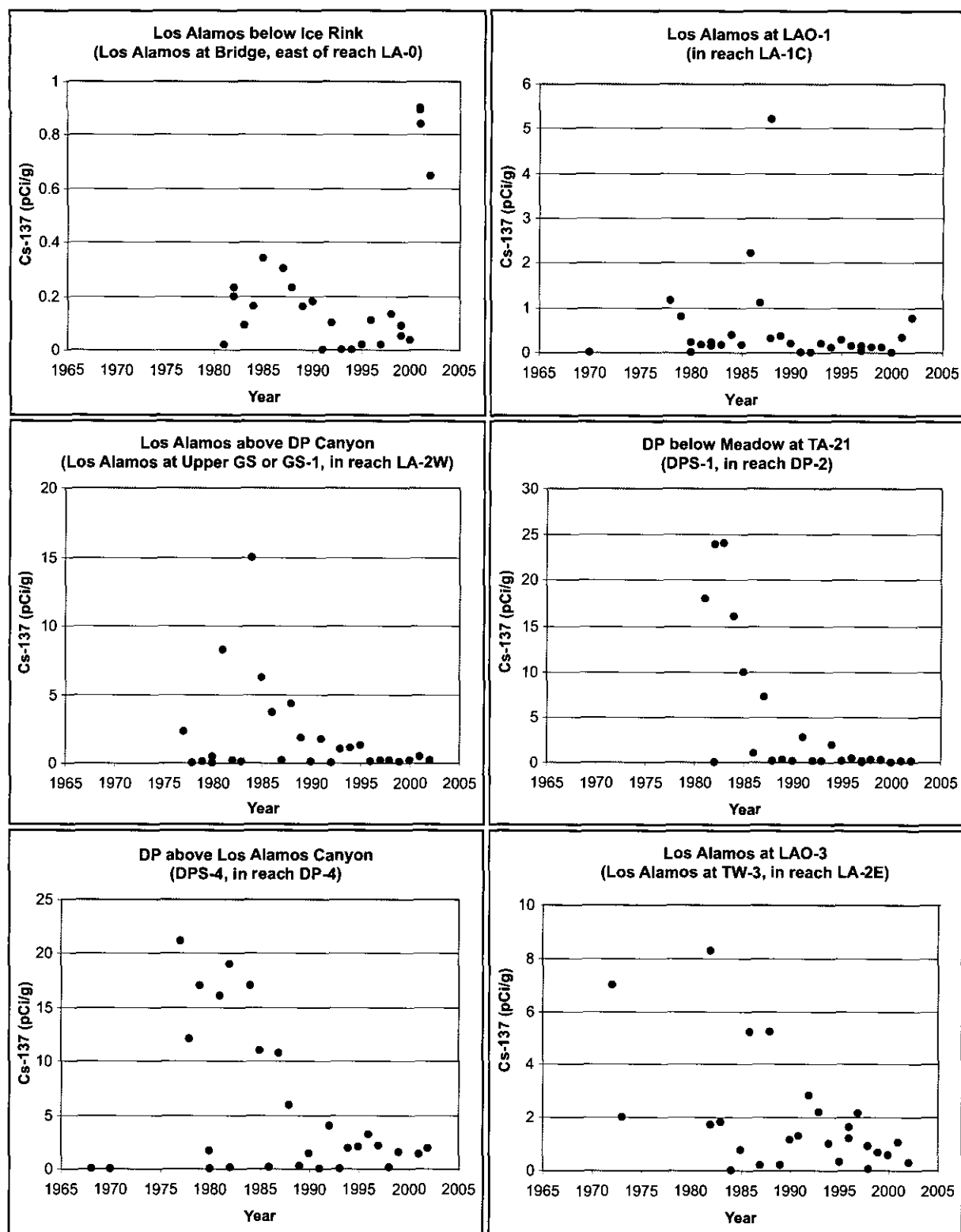


Figure D-1.2-1 (continued). Plots of sample results for cesium-137 in active channel samples from environmental surveillance sampling stations in the Los Alamos and Pueblo watersheds

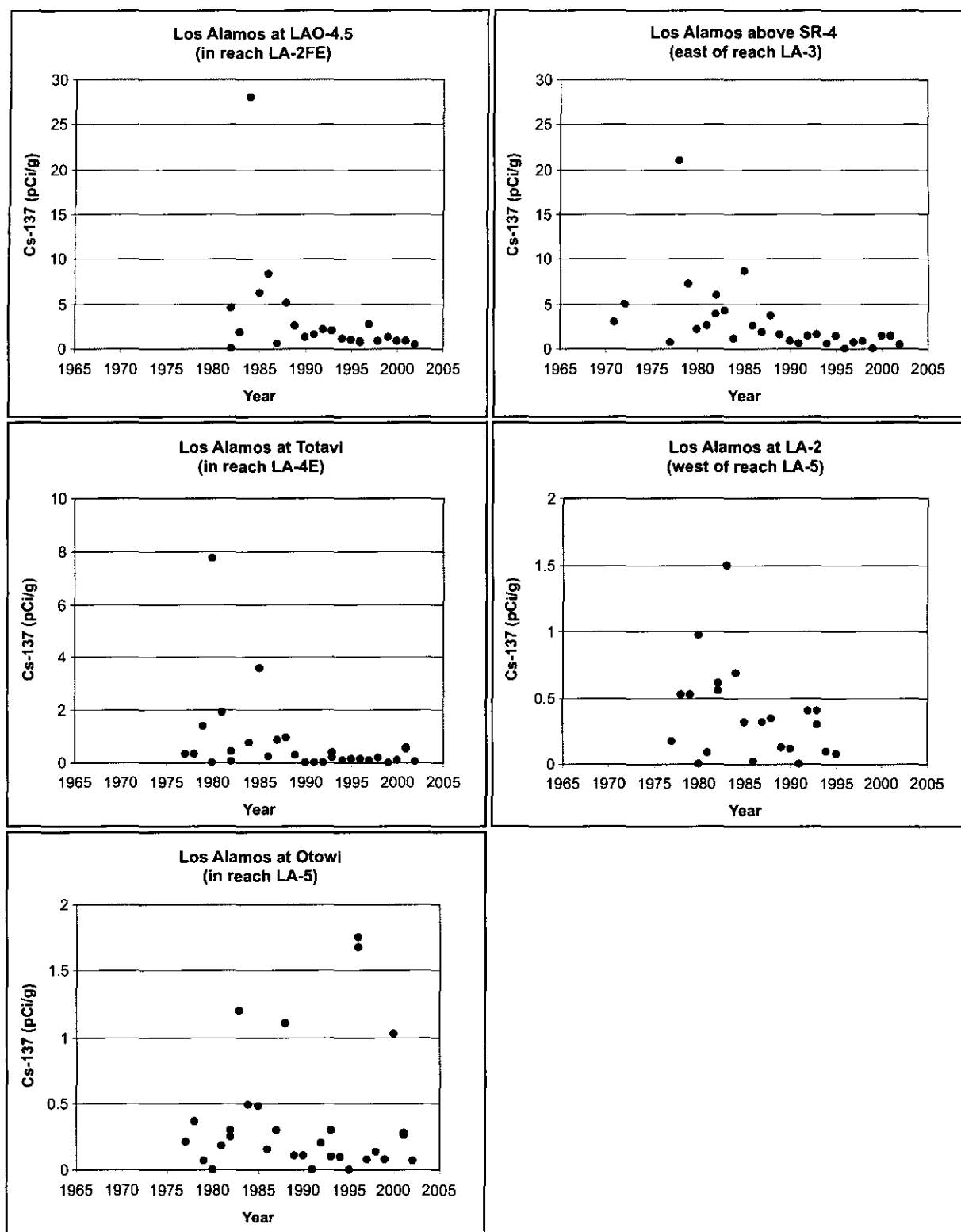


Figure D-1.2-1 (continued). Plots of sample results for cesium-137 in active channel samples from environmental surveillance sampling stations in the Los Alamos and Pueblo watershed

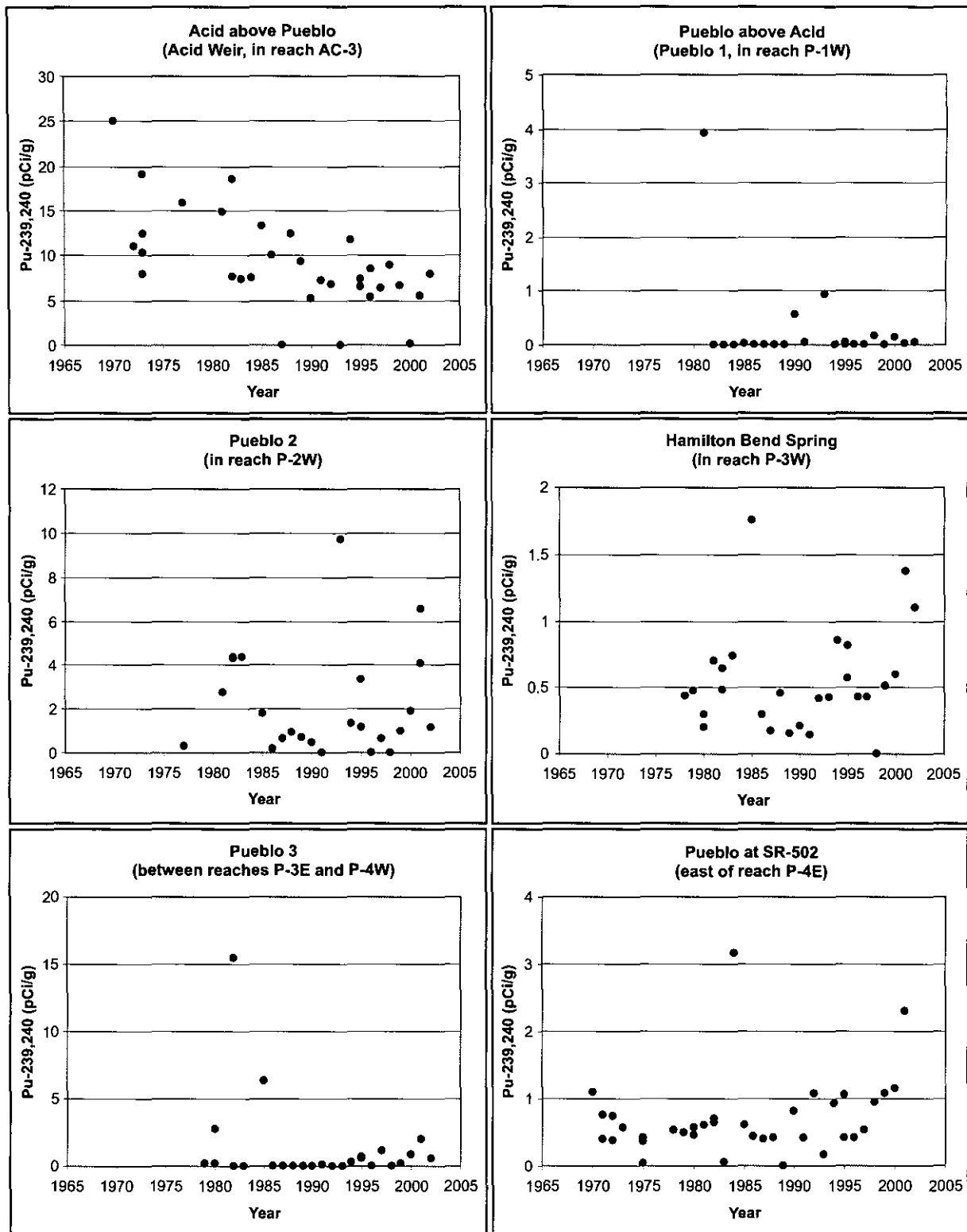


Figure D-1.2-2. Plots of sample results for plutonium-239,-240 in active channel samples from environmental surveillance sampling stations in the Los Alamos and Pueblo watershed

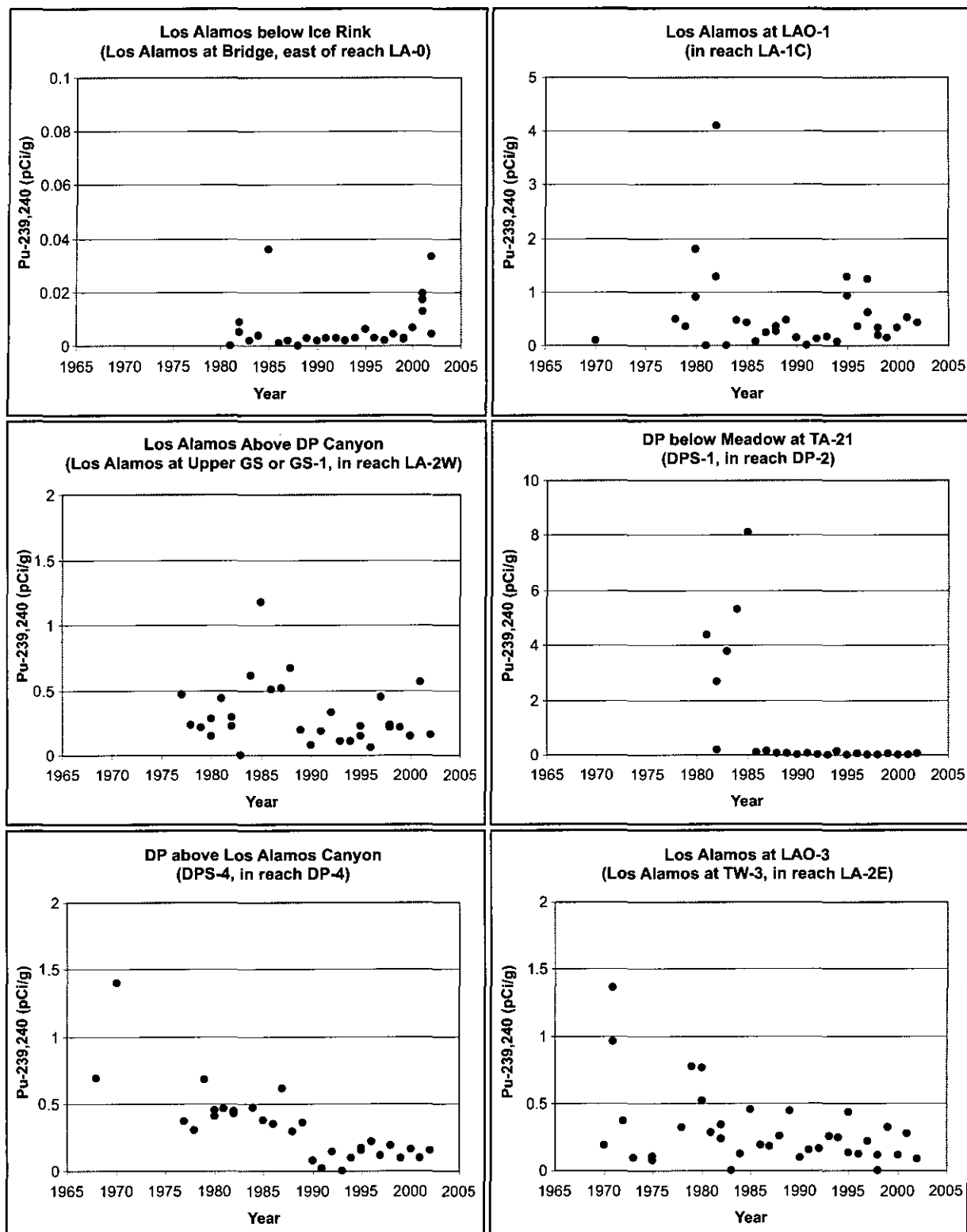


Figure D-1.2-2 (continued). Plots of sample results for plutonium-239,-240 in active channel samples from environmental surveillance sampling stations in the Los Alamos and Pueblo watershed

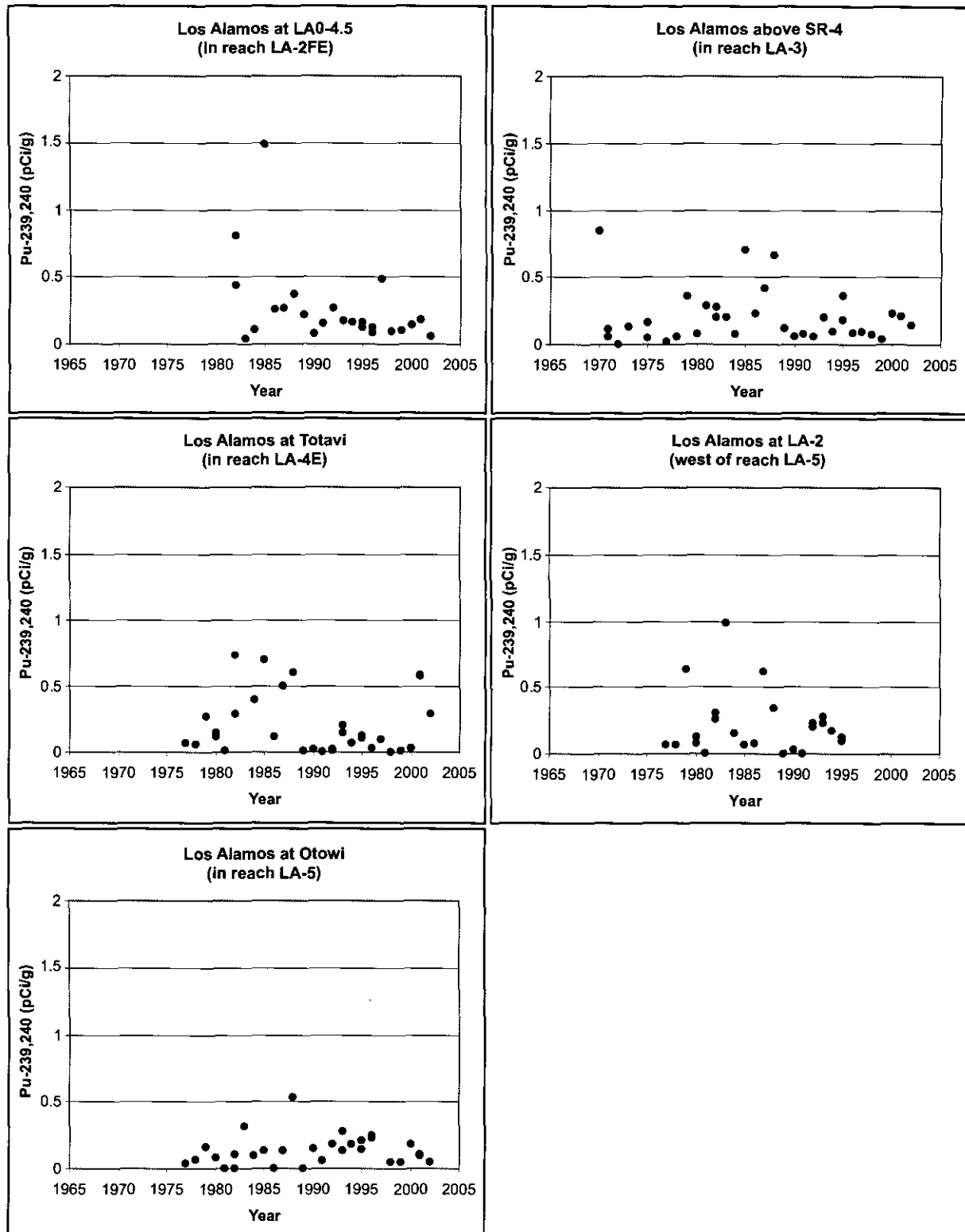
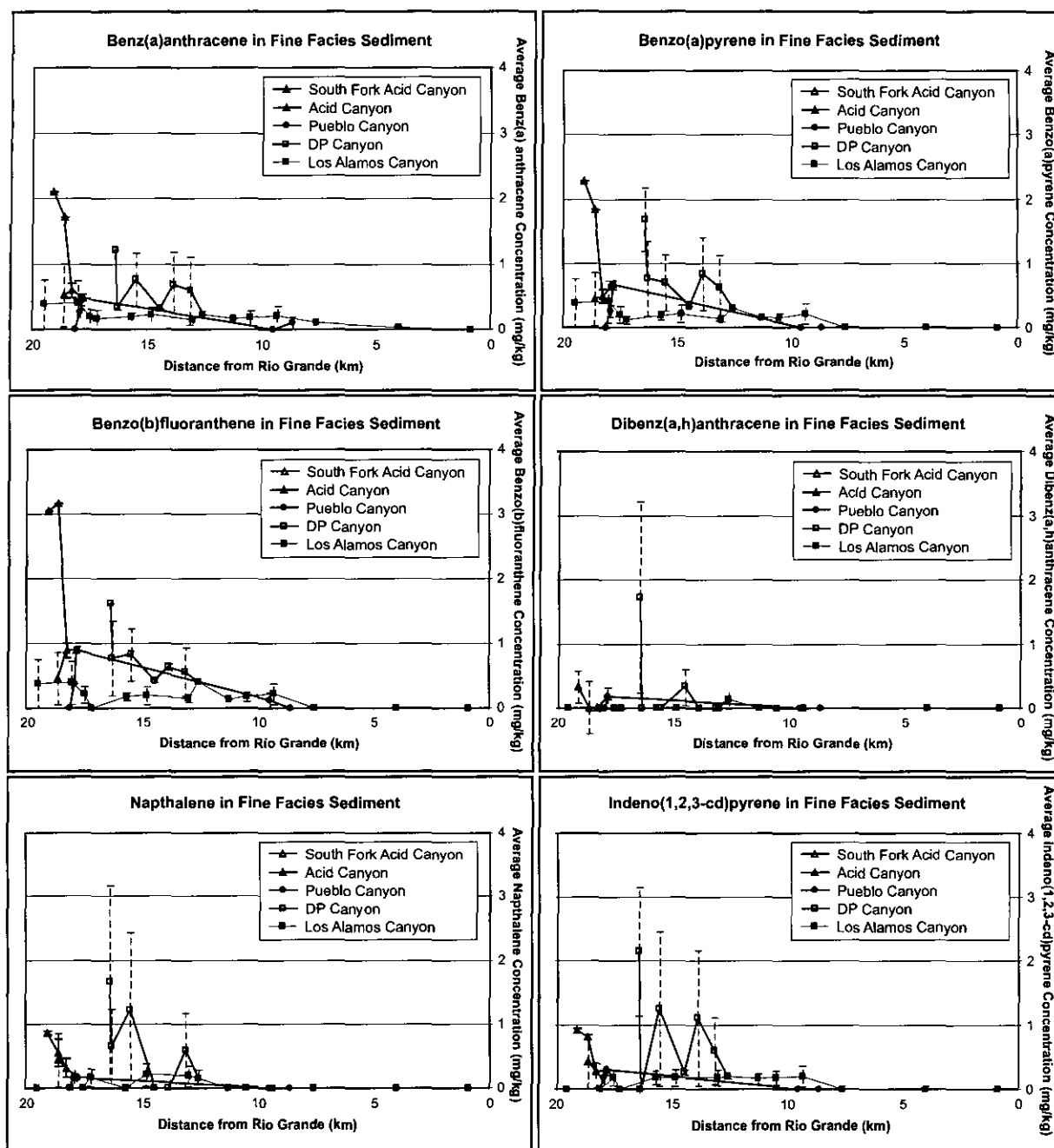


Figure D-1.2-2 (continued). Plots of sample results for plutonium-239,-240 in active channel samples from environmental surveillance sampling stations in the Los Alamos and Pueblo watershed



Note: Error bars indicate upper and lower bounds on average concentrations in a reach.

Figure D-1.6-1. Plots of average concentrations of select PAHs in fine facies sediment in the Los Alamos and Pueblo watershed versus distance from the Rio Grande

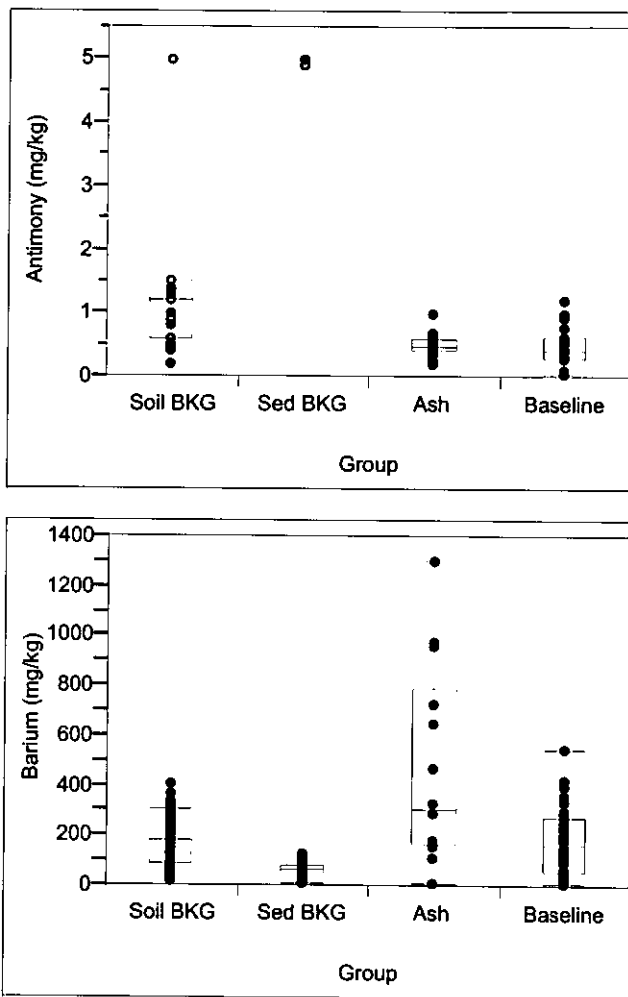
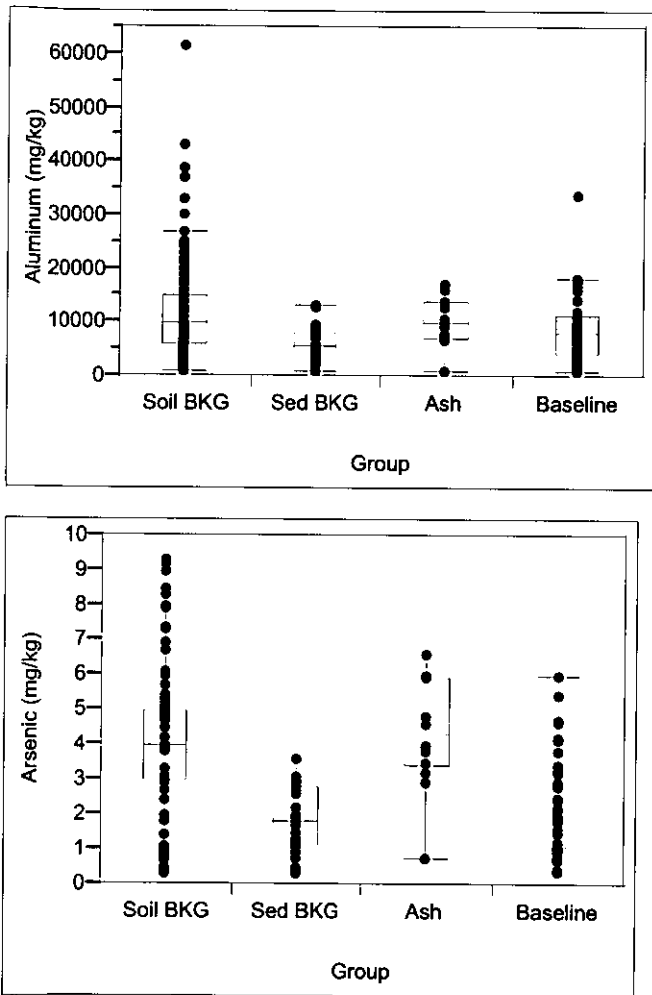


Figure D-1.7-1. Boxplots comparing sample results for inorganic and radionuclide COPCs in ash and fire-affected baseline sediment samples to soil and sediment background sample results

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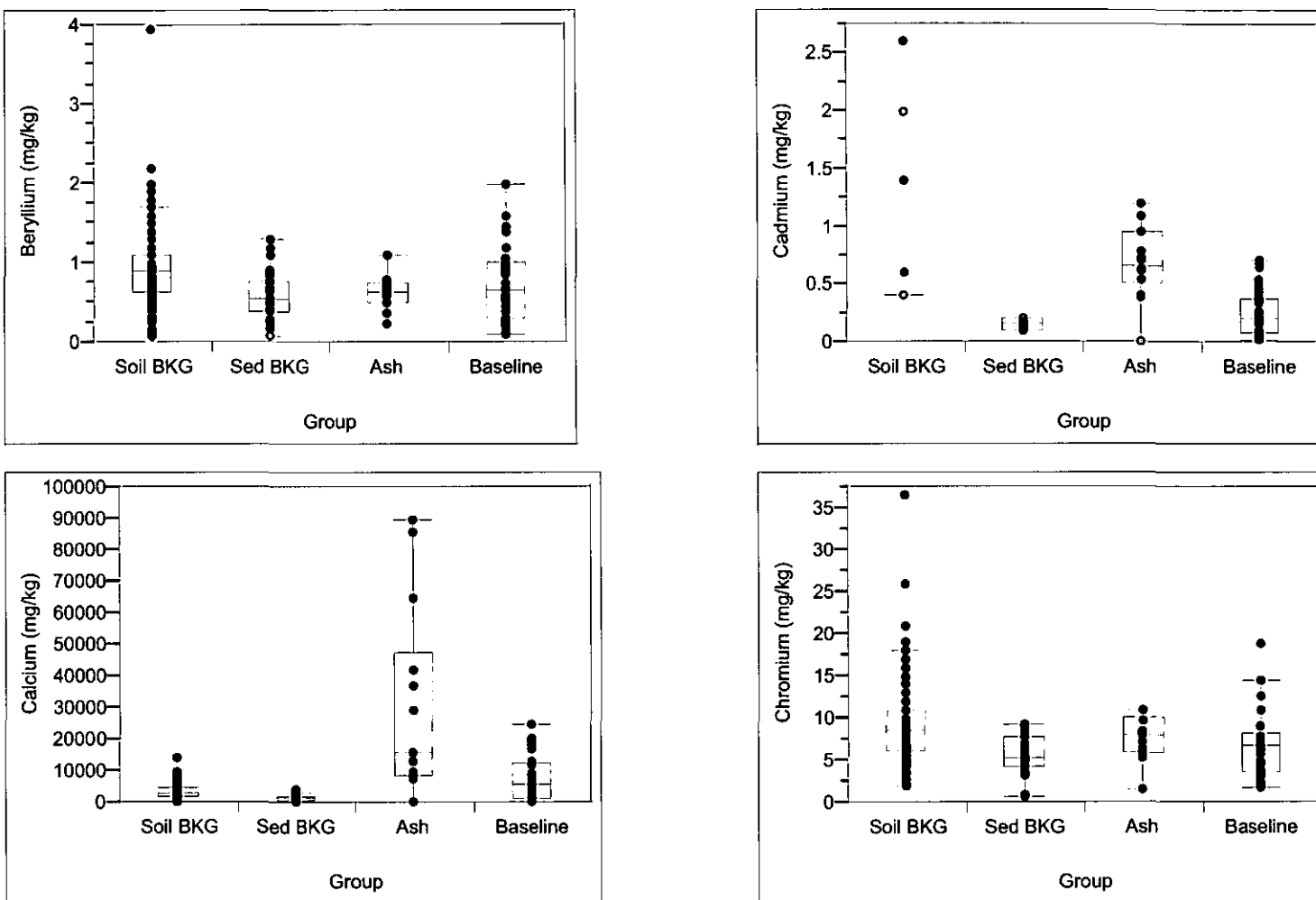


Figure D-1.7-1 (continued). Boxplots comparing sample results for inorganic and radionuclide COPCs in ash and fire-affected baseline sediment samples to soil and sediment background sample results

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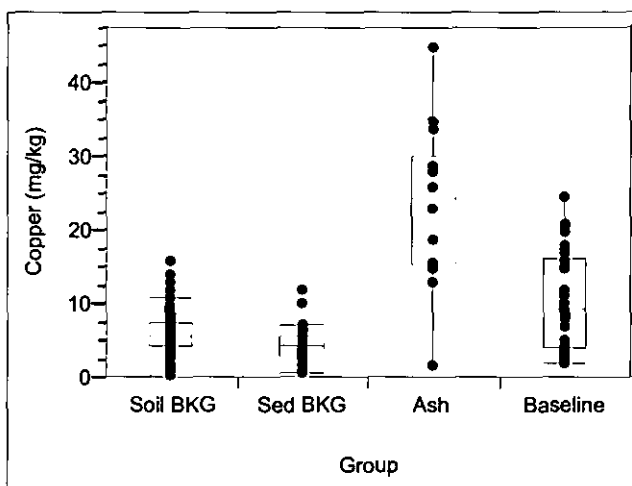
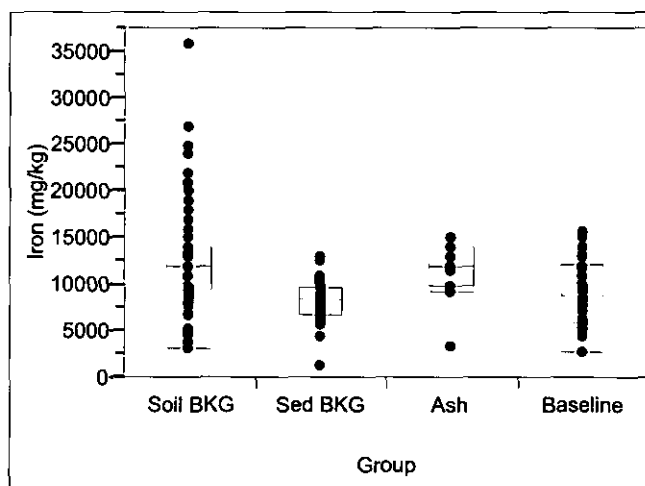
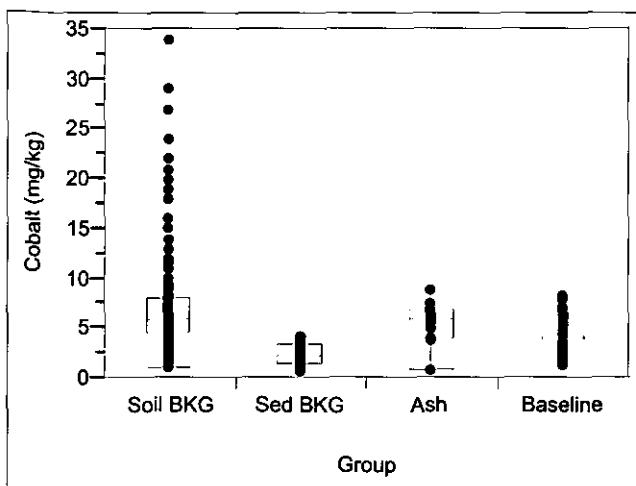
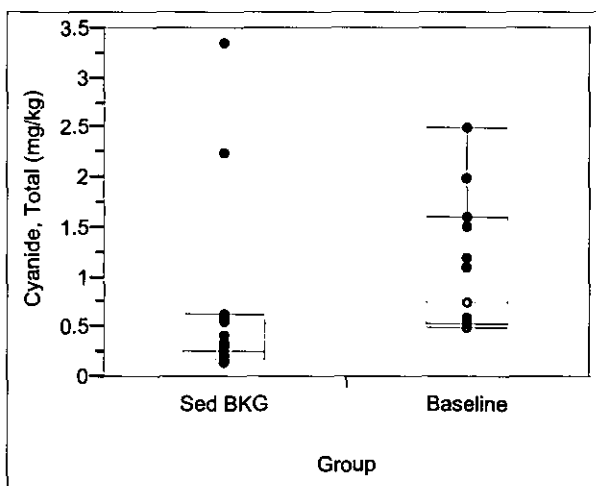


Figure D-1.7-1 (continued). Boxplots comparing sample results for inorganic and radionuclide COPCs in ash and fire-affected baseline sediment samples to soil and sediment background sample results

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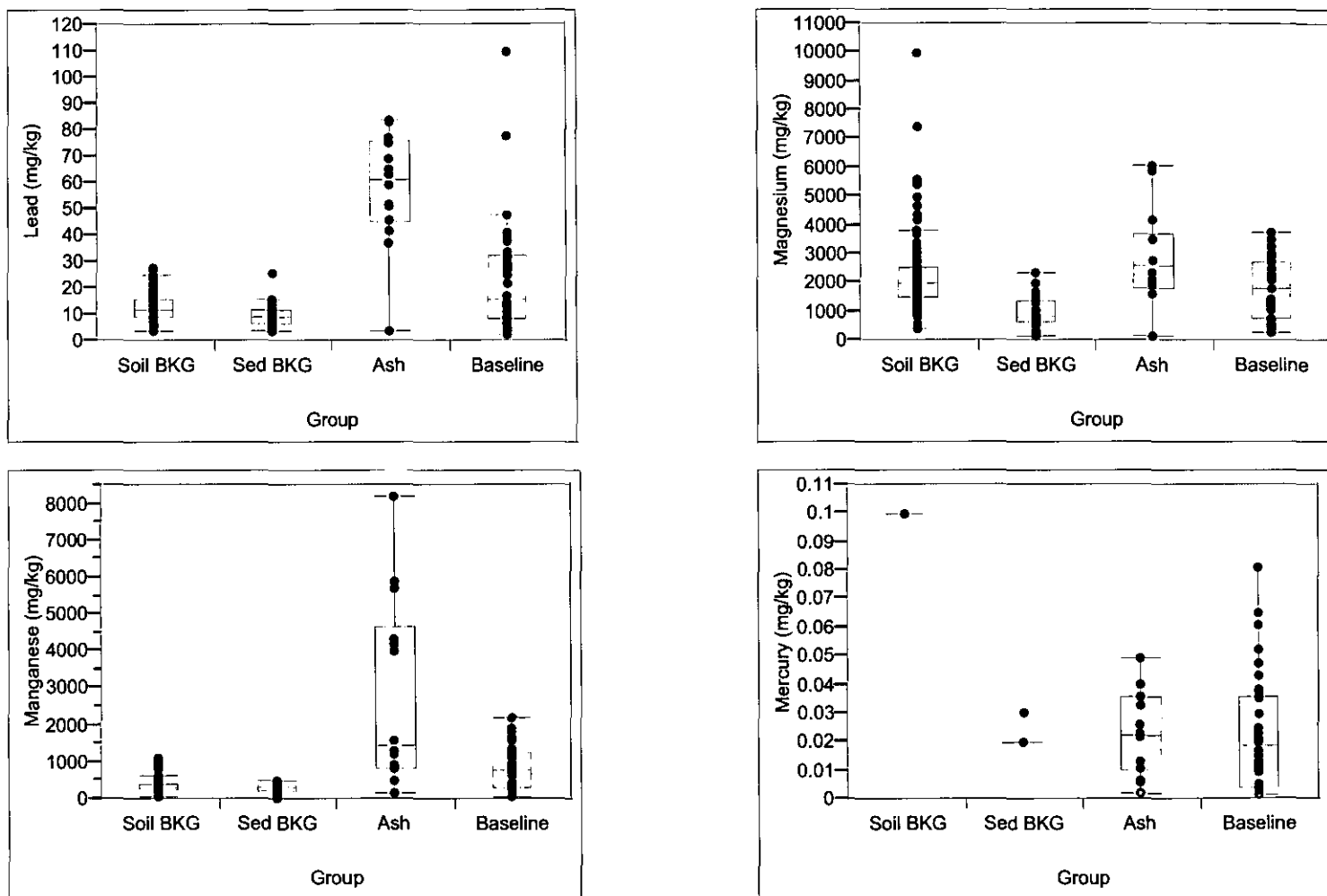


Figure D-1.7-1 (continued). Boxplots comparing sample results for inorganic and radionuclide COPCs in ash and fire-affected baseline sediment samples to soil and sediment background sample results

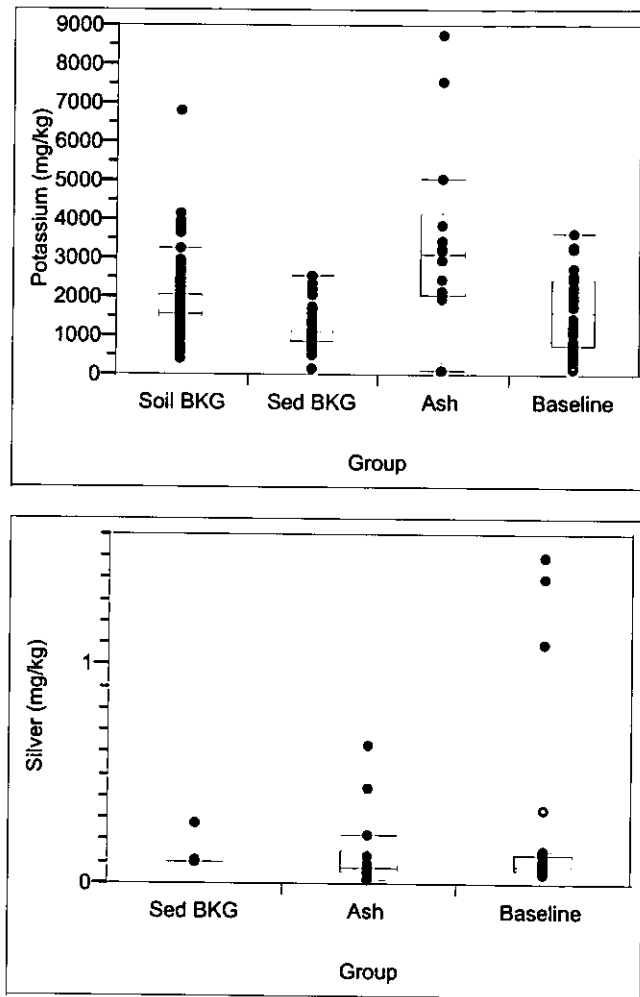
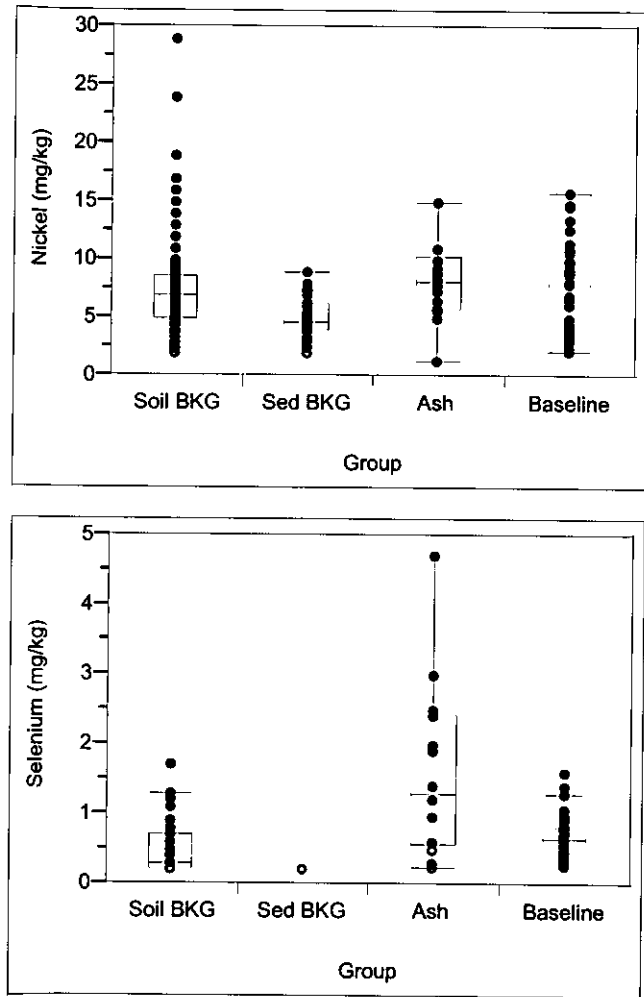


Figure D-1.7-1 (continued). Boxplots comparing sample results for inorganic and radionuclide COPCs in ash and fire-affected baseline sediment samples to soil and sediment background sample results

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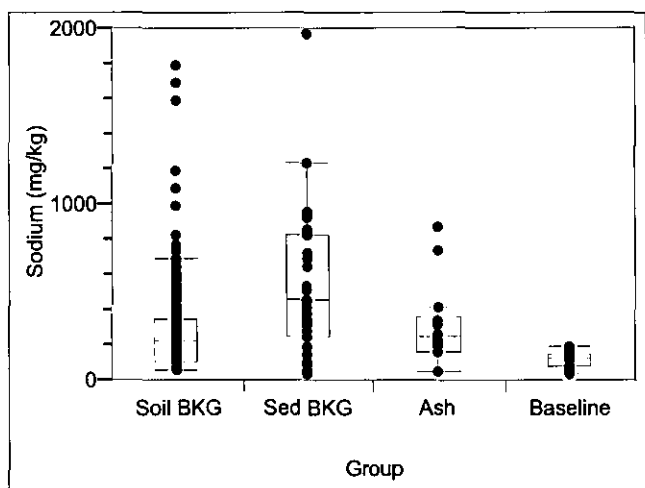
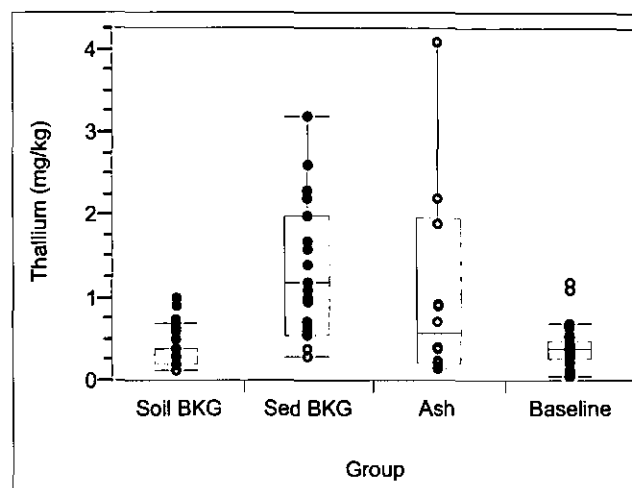
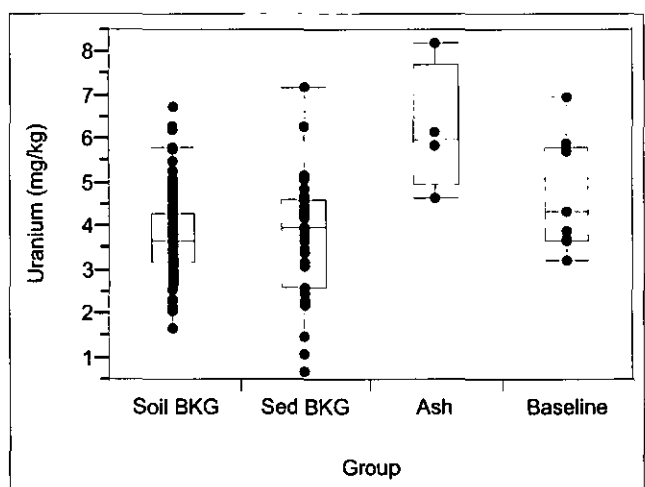
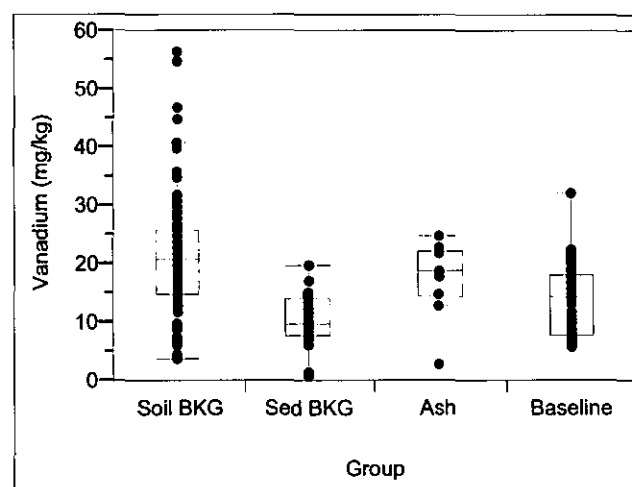


Figure D-1.7-1 (continued). Boxplots comparing sample results for inorganic and radionuclide COPCs in ash and fire-affected baseline sediment samples to soil and sediment background sample results

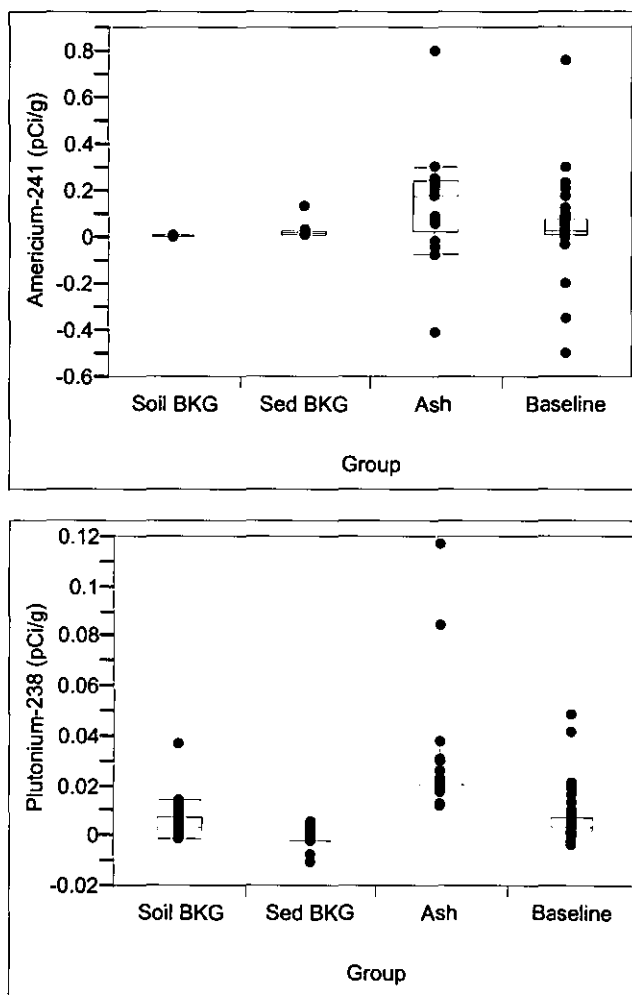
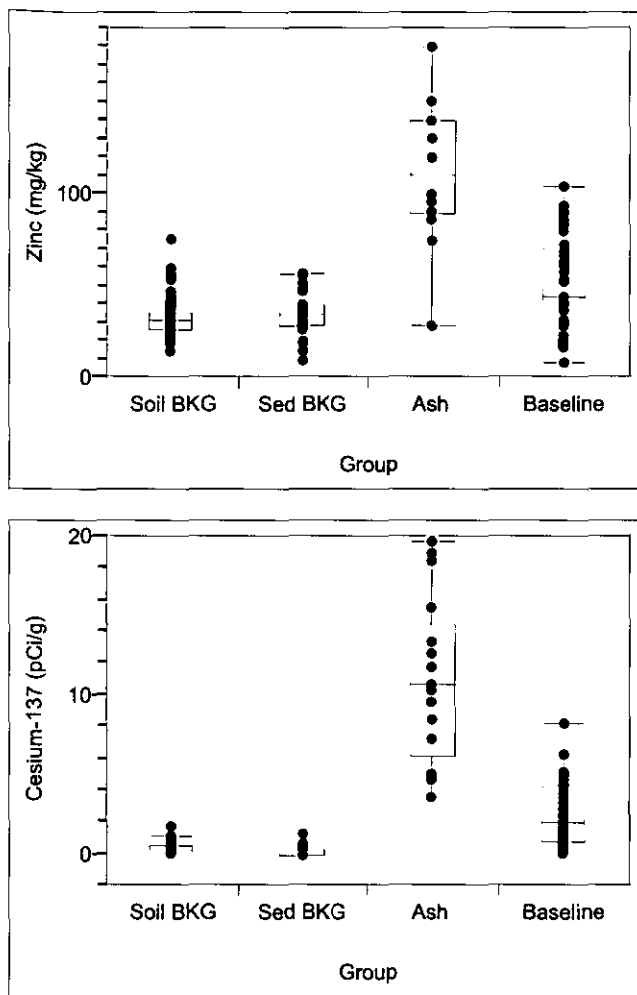


Figure D-1.7-1 (continued). Boxplots comparing sample results for inorganic and radionuclide COPCs in ash and fire-affected baseline sediment samples to soil and sediment background sample results

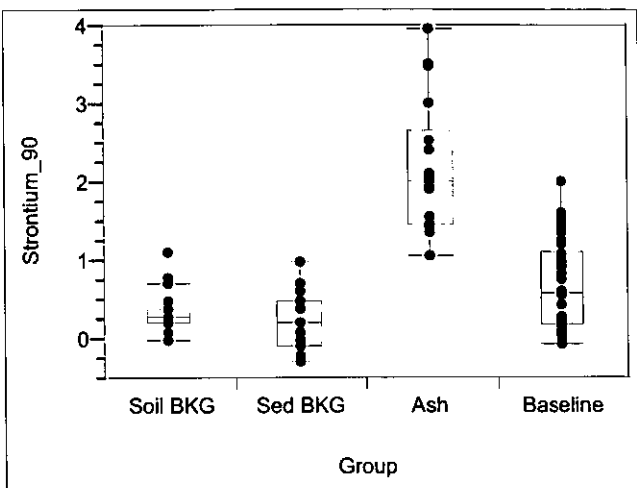
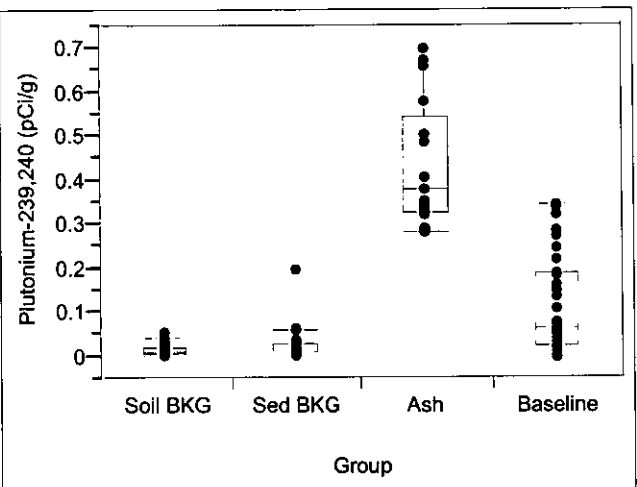


Figure D-1.7-1 (continued). Boxplots comparing sample results for inorganic and radionuclide COPCs in ash and fire-affected baseline sediment samples to soil and sediment background sample results

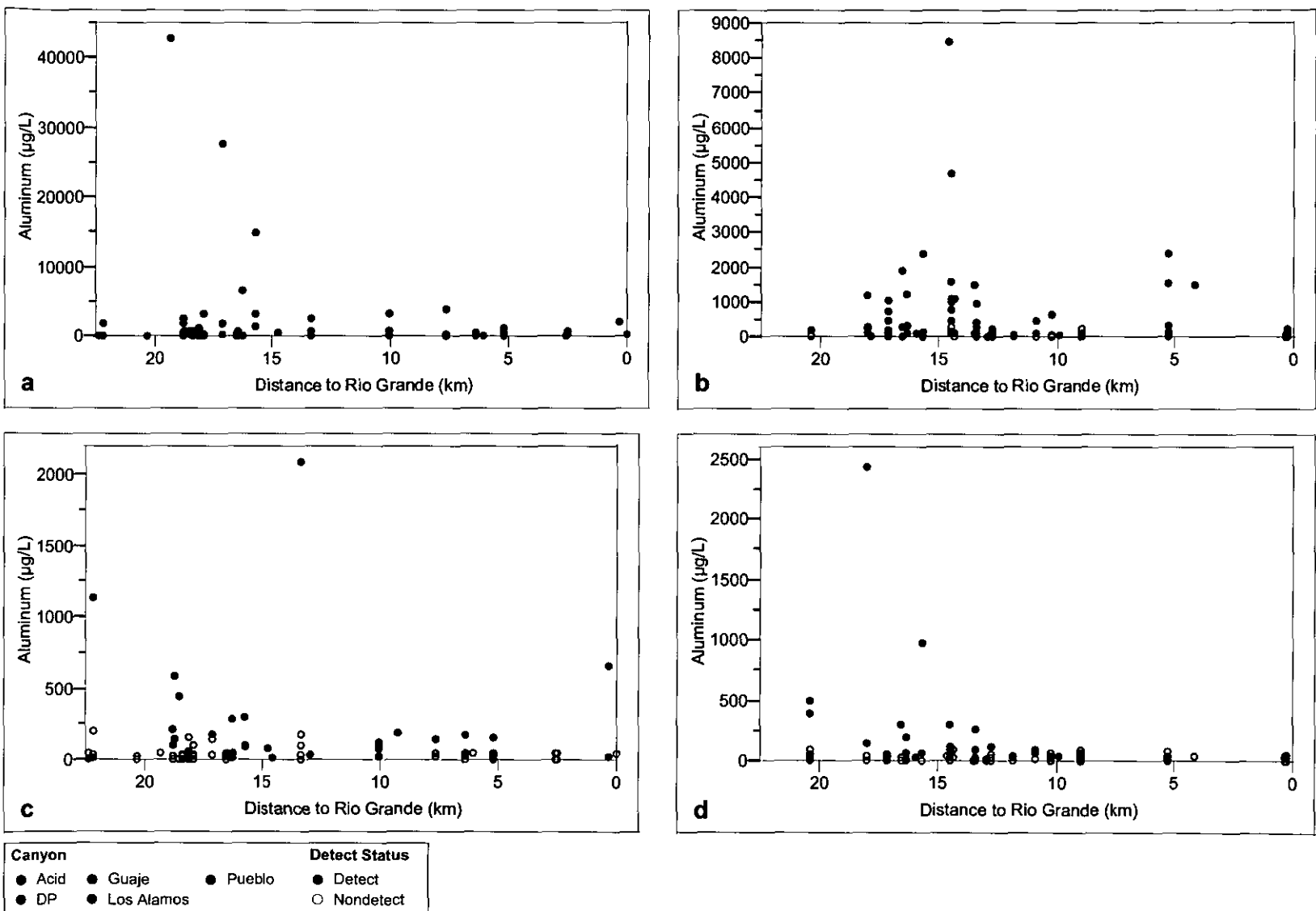


Figure D-2.0-1. Scatter plots of aluminum concentrations versus distance from the Rio Grande in (a) unfiltered surface water and spring water, (b) unfiltered alluvial groundwater, (c) filtered surface water and spring water, and (d) filtered alluvial groundwater

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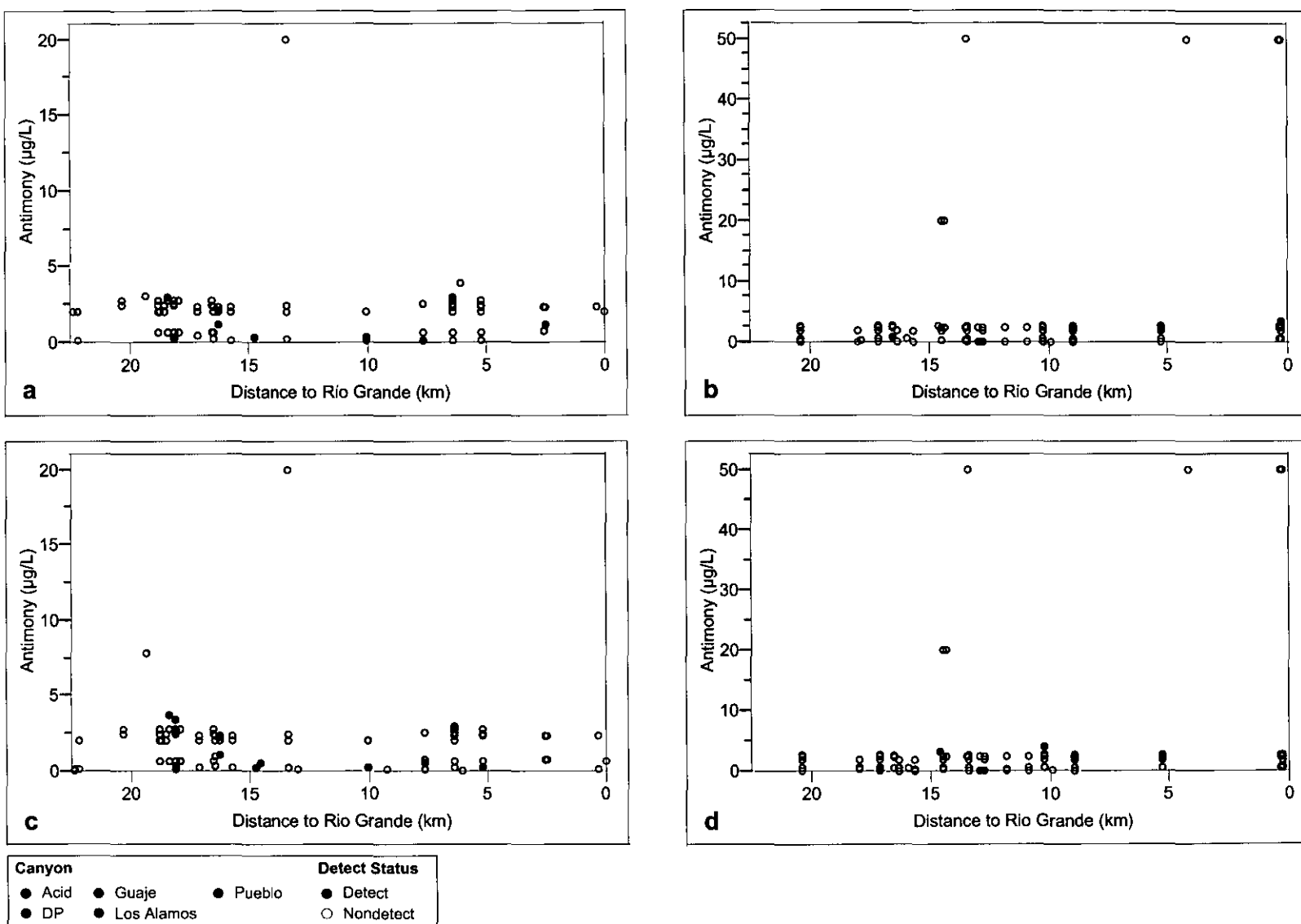


Figure D-2.0-2. Scatter plots of antimony concentrations versus distance from the Rio Grande in (a) unfiltered surface water and spring water, (b) unfiltered alluvial groundwater, (c) filtered surface water and spring water, and (d) filtered alluvial groundwater

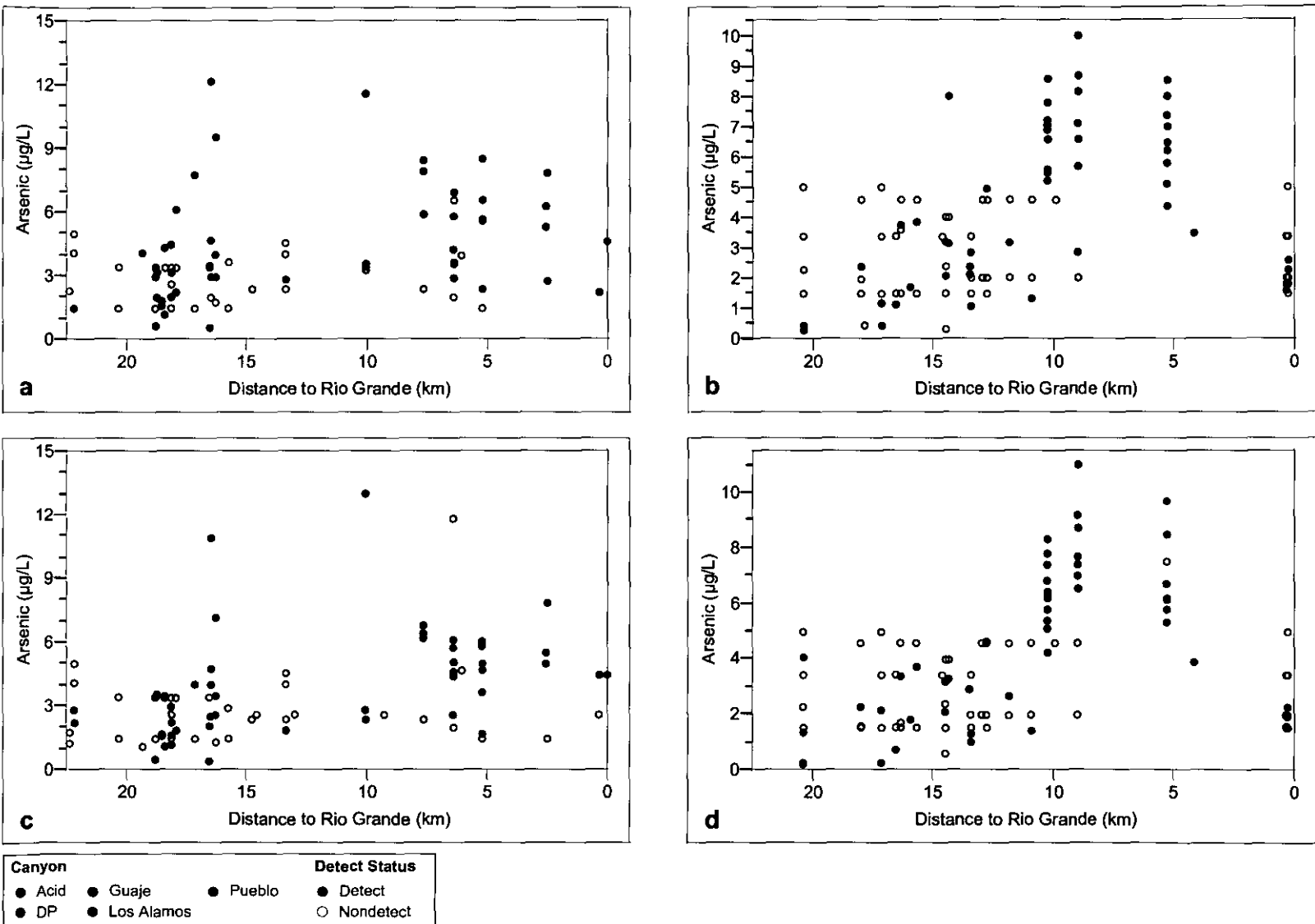


Figure D-2.0-3. Scatter plots of arsenic concentrations versus distance from the Rio Grande in (a) unfiltered surface water and spring water, (b) unfiltered alluvial groundwater, (c) filtered surface water and spring water, and (d) filtered alluvial groundwater

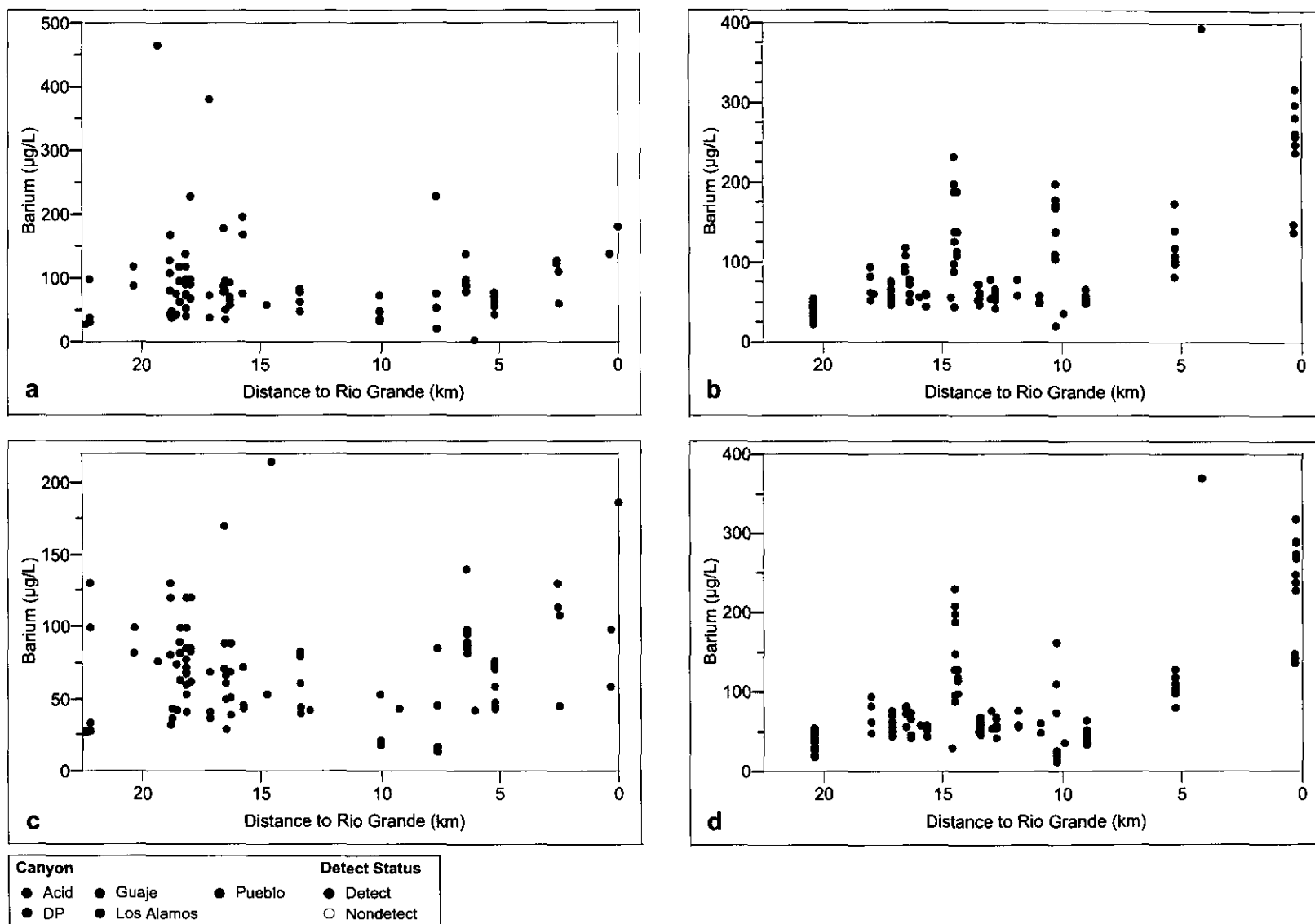


Figure D-2.0-4. Scatter plots of barium concentrations versus distance from the Rio Grande in (a) unfiltered surface water and spring water, (b) unfiltered alluvial groundwater, (c) filtered surface water and spring water, and (d) filtered alluvial groundwater

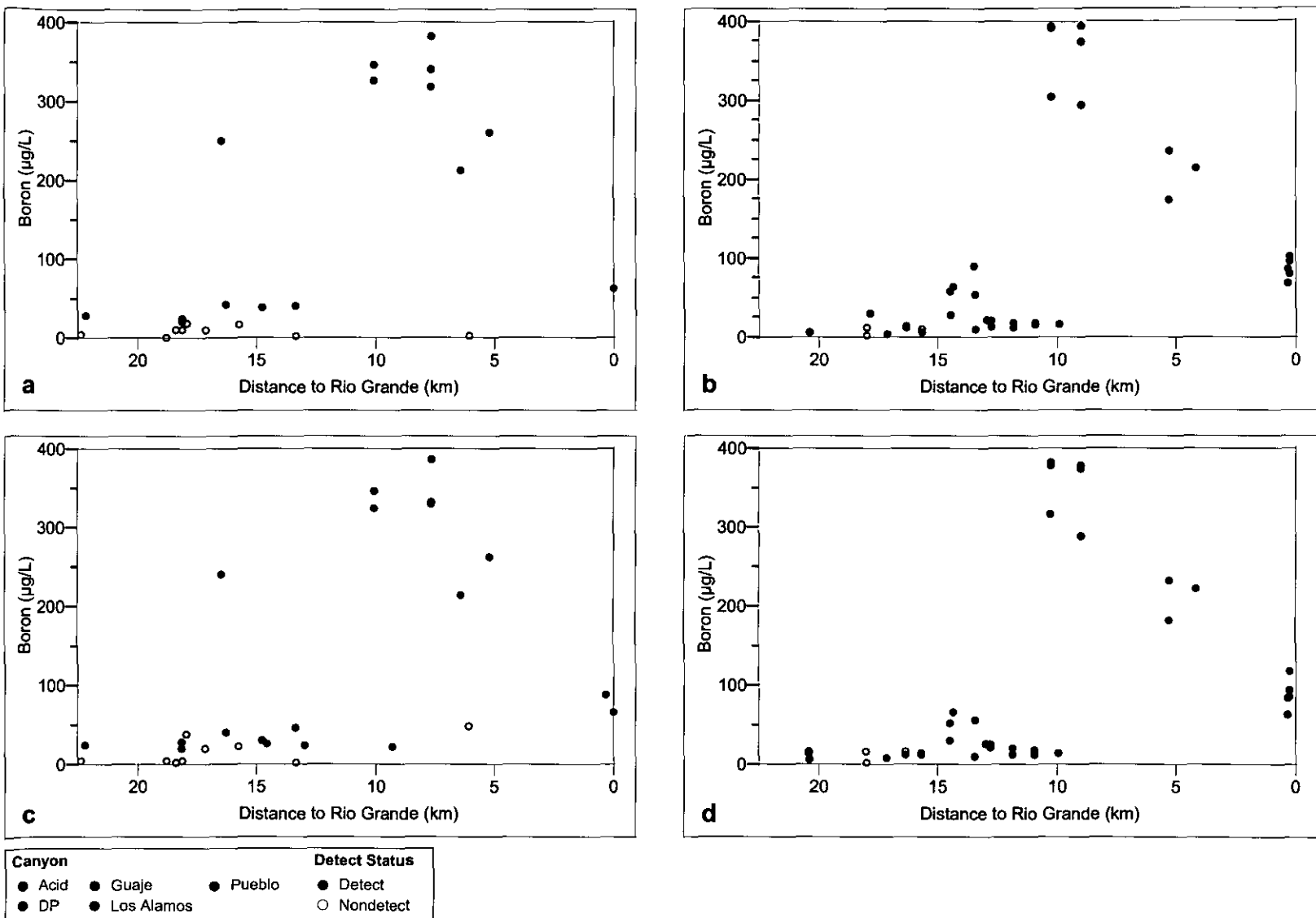


Figure D-2.0-5. Scatter plots of boron concentrations versus distance from the Rio Grande in (a) unfiltered surface water and spring water, (b) unfiltered alluvial groundwater, (c) filtered surface water and spring water, and (d) filtered alluvial groundwater

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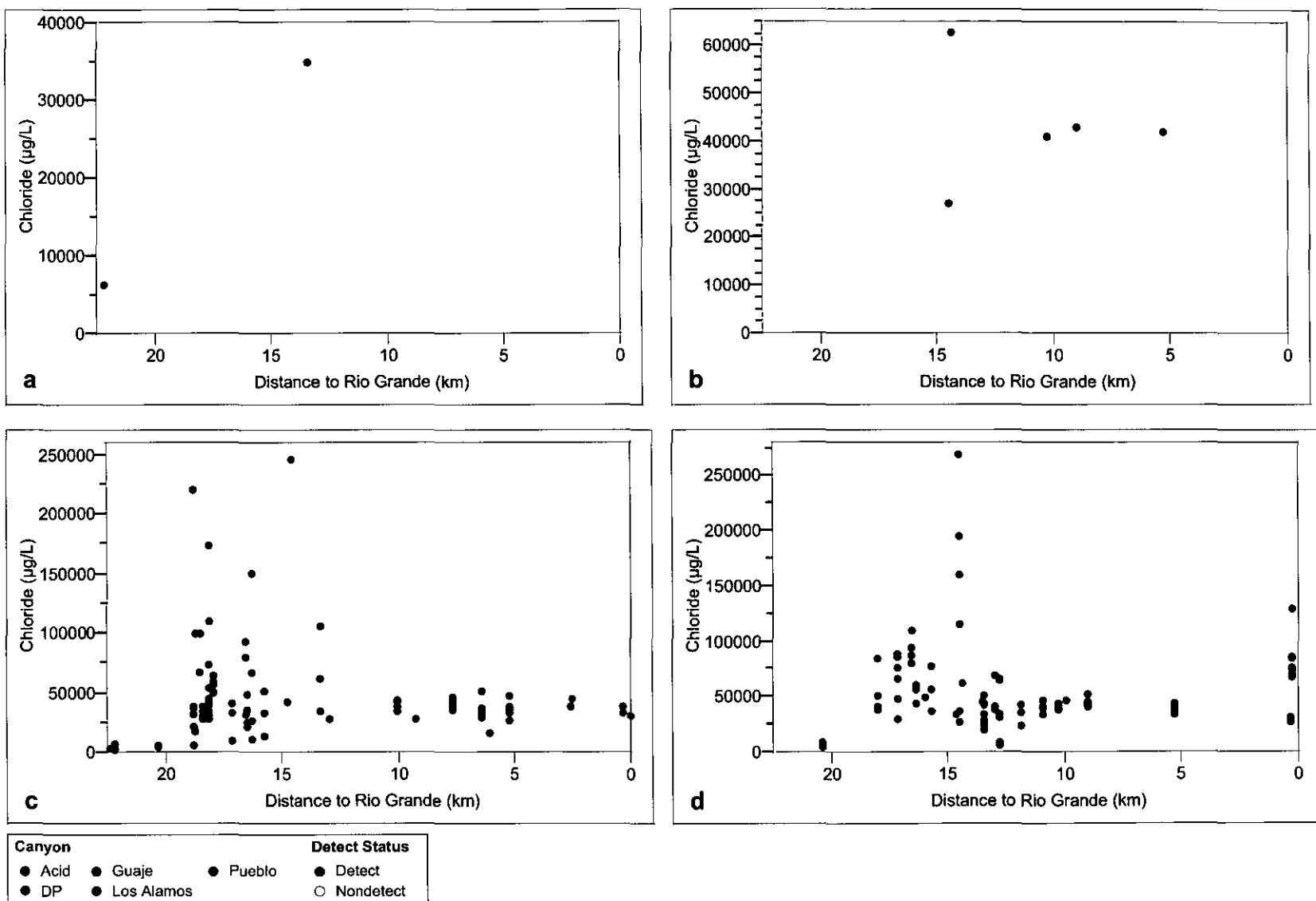


Figure D-2.0-6. Scatter plots of chloride concentrations versus distance from the Rio Grande in (a) unfiltered surface water and spring water, (b) unfiltered alluvial groundwater, (c) filtered surface water and spring water, and (d) filtered alluvial groundwater

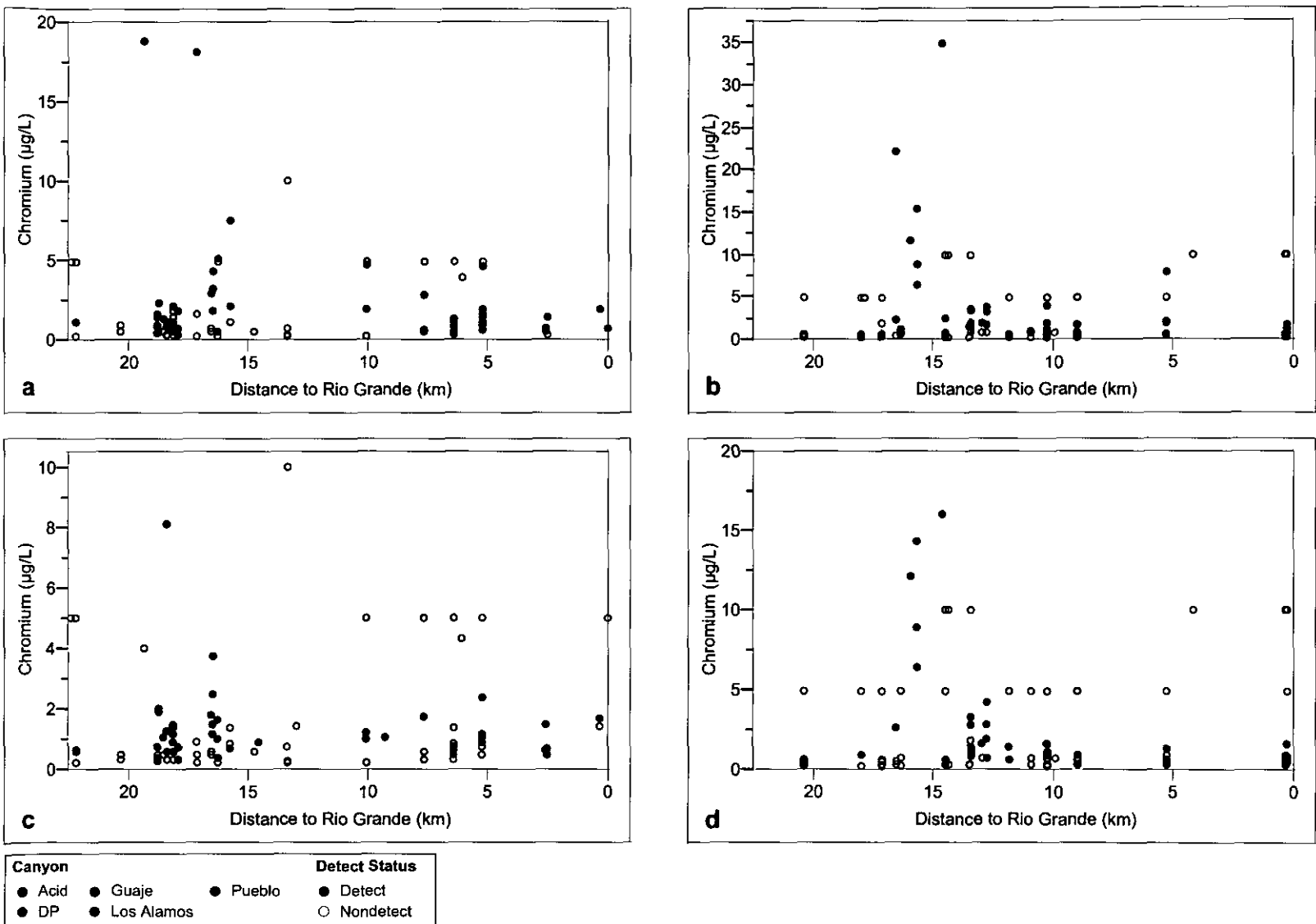


Figure D-2.0-7. Scatter plots of chromium concentrations versus distance from the Rio Grande in (a) unfiltered surface water and spring water, (b) unfiltered alluvial groundwater, (c) filtered surface water and spring water, and (d) filtered alluvial groundwater

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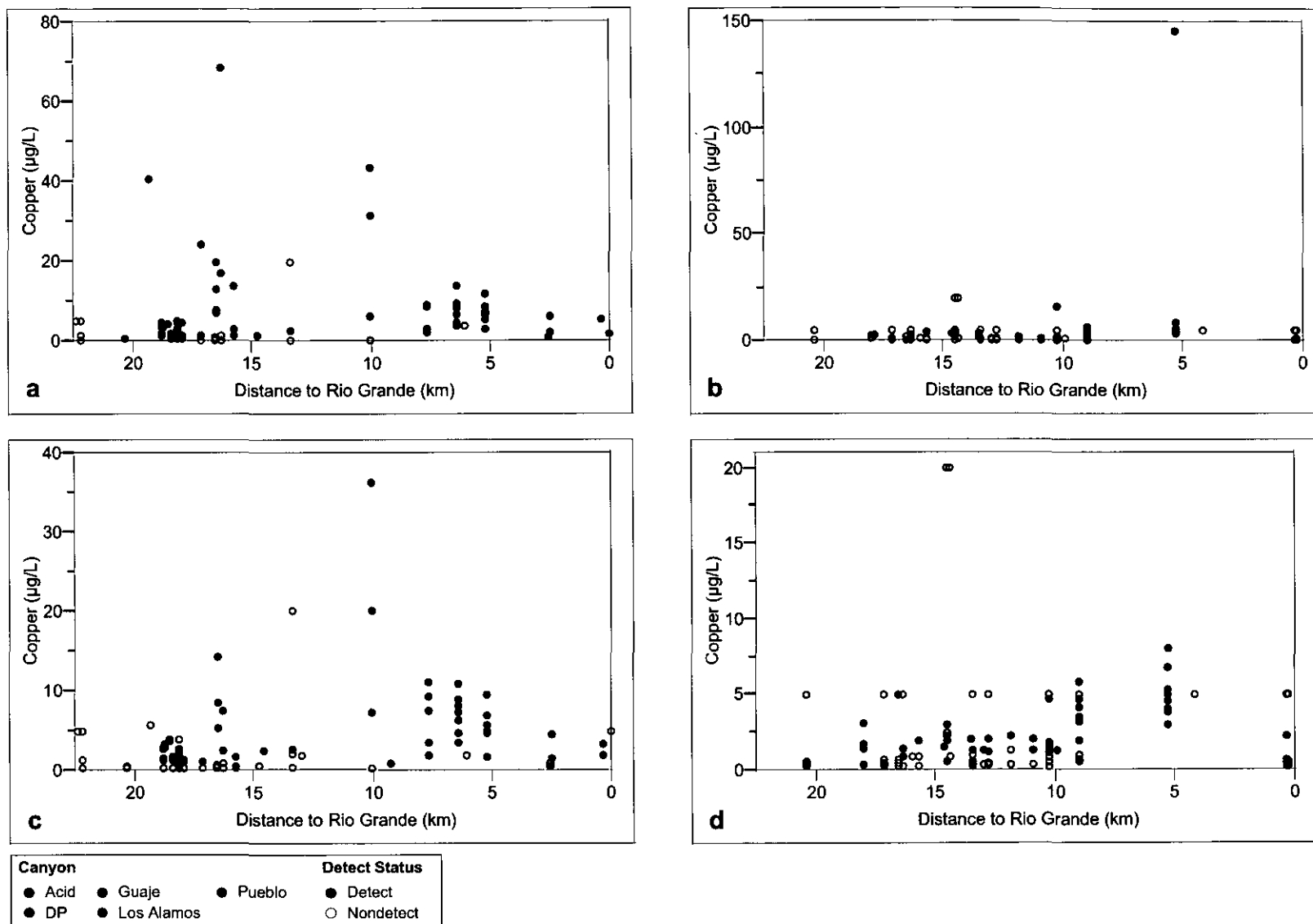


Figure D-2.0-8. Scatter plots of copper concentrations versus distance from the Rio Grande in (a) unfiltered surface water and spring water, (b) unfiltered alluvial groundwater, (c) filtered surface water and spring water, and (d) filtered alluvial groundwater

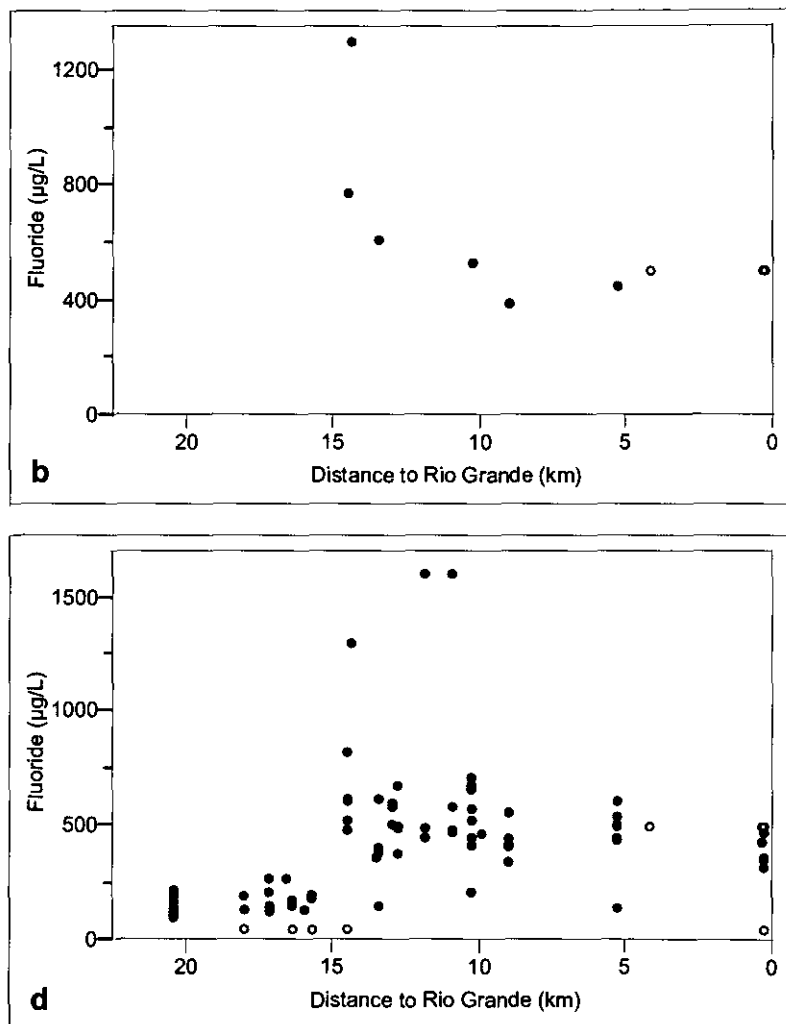
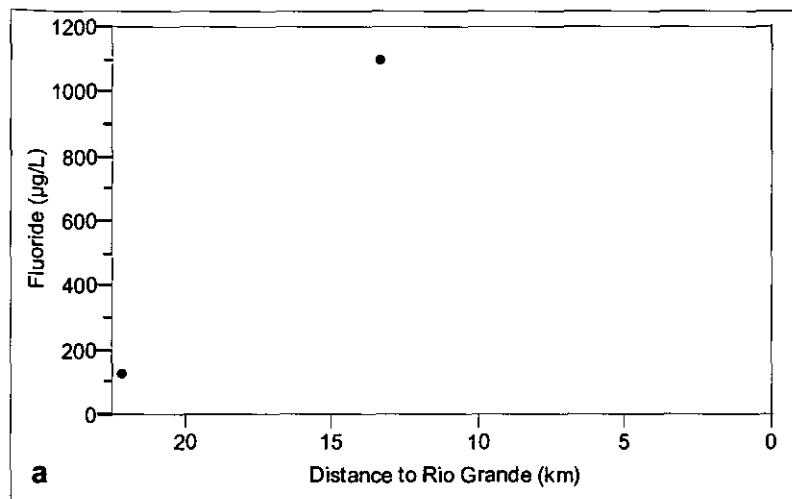
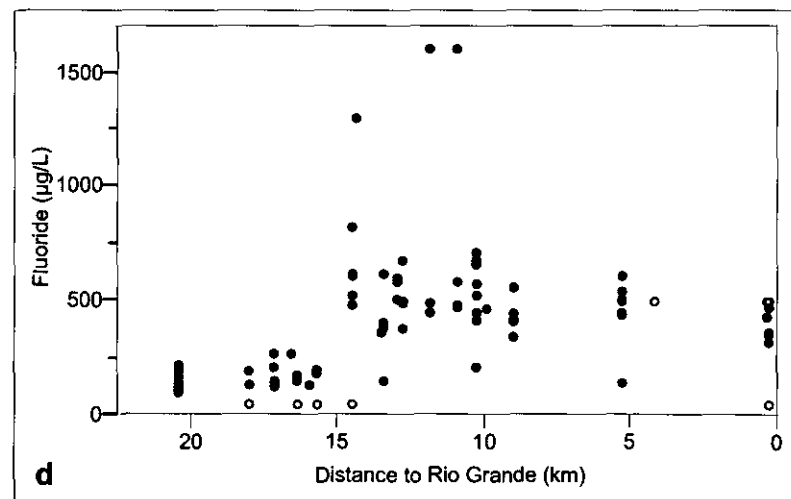
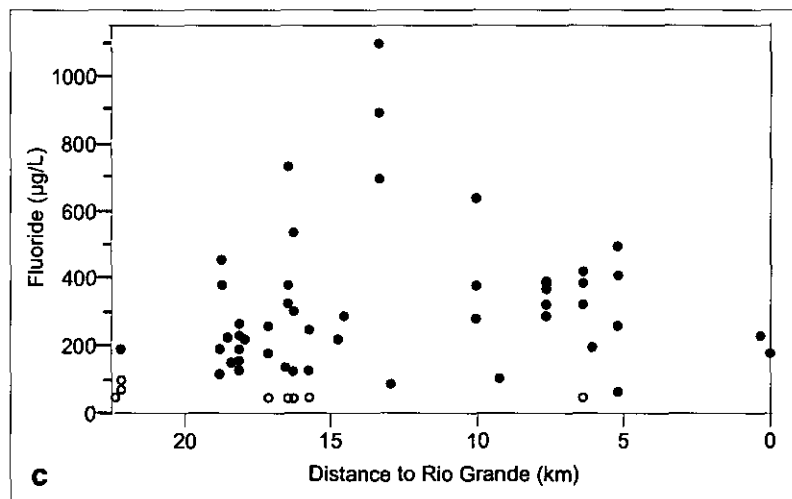
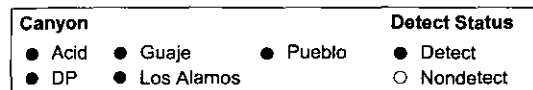


Figure D-2.0-9. Scatter plots of fluoride concentrations versus distance from the Rio Grande in (a) unfiltered surface water and spring water, (b) unfiltered alluvial groundwater, (c) filtered surface water and spring water, and (d) filtered alluvial groundwater

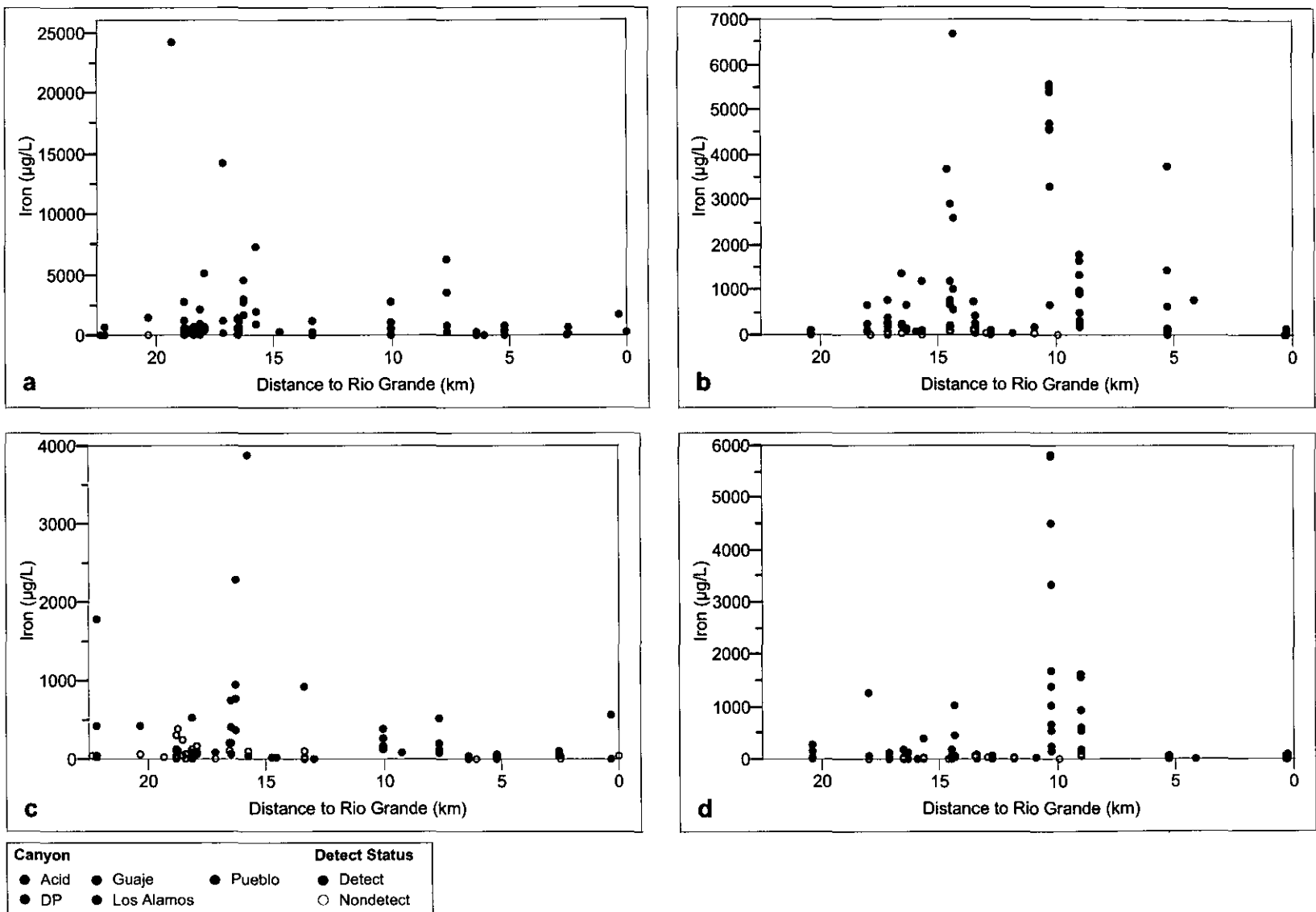


Figure D-2.0-10. Scatter plots of iron concentrations versus distance from the Rio Grande in (a) unfiltered surface water and spring water, (b) unfiltered alluvial groundwater, (c) filtered surface water and spring water, and (d) filtered alluvial groundwater

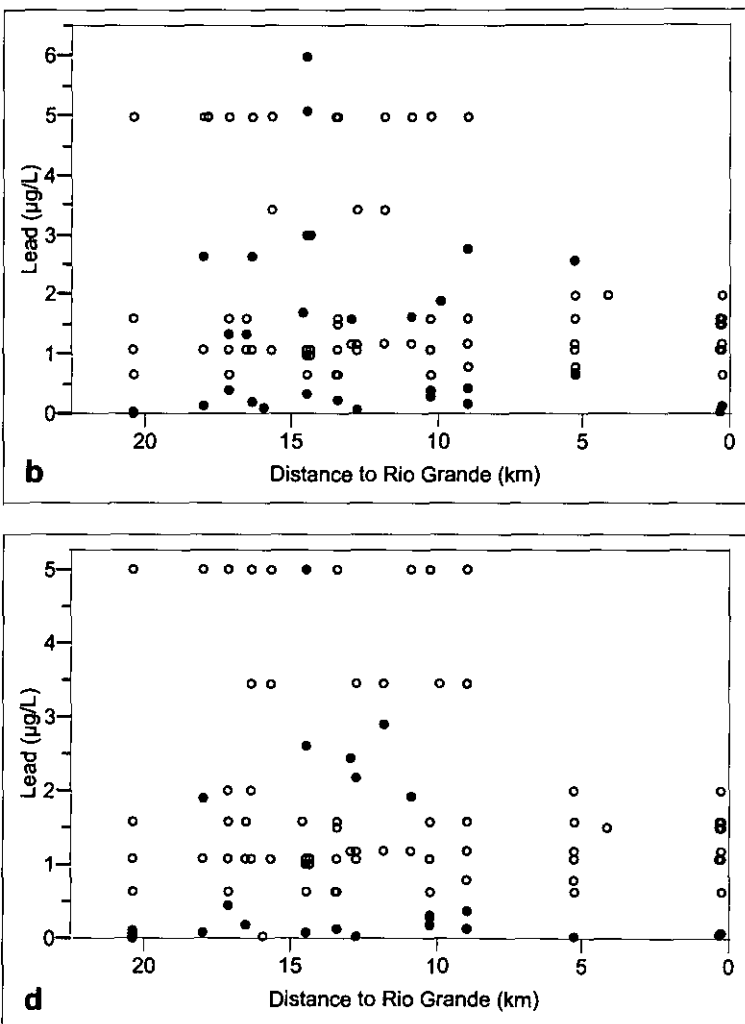
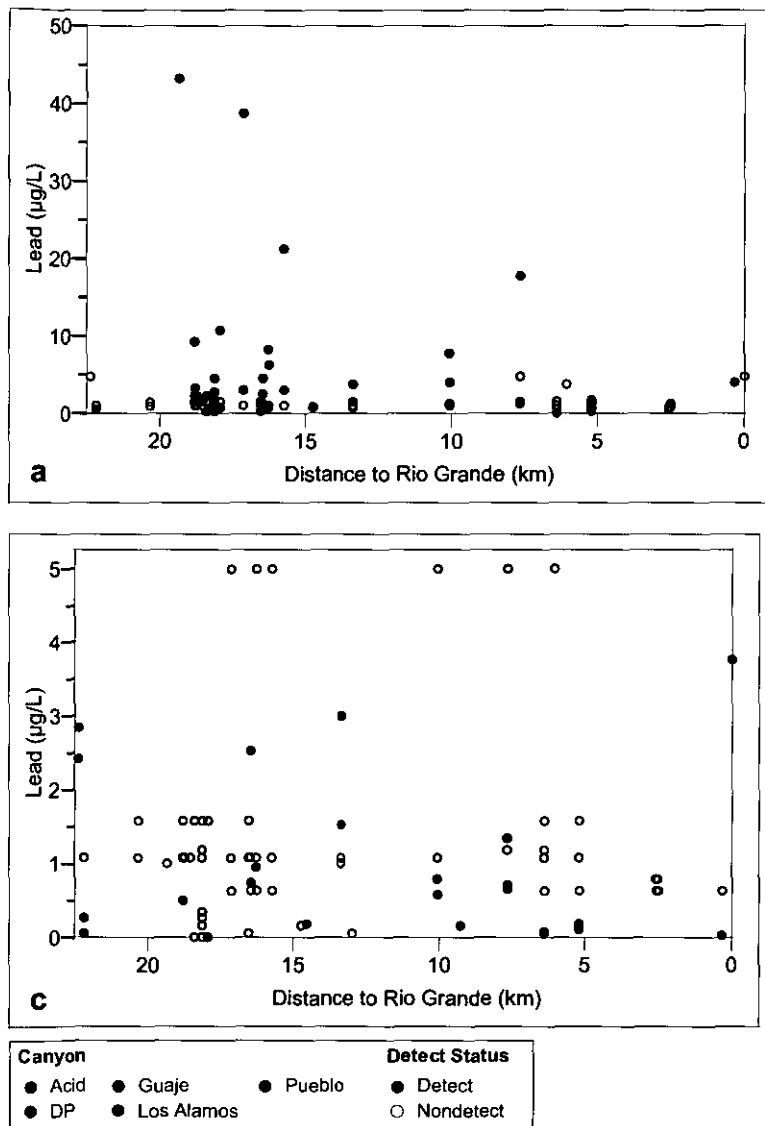


Figure D-2.0-11. Scatter plots of lead concentrations versus distance from the Rio Grande in (a) unfiltered surface water and spring water, (b) unfiltered alluvial groundwater, (c) filtered surface water and spring water, and (d) filtered alluvial groundwater

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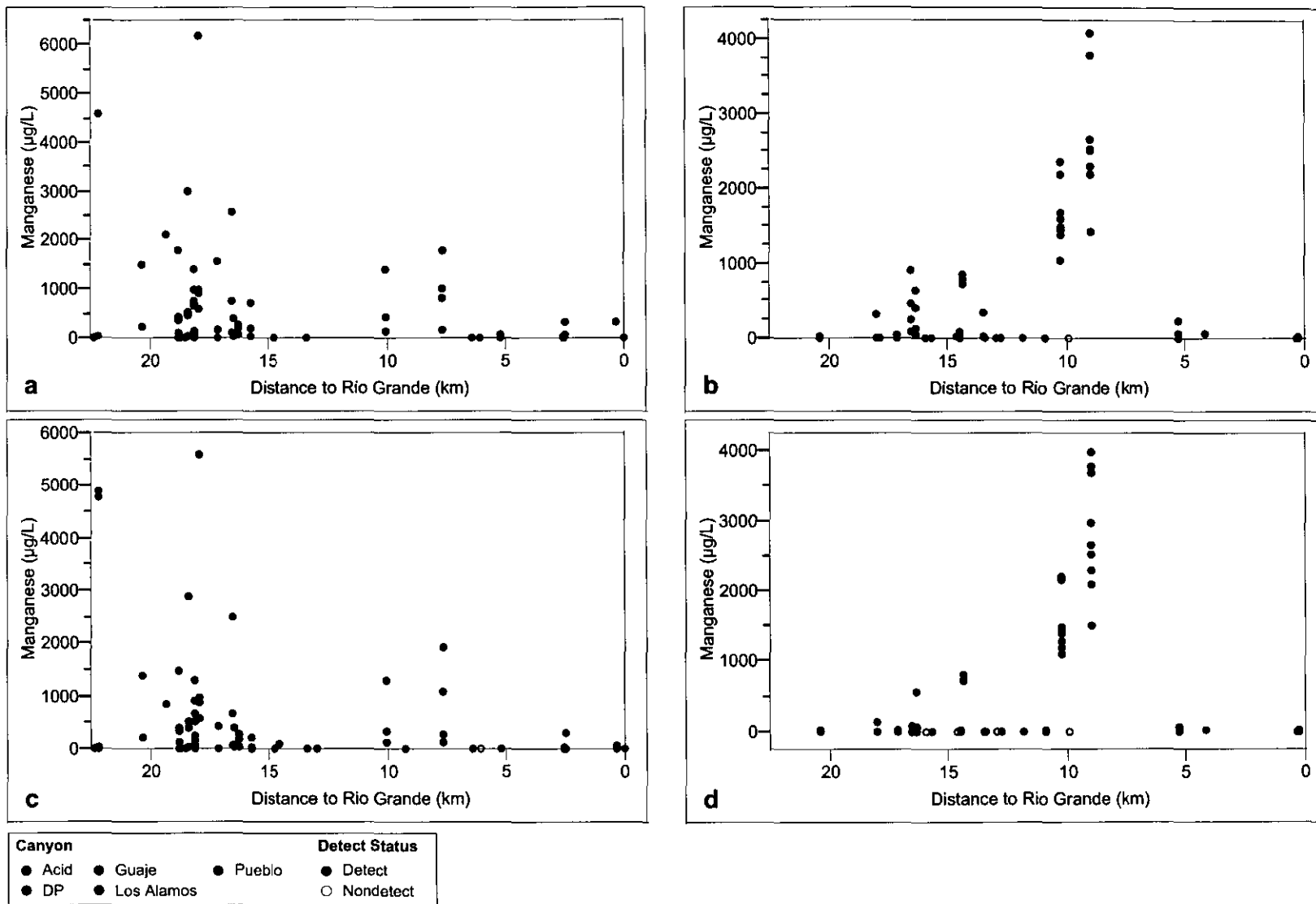


Figure D-2.0-12. Scatter plots of manganese concentrations versus distance from the Rio Grande in (a) unfiltered surface water and spring water, (b) unfiltered alluvial groundwater, (c) filtered surface water and spring water, and (d) filtered alluvial groundwater

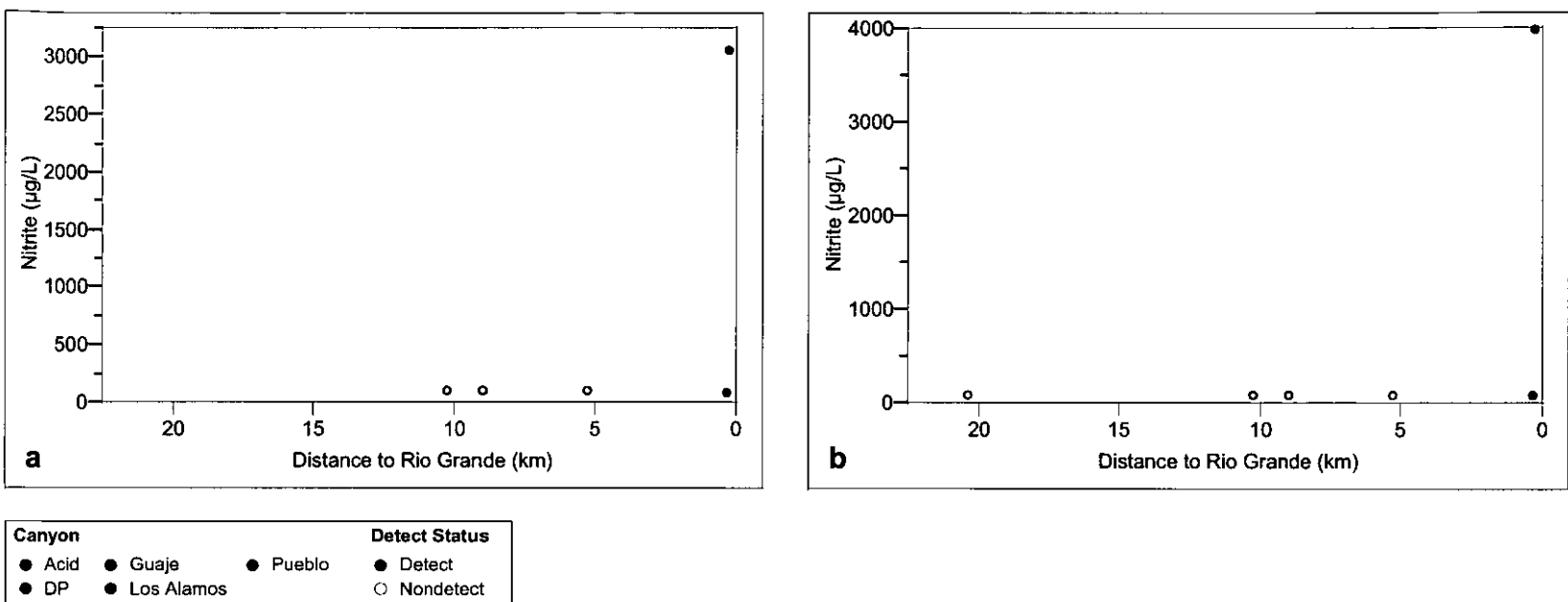


Figure D-2.0-14. Scatter plots of nitrite concentrations versus distance from the Rio Grande in (a) unfiltered alluvial groundwater and (b) filtered alluvial groundwater

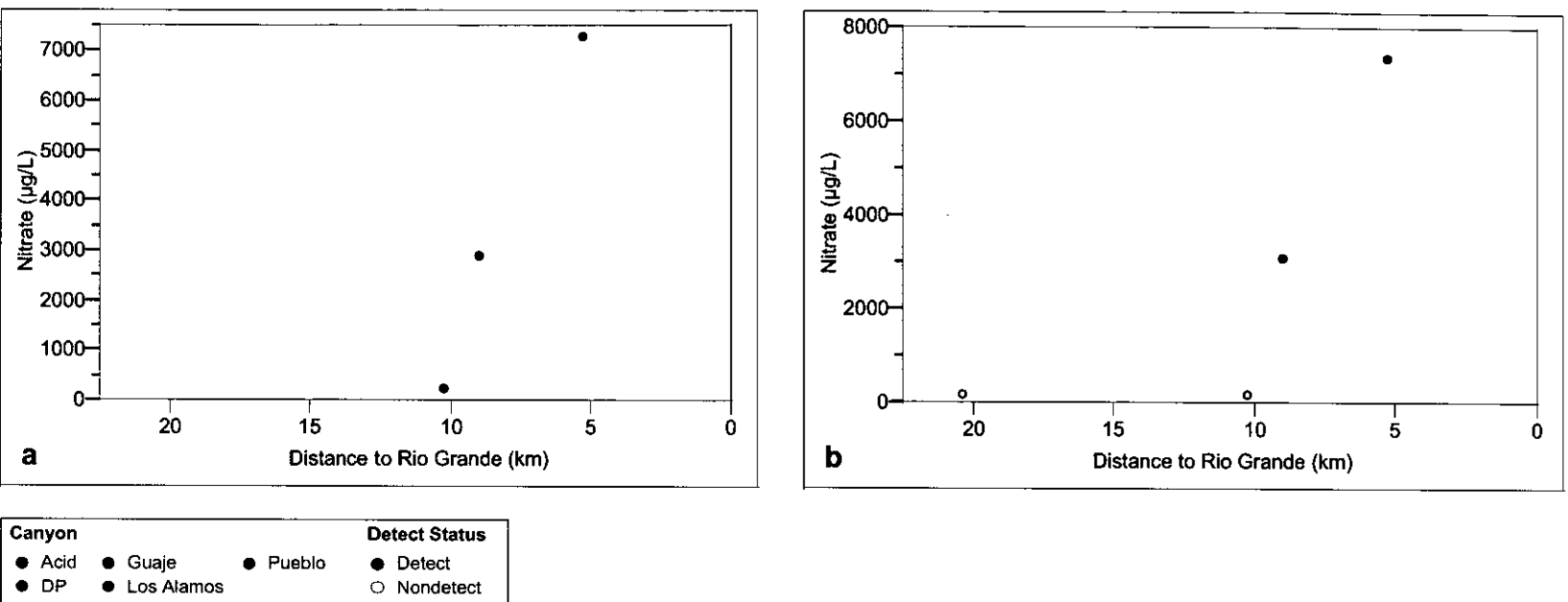


Figure D-2.0-13. Scatter plots of nitrate concentrations versus distance from the Rio Grande in (a) unfiltered alluvial groundwater and (b) filtered alluvial groundwater

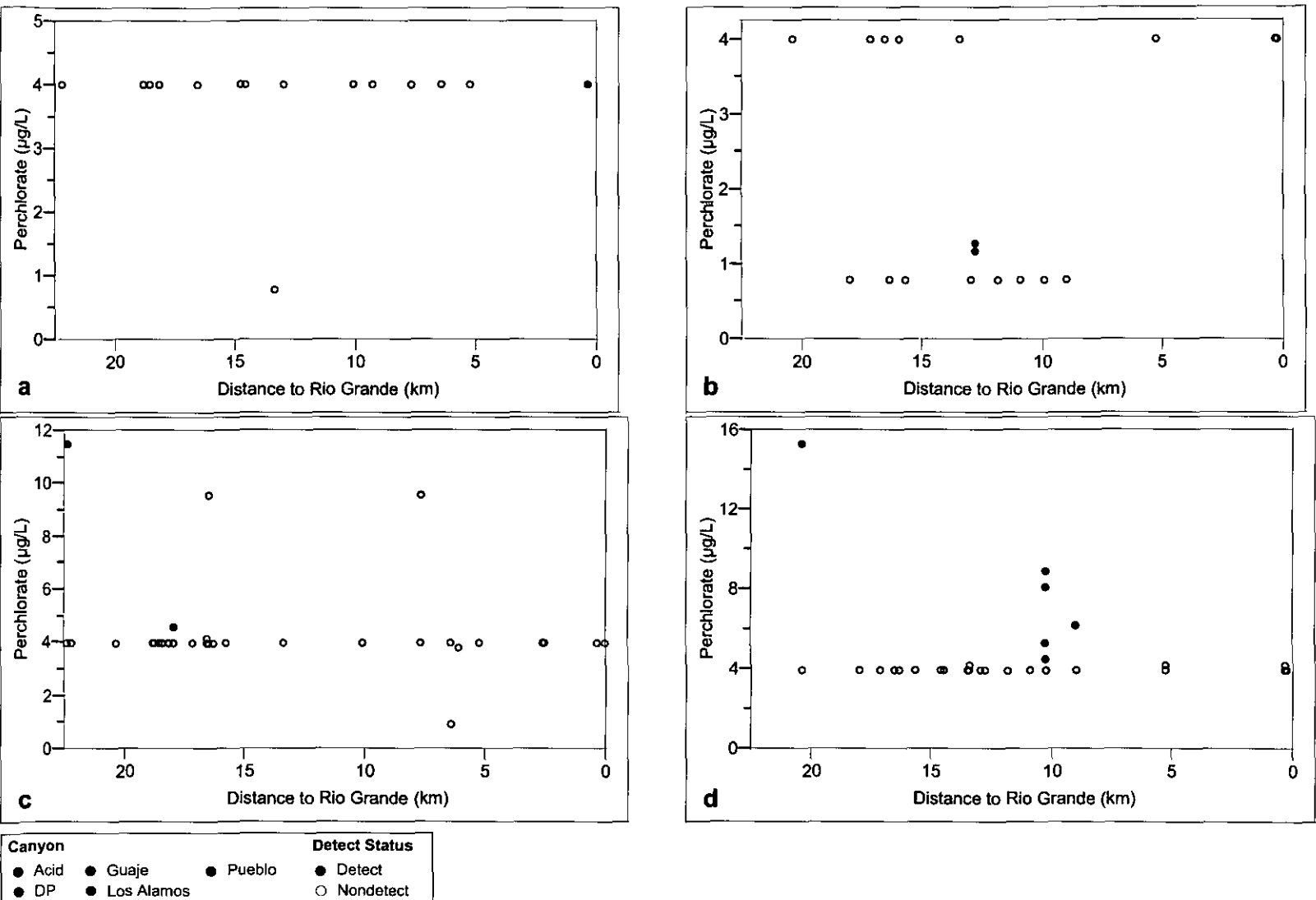


Figure D-2.0-15. Scatter plots of perchlorate concentrations versus distance from the Rio Grande in (a) unfiltered surface water and spring water, (b) unfiltered alluvial groundwater, (c) filtered surface water and spring water, and (d) filtered alluvial groundwater

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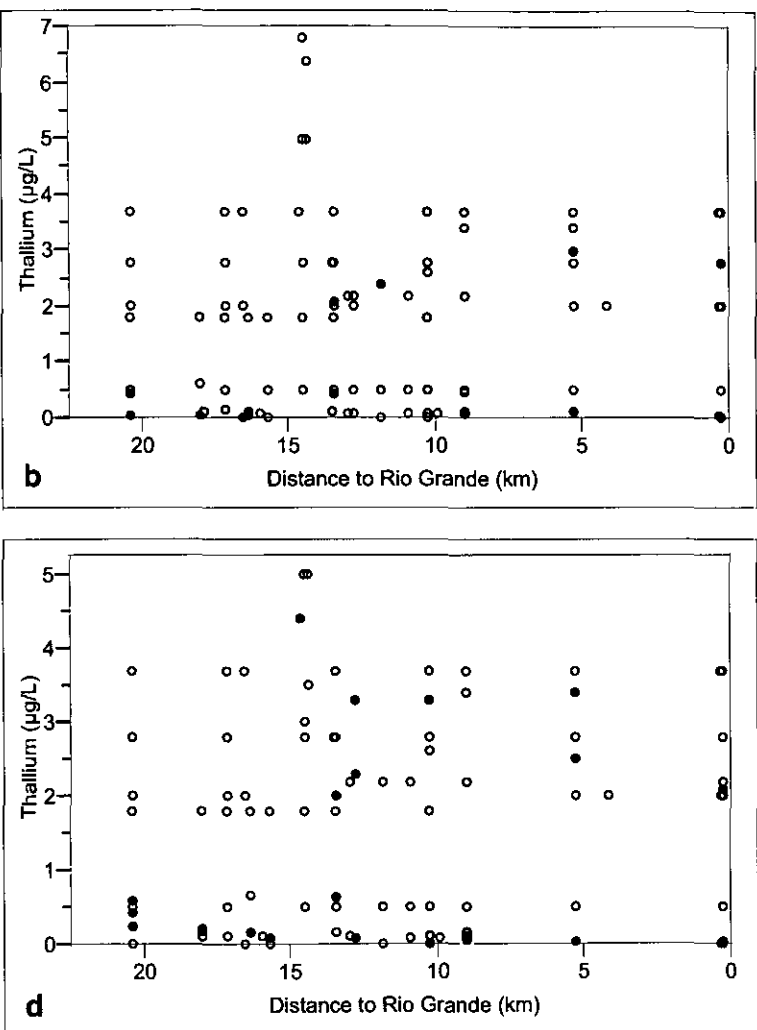
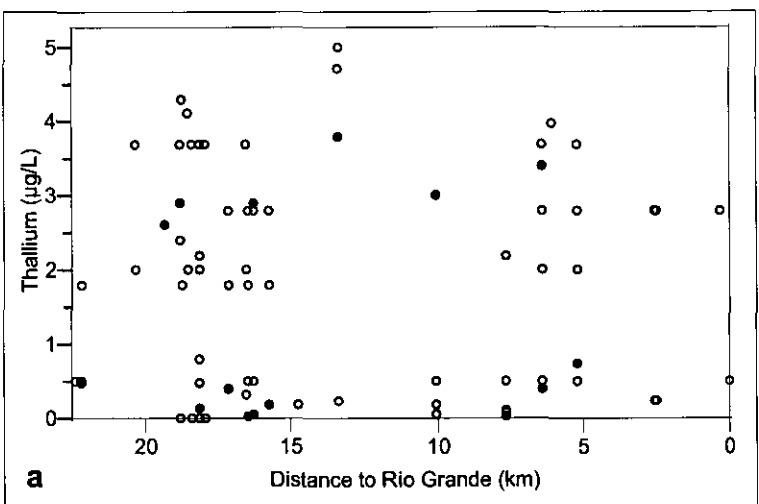
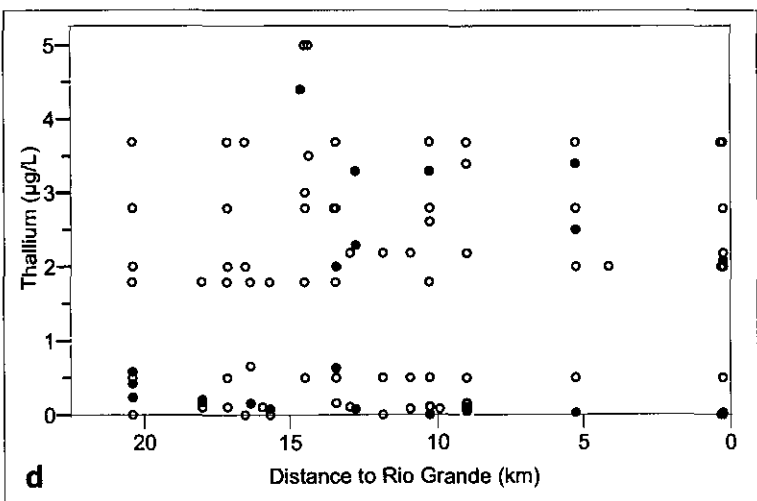
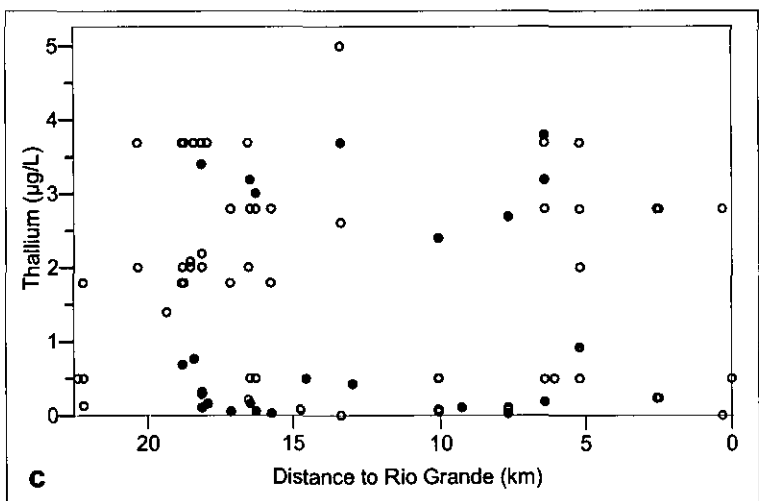
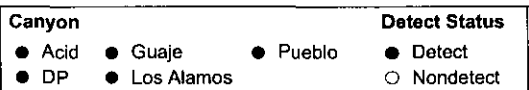


Figure D-2.0-16. Scatter plots of thallium concentrations versus distance from the Rio Grande in (a) unfiltered surface water and spring water, (b) unfiltered alluvial groundwater, (c) filtered surface water and spring water, and (d) filtered alluvial groundwater

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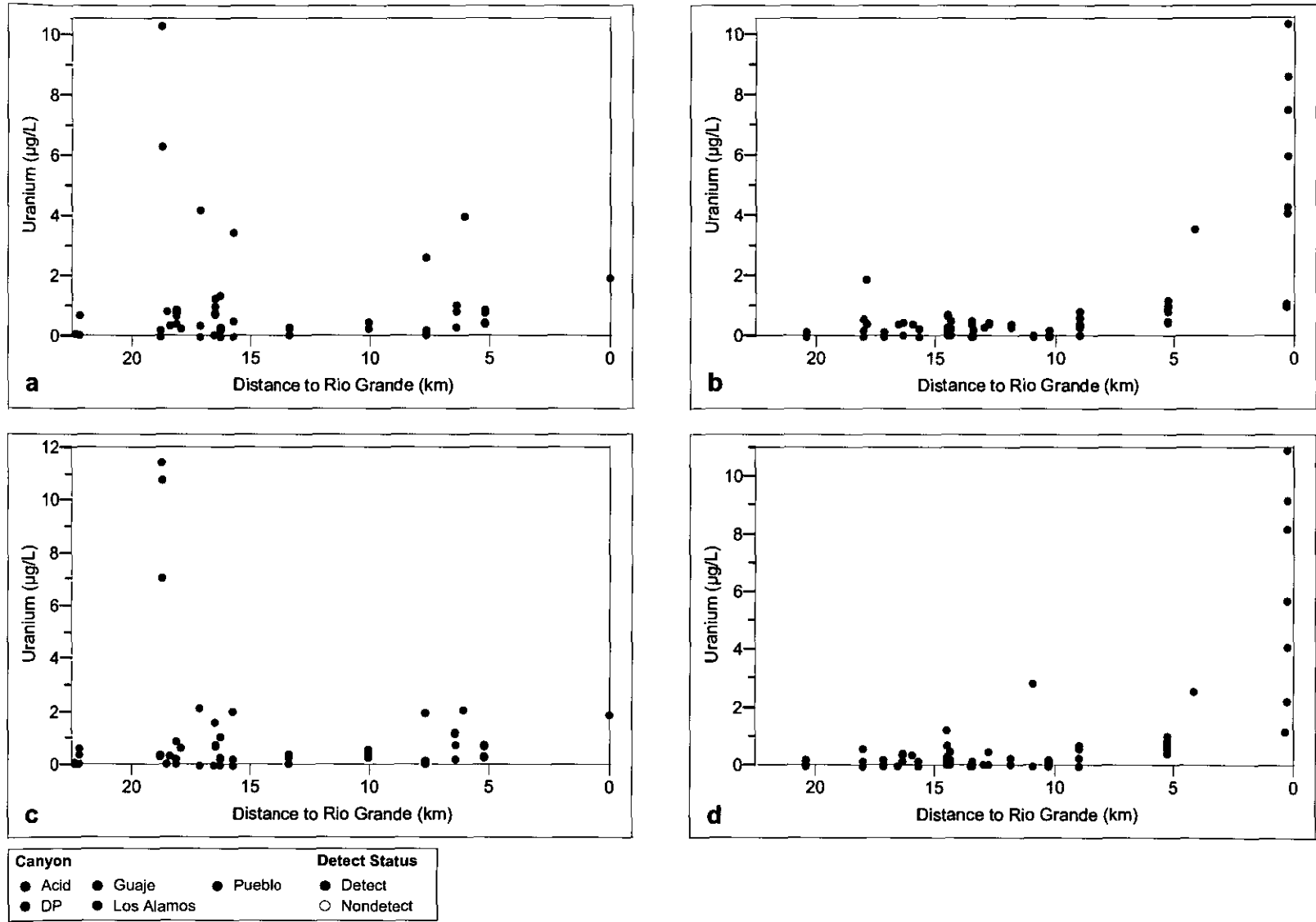


Figure D-2.0-17. Scatter plots of uranium concentrations versus distance from the Rio Grande in (a) unfiltered surface water and spring water, (b) unfiltered alluvial groundwater, (c) filtered surface water and spring water, and (d) filtered alluvial groundwater

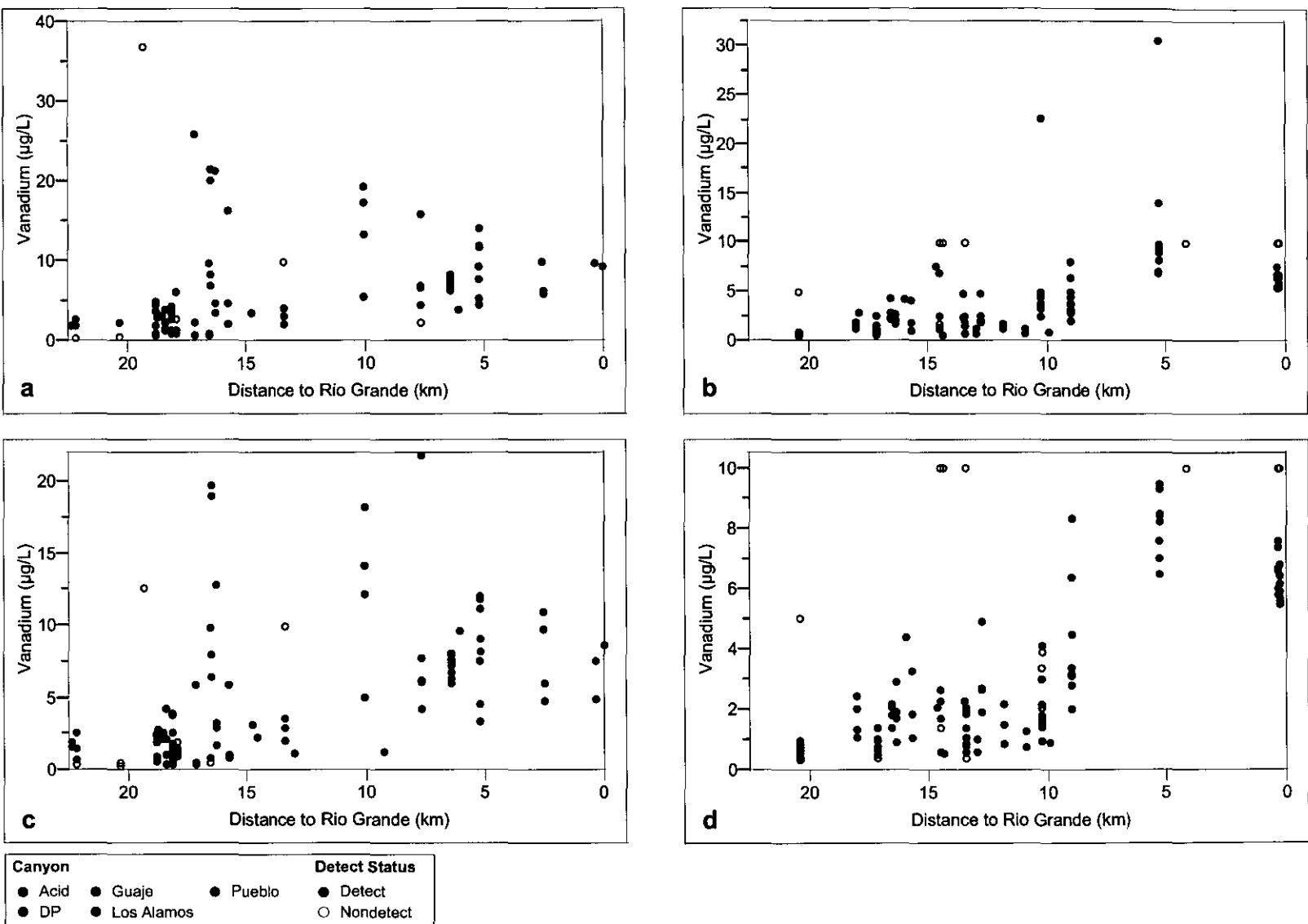


Figure D-2.0-18. Scatter plots of vanadium concentrations versus distance from the Rio Grande in (a) unfiltered surface water and spring water, (b) unfiltered alluvial groundwater, (c) filtered surface water and spring water, and (d) filtered alluvial groundwater

Figure D-2.0-19. Scatter plots of americium-241 concentrations versus distance from the Rio Grande in (a) unfiltered surface water and spring water, (b) unfiltered alluvial groundwater, (c) filtered surface water and spring water, and (d) filtered alluvial groundwater

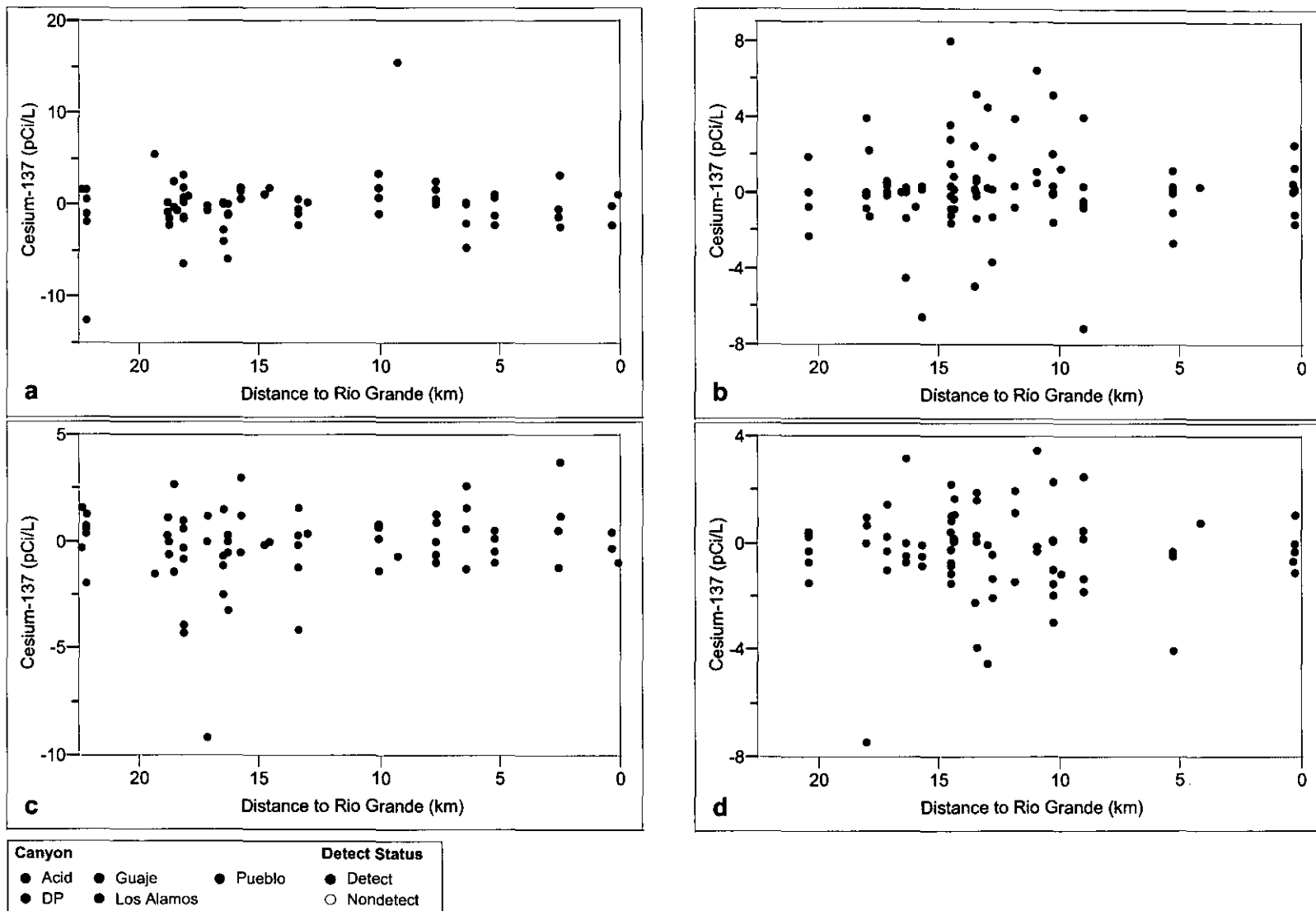


Figure D-2.0-20. Scatter plots of cesium-137 concentrations versus distance from the Rio Grande in (a) unfiltered surface water and spring water, (b) unfiltered alluvial groundwater, (c) filtered surface water and spring water, and (d) filtered alluvial groundwater

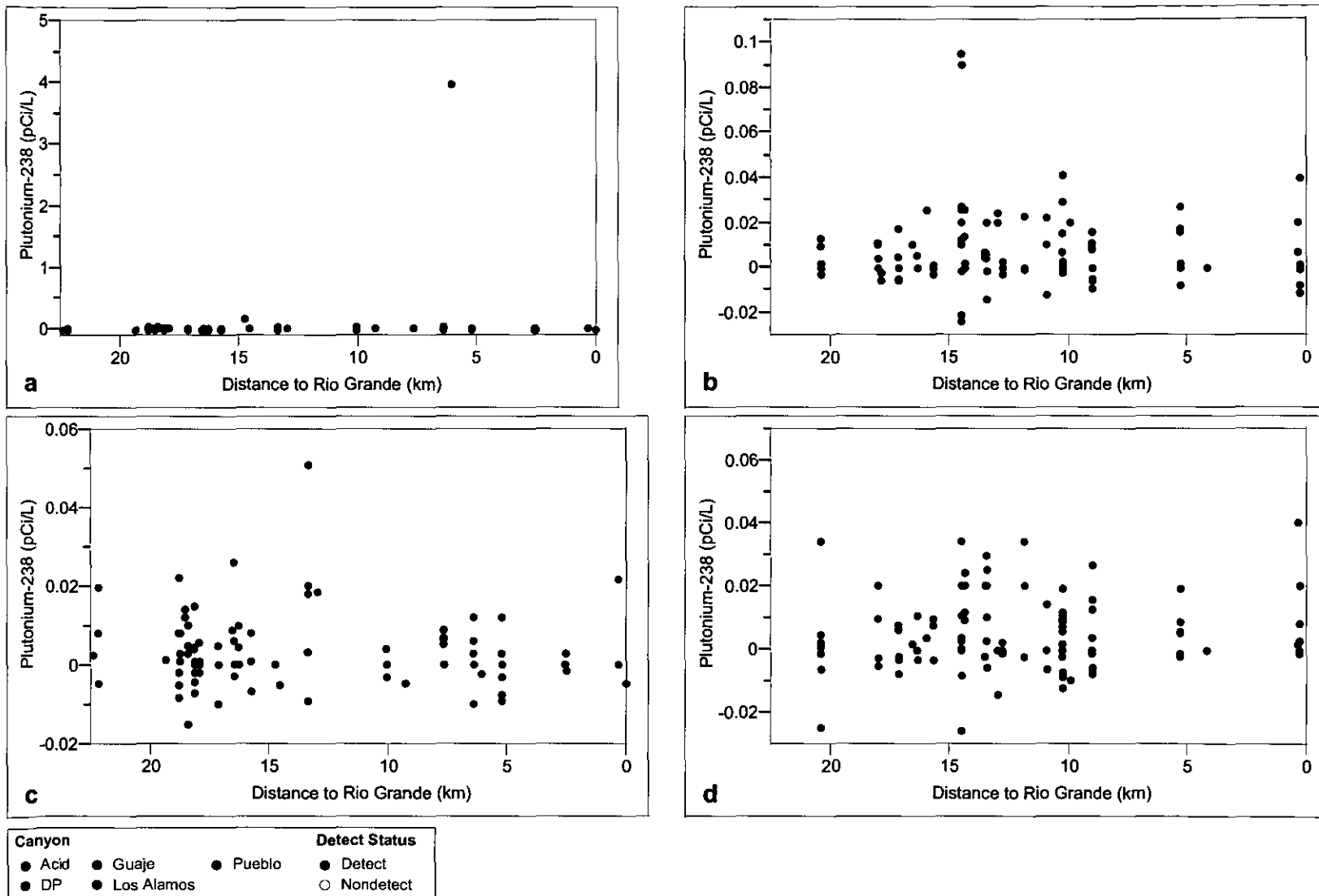


Figure D-2.0-21. Scatter plots of plutonium-238 concentrations versus distance from the Rio Grande in (a) unfiltered surface water and spring water, (b) unfiltered alluvial groundwater, (c) filtered surface water and spring water, and (d) filtered alluvial groundwater

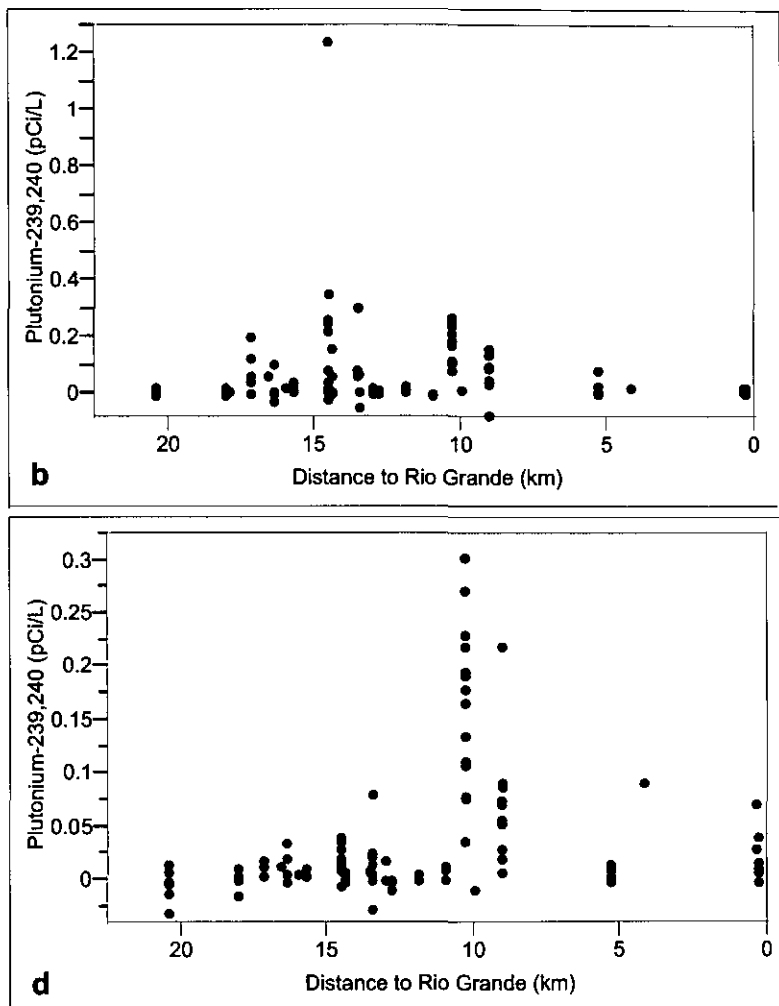
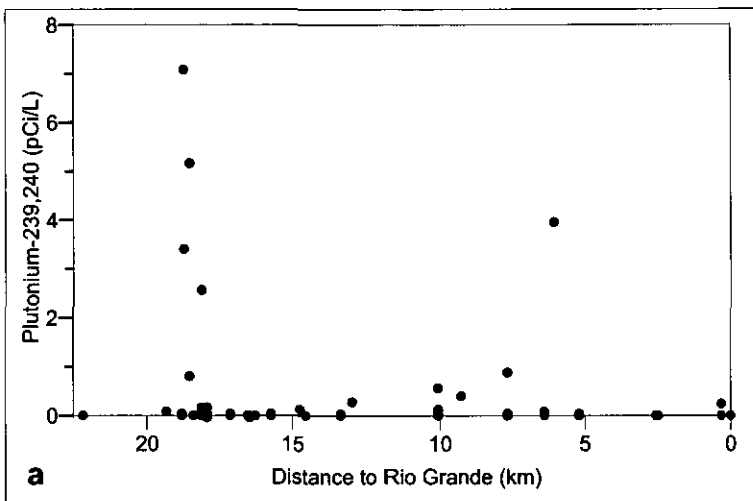
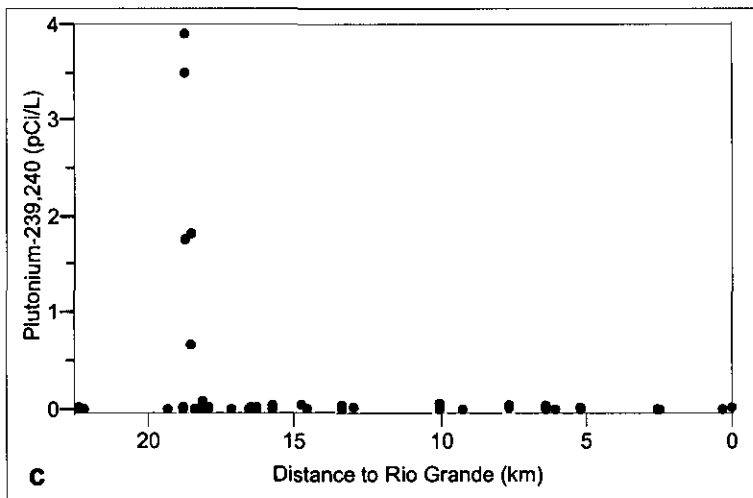
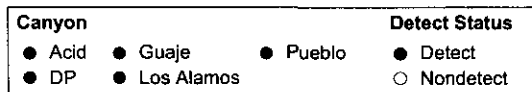


Figure D-2.0-22. Scatter plots of plutonium-239,240 concentrations versus distance from the Rio Grande in (a) unfiltered surface water and spring water, (b) unfiltered alluvial groundwater, (c) filtered surface water and spring water, and (d) filtered alluvial groundwater

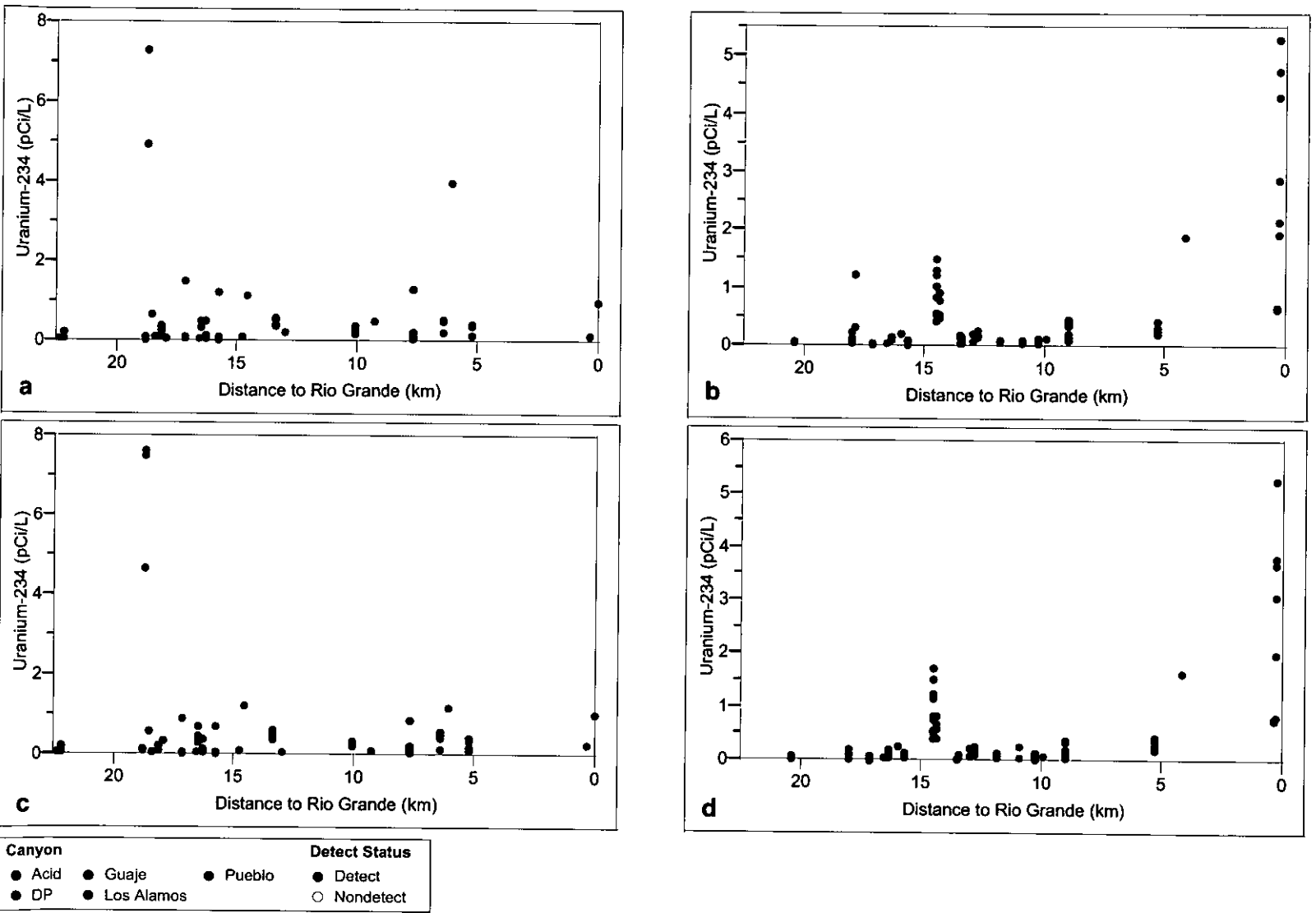


Figure D-2.0-23. Scatter plots of uranium-234 concentrations versus distance from the Rio Grande in (a) unfiltered surface water and spring water, (b) unfiltered alluvial groundwater, (c) filtered surface water and spring water, and (d) filtered alluvial groundwater

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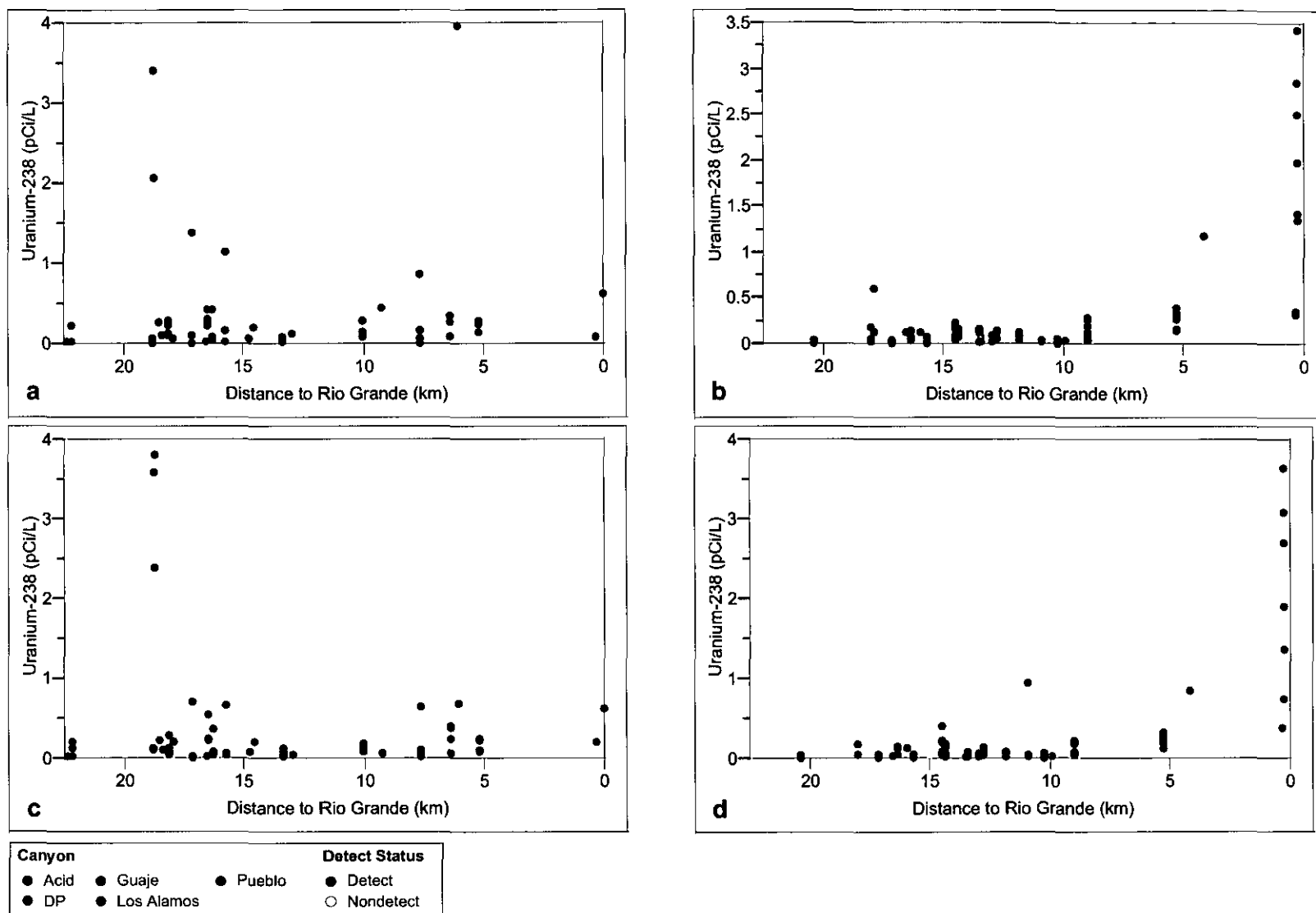


Figure D-2.0-24. Scatter plots of uranium-238 concentrations versus distance from the Rio Grande in (a) unfiltered surface water and spring water, (b) unfiltered alluvial groundwater, (c) filtered surface water and spring water, and (d) filtered alluvial groundwater

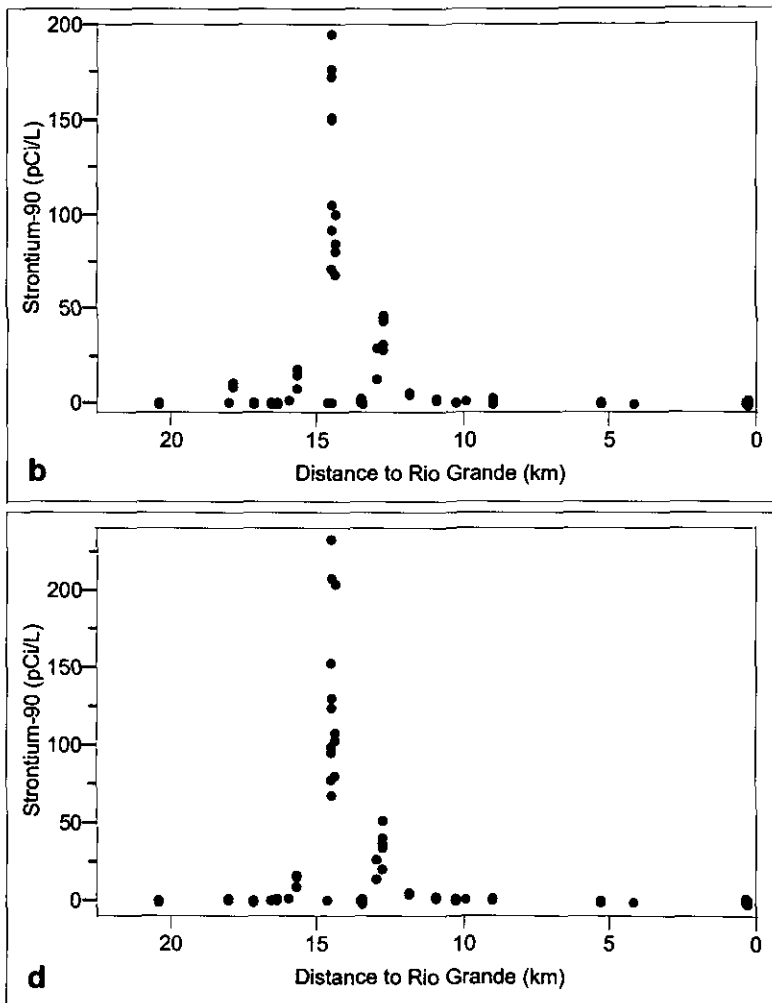
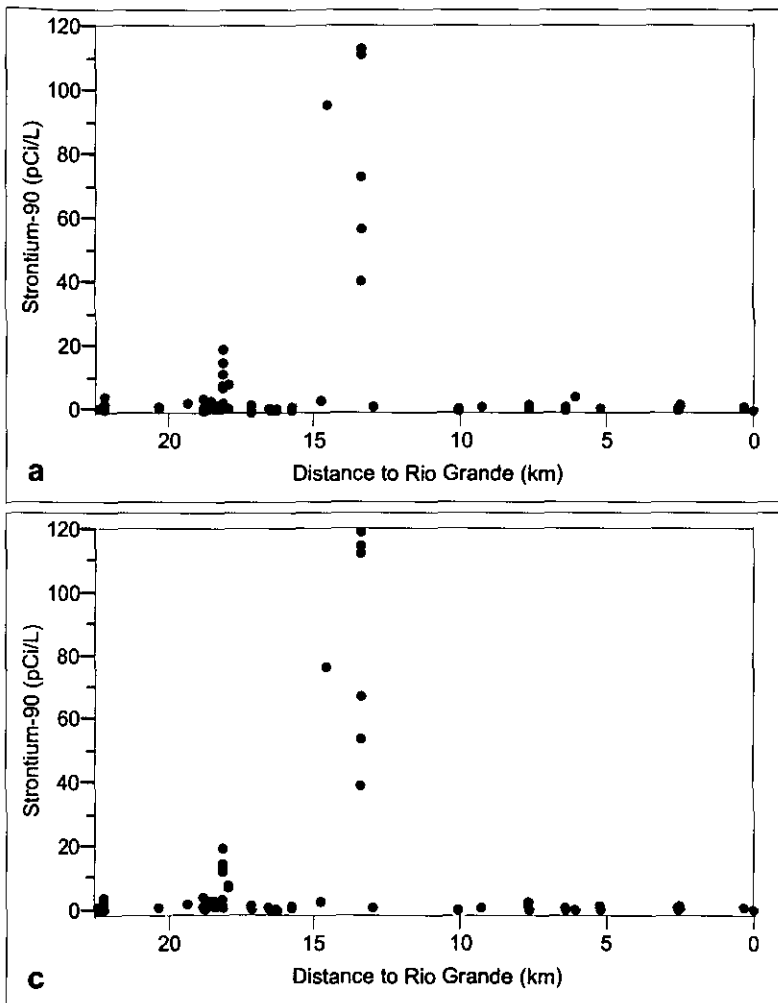
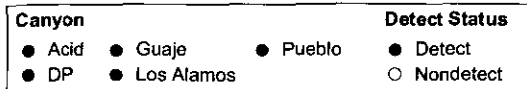


Figure D-2.0-25. Scatter plots of strontium-90 concentrations versus distance from the Rio Grande in (a) unfiltered surface water and spring water, (b) unfiltered alluvial groundwater, (c) filtered surface water and spring water, and (d) filtered alluvial groundwater

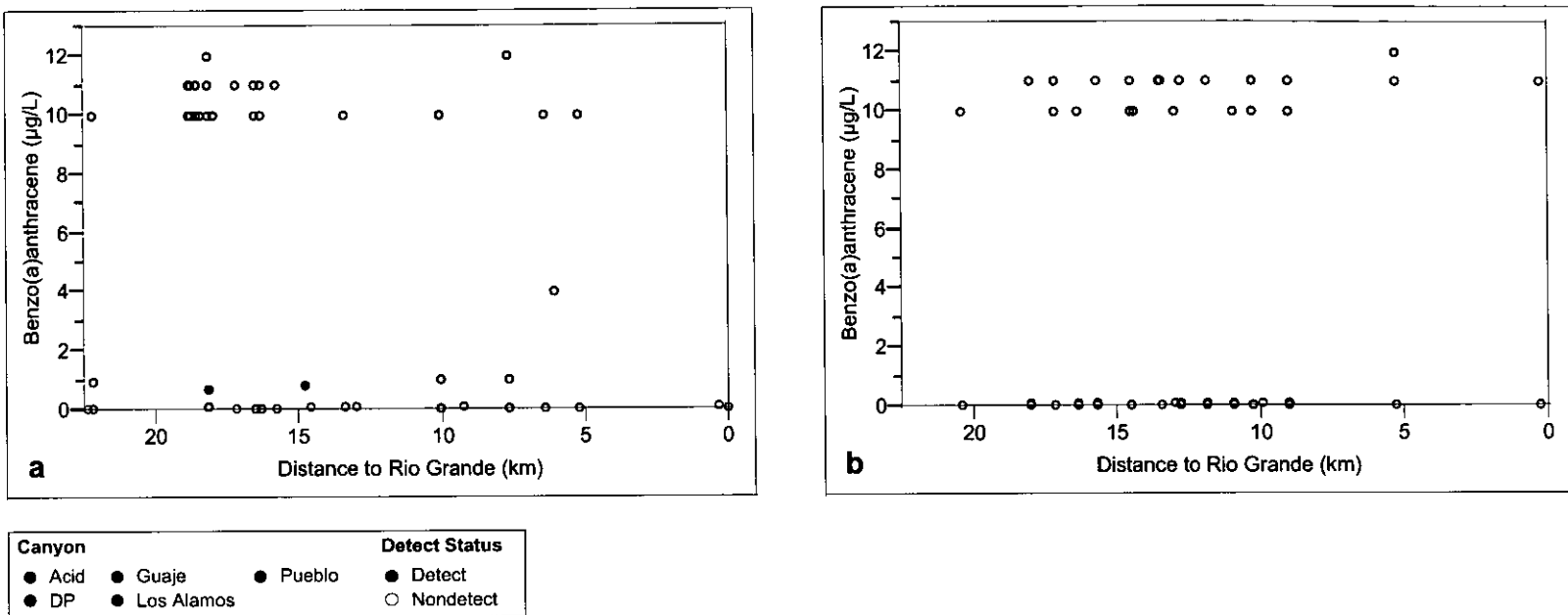


Figure D-2.0-26. Scatter plots of benz(a)anthracene concentrations versus distance from the Rio Grande in (a) unfiltered surface water and spring water and (b) unfiltered alluvial groundwater

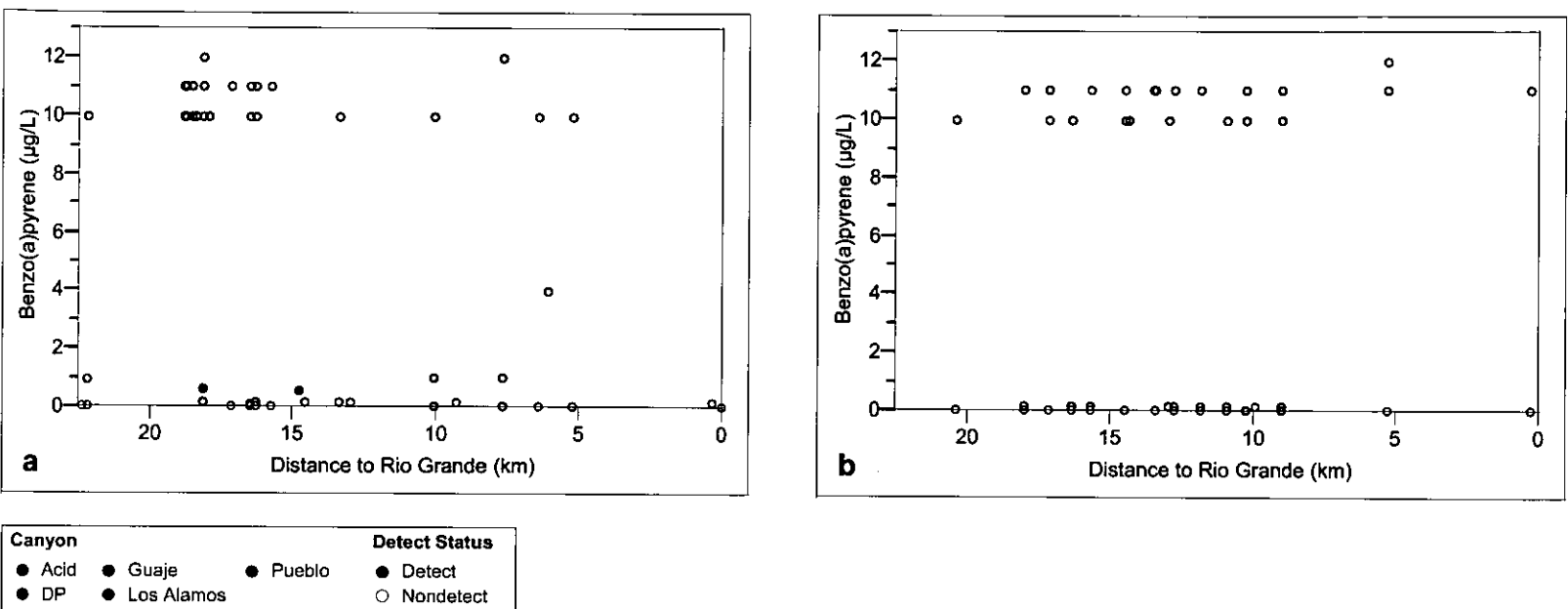


Figure D-2.0-27. Scatter plots of benzo(a)pyrene concentrations versus distance from the Rio Grande in (a) unfiltered surface water and spring water and (b) unfiltered alluvial groundwater

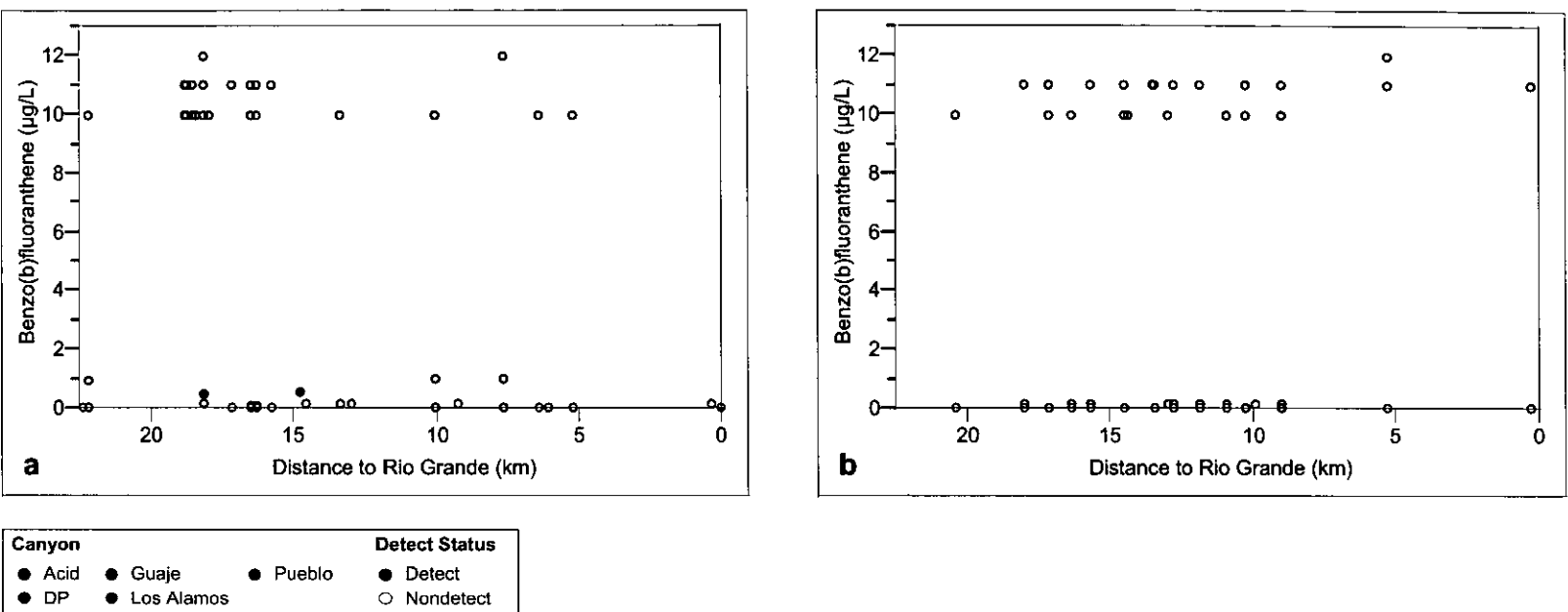


Figure D-2.0-28. Scatter plots of benzo(b)fluoranthene concentrations versus distance from the Rio Grande in (a) unfiltered surface water and spring water and (b) unfiltered alluvial groundwater

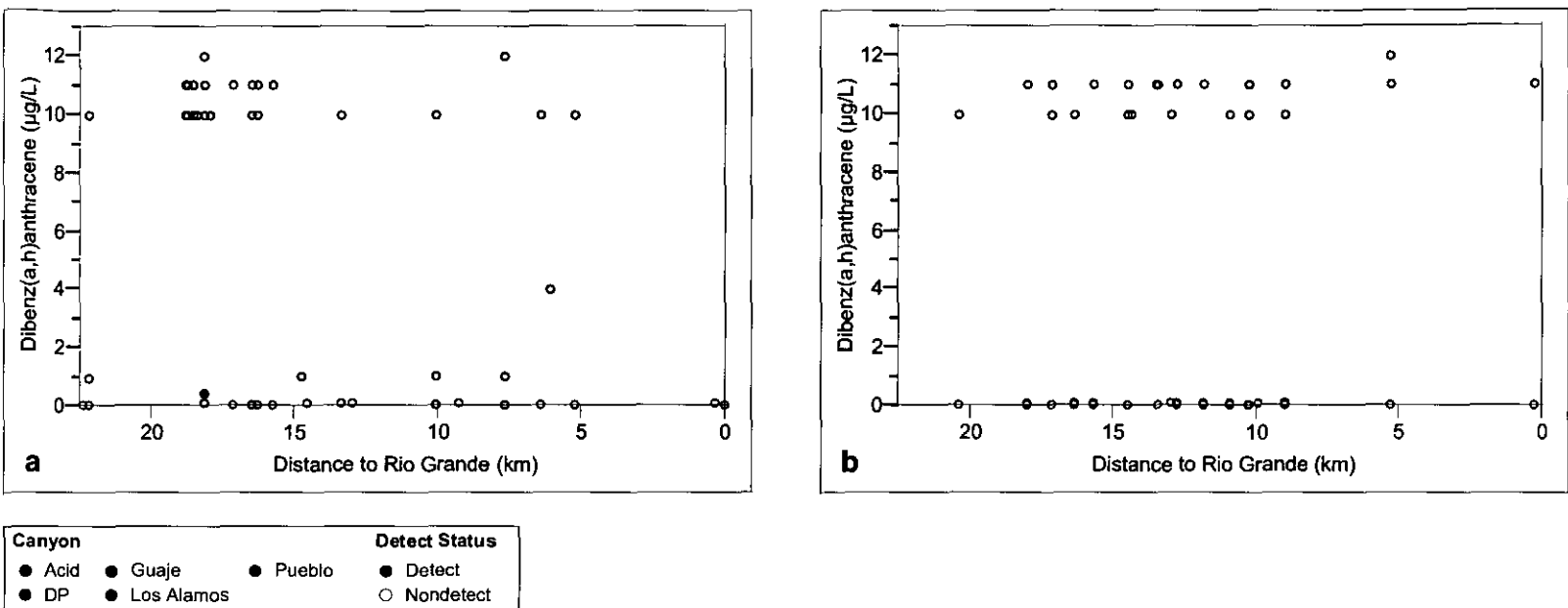


Figure D-2.0-29. Scatter plots of dibenz(a,h)anthracene concentrations versus distance from the Rio Grande in (a) unfiltered surface water and spring water and (b) unfiltered alluvial groundwater

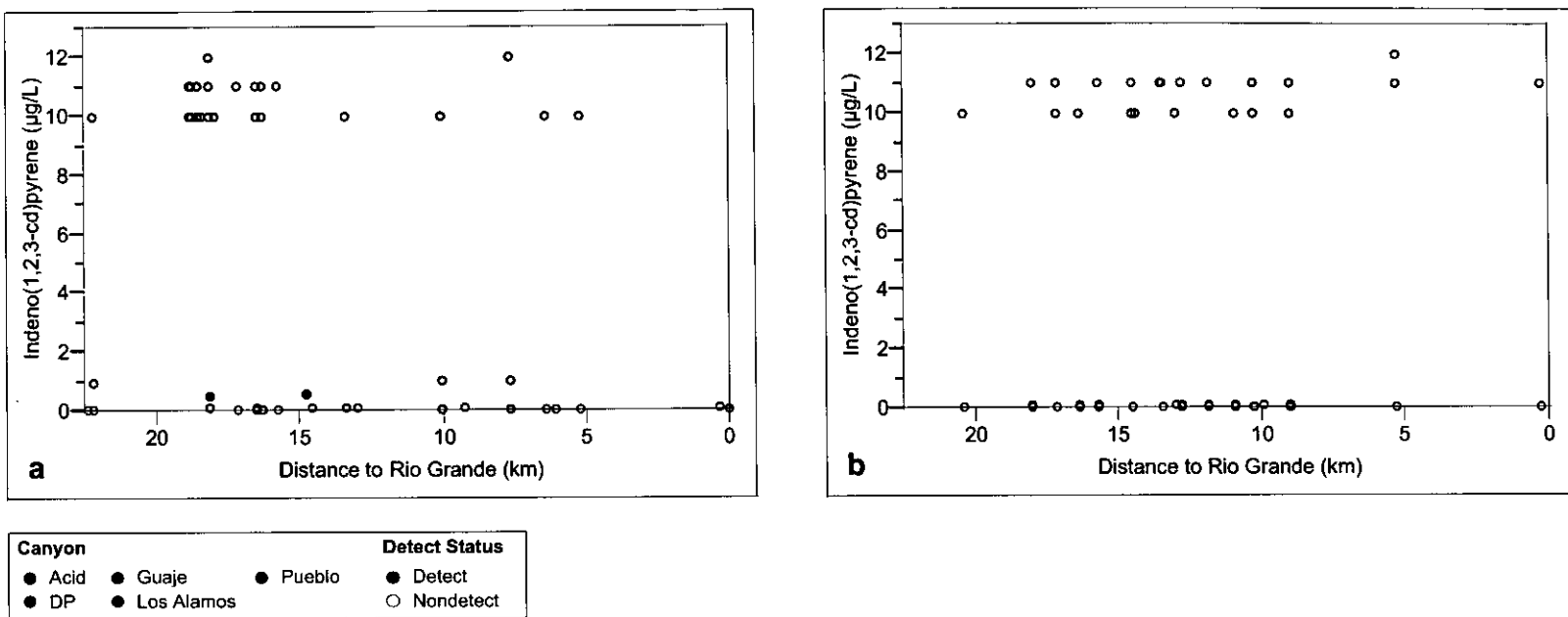


Figure D-2.0-30. Scatter plots of indeno(1,2,3-cd)pyrene concentrations versus distance from the Rio Grande in (a) unfiltered surface water and spring water and (b) unfiltered alluvial groundwater

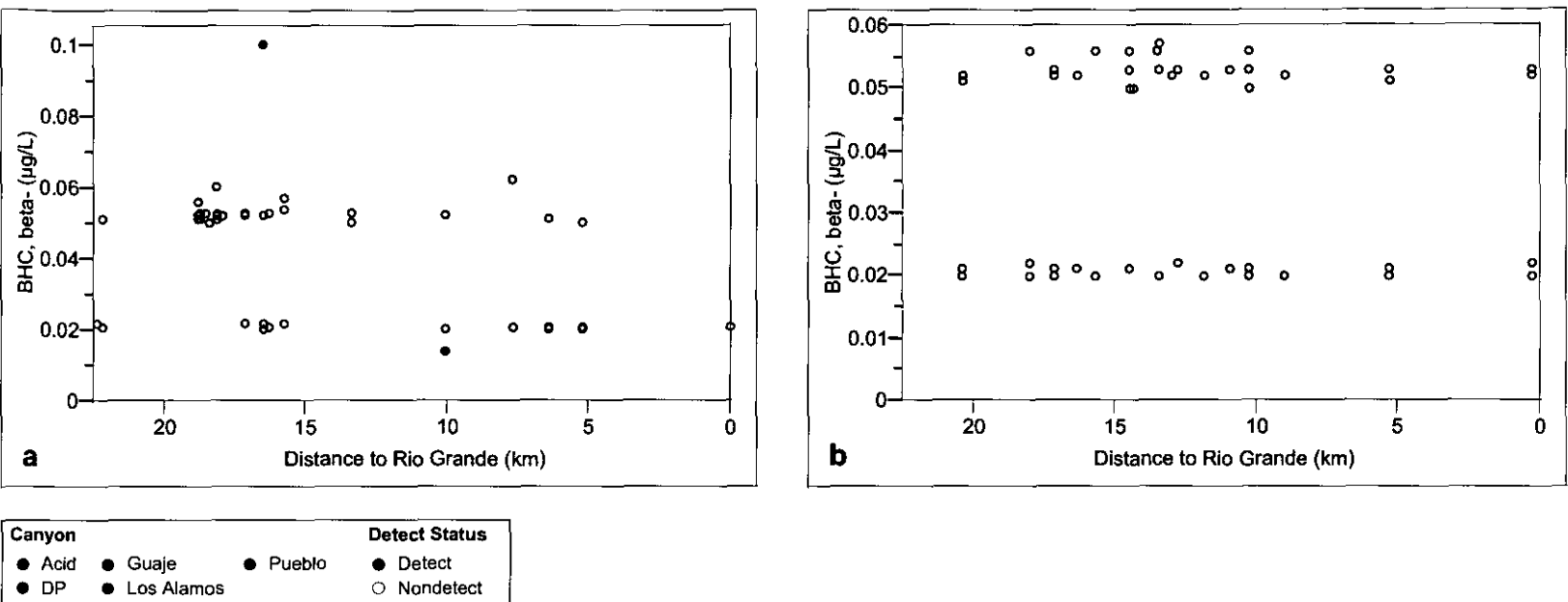


Figure D-2.0-31. Scatter plots of beta-BHC concentrations versus distance from the Rio Grande in (a) unfiltered surface water and spring water and (b) unfiltered alluvial groundwater

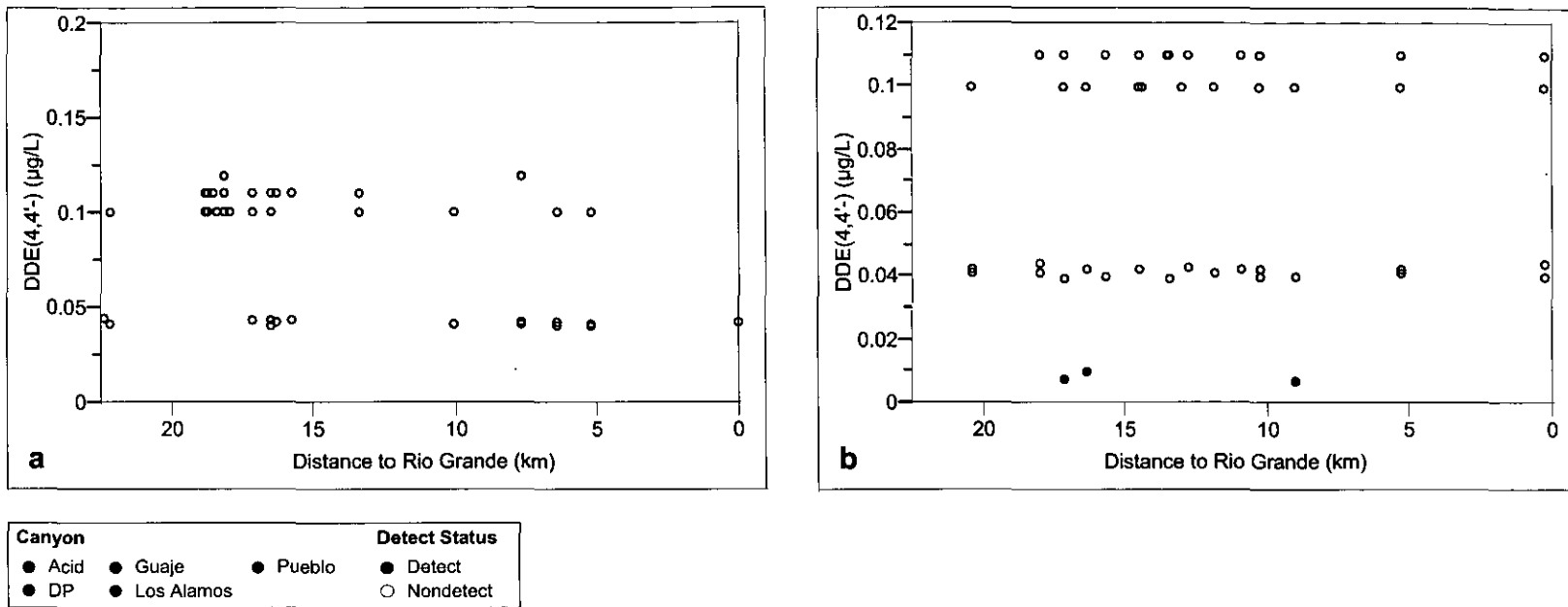


Figure D-2.0-32. Scatter plots of 4,4'-DDE concentrations versus distance from the Rio Grande in (a) unfiltered surface water and spring water and (b) unfiltered alluvial groundwater

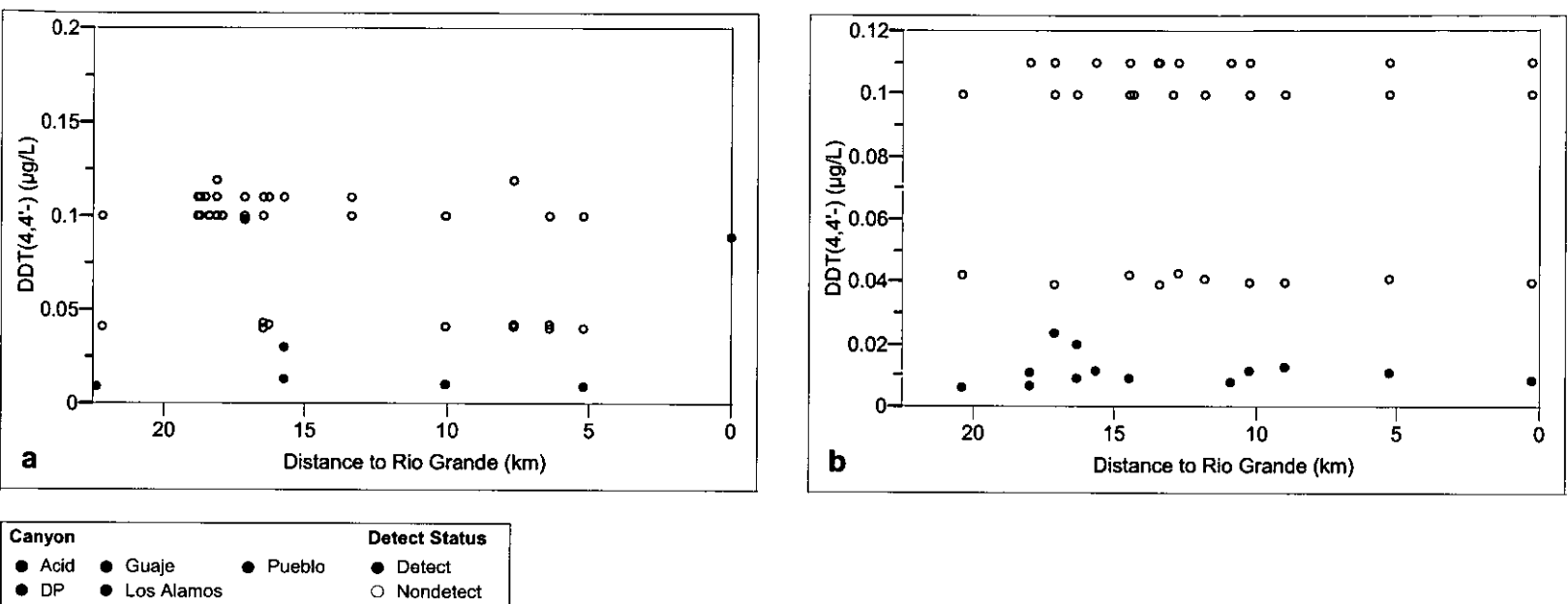


Figure D-2.0-33. Scatter plots of 4,4'-DDT concentrations versus distance from the Rio Grande in (a) unfiltered surface water and spring water and (b) unfiltered alluvial groundwater

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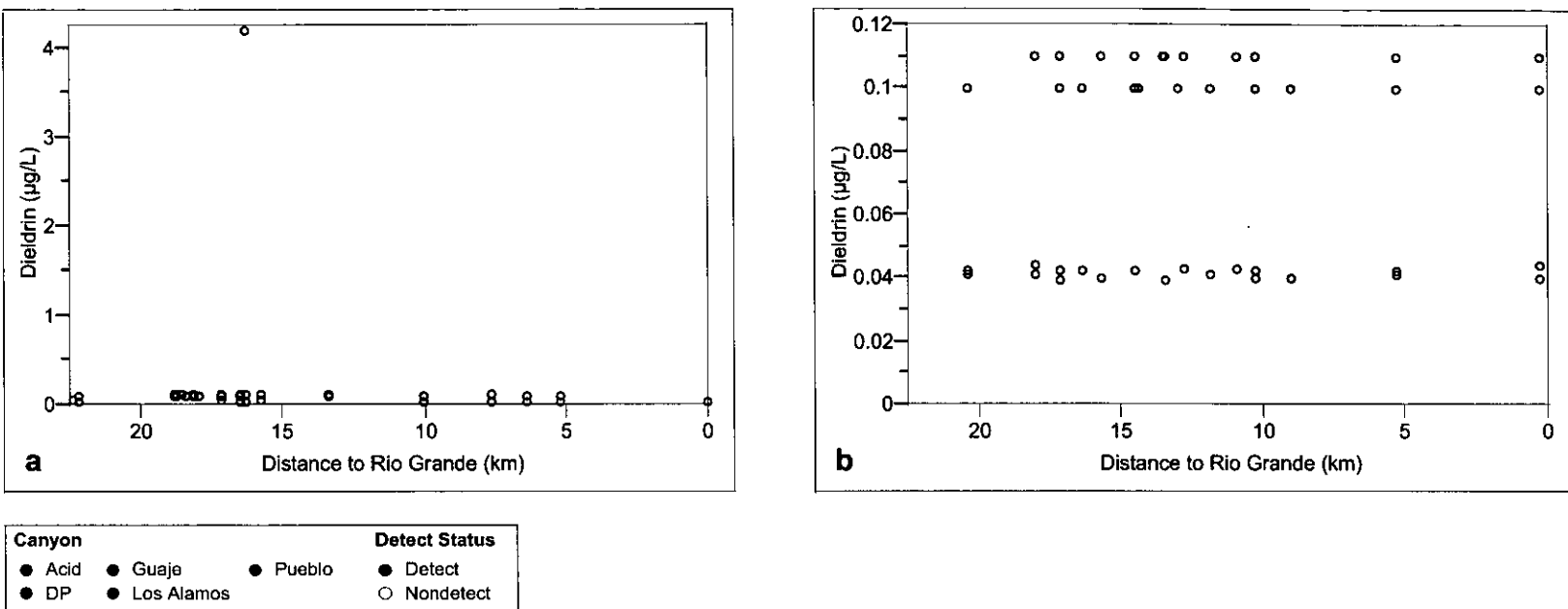


Figure D-2.0-34. Scatter plots of Dieldrin concentrations versus distance from the Rio Grande in (a) unfiltered surface water and spring water and (b) unfiltered alluvial groundwater

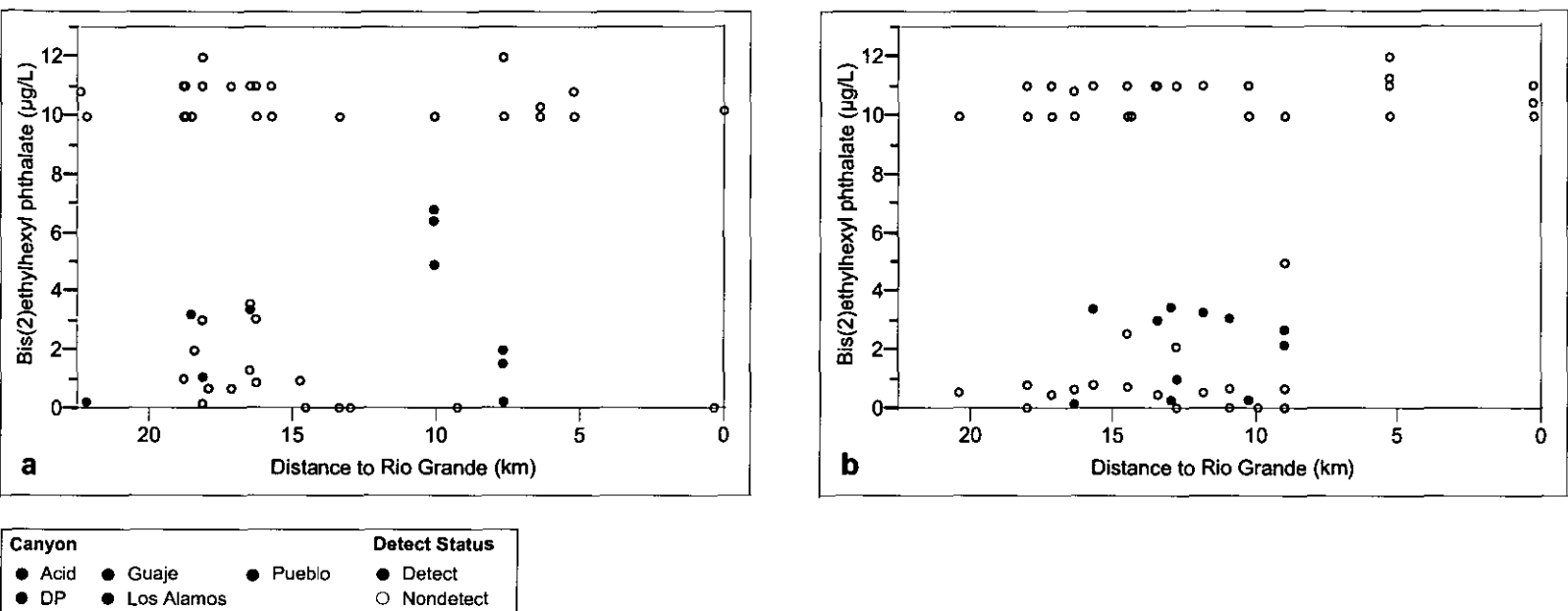


Figure D-2.0-35. Scatter plots of bis(2)ethylhexyl phthalate concentrations versus distance from the Rio Grande in (a) unfiltered surface water and spring water and (b) unfiltered alluvial groundwater

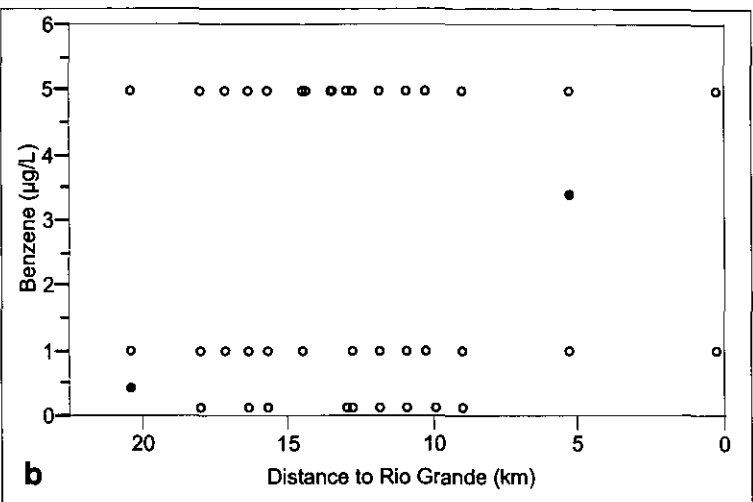
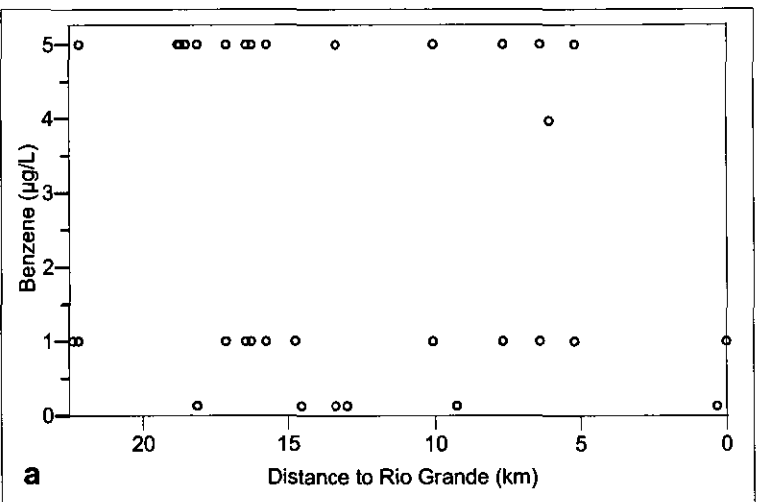
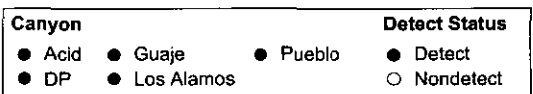


Figure D-2.0-36. Scatter plots of benzene concentrations versus distance from the Rio Grande in (a) unfiltered surface water and spring water and (b) unfiltered alluvial groundwater

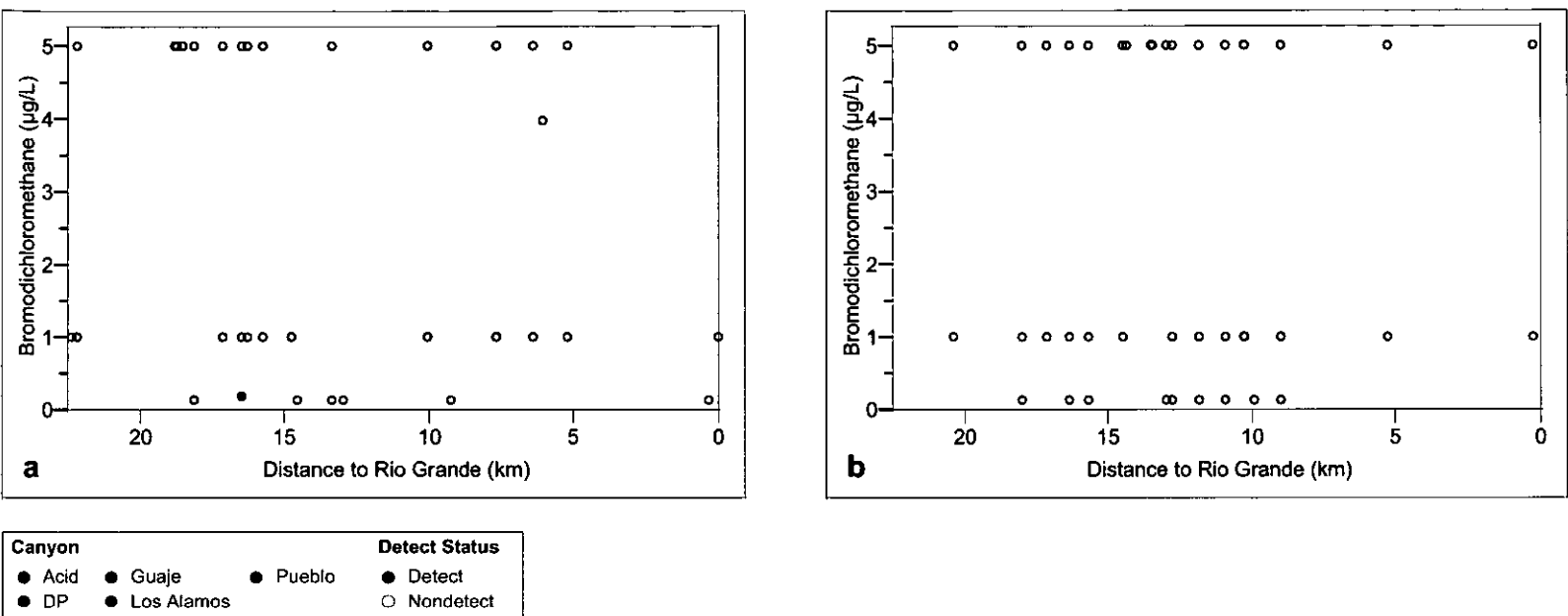


Figure D-2.0-37. Scatter plots of bromodichloromethane concentrations versus distance from the Rio Grande in (a) unfiltered surface water and spring water and (b) unfiltered alluvial groundwater

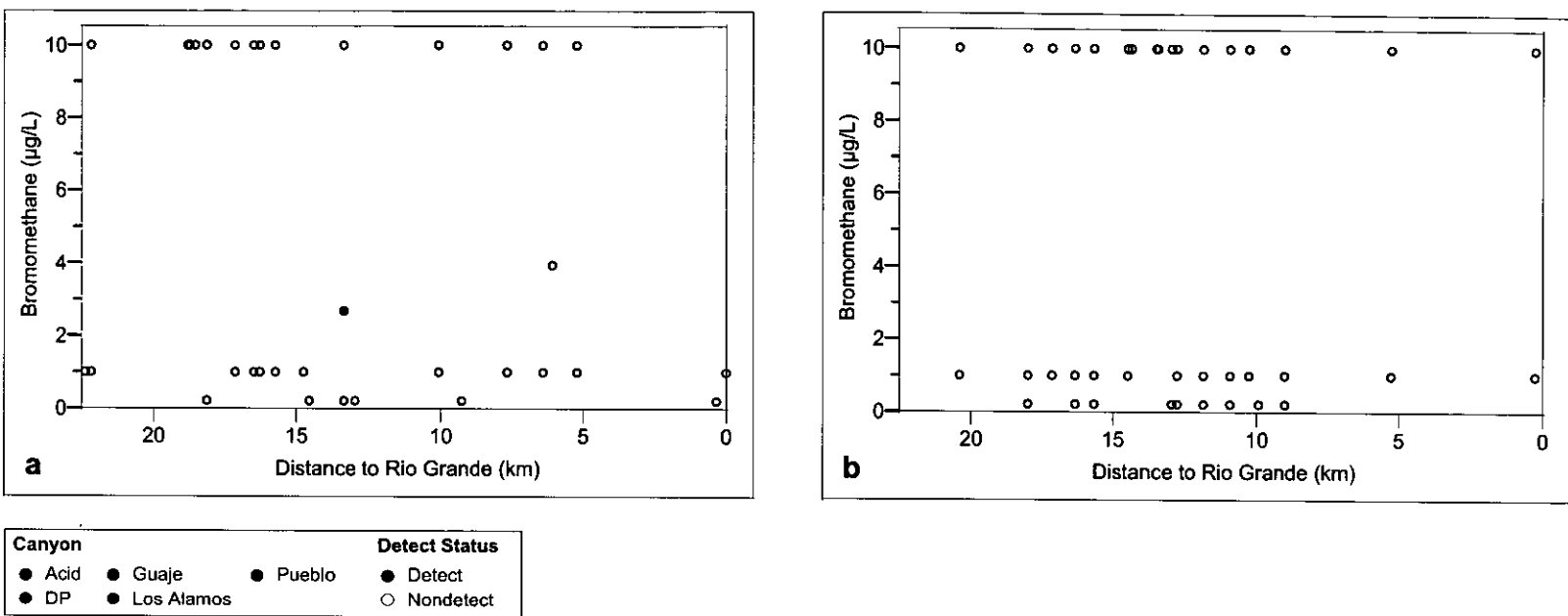


Figure D-2.0-38. Scatter plots of bromomethane concentrations versus distance from the Rio Grande in (a) unfiltered surface water and spring water and (b) unfiltered alluvial groundwater

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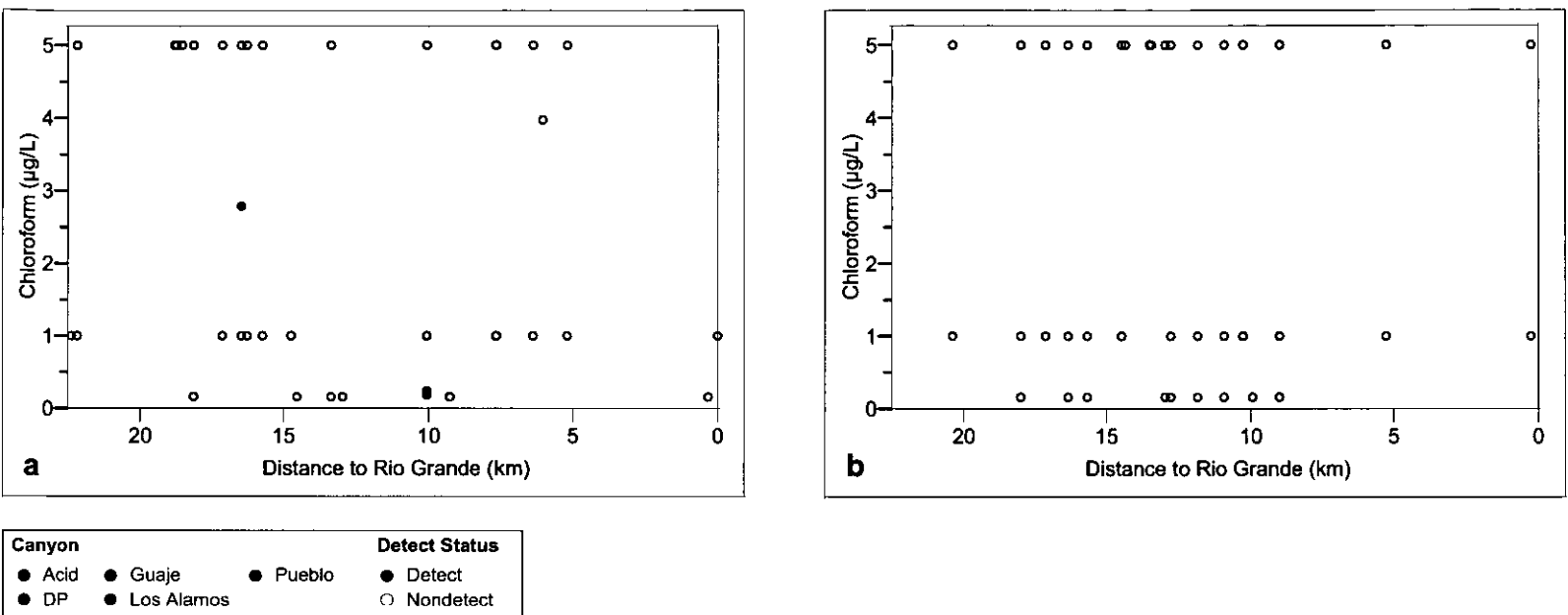


Figure D-2.0-39. Scatter plots of chloroform concentrations versus distance from the Rio Grande in (a) unfiltered surface water and spring water and (b) unfiltered alluvial groundwater

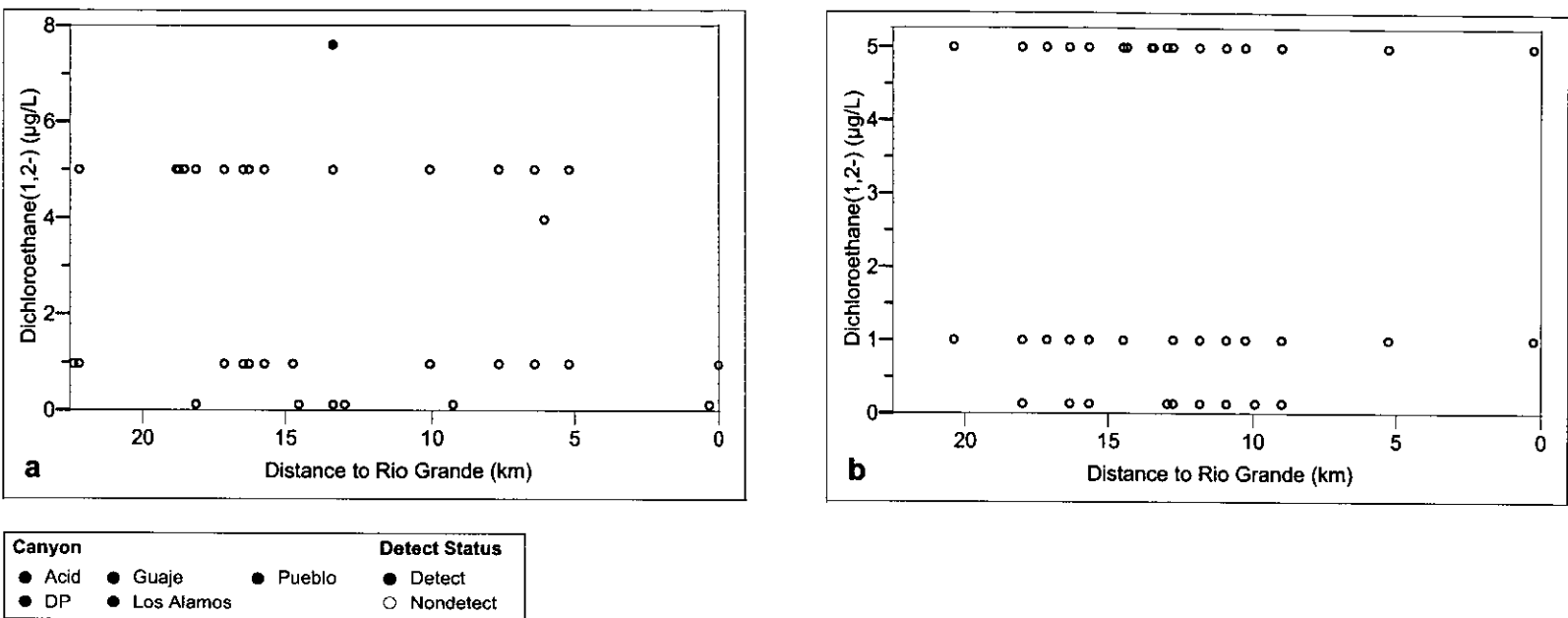


Figure D-2.0-40. Scatter plots of 1,2-dichloroethane concentrations versus distance from the Rio Grande in (a) unfiltered surface water and spring water and (b) unfiltered alluvial groundwater

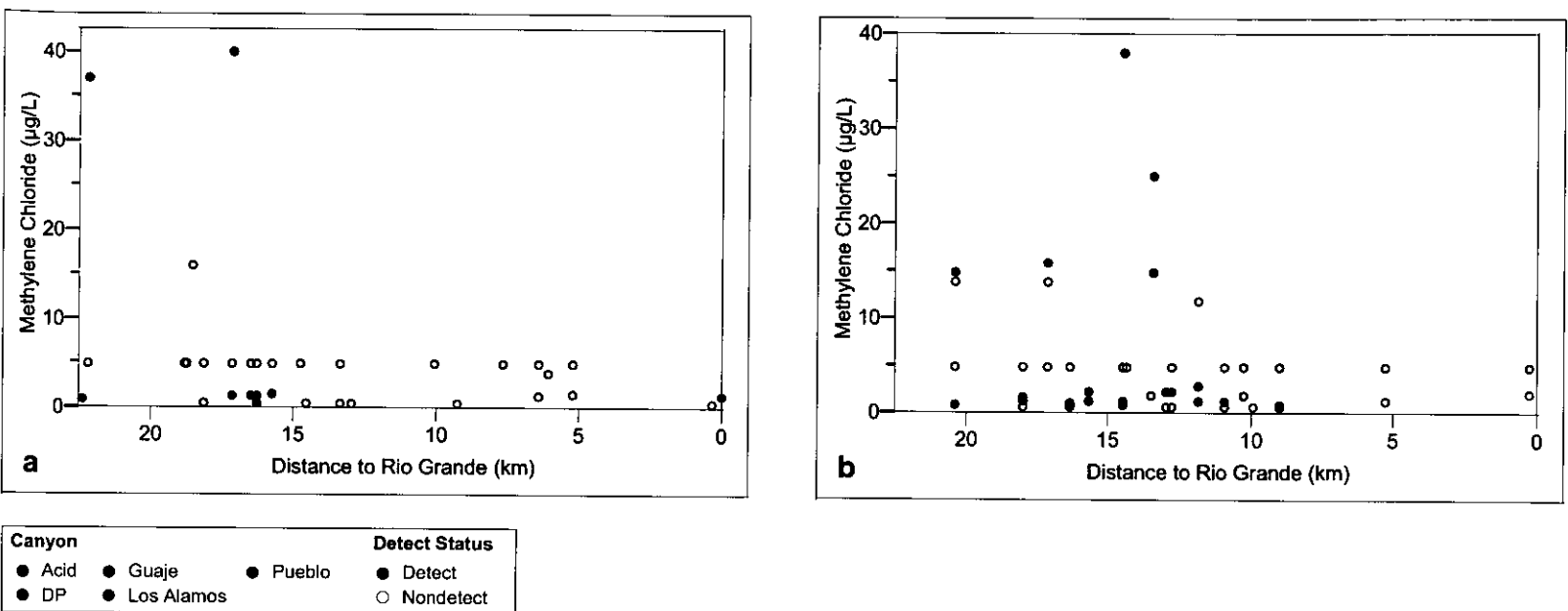


Figure D-2.0-41. Scatter plots of methylene chloride concentrations versus distance from the Rio Grande in (a) unfiltered surface water and spring water and (b) unfiltered alluvial groundwater

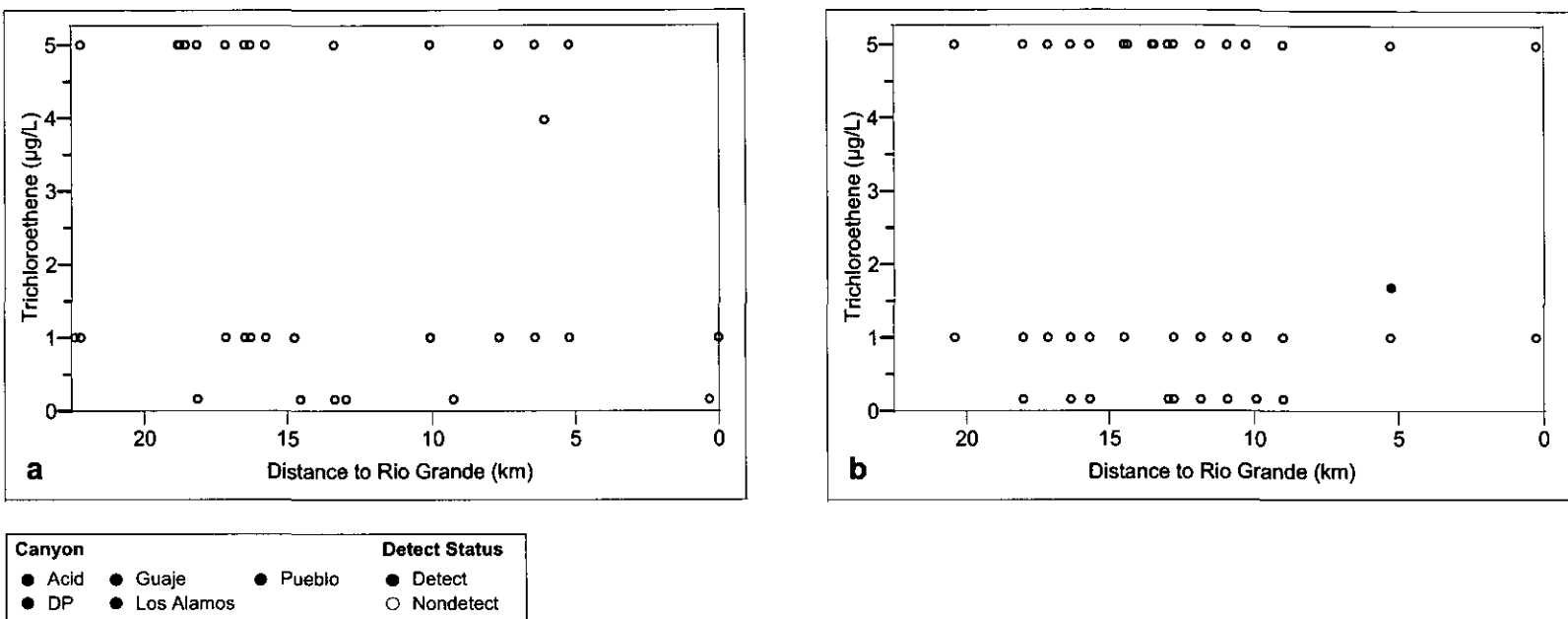


Figure D-2.0-42. Scatter plots of trichloroethene concentrations versus distance from the Rio Grande in (a) unfiltered surface water and spring water and (b) unfiltered alluvial groundwater

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Table D-1.3-1
Binning and Summary of Geomorphic Units in Acid Canyon Reaches

Reach	Geomorphic Unit	Average Unit Width (m) [total area of unit in reach divided by reach length]	Fraction of Reach Area Excluding f2	Sediment Facies	Bin Number for Averaging Analytical Data in a Reach	Notes on Bins	Estimated Average Sediment Thickness (m)	Estimated Volume Excluding f2 (m ³ /m)	Fraction of Sediment Volume Excluding f2	Notes	Source
AC-1	c1	1.5	0.17	Coarse	1	a	0.3	0.44	0.07	Active channel	LANL 2001 70273, and this report
	c2	0.6	0.07	Fine	2	a	0.65	0.36	0.06	Inset abandoned channel	
				Coarse	1	b	0.3	0.17	0.03		
	c3	0.1	0.01	Fine	2	b	0.68	0.05	0.01	High abandoned channel	
				Coarse	1	b	0.3	0.02	0.00		
	f1+c3	6.4	0.75	Fine	2	a	0.63	4.00	0.67	High abandoned channel and post- 1942 floodplain	
				Coarse	1	b	0.15	0.95	0.16		
	Total	8.4	1.00	n/a ^c	n/a	n/a	n/a	5.99	1.00	n/a	
AC-2	c1	1.9	0.31	Coarse	1	a	0.25	0.47	0.13	Active channel	LANL 2001 70273, and this report
	c1b	0.1	0.01	Fine	2	b	0.1	0.01	0.00	Area of fine-grained sediment deposition along active channel	
				Coarse	1	b	0.3	0.02	0.01		
	c2	0.6	0.10	Fine	2	a	0.49	0.28	0.08	Inset abandoned channel	
				Coarse	1	b	0.25	0.14	0.04		
	c3	2.2	0.37	Fine	2	a	0.68	1.52	0.41	High abandoned channel	
				Coarse	1	b	0.3	0.67	0.18		
	f1+c3	0.4	0.06	Fine	2	b	0.63	0.24	0.06	High abandoned channel and post- 1942 floodplain	
				Coarse	1	b	0.15	0.06	0.02		
	f1	0.8	0.14	Fine	2	a	0.26	0.22	0.06	Post-1942 floodplain	
				Coarse	1	b	0.05	0.04	0.01		
	Total	6.0	1.00	n/a	n/a	n/a	n/a	3.67	1.00	n/a	

Table D-1.3-1 (continued)

Reach	Geomorphic Unit	Average Unit Width (m) [total area of unit in reach divided by reach length]	Fraction of Reach Area Excluding f2	Sediment Facies	Bin Number for Averaging Analytical Data in a Reach	Notes on Bins	Estimated Average Sediment Thickness (m)	Estimated Volume Excluding f2 (m³/m)	Fraction of Sediment Volume Excluding f2	Notes	Source
AC-3	c1	3.2	0.57	Coarse	1	d	0.5	1.62	0.52	Active channel	This report
	c2	1.6	0.29	Fine	2	d	0.32	0.52	0.17	Abandoned channel	
				Coarse	1	e	0.5	0.82	0.26		
	f1	0.9	0.15	Fine	2	d	0.18	0.15	0.05	Post-1942 floodplain	
				Coarse	1	e	0.02	0.02	0.01		
	f2	0.8	n/a ^c	Fine	4	d	0.05	n/a	n/a	Possible post-1942 floodplain	
	Total	6.5	1.00	n/a	n/a	n/a	n/a	3.13	1.00	n/a	
ACS (post-IA)	c1	0.8	0.22	Coarse	1	f	0.5	0.42	0.28	Active channel	Reneau et al. 2000, 66867; Reneau et al. 2002, 73660; and this report
	c1b	0.1	0.02	Fine	2	f	0.09	0.01	0.00	Area of fine-grained sediment deposition along active channel	
				Coarse	1	b	0.5	0.03	0.02		
	c2	0.4	0.11	Fine	3	f	0.33	0.14	0.10	Young abandoned channel with relatively low plutonium-239,240	
				Coarse	4	f	0.5	0.22	0.15		
	f1	0.4	0.10	Fine	3	f	0.35	0.13	0.09	Post-1942 floodplain with relatively low plutonium-239,240	
				Coarse	4	b	0.02	0.01	0.01		
	c.a.	2.1	0.56	n/a	3	g	0.25	0.53	0.36	IA cleanup area	
Total	3.8	1.00	n/a	n/a	n/a	n/a	1.49	1.00	n/a		

^a Samples not previously binned in a report; number indicates tentative binning for use in this report.

^b No data available; number indicates bin inferred to be most applicable based on geomorphic context.

^c n/a = Not applicable.

^d Samples not previously binned in a report; number indicates binning following convention in prior report.

^e All coarse facies samples combined in single bin to provide at least one analysis for each analyte in each bin (only c1 coarse has complete analyte suite).

^f Binning of samples from prior report.

^g Samples from c.a. combined with c2 fine facies to provide at least one analysis for each analyte in each bin (c2 samples that were not removed in IA had incomplete analyte suite).

Table D-1.3-2
Binning and Summary of Geomorphic Units in DP Canyon Reaches

Reach	Geomorphic Unit	Average Unit Width (m) [total area of unit in reach divided by reach length]	Fraction of Reach Area Excluding f2	Sediment Facies	Bin Number for Averaging Analytical Data in a Reach	Notes on Bins	Estimated Average Sediment Thickness (m)	Estimated Volume Excluding f2 (m ³ /m)	Fraction of Sediment Volume Excluding f2	Notes	Source
DP-1W	c1	2.2	0.35	Coarse	1	^a	0.25	0.55	0.18	Active channel	Katzman et al. 1999, 63915
	c2	0.3	0.05	Fine	2	^a	0.20	0.06	0.02	Low abandoned post-1942 channel	
				Coarse	1	^b	0.35	0.11	0.04		
	c3	1.5	0.24	Fine	2	^a	0.58	0.87	0.29	High abandoned post-1942 channel	
				Coarse	1	^b	0.25	0.38	0.13		
	f1	2.3	0.37	Fine	2	^a	0.45	1.04	0.35	Post-1942 floodplain	
Total	6.3	1.00	n/a ^c	n/a	n/a	n/a	3.00	1.00	n/a		
DP-1C	c1	2.2	0.64	Coarse	1	^a	0.25	0.55	0.44	Active channel	Katzman et al. 1999, 63915
	c3	0.6	0.18	Fine	2	^a	0.27	0.17	0.14	High abandoned post-1942 channel	
				Coarse	1	^b	0.33	0.21	0.17		
	f1	0.6	0.17	Fine	2	^a	0.52	0.31	0.25	Post-1942 floodplain	
	Total	3.4	1.00	n/a	n/a	n/a	n/a	1.24	1.00	n/a	
DP-1E	c1	2.2	0.30	Coarse	1	^a	0.25	0.55	0.17	Active channel	Katzman et al. 1999, 63915
	c2	0.7	0.09	Fine	2	^a	0.33	0.23	0.07	Low abandoned post-1942 channel	
				Coarse	1	^b	0.09	0.06	0.02		
	c3	1.2	0.16	Fine	2	^a	0.62	0.74	0.23	High abandoned post-1942 channel	
				Coarse	1	^a	0.21	0.25	0.08		
	f1	3.3	0.45	Fine	2	^a	0.42	1.39	0.43	Post-1942 floodplain	
Total	7.4	1.00	n/a	n/a	n/a	n/a	3.23	1.00	n/a		
DP-2 (post- calendar year [CY]03 sediment removal)	c1	1.9	0.16	Coarse	1	^d	0.5	0.95	0.13	Active channel	Katzman et al. 1999, 63915, and this report (incorporation of CY03 cleanup area)
	c2	0.3	0.03	Fine	2	^d	0.37	0.12	0.02	Young abandoned post-1942 channel with relatively low cesium-137	
				Coarse	3	^d	0.5	0.16	0.02		
	c3a	2.0	0.17	Fine	2	^d	0.53	1.04	0.14	Old abandoned post-1942 channel with intermediate cesium-137	
				Coarse	3	^d	0.5	0.98	0.13		
	c3b	1.6	0.14	Fine	4	^d	0.52	0.84	0.11	Old abandoned post-1942 channel with relatively high cesium-137	
Coarse				5	^d	0.5	0.81	0.11			

Table D-1.3-2 (continued)

Reach	Geomorphic Unit	Average Unit Width (m) [total area of unit in reach divided by reach length]	Fraction of Reach Area Excluding f2	Sediment Facies	Bin Number for Averaging Analytical Data in a Reach	Notes on Bins	Estimated Average Sediment Thickness (m)	Estimated Volume Excluding f2 (m³/m)	Fraction of Sediment Volume Excluding f2	Notes	Source
DP-2	c.a.	0.03	0.003	n/a	5	^b	0.25	0.01	0.00	Cleanup area (CY03 sediment removal)	Katzman et al. 1999, 63915, and this report (incorporation of CY03 cleanup area)
	f1	6.0	0.51	Fine	6	^d	0.43	2.58	0.34	Post-1942 floodplain	
				Coarse	7	^d	0.01	0.00	0.00		
	Total	11.8	1.00	1.00	n/a	n/a	n/a	n/a	7.48	1.00	
DP-3	c1	2.4	0.59	Coarse	1	^d	0.25	0.60	0.33	Active channel	Katzman et al. 1999, 63915
	c2	0.4	0.09	Fine	2	^b	0.37	0.13	0.07	Young abandoned post-1942 channel with relatively low cesium-137	
				Coarse	3	^b	0.25	0.09	0.05		
	c3a	0.1	0.03	Fine	2	^d	0.45	0.06	0.03	Old abandoned post-1942 channel with intermediate cesium-137	
				Coarse	3	^d	0.25	0.03	0.02		
	c3b	0.4	0.09	Fine	4	^d	0.65	0.25	0.14	Old abandoned post-1942 channel with relatively high cesium-137	
				Coarse	3	^d	0.25	0.10	0.05		
	f1	0.8	0.20	Fine	5	^d	0.70	0.56	0.31	Post-1942 floodplain	
				Coarse	3	^d	0.01	0.01	0.00		
	f2	0.4	n/a	Fine	6	^d	0.72	n/a	n/a	Possible post-1942 floodplain	
Total	4.5	1.00	1.00	n/a	n/a	n/a	n/a	1.83	1.00	n/a	
DP-4	c1	3.7	0.65	Coarse	1	^d	0.5	1.84	0.69	Active channel	Katzman et al. 1999, 63915
	c2a	0.2	0.03	Fine	2	^d	0.33	0.06	0.02	Young abandoned post-1942 channel with relatively low cesium-137	
				Coarse	3	^b	0.5	0.08	0.03		
	c2b	0.6	0.10	Fine	4	^d	0.22	0.12	0.05	Old abandoned post-1942 channel with relatively high cesium-137	
				Coarse	3	^d	0.5	0.28	0.10		
	f1	1.3	0.22	Fine	2	^d	0.22	0.28	0.11	Post-1942 floodplain	
	Total	5.7	1.00	1.00	n/a	n/a	n/a	n/a	2.66	1.00	

^a Samples not binned in prior report because of absence of key radionuclides above background values; number indicates tentative binning for use in this report.

^b No data available; number indicates bin that is inferred to be most applicable based on geomorphic context.

^c n/a = Not applicable.

^d Binning of samples from prior report.

Table D-1.3-3
Binning and Summary of Geomorphic Units in Los Alamos Canyon Reaches

Reach	Geomorphic Unit	Average Unit Width (m) [total area of unit in reach divided by reach length]	Fraction of Reach Area Excluding f2	Sediment Facies	Bin Number for Averaging Analytical Data in a Reach	Notes on Bins	Estimated Average Sediment Thickness (m)	Estimated Volume Excluding f2 (m³/m)	Fraction of Sediment Volume Excluding f2	Notes	Source
LA-0	c1	1.7	0.14	Coarse	1	^a	0.5	0.87	0.23	Active channel	This report
	c2	0.9	0.07	Fine	2	^a	0.32	0.29	0.08	Abandoned post-1942 channel	
				Coarse	1	^a	0.5	0.46	0.12		
	f1	9.6	0.78	Fine	2	^a	0.23	2.21	0.58	Post-1942 floodplain	
	Total	12.3	1.00	n/a	n/a	n/a	n/a	3.82	1.00	n/a	
LA-1FW	c1	1.8	0.17	Coarse	1	^a	0.5	0.91	0.15	Active channel	Reneau et al. 1998, 59160, and this report (addition of second mapping area in reach)
	c2	2.9	0.28	Fine	2	^a	0.41	1.20	0.20	Low abandoned post-1942 channel	
				Coarse	1	^a	0.5	1.47	0.24		
	c3	1.5	0.14	Fine	2	^a	0.42	0.64	0.11	High abandoned post-1942 channel	
				Coarse	1	^a	0.5	0.77	0.13		
	f1	4.3	0.41	Fine	2	^a	0.24	1.04	0.17	Post-1942 floodplain	
	f2	2.5	n/a	Fine	n/a ^b	n/a	0.02	n/a	n/a	Possible post-1942 floodplain	
	Total	13.1	1.00	n/a	n/a	n/a	n/a	6.02	1.00	n/a	
LA-1W+	c1	1.4	0.16	Coarse	1	^c	0.5	0.71	0.16	Active channel	Reneau et al. 1998, 59160
	c2	0.8	0.09	Fine	2	^c	0.25	0.19	0.04	Low abandoned post-1942 channel	
				Coarse	1	^d	0.5	0.39	0.09		
	c3	2.4	0.28	Fine	2	^c	0.42	1.00	0.23	High abandoned post-1942 channel	
				Coarse	1	^d	0.5	1.19	0.27		
	f1	4.0	0.47	Fine	2	^d	0.24	0.97	0.22	Post-1942 floodplain	
	f2	3.7	n/a	Fine	n/a	n/a	0.02	n/a	n/a	Possible post-1942 floodplain	
	Total	12.3	1.00	n/a	n/a	n/a	n/a	4.45	1.00	n/a	
LA-1W	c1	1.9	0.13	Coarse	1	^c	0.5	0.97	0.13	Active channel	Reneau et al. 1998, 59160
	c2	0.8	0.05	Fine	2	^c	0.25	0.20	0.03	Low abandoned post-1942 channel	
				Coarse	3	^d	0.5	0.40	0.05		
	c3	4.4	0.30	Fine	2	^c	0.42	1.83	0.25	High abandoned post-1942 channel	
				Coarse	3	^c	0.5	2.18	0.30		

Table D-1.3-3 (continued)

Reach	Geomorphic Unit	Average Unit Width (m) [total area of unit in reach divided by reach length]	Fraction of Reach Area Excluding f2	Sediment Facies	Bin Number for Averaging Analytical Data in a Reach	Notes on Bins	Estimated Average Sediment Thickness (m)	Estimated Volume Excluding f2 (m ³ /m)	Fraction of Sediment Volume Excluding f2	Notes	Source
LA-1W	f1	7.5	0.52	Fine	4	^c	0.24	1.80	0.24	Post-1942 floodplain	Reneau et al. 1998, 59160
	Total	14.6	1.00	n/a	n/a	n/a	n/a	7.37	1.00	n/a	
LA-1C	c1	1.7	0.13	Coarse	1	^c	0.5	0.87	0.18	Active channel	Reneau et al. 1998, 59160
	c1b	0.1	0.01	Coarse	1	^d	0.5	0.04	0.01	Part of active channel during large floods	
	c2	2.1	0.15	Fine	2	^c	0.31	0.64	0.13	Low abandoned post-1942 channel	
				Coarse	3	^c	0.5	1.03	0.22		
	c3	1.9	0.14	Fine	4	^c	0.22	0.42	0.09	High abandoned post-1942 channel	
				Coarse	5	^c	0.5	0.95	0.20		
	f1	7.6	0.57	Fine	4	^c	0.11	0.83	0.17	Post-1942 floodplain	
	f2	3.3	n/a	Fine	n/a	n/a	0.02	n/a	n/a	Possible post-1942 floodplain	
	Total	16.6	1.00	n/a	n/a	n/a	n/a	4.78	1.00	n/a	
LA-1E	c1	1.4	0.10	Coarse	1	^c	0.5	0.69	0.11	Active channel	Reneau et al. 1998, 59160
	c2	2.8	0.20	Fine	2	^c	0.3	0.84	0.13	Low abandoned post-1942 channel	
				Coarse	3	^c	0.5	1.40	0.22		
	c3	2.2	0.16	Fine	2	^c	0.25	0.56	0.09	High abandoned post-1942 channel	
				Coarse	4	^c	0.5	1.12	0.18		
	f1	7.8	0.55	Fine	5	^c	0.21	1.65	0.26	Post-1942 floodplain	
	f2	3.4	n/a	Fine	n/a	n/a	0.02	n/a	n/a	Possible post-1942 floodplain	
Total	17.7	1.00	n/a	n/a	n/a	n/a	6.26	1.00	n/a		
LA-2W	c1	1.7	0.11	Coarse	1	^c	0.5	0.83	0.13	Active channel	Reneau et al. 1998, 59160
	c2	2.4	0.16	Fine	2	^c	0.24	0.58	0.09	Low abandoned post-1942 channel	
				Coarse	3	^c	0.5	1.21	0.20		
	c3	4.8	0.32	Fine	4	^c	0.05	0.24	0.04	High abandoned post-1942 channel	
				Coarse	3	^c	0.5	2.40	0.39		
	f1	6.2	0.41	Fine	4	^c	0.15	0.93	0.15	Post-1942 floodplain	
Total	15.1	1.00	n/a	n/a	n/a	n/a	6.19	1.00	n/a		

Table D-1.3-3 (continued)

Reach	Geomorphic Unit	Average Unit Width (m) [total area of unit in reach divided by reach length]	Fraction of Reach Area Excluding f2	Sediment Facies	Bin Number for Averaging Analytical Data in a Reach	Notes on Bins	Estimated Average Sediment Thickness (m)	Estimated Volume Excluding f2 (m ³ /m)	Fraction of Sediment Volume Excluding f2	Notes	Source
LA-2E (post- CY00 sediment removal)	c1	1.9	0.19	Coarse	1	c	0.5	0.97	0.15	Active channel	Reneau et al. 1998, 59160 and this report (incorporation of CY00 cleanup area)
	c2	4.8	0.46	Fine	2	c	0.49	2.37	0.36	Young abandoned post-1942 channel with relatively low cesium-137	
				Coarse	1	e	0.5	2.42	0.37		
	c2b	0.2	0.02	Fine	4	c	0.55	0.12	0.02	Old abandoned post-1942 channel with intermediate cesium-137	
				Coarse	1	e	0.5	0.11	0.02		
	c.a.	0.8	0.08	n/a	1	d, e	0.25	0.20	0.03	Cleanup area (CY00 sediment removal)	
	f1	2.6	0.25	Fine	2	f	0.15	0.39	0.06	Post-1942 floodplain	
Total	10.4	1.00	n/a	n/a	n/a	n/a	6.59	1.00	n/a		
LA-2FE	c1	2.2	0.14	Fine	1	g	0.01	0.02	0.00	Active channel	This report
				Coarse	2	g	0.5	1.08	0.12		
	c2	3.1	0.19	Fine	3	g	0.35	1.08	0.12	Young abandoned post-1942 channel with relatively low cesium-137	
				Coarse	4	g	0.5	1.54	0.17		
	c3	4.0	0.25	Fine	5	g	0.16	0.64	0.07	Old abandoned post-1942 channel with intermediate cesium-137	
				Coarse	6	g	0.5	1.99	0.22		
	c3a	0.5	0.03	Fine	7	g	0.72	0.38	0.04	Old abandoned post-1942 channel with relatively high cesium-137	
				Coarse	8	g	0.5	0.26	0.03		
	f1	6.1	0.39	Fine	9	g	0.29	1.78	0.20	Post-1942 floodplain	
				Coarse	6	d	0.04	0.25	0.03		
	f2	4.9	n/a	Fine	10	g	0.16	n/a	n/a	Possible post-1942 floodplain	
				Coarse	n/a	n/a	0.05	n/a	n/a		
Total	20.8	1.00	n/a	n/a	n/a	n/a	9.00	1.00	n/a		
LA-3W	c1	1.8	0.17	Coarse	1	h	0.5	0.88	0.14	Active channel	This report
	c2	2.8	0.26	Fine	2	g	0.35	0.96	0.15	Young abandoned post-1942 channel with relatively low cesium-137	
				Coarse	3	h	0.5	1.38	0.21		
	c3	3.0	0.29	Fine	4	g	0.39	1.17	0.18	Intermediate-age abandoned post-1942 channel with intermediate cesium-137	
				Coarse	5	g	0.5	1.51	0.23		
f1	2.9	0.28	Fine	6	g	0.15	0.43	0.07	Post-1942 floodplain		

Table D-1.3-3 (continued)

Reach	Geomorphic Unit	Average Unit Width (m) [total area of unit in reach divided by reach length]	Fraction of Reach Area Excluding f2	Sediment Facies	Bin Number for Averaging Analytical Data in a Reach	Notes on Bins	Estimated Average Sediment Thickness (m)	Estimated Volume Excluding f2 (m ³ /m)	Fraction of Sediment Volume Excluding f2	Notes	Source
LA-3W				Coarse	5	^g	0.04	0.11	0.02		
	f2	2.8	n/a	Fine	7	^g	0.06	n/a	n/a	Possible post-1942 floodplain	
				Coarse	n/a	n/a	0.04	n/a	n/a		
	Total	13.1	1.00	n/a	n/a	n/a	n/a	6.44	1.00	n/a	
LA-3E	c1	2.0	0.3	Coarse	1	^c	0.5	1.02	0.21	Active channel	Reneau et al. 1998, 59160
	c1b	0.1	0.0	Coarse	1	^d	0.5	0.07	0.01	Sand and gravel bars adjacent to active channel	
	c2	1.5	0.2	Fine	2	^c	0.41	0.61	0.13	Young abandoned post-1942 channel with relatively low cesium-137	
				Coarse	3	^c	0.5	0.74	0.15		
	c3	1.9	0.3	Fine	4	^c	0.55	1.04	0.21	Intermediate-age abandoned post-1942 channel with intermediate cesium-137	
				Coarse	5	^c	0.5	0.95	0.20		
	f1	1.0	0.2	Fine	2	^f	0.42	0.41	0.09	Post-1942 floodplain	
				Coarse	3	^c	0.01	0.01	0.00		
	f2	2.4	n/a	Fine	7	^c	0.05	n/a	n/a	Possible post-1942 floodplain	
	Total	8.9	1.00	n/a	n/a	n/a	n/a	4.85	1.00	n/a	
LA-4W	c1	4.7	0.27	Fine	1	ⁱ	0.10	0.47	0.05	Active channel	Reneau et al. 1998, 59667
				Coarse	2	ⁱ	0.5	2.35	0.23		
	c2	1.8	0.10	Fine	1	ⁱ	0.24	0.44	0.04	Younger abandoned post-1942 channel	
				Coarse	3	ⁱ	0.5	0.91	0.09		
	c3	3.8	0.22	Fine	4	ⁱ	0.51	1.92	0.19	Older abandoned post-1942 channel	
				Coarse	5	ⁱ	0.5	1.89	0.19		
	f1	4.1	0.24	Fine	6	ⁱ	0.29	1.20	0.12	Post-1942 floodplain with relatively low plutonium concentrations	
				Coarse	7	ⁱ	0.05	0.21	0.02		
	f1b	3.1	0.18	Fine	8	ⁱ	0.17	0.53	0.05	Floodplain with highest plutonium concentrations	
				Coarse	9	ⁱ	0.05	0.16	0.02		
	f2	0.5	n/a	Fine	10	ⁱ	0.05	n/a	n/a	Possible post-1942 floodplain	
	Total	18.0	1.00	n/a	n/a	n/a	n/a	10.06	1.00	n/a	

Table D-1.3-3 (continued)

Reach	Geomorphic Unit	Average Unit Width (m) [total area of unit in reach divided by reach length]	Fraction of Reach Area Excluding f2	Sediment Facies	Bin Number for Averaging Analytical Data in a Reach	Notes on Bins	Estimated Average Sediment Thickness (m)	Estimated Volume Excluding f2 (m ³ /m)	Fraction of Sediment Volume Excluding f2	Notes	Source
LA-4E	c1	3.4	0.21	Fine	1		0.08	0.29	0.03	Active channel	Reneau et al. 1998, 59667
				Coarse	2		0.5	1.70	0.19		
	c2	3.0	0.18	Fine	1		0.13	0.38	0.04	Younger abandoned post-1942 channel	
				Coarse	3		0.5	1.48	0.16		
	c3	4.0	0.25	Fine	4		0.48	1.93	0.22	Older abandoned post-1942 channel	
				Coarse	5		0.5	2.01	0.22		
	f1	5.9	0.36	Fine	6		0.20	1.17	0.13	Post-1942 floodplain	
	Total	16.2	1.00	n/a	n/a	n/a	n/a	8.95	1.00	n/a	
LA-5	c1	35	0.25	Coarse	1	^c	1.0	34.61	0.42	Active channel and adjacent bars from 1990s	Reneau et al. 1998, 59667
	c2	16	0.12	Fine	2	^c	0.15	2.38	0.03	Younger abandoned post-1942 channel	
				Coarse	1	^c	1.0	15.88	0.19		
	c3	33	0.24	Fine	3	^c	0.1	3.29	0.04	Older abandoned post-1942 channel	
				Coarse	4	^c	0.5	16.47	0.20		
	f1	52	0.39	Fine	2	^c	0.2	10.48	0.13	Post-1942 floodplain	
	f2	15	n/a	Fine	5	^c	0.1	n/a	n/a	Possible post-1942 floodplain	
	Total	151	1.00	n/a	n/a	n/a	n/a	83.11	1.00	n/a	

^a Samples not previously binned in a report; number indicates tentative binning for use in this report.

^b n/a = Not applicable.

^c Binning of samples from prior report.

^d No data available; number indicates bin that is inferred to be most applicable based on geomorphic context.

^e All coarse facies samples combined in single bin to provide at least one analysis for each analyte in each bin (only c1 coarse has complete analyte suite).

^f f1 analyses combined with c2 fine facies to provide at least one analysis for each analyte in each bin (f1 samples have incomplete analyte suite).

^g Samples not previously binned in a report; number indicates binning following convention in prior report.

^h No data available; use value from same unit in reach LA-3E.

ⁱ Binning of samples from prior report; samples from reaches LA-4W and LA-4E combined for calculating average concentrations.

Table D-1.3-4
Binning and Summary of Geomorphic Units in Pueblo Canyon Reaches

Reach	Geomorphic Unit	Average Unit Width (m) [total area of unit in reach divided by reach length]	Fraction of Reach Area Excluding f2	Sediment Facies	Bin Number for Averaging Analytical Data in a Reach	Notes on Bins	Estimated Average Sediment Thickness (m)	Estimated Volume Excluding f2 (m ³ /m)	Fraction of Sediment Volume Excluding f2	Notes	Source
P-1FW	c1	3.9	0.58	Coarse	1	^a	0.5	1.93	0.48	Active channel	This report
	c2	2.8	0.41	Fine	2	^a	0.24	0.66	0.17	Abandoned post-1942 channel	
				Coarse	1	^a	0.5	1.38	0.35		
	f1	0.1	0.01	Fine	2	^a	0.15	0.01	0.00	Post-1942 floodplain	
	Total	6.7	1.00	n/a ^b	n/a	n/a	n/a	3.98	1.00	n/a	
P-1W	c1	2.0	0.36	Coarse	1	^a	0.5	1.00	0.30	Active channel	Reneau et al. 1998, 59159, and this report (addition of second mapping area in reach)
	c2	3.1	0.56	Fine	2	^a	0.24	0.73	0.22	Abandoned post-1942 channel	
				Coarse	1	^a	0.5	1.53	0.46		
	f1	0.4	0.08	Fine	2	^a	0.20	0.09	0.03	Post-1942 floodplain	
	f2	0.9	n/a	Fine	n/a	n/a	0.01	n/a	n/a	Possible post-1942 floodplain	
	Total	6.4	1.00	n/a	n/a	n/a	n/a	3.35	1.00	n/a	
P-1E	c1	2.8	0.27	Coarse	1	^c	0.5	1.40	0.25	Active channel	Reneau et al. 1998, 59159
	c2	2.7	0.26	Fine	2	^c	0.57	1.52	0.27	Abandoned post-1942 channel with relatively low Pu-239,240	
				Coarse	1	^d	0.5	1.34	0.23		
	c2b	0.1	0.01	Fine	4	^c	0.9	0.12	0.02	Abandoned post-1942 channel with relatively high Pu-239,240	
				Coarse	1	^d	0.5	0.07	0.01		
	f1	4.6	0.45	Fine	6	^c	0.27	1.25	0.22	Post-1942 floodplain	
	f2	0.9	n/a	Fine	7	^c	0.01	n/a	n/a	Possible post-1942 floodplain	
Total	11.1	1.00	n/a	n/a	n/a	n/a	5.69	1.00	n/a		
P-2W	c1	2.7	0.12	Coarse	1	^c	1.0	2.69	0.15	Active channel	Reneau et al. 1998, 59159
	c1b	3.4	0.15	Fine	2	^c	0.10	0.34	0.02	Area of fine-grained sediment deposition along active channel	
				Coarse	1	^c	1.0	3.38	0.19		
	c2	5.6	0.26	Fine	2	^c	0.41	2.32	0.13	Typical abandoned post-1942 channel	
				Coarse	3	^c	1.0	5.65	0.32		
	c3	0.4	0.02	Fine	2	^e	0.63	0.24	0.01	Possible older abandoned post-1942 channel	
				Coarse	3	^e	1.0	0.39	0.02		

Table D-1.3-4 (continued)

Reach	Geomorphic Unit	Average Unit Width (m) [total area of unit in reach divided by reach length]	Fraction of Reach Area Excluding f2	Sediment Facies	Bin Number for Averaging Analytical Data in a Reach	Notes on Bins	Estimated Average Sediment Thickness (m)	Estimated Volume Excluding f2 (m³/m)	Fraction of Sediment Volume Excluding f2	Notes	Source
P-2W	f1	9.9	0.45	Fine	2	c	0.27	2.67	0.15	Post-1942 floodplain	
	f2	1.7	n/a	Fine	n/a	n/a	0.05	n/a	n/a	Possible post-1942 floodplain	
	Total	23.7	1.00	n/a	n/a	n/a	n/a	17.68	1.00	n/a	
P-2E	c1	6.8	0.18	Coarse	1	c	2.0	13.54	0.29	Active channel	Reneau et al. 1998, 59159
	c1b	0.6	0.02	Fine	2	c	0.13	0.08	0.00	Area of fine-grained sediment deposition along active channel	
				Coarse	1	c	2.1	1.36	0.03		
	c2	12.6	0.33	Fine	2	c	0.50	6.30	0.13	Typical abandoned post-1942 channel	
				Coarse	1	c	1.8	22.69	0.48		
	c3	1.6	0.04	Fine	3	c	0.25	0.40	0.01	Older abandoned post-1942 channel	
				Coarse	1	c	0.5	0.81	0.02		
	f1	16.6	0.43	Fine	2	c	0.13	2.15	0.05	Post-1942 floodplain	
Total	38.2	1.00	n/a	n/a	n/a	n/a	47.33	1.00	n/a		
P-3W	c1	5.7	0.23	Fine	2	e	0.04	0.23	0.01	Active channel	Reneau et al. 1998, 59159
				Coarse	1	f	2.0	11.33	0.34		
	c2	6.8	0.28	Fine	2	f	0.29	1.97	0.06	Typical abandoned post-1942 channel	
				Coarse	1	f	1.9	12.93	0.39		
	c3	3.7	0.15	Fine	3	f	0.28	1.05	0.03	Older abandoned post-1942 channel	
				Coarse	4	f	1.0	3.74	0.11		
	c4	0.7	0.03	Fine	3	f	0.22	0.15	0.00	Older abandoned post-1942 channel	
				Coarse	5	f	1.0	0.67	0.02		
f1	7.6	0.31	Fine	2	f	0.20	1.51	0.05	Post-1942 floodplain		
f2	8.5	n/a	Fine	n/a	n/a	0.05	n/a	n/a	Possible post-1942 floodplain		
Total	32.9	1.00	n/a	n/a	n/a	n/a	33.57	1.00	n/a		
P-3E	c1	3.4	0.06	Coarse	1	f	1.5	5.05	0.07	Active channel	Reneau et al. 1998, 59159
	c2	24.5	0.47	Fine	2	f	0.49	11.99	0.17	Typical abandoned post-1942 channel	
				Coarse	1	f	1.5	36.71	0.53		
	c3	0.8	0.02	Fine	3	f	0.08	0.07	0.00	Older abandoned post-1942 channel	

Table D-1.3-4 (continued)

Reach	Geomorphic Unit	Average Unit Width (m) [total area of unit in reach divided by reach length]	Fraction of Reach Area Excluding f2	Sediment Facies	Bin Number for Averaging Analytical Data in a Reach	Notes on Bins	Estimated Average Sediment Thickness (m)	Estimated Volume Excluding f2 (m ³ /m)	Fraction of Sediment Volume Excluding f2	Notes	Source
P-4W				Coarse	4		1.5	1.27	0.02		Reneau et al. (1998, 59159)
	c4	3.7	0.07	Fine	3		0.50	1.87	0.03	Older abandoned post-1942 channel	
				Coarse	5		3.0	11.20	0.16		
	f1	19.5	0.38	Fine	2		0.09	1.75	0.03	Post-1942 floodplain	
	f2	6.2	n/a	Fine	n/a	n/a	0.05	n/a	n/a	Possible post-1942 floodplain	
	Total	58.1	1.00	n/a	n/a	n/a	n/a	69.91	1.00	n/a	
	c1	3.6	0.04	Coarse	1	^g	0.45	1.60	0.02	Active channel	
				Fine	2	^g	0.05	0.18	0.00		
	c1b	3.2	0.03	Coarse	1	^g	0.45	1.43	0.01	Young abandoned channel (sandbars from 1991 flood)	
				Fine	2	^g	0.05	0.16	0.00		
	c2a, c2b, c2c	11.8	0.12	Coarse	1	^e	0.45	5.30	0.05	Inset abandoned channels (active in 1980s, abandoned before 1991)	
				Fine	2	^e	0.05	0.59	0.01		
	c3	0.5	0.01	Coarse	1	^g	0.45	0.24	0.00	Inset abandoned channel (active in 1981, abandoned before 1986)	
				Fine	2	^g	0.05	0.03	0.00		
	c4a	15.5	0.16	Coarse	1	^g	2.4	37.22	0.38	Abandoned channel (active ~1965, abandoned before 1974?)	
				Fine	2	^e	0.05	0.78	0.01		
	c4b	7.3	0.08	Coarse	3	^g	2.4	17.50	0.18	Abandoned channel (active ~1960, abandoned before 1965)	
				Fine	2	^g	0.1	0.73	0.01		
	c5	8.3	0.09	Coarse	3	^g	2.4	19.83	0.20	Abandoned channel (active in 1950s, abandoned before 1960)	
				Fine	2	^g	0.1	0.83	0.01		
	c6	9.4	0.10	Coarse	4	^g	0.8	7.53	0.08	Abandoned channel (active in 1935, abandoned before 1954)	
				Fine	5	^g	0.2	1.88	0.02		
	f1	24.7	0.26	Fine	2	^g	0.05	1.24	0.01	Post-1942 floodplain	
	f1a	11.0	0.12	Fine	6	^g	0.15	1.66	0.02	Floodplain with sediment dominantly from canyon-wall drainages	
	f2	10.0	n/a	Fine	7	^g	0.01	n/a	n/a	Possible post-1942 floodplain	
	Total	105.3	1.00	n/a	n/a	n/a	n/a	98.71	1.00	n/a	

Table D-1.3-4 (continued)

Reach	Geomorphic Unit	Average Unit Width (m) [total area of unit in reach divided by reach length]	Fraction of Reach Area Excluding f2	Sediment Facies	Bin Number for Averaging Analytical Data in a Reach	Notes on Bins	Estimated Average Sediment Thickness (m)	Estimated Volume Excluding f2 (m³/m)	Fraction of Sediment Volume Excluding f2	Notes	Source
P-4E	c1	16.7	0.17	Coarse	1	g	0.45	7.54	0.11	Active channel	Reneau et al. (1998, 59159)
				Fine	2	g	0.05	0.84	0.01		
	c1b	6.8	0.07	Coarse	1	g	0.45	3.08	0.04	Young abandoned channel (sandbars from 1991 flood)	
				Fine	2	g	0.05	0.34	0.00		
	c2a, c2b, c2c	2.3	0.02	Coarse	1	e	0.45	1.02	0.01	Inset abandoned channels (active in 1980s, abandoned before 1991)	
				Fine	2	e	0.05	0.11	0.00		
	c3	21.9	0.22	Coarse	1	g	2.2	48.25	0.69	Abandoned channel (active in 1981, abandoned before 1986)	
				Fine	2	g	0.05	1.10	0.02		
	f1	52.9	0.53	Fine	2	g	0.1	5.29	0.08	Post-1942 floodplain	
				Coarse	1	g	0.05	2.65	0.04		
f2	25.1	n/a	Fine	7	g	0.01	n/a	n/a	Possible post-1942 floodplain		
Total	125.8	1.00	n/a	n/a	n/a	n/a	70.21	1.00	n/a		
WC	c1	3.3	0.43	Coarse	1	a	0.5	1.66	0.56	Active channel	This report
	c2	1.5	0.20	Fine	2	a	0.15	0.23	0.08	Abandoned post-1942 channel	
				Coarse	1	a	0.5	0.77	0.26		
	f1	2.9	0.37	Fine	2	a	0.08	0.23	0.08	Post-1942 floodplain	
				Coarse	1	a	0.03	0.09	0.03		
	f2	5.5	n/a	Fine	n/a	n/a	0.01	n/a	n/a	Possible post-1942 floodplain	
	Total	13.2	1.00	n/a	n/a	n/a	n/a	2.98	1.00	n/a	

^a Samples not previously binned in a report; number indicates tentative binning for use in this report.

^b n/a = Not applicable.

^c Binning of samples from prior report.

^d All coarse facies samples combined in single bin to provide at least one analysis for each analyte in each bin (only c1 coarse has complete analyte suite).

^e No data available; number indicates bin that is inferred to be most applicable based on geomorphic context.

^f Binning of samples from prior report; samples from reaches P-3W and P-3E combined for calculating average concentrations.

^g Binning of samples from prior report; samples from reaches P-4W and P-4E combined for calculating average concentrations.

Table D-1.4-1
Estimated Plutonium-239,240 Inventory in Reach ACS Prior to Interim Action

Geomorphic Unit	Sediment Facies	Area (m ²)	Estimated Average Thickness (m)	Estimated Volume (m ³)	Estimated Non-Gravel Fraction	Estimated Average Density (g/cm ³)	Estimated Average Pu-239,240 Concentration (pCi/g)	Estimated Pu-239,240 Inventory (mCi)	Percent of Total Estimated Inventory
c1	Coarse	402	0.5	201	0.5	1.23	19	2.3	1%
c1b	Coarse	21	0.5	11	0.5	1.23	19	0.1	0%
c2	Coarse	298	0.5	149	0.4	1.23	83	6.1	3%
c2a	Coarse	94	0.5	47	0.4	1.23	250	5.8	3%
c3	Coarse	32	0.5	16	0.3	1.23	574	3.4	2%
f1	Coarse	135	0.02	3	0.3	1.23	83	0.1	0%
f1b	Coarse	44	0.11	5	0.3	1.23	250	0.4	0%
f1a	Coarse	89	0.08	7	0.3	1.23	574	1.5	1%
Coarse Facies Subtotal			m ³	438			mCi	19.7	11%
			m ³ /km	1511			mCi/km	68	
c1b	Fine	21	0.09	2	0.99	1.04	26	0.1	0%
c2	Fine	298	0.33	98	0.97	1.04	101	10.0	6%
c2a	Fine	94	0.42	39	0.97	1.04	470	18.7	10%
c3	Fine	32	0.36	12	0.97	1.04	2511	29.2	16%
f1	Fine	135	0.35	47	0.97	1.04	101	4.8	3%
f1b	Fine	44	0.34	15	0.97	1.04	470	7.1	4%
f1a	Fine	89	0.39	35	0.97	1.04	2511	87.9	49%
Fine Facies Subtotal			m ³	248			mCi	157.8	87%
			m ³ /km	856			mCi/km	544	
f1	Pre-1943	135	0.4	54	0.9	1.23	26	1.6	1%
f1b	Pre-1943	44	0.4	18	0.9	1.23	26	0.5	0%
f1a	Pre-1943	89	0.4	36	0.9	1.23	26	1.0	1%
Pre-1943 Subtotal			m ³	107			mCi	3.1	2%
			m ³ /km	370			mCi/km	11	
Total			m ³	794			mCi	180.6	100%
			m ³ /km	2736			mCi/km	623	

Table D-1.4-2
Estimated Plutonium-239, 240 Inventory in Reach ACS After Interim Action

Geomorphic Unit	Sediment Facies	Area (m ²)	Estimated Average Thickness (m)	Estimated Volume (m ³)	Estimated Non-Gravel Fraction	Estimated Average Density (g/cm ³)	Estimated Average Pu-239, 240 Concentration (pCi/g)	Estimated Pu-239, 240 Inventory (mCi)	Percent of Total Estimated Inventory
c1	Coarse	242	0.5	121	0.5	1.23	19	1.4	4%
c1b	Coarse	18	0.5	9	0.5	1.23	19	0.1	0%
c2	Coarse	125	0.5	63	0.4	1.23	126	3.9	12%
f1	Coarse	109	0.02	2	0.3	1.23	21	0.0	0%
Coarse Facies Subtotal			m³	195			mCi	5.4	17%
			m³/km	671			mCi/km	19	
c1b	Fine	18	0.09	2	0.99	1.04	26	0.0	0%
c2	Fine	125	0.33	41	0.97	1.04	101	4.2	13%
f1	Fine	109	0.35	38	0.97	1.04	101	3.9	12%
Fine Facies Subtotal			m³	81			mCi	8.1	25%
			m³/km	279			mCi/km	28	
f1	Pre-1943	109	0.4	44	0.9	1.23	26	1.3	4%
Pre-1943 Subtotal			m³	44			mCi	1.3	4%
			m³/km	150			mCi/km	4	
c.a.	n/a*	620	0.25	155	0.7	1.14	140	17.3	54%
Cleanup Area Subtotal			m³	155			mCi	17.3	54%
			m³/km	534			mCi/km	60	
Total			m³	431			mCi	32.1	100%
			m³/km	1485			mCi/km	111	

*n/a = Not applicable.

Table D-1.4-3
Estimated Plutonium-239,240 Inventory in Reach AC-2

Geomorphic Unit	Sediment Facies	Area (m ²)	Estimated Average Thickness (m)	Estimated Volume (m ³)	Estimated Non-Gravel Fraction	Estimated Average Density (g/cm ³)	Estimated Average Pu-239,240 Concentration (pCi/g)	Estimated Pu-239,240 Inventory (mCi)	Percent of Total Estimated Inventory
AC-2, West Part (Acid Canyon Downstream of 0-030(g) Drainage)									
c1	Coarse	66	0.3	20	0.7	1.23	0.02	0.00	0%
c1b	Coarse	7	0.3	2	0.7	1.23	0.02	0.00	0%
c2	Coarse	10	0.3	3	0.7	1.23	0.1	0.00	0%
c3+f1	Coarse	209	0.3	63	0.7	1.23	0.1	0.01	8%
Coarse Facies Subtotal			m ³	87			mCi	0.01	8%
			m ³ /km	2184			mCi/km	0.15	
c1b	Fine	7	0.1	1	0.96	1.04	0.44	0.00	0%
c2	Fine	10	0.65	7	0.96	1.04	0.44	0.00	4%
c3+f1	Fine	209	0.68	142	0.96	1.04	0.44	0.06	87%
Fine Facies Subtotal			m ³	149			mCi	0.07	92%
			m ³ /km	3732			mCi/km	1.64	
Total			m ³	237			mCi	0.07	100%
			m ³ /km	5916			mCi/km	1.79	
AC-2, East Part (Acid Canyon Upstream of South Fork)									
c1	Coarse	97	0.2	19	0.7	1.23	0.02	0.00	2%
c2	Coarse	41	0.2	8	0.7	1.23	0.1	0.00	4%
f1	Coarse	78	0.05	4	0.7	1.23	0.1	0.00	2%
Coarse Facies Subtotal			m ³	32			mCi	0.00	8%
			m ³ /km	685			mCi/km	0.03	
c2	Fine	41	0.33	14	0.96	1.04	0.44	0.01	37%
f1	Fine	78	0.26	20	0.96	1.04	0.44	0.01	55%
Fine Facies Subtotal			m ³	34			mCi	0.01	92%
			m ³ /km	735			mCi/km	0.32	
Total			m ³	65			mCi	0.02	100%
			m3/km	1420			mCi/km	0.35	
AC-2 Average (Average of West and East Parts)									
Coarse Facies			m ³ /km	1435			mCi/km	0.09	
Fine Facies			m ³ /km	2233			mCi/km	0.98	
Total			m ³ /km	3668			mCi/km	1.07	

Table D-1.4-4
Estimated Plutonium-239,240 Inventory in Reach AC-3

Geomorphic Unit	Sediment Facies	Area (m ²)	Estimated Average Thickness (m)	Estimated Volume (m ³)	Estimated Non-Gravel Fraction	Estimated Average Density (g/cm ³)	Estimated Average Pu-239,240 Concentration (pCi/g)	Estimated Pu-239,240 Inventory (mCi)	Percent of Total Estimated Inventory
c1	Coarse	1345	0.5	673	0.5	1.23	8.6	3.6	11%
c2	Coarse	678	0.5	339	0.5	1.23	16.4	3.4	11%
f1	Coarse	357	0.02	7	0.5	1.23	16.4	0.1	0%
Coarse Facies Subtotal			m ³	1019			mCi	7.0	22%
			m ³ /km	2455			mCi/km	17.0	
c2	Fine	678	0.32	217	0.94	1.04	88.6	18.8	60%
f1	Fine	357	0.18	64	0.94	1.04	88.6	5.6	18%
f2	Fine	328	0.05	16	0.99	1.04	0.9	0.0	0%
Fine Facies Subtotal			m ³	298			mCi	24.4	78%
			m ³ /km	717			mCi/km	58.7	
Total			m ³	1316			mCi	31.4	100%
			m ³ /km	3172			mCi/km	75.7	

Table D-1.4-5
Estimated Plutonium-239,240 Inventory in SWMU 0-030(g) Drainage

Geomorphic Unit	Sediment Facies	Area (m ²)	Estimated Average Thickness (m)	Estimated Volume (m ³)	Estimated Non-Gravel Fraction	Estimated Average Density (g/cm ³)	Estimated Average Pu-239,240 Concentration (pCi/g)	Estimated Pu-239,240 Inventory (mCi)	Percent of Total Estimated Inventory
c1	Coarse	208	0.29	60	0.7	1.23	5.9	0.3	3%
c1b	Coarse	59	0.43	26	0.7	1.23	5.9	0.1	1%
c1w	Coarse	61	0.22	14	0.7	1.23	5.9	0.1	1%
c2a	Coarse	508	0.32	162	0.7	1.23	5.9	0.8	8%
c2b	Coarse	223	0.19	42	0.7	1.23	5.9	0.2	2%
c2c	Coarse	829	0.06	50	0.7	1.23	5.9	0.3	2%
c3?	Coarse	21	0.15	3	0.7	1.23	5.9	0.0	0%
Coarse Facies Subtotal			m ³	357			mCi	1.8	17%
			m ³ /km	1551			mCi/km	8	
c1	Fine	208	0.13	27	0.86	1.04	29.1	0.7	7%
c1b	Fine	59	0.07	4	0.86	1.04	29.1	0.1	1%
c1w	Fine	61	0.23	14	0.86	1.04	29.1	0.4	3%
c2a	Fine	508	0.22	112	0.86	1.04	29.1	2.9	28%
c2b	Fine	223	0.19	42	0.86	1.04	29.1	1.1	10%
c2c	Fine	829	0.16	133	0.86	1.04	29.1	3.5	33%
c3?	Fine	21	0.15	3	0.86	1.04	29.1	0.1	1%
Fine Facies Subtotal			m ³	335			mCi	8.7	83%
			m ³ /km	1456			mCi/km	38	
Total			m ³	692			mCi	10.5	100%
			m ³ /km	3008			mCi/km	46	

Table D-1.4-6
Estimated Plutonium-239,240 Inventory in Nonsampled Parts of Reach P-3

Geomorphic Unit	Sediment Facies	Area (m²)	Estimated Average Thickness (m)	Estimated Volume (m³)	Estimated Non-Gravel Fraction	Estimated Average Density (g/cm³)	Estimated Average Pu-239,240 Concentration (pCi/g)	Estimated Pu-239,240 Inventory (mCi)	Percent of Total Estimated Inventory
P-3C (between P-3W and P-3E)									
c1+c1a	Coarse	1360	1.75	2380	0.7	1.23	0.89	1.8	9%
c2	Coarse	9697	1.50	14546	0.7	1.23	0.89	11.1	55%
Coarse Facies Subtotal			m³	16926			mCi	13.0	63%
			m³/km	37612			mCi/km	29	
c1+c1a	Fine	1360	0.02	27	0.87	1.04	1.54	0.0	0%
c2	Fine	9697	0.49	4752	0.87	1.04	1.54	6.6	32%
f1	Fine	3786	0.15	549	0.93	1.04	1.54	0.8	4%
Fine Facies Subtotal			m³	5328			mCi	7.5	37%
			m³/km	11839			mCi/km	17	
Total			m³	22253			mCi	20.4	100%
			m³/km	49452			mCi/km	45	
P-3FE (between P-3E and P-4W)									
c1a	Coarse	4643	1.5	6965	0.7	1.23	0.89	5.3	23%
c2+c2a+c2b	Coarse	5505	1.5	8258	0.7	1.23	0.89	6.3	27%
c4a	Coarse	92	2.7	248	0.7	1.23	2.41	0.5	2%
c4b	Coarse	158	2.7	427	0.7	1.23	3.26	1.2	5%
c6	Coarse	351	0.8	281	0.8	1.23	1.27	0.4	1%
Coarse Facies Subtotal			m³	16178			mCi	13.7	59%
			m³/km	40445			mCi/km	34	
c2+c2a+c2b	Fine	5505	0.49	2697	0.87	1.04	1.54	3.8	16%
c4a	Fine	92	0.28	26	0.84	1.04	7.32	0.2	1%
c4b	Fine	158	0.30	47	0.84	1.04	7.32	0.3	1%
c6	Fine	351	0.20	70	0.93	1.04	37.83	2.6	11%
f1	Fine	9668	0.07	677	0.94	1.04	3.77	2.5	11%
f1a	Fine	4895	0.15	734	0.91	1.04	0.38	0.3	1%
f2	Fine	1304	0.03	39	0.94	1.04	3.77	0.1	1%
Fine Facies Subtotal			m³	4291			mCi	9.7	41%
			m³/km	10727			mCi	24	
Total			m³	20469			mCi	23.4	100%
			m³/km	51172			mCi/km	59	

Table D-1.4-7
Estimated Plutonium-239,240 Inventory in Nonsampled Parts of Reach P-4

Geomorphic Unit	Sediment Facies	Area (m ²)	Estimated Average Thickness (m)	Estimated Volume (m ³)	Estimated Non-Gravel Fraction	Estimated Average Density (g/cm ³)	Estimated Average Pu-239,240 Concentration (pCi/g)	Estimated Pu-239,240 Inventory (mCi)	Percent of Total Estimated Inventory
P-4C (between P-4W and P-4E)									
c1a,c1b	Coarse	3761	0.45	1692	0.8	1.23	1.32	2.2	8%
c2a,b,c	Coarse	3478	0.45	1565	0.8	1.23	1.32	2.0	8%
c3	Coarse	2000	2.2	4400	0.8	1.23	1.81	7.8	29%
c4a	Coarse	164	2.4	394	0.8	1.23	1.77	0.7	3%
f1	Coarse	1853 7	0.03	556	0.8	1.23	1.32	0.7	3%
Coarse Facies Subtotal			m ³	8607			mCi	13.5	50%
			m ³ /km	26083			mCi/km	41	
c1a,c1b	Fine	3761	0.05	188	0.85	1.04	5.99	1.0	4%
c2a,b,c	Fine	3478	0.05	174	0.85	1.04	5.99	0.9	3%
c3	Fine	2000	0.05	100	0.85	1.04	5.99	0.5	2%
c4a	Fine	164	0.05	8	0.85	1.04	5.99	0.0	0%
f1	Fine	1853 7	0.1	1854	0.94	1.04	5.99	10.9	40%
f2	Fine	4691	0.01	47	0.94	1.04	5.99	0.3	1%
Fine Facies Subtotal			m ³	2371			mCi	13.6	50%
			m ³ /km	7184			mCi/km	41	
Total			m ³	10978			mCi	27.1	100%
			m ³ /km	33267			mCi/km	82	
P-4FE (P-4E to Los Alamos Canyon)									
c1a,c1b	Coarse	8401	0.45	3780	0.8	1.23	1.32	4.9	14%
c2a	Coarse	311	0.45	140	0.8	1.23	1.32	0.2	1%
c2+c3	Coarse	5977	2.2	13149	0.8	1.23	1.81	23.4	66%
f1	Coarse	4683	0.05	234	0.8	1.23	1.32	0.3	1%
Coarse Facies Subtotal			m ³	17304			mCi	28.8	81%
			m ³ /km	23704			mCi/km	39	
c1a,c1b	Fine	8401	0.05	420	0.85	1.04	5.99	2.2	6%
c2a	Fine	311	0.05	16	0.85	1.04	5.99	0.1	0%
c2+c3	Fine	5977	0.05	299	0.85	1.04	5.99	1.6	4%
f1	Fine	4683	0.1	468	0.94	1.04	5.99	2.7	8%
f2	Fine	2881	0.01	29	0.94	1.04	5.99	0.2	0%
Fine Facies Subtotal			m ³	1232			mCi	6.8	19%
			m ³ /km	1687			mCi/km	9	
Total			m ³	18536			mCi	35.6	100%
			m ³ /km	25391			mCi/km	49	

Table D-1.4-8
Estimated Plutonium-239,240 Inventory in Acid and Pueblo Canyons

Reach	Approximate Distance Above Rio Grande, Upstream End (km)	Approximate Reach Length (km)	Sampling Status	Estimated Coarse Facies Inventory, Pu-239,240 (mCi)	Estimated Fine Facies Inventory, Pu-239,240 (mCi)	Estimated Total Pu-239,240 Inventory (mCi)	Percent of Estimated Total Pu-239,240 Inventory
0-030(g)	18.97	0.23	Sampled	1.8	8.7	10.5	1.0%
AC-2	18.76	0.29	Sampled	0.0	0.3	0.3	0.0%
ACS	18.76	0.29	Sampled	22.8	157.8	180.6	16.8%
AC-3	18.47	0.41	Sampled	7.0	24.4	31.4	2.9%
P-1E	18.06	0.51	Sampled	7.5	34.8	42.3	3.9%
P-1 to P-2	17.55	2.69	Not sampled	44.8	173.0	217.8	20.3%
P-2W	14.86	0.51	Sampled	9.5	30.8	40.3	3.7%
P-2C	14.35	0.78	Not sampled	14.5	47.1	61.6	5.7%
P-2E	13.57	0.46	Sampled	7.4	9.7	17.1	1.6%
P-2 to P-3	13.11	1.46	Not sampled	31.2	26.8	57.9	5.4%
P-3W	11.65	0.51	Sampled	13.6	8.0	21.5	2.0%
P-3C	11.14	0.45	Not sampled	13.0	7.5	20.5	1.9%
P-3E	10.69	0.54	Sampled	20.5	18.1	38.6	3.6%
P-3FE	10.15	0.40	Not sampled	13.7	9.7	23.4	2.2%
P-4W	9.75	0.52	Sampled	109.3	49.3	158.6	14.8%
P-4C	9.23	0.33	Not sampled	13.5	13.6	27.1	2.5%
P-4E	8.90	0.60	Sampled	62.7	27.0	89.7	8.3%
P-4 FE	8.30	0.73	Not sampled	28.8	6.8	35.6	3.3%
Confluence	7.57						
Total Prior to IA		11.71		421.6	653.4	1074.9	100%
ACS Removed						148.5	14%
Total After IA						926.4	86%

Table D-1.4-9
Estimated Radionuclide Inventory in Reach LA-2FE

Geomorphic Unit	Sediment Facies	Area (m ²)	Estimated Average Thickness (m)	Estimated Volume (m ³)	Estimated Non-Gravel Fraction	Estimated Average Density (g/cm ³)	Estimated Average Am-241 Concentration (pCi/g)	Estimated Am-241 Inventory (mCi)	Percent of Total Estimated Am-241 Inventory	Estimated Average Cs-137 Concentration (pCi/g)	Estimated Cs-137 Inventory (mCi)	Percent of Total Estimated Cs-137 Inventory	Estimated Average Pu-239,240 Concentration (pCi/g)	Estimated Pu-239,240 Inventory (mCi)	Percent of Total Estimated Pu-239,240 Inventory	Estimated Average Sr-90 Concentration (pCi/g)	Estimated Sr-90 Inventory (mCi)	Percent of Total Estimated Sr-90 Inventory
c1	Coarse	2160	0.5	1080	0.5	1.23	0.3	0.2	2%	0.5	0.3	0%	0.1	0.1	1%	0.2	0.1	1%
c2	Coarse	3074	0.5	1537	0.5	1.23	2.1	1.9	15%	8.9	8.4	7%	1.2	1.1	11%	0.6	0.5	4%
c3	Coarse	3972	0.5	1986	0.5	1.23	0.2	0.2	2%	15.5	18.9	16%	0.8	1.0	10%	1.5	1.9	12%
c3a	Coarse	522	0.5	261	0.5	1.23	0.5	0.1	1%	17.2	2.8	2%	1.7	0.3	3%	2.6	0.4	3%
f1	Coarse	6148	0.04	246	0.5	1.23	0.2	0.0	0%	15.5	2.3	2%	0.8	0.1	1%	1.5	0.2	2%
f2	Coarse	4921	0.05	246	0.5	1.23	0.0	0.0	0%	0.0	0.0	0%	0.0	0.0	0%	0.0	0.0	0%
Coarse Facies Subtotal			m ³	5356			mCi	2.5	20%	mCi	32.7	27%	mCi	2.6	26%	mCi	3.15	21%
			m ³ /km	5356			mCi/km	2.5		mCi/km	32.7		mCi/km	2.6		mCi/km	3.1	
c1	Fine	2160	0.01	22	0.95	1.04	0.8	0.0	0%	2.4	0.1	0%	0.4	0.0	0%	0.3	0.0	0%
c2	Fine	3074	0.35	1076	0.95	1.04	7.2	7.7	61%	9.2	9.8	8%	2.1	2.2	22%	1.5	1.5	10%
c3	Fine	3972	0.16	636	0.95	1.04	1.1	0.7	5%	25.5	16.0	13%	1.7	1.1	10%	5.1	3.2	21%
c3a	Fine	522	0.72	376	0.95	1.04	1.4	0.5	4%	70.2	26.1	22%	4.4	1.6	16%	11.0	4.1	27%
f1	Fine	6148	0.29	1783	0.95	1.04	0.5	1.0	8%	18.4	32.4	27%	1.4	2.5	24%	4.6	3.0	20%
f2	Fine	4921	0.16	787	0.95	1.04	0.4	0.3	2%	2.6	2.0	2%	0.2	0.2	2%	0.0	0.0	0%
Fine Facies Subtotal			m ³	4679			mCi	10.1	80%	mCi	86.4	73%	mCi	7.6	74%	mCi	11.83	79%
			m ³ /km	4679			mCi/km	10.1		mCi/km	86.4		mCi/km	7.6		mCi/km	11.8	
Total			m ³	10035			mCi	12.7	100%	mCi	119.1	100%	mCi	10.2	100%	mCi	15.0	100%
			m ³ /km	10035			mCi/km	12.7		mCi/km	119.1		mCi/km	10.2		mCi/km	15.0	

Table D-1.4-10
Estimated Radionuclide Inventory in Reach LA-3W

Geomorphic Unit	Sediment Facies	Area (m ²)	Estimated Average Thickness (m)	Estimated Volume (m ³)	Estimated Non-Gravel Fraction	Estimated Average Density (g/cm ³)	Estimated Average Am-241 Concentration (pCi/g)	Estimated Am-241 Inventory (mCi)	Percent of Total Estimated Am-241 Inventory	Estimated Average Cs-137 Concentration (pCi/g)	Estimated Cs-137 Inventory (mCi)	Percent of Total Estimated Cs-137 Inventory	Estimated Average Pu-239,240 Concentration (pCi/g)	Estimated Pu-239,240 Inventory (mCi)	Percent of Total Estimated Pu-239,240 Inventory	Estimated Average Sr-90 Concentration (pCi/g)	Estimated Sr-90 Inventory (mCi)	Percent of Total Estimated Sr-90 Inventory
c1	Coarse	864	0.5	432	0.5	1.23	0.2	0.0	1%	1.0	0.3	1%	0.1	0.0	1%	0.0	0.0	0%
c2	Coarse	1348	0.5	674	0.5	1.23	0.5	0.2	6%	2.4	1.0	5%	0.4	0.2	7%	0.5	0.2	5%
c3	Coarse	1474	0.5	737	0.5	1.23	0.5	0.2	6%	5.7	2.6	13%	1.1	0.5	18%	1.7	0.8	19%
f1	Coarse	1403	0.04	56	0.5	1.23	0.5	0.0	1%	2.4	0.1	0%	0.4	0.0	1%	0.5	0.0	0%
f2	Coarse	1351	0.04	54	0.5	1.23	0.0	0.0	0%	0.2	0.0	0%	0.0	0.0	0%	0.0	0.0	0%
Coarse Facies Subtotal			m ³	1953			mCi	0.48	15%	mCi	3.9	20%	mCi	0.69	27%	mCi	1.00	25%
			m ³ /km	3986			mCi/km	1.0		mCi/km	8.0		mCi/km	1.4		mCi/km	2.0	
c2	Fine	1348	0.35	472	0.97	1.04	2.8	1.3	41%	5.8	2.8	14%	1.1	0.5	21%	0.7	0.3	8%
c3	Fine	1474	0.39	575	0.98	1.04	2.2	1.3	40%	17.8	10.4	54%	1.9	1.1	42%	4.1	2.4	59%
f1	Fine	1403	0.15	210	0.98	1.04	0.7	0.2	5%	9.6	2.1	11%	1.2	0.3	10%	1.6	0.3	8%
f2	Fine	1351	0.06	81	0.89	1.04	0.0	0.0	0%	0.7	0.1	0%	0.1	0.0	0%	0.0	0.0	0%
Fine Facies Subtotal			m ³	1338			mCi	2.76	85%	mCi	15.3	80%	mCi	1.89	73%	mCi	3.09	75%
			m ³ /km	2731			mCi/km	5.6		mCi/km	31.2		mCi/km	3.9		mCi/km	6.3	
Total			m ³	3291			mCi	3.2	100%	mCi	19.2	100%	mCi	2.6	100%	mCi	4.1	100%
			m ³ /km	6717			mCi/km	6.6		mCi/km	39.2		mCi/km	5.3		mCi/km	8.4	

Table D-1.4-11
Estimated Radionuclide Inventory Removed in LA-2E and DP-2 Sediment Removal Tasks

Geomorphic Unit	Sediment Facies	Area (m ²)	Estimated Average Thickness (m)	Estimated Volume (m ³)	Estimated Non-Gravel Fraction	Estimated Average Density (g/cm ³)	Estimated Average Cs-137 Concentration (pCi/g)	Estimated Cs-137 Inventory (mCi)	Estimated Average Am-241 Concentration (pCi/g)	Estimated Am-241 Inventory (mCi)	Estimated Average Pu-239,240 Concentration (pCi/g)	Estimated Pu-239,240 Inventory (mCi)	Estimated Average Sr-90 Concentration (pCi/g)	Estimated Sr-90 Inventory (mCi)
Reach LA-2E, CY00 Sediment Removal														
c2b	Coarse	74	0.5	37	0.5	1.23	11.2	0.3	0.79	0.0	0.5	0.0	0.3	0.0
c3	Coarse	299	0.67	199	0.5	1.23	37.0	4.5	0.83	0.1	1.9	0.2	7.5	0.9
Coarse Facies Subtotal				236				4.8		0.1		0.2		0.9
c2b	Fine	74	0.55	41	0.92	1.04	23.7	0.9	6.1	0.2	2.3	0.1	2.6	0.1
c3	Fine	299	0.24	72	0.76	1.04	120.8	6.9	1.4	0.1	3.7	0.2	27.6	1.6
f1b	Fine	174	0.15	26	0.76	1.04	54.5	1.4	0.3	0.0	2.4	0.1	9.0	0.2
Fine Facies Subtotal				139				9.3		0.3		0.4		1.9
Total				376				14.1		0.4		0.6		2.8
Reach DP-2, CY03 Sediment Removal														
c3b	Coarse	10	0.3	3	0.5	1.23	128.0	0.2	2.6	0.0	4.2	0.01	1.7	0.00
c3b	Fine	10	0.65	6	0.96	1.04	159.7	1.0	17.2	0.1	3.0	0.02	4.1	0.03
Total				9				1.2		0.1		0.03		0.03

Table D-1.4-12
Estimated Inventory of Key Radionuclides in DP and Upper Los Alamos Canyons

Reach	Approx. Distance Above Rio Grande, Upstream End (km)	Approx. Reach Length (km)	Sampling Status	Am-241				Cs-137				Pu-239,240				Sr-90			
				Estimated Coarse Facies Inventory, Am-241 (mCi)	Estimated Fine Facies Inventory, Am-241 (mCi)	Estimated Total Am-241 Inventory (mCi)	Percent of Estimated Total Am-241 Inventory	Estimated Coarse Facies Inventory, Cs-137 (mCi)	Estimated Fine Facies Inventory, Cs-137 (mCi)	Estimated Total Cs-137 Inventory (mCi)	Percent of Estimated Total Cs-137 Inventory	Estimated Coarse Facies Inventory, Pu-239,240 (mCi)	Estimated Fine Facies Inventory, Pu-239,240 (mCi)	Estimated Total Pu-239,240 Inventory (mCi)	Percent of Estimated Total Pu-239,240 Inventory	Estimated Coarse Facies Inventory, Sr-90 (mCi)	Estimated Fine Facies Inventory, Sr-90 (mCi)	Estimated Total Sr-90 Inventory (mCi)	Percent of Estimated Total Sr-90 Inventory
LA-1FW	18.08	0.11	Sampled	0.0	0.0	0.0	0%	0.0	0.0	0.0	0%	0.0	0.0	0.0	0%	0.0	0.0	0.0	0%
LA-1FW to LA-1W+	17.97	0.43	Not sampled	0.0	0.0	0.0	0%	0.0	0.0	0.0	0%	0.0	0.0	0.0	0%	0.0	0.0	0.0	0%
LA-1W+	17.54	0.14	Sampled	0.0	0.0	0.0	0%	0.0	0.0	0.0	0%	0.0	0.1	0.1	0%	0.0	0.0	0.0	0%
LA-1W+ to LA-1W	17.40	0.04	Not sampled	0.0	0.0	0.0	0%	0.0	0.0	0.0	0%	0.0	0.4	0.4	0%	0.0	0.0	0.0	0%
LA-1W	17.36	0.37	Sampled	0.0	0.3	0.3	0%	0.0	0.0	0.0	0%	0.3	6.2	6.5	7%	0.0	0.0	0.0	0%
LA-1W to LA-1C	16.99	1.14	Not sampled	0.1	0.5	0.6	1%	0.0	0.0	0.0	0%	0.7	12.8	13.5	15%	0.0	0.0	0.0	0%
LA-1C	15.85	0.39	Sampled	0.0	0.0	0.1	0%	0.0	0.0	0.0	0%	0.2	2.2	2.4	3%	0.0	0.0	0.0	0%
LA-1C to LA-1E	15.46	0.44	Not sampled	0.0	0.1	0.1	0%	0.1	1.0	1.1	0%	0.3	4.0	4.3	5%	0.0	0.0	0.0	0%
LA-1E	15.02	0.43	Sampled	0.0	0.2	0.2	0%	0.2	1.9	2.2	1%	0.5	5.3	5.8	6%	0.0	0.0	0.0	0%
LA-1E to LA-2W	14.59	1.49	Not sampled	0.1	0.4	0.5	1%	0.9	4.3	5.2	1%	2.1	11.8	13.9	15%	0.0	0.0	0.0	0%
LA-2W	13.10	0.21	Sampled	0.0	0.0	0.0	0%	0.1	0.3	0.4	0%	0.4	0.7	1.1	1%	0.0	0.0	0.0	0%
DP-2	14.59	0.32	Sampled	0.7	6.7	7.4	10%	15.9	36.4	52.3	13%	1.5	4.1	5.6	6%	0.9	7.7	8.6	12%
DP-2 to DP-3	14.28	0.33	Not sampled	0.1	5.4	5.4	7%	0.5	15.0	15.5	4%	0.5	2.2	2.7	3%	0.1	2.6	2.8	4%
DP-3	13.95	0.21	Sampled	0.0	3.4	3.5	5%	0.3	9.6	10.0	3%	0.3	1.4	1.7	2%	0.1	1.7	1.8	2%
DP-3 to DP-4	13.74	0.39	Not sampled	0.1	6.4	6.4	8%	0.6	17.8	18.4	5%	0.6	2.6	3.2	4%	0.2	3.1	3.3	5%
DP-4	13.34	0.45	Sampled	0.2	1.4	1.6	2%	3.9	8.8	12.6	3%	0.1	0.9	1.0	1%	0.4	1.6	2.0	3%
LA-2E	12.89	0.68	Sampled	1.7	11.2	12.9	17%	12.4	32.2	44.7	11%	0.8	4.1	4.9	5%	3.4	7.8	11.2	16%
LA-2E to LA-2FE	12.21	0.49	Not sampled	1.2	8.0	9.3	12%	9.0	23.2	32.2	8%	0.6	2.9	3.5	4%	2.5	5.6	8.0	11%
LA-2FE	11.72	1.00	Sampled	2.5	10.1	12.7	17%	35.8	94.7	130.5	33%	2.6	7.6	10.2	11%	3.5	13.0	16.5	23%
LA-3W	10.72	0.49	Sampled	0.5	2.8	3.2	4%	4.3	16.8	21.0	5%	0.7	1.9	2.6	3%	1.1	3.4	4.5	6%
LA-3W to LA-3E	10.23	0.69	Not sampled	0.6	3.2	3.8	5%	4.3	15.3	19.6	5%	0.7	2.1	2.8	3%	1.0	3.6	4.7	6%
LA-3E	9.54	0.44	Sampled	0.3	1.6	1.9	2%	1.6	4.5	6.1	2%	0.3	0.9	1.2	1%	0.3	1.6	1.9	3%
LA-3E to Pueblo	9.10	1.53	Not sampled	1.0	5.6	6.6	9%	5.6	15.6	21.2	5%	1.0	3.2	4.2	5%	1.0	5.6	6.6	9%
Confluence	7.57																		
Total, ca. 1997	n/a*	12.21	n/a	9.1	67.3	76.4	100%	95.5	297.5	393.0	100%	14.1	77.3	91.4	100%	14.5	57.3	71.7	100%
LA-2E Removed				0.1	0.3	0.5	1%	4.8	9.3	14.1	4%	0.3	0.4	0.6	1%	0.9	1.9	2.9	4%
DP-2 Removed				0.0	0.1	0.1	0%	0.4	1.0	1.4	0.3%	0.0	0.0	0.0	0.0%	0.0	0.0	0.0	0.04%
Total, After Removal				9.0	66.9	75.9	99%	90.4	287.2	377.6	96%	13.8	76.9	90.7	99%	13.5	55.3	68.9	96%
Total, Decay-Corrected to 2004				n/a	n/a	n/a	n/a	77.0	244.7	321.7	82%	n/a	n/a	n/a	n/a	11.5	47.1	58.7	82%

*n/a = Not applicable.

Table D-1.5-1
Summary of Americium-241 Concentration and Inventory in Los Alamos and Pueblo Watershed

Reach	Approximate Distance Above Rio Grande, Midpoint of Reach (km)	Estimated Average Am-241 Concentration, Coarse Facies (pCi/g)	Estimated Average Am-241 Concentration, Fine Facies (pCi/g)	Estimated Coarse Facies Inventory, Am-241 (mCi/km)	Estimated Fine Facies Inventory, Am-241 (mCi/km)	Estimated Total Am-241 Inventory (mCi/km)
AC-1	19.08	— ^a	—	—	—	—
O-030(g)	18.86	0.5	1.3	0.6	1.7	2.3
AC-2	18.62	0.0	0.1	0.0	0.0	0.0
ACS	18.62	4.9	30.3	3.6	26.2	29.7
AC-3	18.27	0.6	14.1	1.0	9.4	10.3
DP-1W	16.39	—	—	—	—	—
DP-1C	16.29	—	—	—	—	—
DP-1E	15.47	—	—	—	—	—
DP-2	14.44	1.2	4.6	2.2	21.0	23.2
DP-3	13.84	0.4	12.9	0.2	16.4	16.6
DP-4	13.12	0.3	6.6	0.4	3.1	3.5
LA-0	19.50	n.d. ^b	n.d.	n.d.	n.d.	n.d.
LA-1FW	18.03	—	—	—	—	—
LA-1W+	17.47	n.d.	n.d.	n.d.	n.d.	n.d.
LA-1W	17.18	n.d.	0.2	n.d.	0.8	n.d.
LA-1C	15.66	n.d.	0.1	n.d.	0.1	n.d.
LA-1E	14.81	n.d.	0.1	n.d.	0.4	n.d.
LA-2W	13.00	0.0	0.1	0.1	0.1	0.2
LA-2E	12.55	1.1	6.0	2.5	16.4	18.9
LA-2FE	11.22	0.4	1.7	2.5	10.1	12.6
LA-3W	10.48	0.2	1.7	1.0	5.6	6.6
LA-3E	9.32	0.4	1.9	0.7	3.6	4.3
LA-4W	6.04	0.0	0.4	0.1	1.4	1.6
LA-4E	5.03	0.0	0.4	0.0	1.4	1.5
LA-5	0.88	0.0	0.0	1.2	0.6	1.7
P-1FW	18.10	n.d.	n.d.	n.d.	n.d.	n.d.
P-1W	17.90	—	—	—	—	—
P-1E	17.81	0.2	0.6	0.4	1.6	2.0
P-2W	14.61	0.1	0.7	0.6	3.5	4.0
P-2E	13.34	n.d.	n.d.	n.d.	n.d.	n.d.
P-3W	11.40	0.0	0.3	0.6	1.5	2.2
P-3E	10.42	n.d.	n.d.	n.d.	n.d.	n.d.
P-4W	9.49	0.1	0.5	5.6	3.3	0.3
P-4E	8.60	0.1	0.2	3.6	1.9	5.4

Note: Table does not include post-fire effects or estimates after sediment removal; average concentrations are for < 2 mm fraction, and are not adjusted for gravel content.

^a Dash indicates not a COPC in that reach.

^b n.d. = No data.

Table D-1.5-2
Summary of Cesium-137 Concentration and Inventory in Los Alamos and Pueblo Watershed

Reach	Approx. Distance Above Rio Grande, Midpoint of Reach (km)	Estimated Average Cs-137 Concentration, Coarse Facies (pCi/g)	Estimated Average Cs-137 Concentration, Fine Facies (pCi/g)	Estimated Coarse Facies Inventory, Cs-137 (mCi/km)	Estimated Fine Facies Inventory, Cs-137 (mCi/km)	Estimated Total Cs-137 Inventory (mCi/km)
AC-1	19.08	0.0	0.4	0.0	1.8	1.8
0-030(g)	18.86	— ^a	—	—	—	—
AC-2	18.62	—	—	—	—	—
ACS	18.62	4.0	12.7	3.0	10.9	13.9
AC-3	18.27	0.1	5.2	0.2	3.5	3.7
DP-1W	16.39	—	—	—	—	—
DP-1C	16.29	—	—	—	—	—
DP-1E	15.47	—	—	—	—	—
DP-2	14.44	27.2	24.3	49.3	112.5	161.8
DP-3	13.84	2.9	35.3	1.5	44.5	46.0
DP-4	13.12	6.1	40.6	8.3	18.9	27.2
LA-0	19.50	n.d. ^b	n.d.	n.d.	n.d.	n.d.
LA-1FW	18.03	—	—	—	—	—
LA-1W+	17.47	n.d.	n.d.	n.d.	n.d.	n.d.
LA-1W	17.18	—	—	—	—	—
LA-1C	15.66	0.2	0.6	0.3	1.1	1.4
LA-1E	14.81	0.2	1.4	0.4	3.8	4.2
LA-2W	13.00	0.2	0.7	0.7	0.8	1.4
LA-2E	12.55	7.7	17.5	18.3	47.4	65.7
LA-2FE	11.22	4.9	14.8	32.7	86.4	119.1
LA-3W	10.48	1.6	9.1	8.0	31.2	39.2
LA-3E	9.32	2.1	5.3	3.7	10.2	13.9
LA-4W	6.04	0.1	0.9	0.5	3.9	4.4
LA-4E	5.03	0.2	1.0	0.6	3.8	4.4
LA-5	0.88	0.1	0.5	4.1	8.0	12.1
P-1FW	18.10	n.d.	n.d.	n.d.	n.d.	n.d.
P-1W	17.90	—	—	—	—	—
P-1E	17.81	0.1	0.9	0.2	2.4	2.7
P-2W	14.61	—	—	—	—	—
P-2E	13.34	n.d.	n.d.	n.d.	n.d.	n.d.
P-3W	11.40	—	—	—	—	—
P-3E	10.42	n.d.	n.d.	n.d.	n.d.	n.d.
P-4W	9.49	—	—	—	—	—
P-4E	8.60	—	—	—	—	—

Note: Table does not include post-fire effects or estimates after sediment removal; average concentrations and inventory apply to time of sampling and are not adjusted for radioactive decay; average concentrations are for <2 mm fraction and are not adjusted.

^a — = Not a COPC in that reach.

^b n.d. = No data.

Table D-1.5-3
Summary of Plutonium-239,240 Concentration
and Inventory in Los Alamos and Pueblo Watershed

Reach	Approx. Distance Above Rio Grande, Midpoint of Reach (km)	Estimated Average Pu-239,240 Concentration, Coarse Facies (pCi/g)	Estimated Average Pu-239,240 Concentration, Fine Facies (pCi/g)	Estimated Coarse Facies Inventory, Pu-239,240 (mCi/km)	Estimated Fine Facies Inventory, Pu-239,240 (mCi/km)	Estimated Total Pu-239,240 Inventory (mCi/km)
AC-1	19.08	— ^a	—	—	—	—
O-030(g)	18.86	5.9	29.1	7.9	37.9	45.8
AC-2	18.62	0.1	0.4	0.1	1.0	1.1
ACS	18.62	111.0	574.1	97.6	630.4	728.0
AC-3	18.27	11.3	83.8	11.3	83.8	95.1
DP-1W	16.39	n.d. ^b	0.1	n.d.	0.1	n.d.
DP-1C	16.29	n.d.	0.0	n.d.	0.0	n.d.
DP-1E	15.47	n.d.	0.1	n.d.	0.1	n.d.
DP-2	14.44	2.7	5.3	4.8	12.8	17.6
DP-3	13.84	2.9	4.3	1.5	6.8	8.3
DP-4	13.12	0.1	2.2	0.2	2.0	2.2
LA-0	19.50	n.d.	n.d.	n.d.	n.d.	n.d.
LA-1FW	18.03	—	—	—	—	—
LA-1W+	17.47	0.0	0.4	0.1	0.8	0.9
LA-1W	17.18	0.4	4.6	0.8	16.8	17.6
LA-1C	15.66	0.2	2.9	0.4	5.6	6.0
LA-1E	14.81	0.5	4.0	1.1	12.4	13.4
LA-2W	13.00	0.6	2.2	1.7	3.5	5.2
LA-2E	12.55	0.5	2.2	1.2	6.0	7.2
LA-2FE	11.22	0.4	1.3	2.6	7.6	10.2
LA-3W	10.48	0.3	1.1	1.4	3.9	5.3
LA-3E	9.32	0.4	1.1	0.6	2.1	2.7
LA-4W	6.04	0.9	2.5	3.4	10.6	14.0
LA-4E	5.03	0.9	1.7	3.1	6.2	9.3
LA-5	0.88	0.1	0.5	3.9	8.7	12.6
P-1FW	18.10	n.d.	n.d.	n.d.	n.d.	n.d.
P-1W	17.90	n.d.	0.1	n.d.	?	n.d.
P-1E	17.81	7.1	20.6	14.7	68.2	82.9
P-2W	14.61	2.5	11.2	18.6	60.4	79.0
P-2E	13.34	0.4	2.6	16.1	21.1	37.2
P-3W	11.40	1.1	3.1	26.7	15.7	42.4
P-3E	10.42	0.9	2.4	37.8	33.5	71.3
P-4W	9.49	2.4	15.2	210.2	94.8	305.0
P-4E	8.60	1.7	6.0	104.5	45.0	149.5

Note: Table does not include post-fire effects or estimates after sediment removal; average concentrations are for <2 mm fraction and are not adjusted for gravel content.

^a — = Not a COPC in that reach.

^b n.d. = No data.

Table D-1.5-4
Summary of Strontium-90 Concentration and Inventory in Los Alamos and Pueblo Watershed

Reach	Approx. Distance Above Rio Grande, Midpoint of Reach (km)	Estimated Average Sr-90 Concentration, Coarse Facies (pCi/g)	Estimated Average Sr-90 Concentration, Fine Facies (pCi/g)	Estimated Coarse Facies Inventory, Sr-90 (mCi/km)	Estimated Fine Facies Inventory, Sr-90 (mCi/km)	Estimated Total Sr-90 Inventory (mCi/km)
AC-1	19.08	— ^a	—	—	—	—
0-030(g)	18.86	n.d. ^b	n.d.	n.d.	n.d.	n.d.
AC-2	18.62	—	—	—	—	—
ACS	18.62	4.1	12.7	3.0	10.9	13.9
AC-3	18.27	0.6	6.1	0.8	4.0	4.9
DP-1W	16.39	—	—	—	—	—
DP-1C	16.29	—	—	—	—	—
DP-1E	15.47	—	—	—	—	—
DP-2	14.44	1.6	5.2	2.8	23.6	26.3
DP-3	13.84	0.9	6.1	0.4	7.8	8.3
DP-4	13.12	0.7	7.2	0.9	3.4	4.3
LA-0	19.50	n.d.	n.d.	n.d.	n.d.	n.d.
LA-1FW	18.03	n.d.	n.d.	n.d.	n.d.	n.d.
LA-1W+	17.47	n.d.	n.d.	n.d.	n.d.	n.d.
LA-1W	17.18	n.d.	n.d.	n.d.	n.d.	n.d.
LA-1C	15.66	—	—	—	—	—
LA-1E	14.81	n.d.	n.d.	n.d.	n.d.	n.d.
LA-2W	13.00	—	—	—	—	—
LA-2E	12.55	2.1	4.2	5.0	11.4	16.4
LA-2FE	11.22	0.5	2.0	3.1	11.8	14.9
LA-3W	10.48	0.4	1.8	2.0	6.3	8.3
LA-3E	9.32	0.1	1.7	0.1	3.3	3.4
LA-4W	6.04	—	—	—	—	—
LA-4E	5.03	—	—	—	—	—
LA-5	0.88	—	—	—	—	—
P-1FW	18.10	n.d.	n.d.	n.d.	n.d.	n.d.
P-1W	17.90	—	—	—	—	—
P-1E	17.81	1.0	0.9	1.8	2.5	4.3
P-2W	14.61	n.d.	n.d.	n.d.	n.d.	n.d.
P-2E	13.34	n.d.	n.d.	n.d.	n.d.	n.d.
P-3W	11.40	n.d.	n.d.	n.d.	n.d.	n.d.
P-3E	10.42	n.d.	n.d.	n.d.	n.d.	n.d.
P-4W	9.49	—	—	—	—	—
P-4E	8.60	—	—	—	—	—

Note: Table does not include post-fire effects or estimates after sediment removal; average concentrations and inventory apply to time of sampling and are not adjusted for radioactive decay; average concentrations are for <2 mm fraction and are not adjusted for gravel content.

^a — = Not a COPC in that reach.

^b n.d. = No data.

Table D-1.5-5
Summary of Uranium-234 Concentration and Inventory in Los Alamos and Pueblo Watershed

Reach	Approx. Distance Above Rio Grande, Midpoint of Reach (km)	Estimated Average U-234 Concentration, Coarse Facies (pCi/g)	Estimated Average U-234 Concentration, Fine Facies (pCi/g)	Estimated Coarse Facies Inventory, U-234 (mCi/km)	Estimated Fine Facies Inventory, U-234 (mCi/km)	Estimated Total U-234 Inventory (mCi/km)
AC-1	19.08	— ^a	—	—	—	—
O-030(g)	18.86	—	—	—	—	—
AC-2	18.62	—	—	—	—	—
ACS	18.62	1.2	4.9	0.9	4.2	5.2
AC-3	18.27	1.0	1.6	1.5	1.1	2.6
DP-1W	16.39	—	—	—	—	—
DP-1C	16.29	—	—	—	—	—
DP-1E	15.47	—	—	—	—	—
DP-2	14.44	—	—	—	—	—
DP-3	13.84	—	—	—	—	—
DP-4	13.12	0.9	1.5	1.3	0.7	2.0
LA-0	19.50	n.d. ^b	n.d.	n.d.	n.d.	n.d.
LA-1FW	18.03	—	—	—	—	—
LA-1W+	17.47	—	—	—	—	—
LA-1W	17.18	—	—	—	—	—
LA-1C	15.66	—	—	—	—	—
LA-1E	14.81	—	—	—	—	—
LA-2W	13.00	1.1	1.8	3.0	2.9	5.9
LA-2E	12.55	—	—	—	—	—
LA-2FE	11.22	—	—	—	—	—
LA-3W	10.48	—	—	—	—	—
LA-3E	9.32	—	—	—	—	—
LA-4W	6.04	n.d.	n.d.	n.d.	n.d.	n.d.
LA-4E	5.03	n.d.	n.d.	n.d.	n.d.	n.d.
LA-5	0.88	—	—	—	—	—
P-1FW	18.10	n.d.	n.d.	n.d.	n.d.	n.d.
P-1W	17.90	—	—	—	—	—
P-1E	17.81	—	—	—	—	—
P-2W	14.61	n.d.	n.d.	n.d.	n.d.	n.d.
P-2E	13.34	n.d.	n.d.	n.d.	n.d.	n.d.
P-3W	11.40	n.d.	n.d.	n.d.	n.d.	n.d.
P-3E	10.42	n.d.	n.d.	n.d.	n.d.	n.d.
P-4W	9.49	—	—	—	—	—
P-4E	8.60	—	—	—	—	—

Note: Table does not include post-fire effects or estimates after sediment removal; average concentrations are for <2 mm fraction and are not adjusted for gravel content.

^a — = Not a COPC in that reach.

^b n.d. = No data.

Table D-1.6-1

Summary of Average Concentrations of Select Inorganic Chemicals in Sediment in the Los Alamos and Pueblo Watershed

Reach	Fire-Impacted?	Antimony						Arsenic						Barium		Cadmium					
		Fine Facies			Coarse Facies			Fine Facies			Coarse Facies			Fine Facies	Coarse Facies	Fine Facies			Coarse Facies		
		Upper Bound on Mean (mg/kg)	Mid-Point of Range (mg/kg)	Lower Bound on Mean (mg/kg)	Upper Bound on Mean (mg/kg)	Mid-Point of Range (mg/kg)	Lower Bound on Mean (mg/kg)	Upper Bound on Mean (mg/kg)	Mid-Point of Range (mg/kg)	Lower Bound on Mean (mg/kg)	Upper Bound on Mean (mg/kg)	Mid-Point of Range (mg/kg)	Lower Bound on Mean (mg/kg)	Average (mg/kg)	Average (mg/kg)	Upper Bound on Mean (mg/kg)	Mid-Point of Range (mg/kg)	Lower Bound on Mean (mg/kg)	Upper Bound on Mean (mg/kg)	Mid-Point of Range (mg/kg)	Lower Bound on Mean (mg/kg)
AC-1		0.59	0.56	0.52	+ ^a	+	+	3.78	3.78	3.78	2.00	2.00	2.00	95.98	32.60	0.07	0.06	0.06	+	+	+
AC-2		0.57	0.54	0.50	+	+	+	4.04	4.04	4.04	1.60	1.60	1.60	90.56	23.00	0.06	0.06	0.06	+	+	+
AC-3		0.47	0.35	0.23	- ^b	-	-	2.72	2.72	2.72	1.90	0.95	0.00	67.84	43.50	1.27	1.27	1.26	0.25	0.25	0.25
ACS		0.34	0.28	0.21	0.32	0.26	0.19	2.59	2.59	2.59	1.75	1.75	1.75	63.05	26.92	2.12	2.12	2.12	1.72	1.72	1.72
DP-1C		+	+	+	0.50	0.30	0.10	2.50	2.50	2.50	1.88	1.88	1.88	91.53	48.75	0.39	0.39	0.39	0.09	0.08	0.07
DP-1E		+	+	+	+	+	+	2.50	2.50	2.50	1.13	1.13	1.13	68.25	25.25	0.22	0.22	0.22	0.13	0.12	0.11
DP-1W		+	+	+	+	+	+	2.38	2.38	2.38	0.83	0.83	0.83	92.40	30.60	0.31	0.31	0.31	0.04	0.03	0.03
DP-2		+	+	+	+	+	+	2.35	2.35	2.35	1.41	1.41	1.41	78.31	52.62	0.44	0.29	0.14	0.16	0.14	0.12
DP-3		+	+	+	+	+	+	1.89	1.89	1.89	1.08	0.92	0.75	60.72	18.60	0.18	0.17	0.16	+	+	+
DP-4		+	+	+	+	+	+	2.04	2.04	2.04	1.34	1.24	1.13	60.16	30.87	+	+	+	+	+	+
LA-1C		+	+	+	-	-	-	1.22	1.22	1.22	-	-	-	76.02	-	+	+	+	-	-	-
LA-1E		+	+	+	-	-	-	1.40	1.40	1.40	-	-	-	84.80	-	0.37	0.19	0.01	-	-	-
LA-1FW		+	+	+	+	+	+	1.50	1.50	1.50	0.83	0.83	0.83	47.35	12.50	+	+	+	+	+	+
LA-1W		+	+	+	-	-	-	1.46	1.46	1.46	-	-	-	63.91	-	+	+	+	-	-	-
LA-1W+		+	+	+	+	+	+	1.68	1.68	1.68	0.55	0.55	0.55	63.65	10.40	+	+	+	+	+	+
LA-2E		+	+	+	+	+	+	2.50	2.00	1.50	1.85	1.53	1.20	68.30	33.30	0.32	0.23	0.15	+	+	+
LA-2FE		0.50	0.50	0.50	-	-	-	2.10	2.10	2.10	-	-	-	62.80	-	0.17	0.17	0.17	-	-	-
LA-2W		+	+	+	+	+	+	2.45	2.45	2.45	+	+	+	66.03	37.00	0.22	0.12	0.02	+	+	+
LA-3E		+	+	+	+	+	+	1.17	1.17	1.17	0.49	0.49	0.49	56.00	14.30	+	+	+	+	+	+
LA-3FE	Yes	0.34	0.24	0.14	+	+	+	2.08	2.08	2.08	0.29	0.29	0.29	201.97	20.30	0.36	0.36	0.36	0.03	0.03	0.03
LA-3W		0.39	0.35	0.30	-	-	-	1.77	1.77	1.77	-	-	-	53.50	-	0.09	0.09	0.09	-	-	-

Table D-1.6-1 (continued)

Reach	Fire-Impacted?	Antimony						Arsenic						Barium		Cadmium					
		Fine Facies			Coarse Facies			Fine Facies			Coarse Facies			Fine Facies	Coarse Facies	Fine Facies			Coarse Facies		
		Upper Bound on Mean (mg/kg)	Mid-Point of Range (mg/kg)	Lower Bound on Mean (mg/kg)	Upper Bound on Mean (mg/kg)	Mid-Point of Range (mg/kg)	Lower Bound on Mean (mg/kg)	Upper Bound on Mean (mg/kg)	Mid-Point of Range (mg/kg)	Lower Bound on Mean (mg/kg)	Upper Bound on Mean (mg/kg)	Mid-Point of Range (mg/kg)	Lower Bound on Mean (mg/kg)	Average (mg/kg)	Average (mg/kg)	Upper Bound on Mean (mg/kg)	Mid-Point of Range (mg/kg)	Lower Bound on Mean (mg/kg)	Upper Bound on Mean (mg/kg)	Mid-Point of Range (mg/kg)	Lower Bound on Mean (mg/kg)
LA-4E		+	+	+	+	+	+	1.22	1.22	1.22	1.44	1.44	1.44	72.40	26.33	+	+	+	+	+	+
LA-4FE	Yes	0.35	0.25	0.16	0.29	0.23	0.17	1.97	1.97	1.97	0.93	0.93	0.93	125.35	62.83	0.12	0.11	0.10	+	+	+
LA-4W		+	+	+	-	-	-	1.05	1.05	1.05	-	-	-	52.52	-	0.41	0.21	0.01	-	-	-
LA-5		-	-	-	-	-	-	+	+	+	+	+	+	93.28	38.75	+	+	+	+	+	+
LA-5E	Yes	0.30	0.24	0.19	0.21	0.19	0.17	1.73	1.73	1.73	0.36	0.36	0.36	115.70	14.70	0.16	0.15	0.15	+	+	+
P-1E		+	+	+	-	-	-	2.86	1.99	1.13	+	+	+	68.94	36.00	0.45	0.45	0.45	0.21	0.21	0.21
P-1E	Yes	0.41	0.26	0.10	+	+	+	2.26	2.26	2.26	0.88	0.88	0.88	86.43	15.00	0.08	0.08	0.08	+	+	+
P-1FW		+	+	+	0.42	0.42	0.42	2.84	2.84	2.84	1.60	1.60	1.60	76.40	26.00	+	+	+	+	+	+
P-1W		0.54	0.34	0.15	+	+	+	2.54	2.37	2.20	1.50	1.50	1.50	70.91	21.00	0.23	0.23	0.23	+	+	+
P-1W	Yes	0.48	0.39	0.30	-	-	-	2.85	2.85	2.85	-	-	-	152.50	-	0.18	0.17	0.17	-	-	-
P-2W		+	+	+	+	+	+	1.87	1.87	1.87	+	+	+	56.78	21.80	+	+	+	+	+	+
P-2W	Yes	+	+	+	+	+	+	0.91	0.91	0.91	+	+	+	144.29	21.30	0.24	0.24	0.24	+	+	+
P-3E	Yes	0.40	0.26	0.13	-	-	-	3.45	3.45	3.45	-	-	-	161.00	-	0.14	0.14	0.14	-	-	-
P-3W		+	+	+	+	+	+	1.48	1.34	1.20	+	+	+	47.40	17.80	+	+	+	+	+	+
P-3W	Yes	0.85	0.48	0.11	+	+	+	1.61	1.61	1.61	0.71	0.71	0.71	136.80	14.00	0.17	0.17	0.17	+	+	+
P-4E		-	-	-	-	-	-	+	+	+	+	+	+	72.45	17.43	0.31	0.26	0.21	+	+	+
P-4E	Yes	0.64	0.61	0.59	0.30	0.24	0.17	3.83	3.83	3.83	0.73	0.73	0.73	203.33	22.00	0.14	0.14	0.14	+	+	+
P-4W		+	+	+	-	-	-	2.54	2.09	1.64	+	+	+	81.18	21.20	0.38	0.27	0.16	+	+	+
WC		0.32	0.21	0.09	+	+	+	1.88	1.88	1.88	1.50	1.50	1.50	45.25	22.50	+	+	+	+	+	+
Baseline	Yes	0.32	0.26	0.19				2.48	2.48	2.48				206.90		0.29	0.29	0.29			
Garcia Cyn	Yes	-	-	-				3.97	3.97	3.97				215.33		0.26	0.26	0.26			
Guaje Cyn	Yes	0.48	0.39	0.30				1.84	1.84	1.84				150.20		0.18	0.18	0.17			
Rendija Cyn	Yes	0.64	0.53	0.42				2.81	2.78	2.76				122.57		0.13	0.12	0.12			

Table D-1.6-1 (continued)

Reach	Fire-Impacted?	Cobalt				Chromium				Manganese		Mercury					
		Fine Facies	Coarse Facies			Fine Facies	Coarse Facies			Fine Facies	Coarse Facies	Fine Facies			Coarse Facies		
		Average (mg/kg)	Upper Bound on Mean (mg/kg)	Mid-Point of Range (mg/kg)	Lower Bound on Mean (mg/kg)	Average (mg/kg)	Upper Bound on Mean (mg/kg)	Mid-Point of Range (mg/kg)	Lower Bound on Mean (mg/kg)	Average (mg/kg)	Average (mg/kg)	Upper Bound on Mean (mg/kg)	Mid-Point of Range (mg/kg)	Lower Bound on Mean (mg/kg)	Upper Bound on Mean (mg/kg)	Mid-Point of Range (mg/kg)	Lower Bound on Mean (mg/kg)
AC-1		5.10	2.20	2.20	2.20	9.60	19.00	19.00	19.00	429.20	275.00	0.04	0.04	0.04	+	+	+
AC-2		5.66	2.20	2.20	2.20	10.74	2.60	2.60	2.60	474.80	191.00	0.04	0.04	0.04	+	+	+
AC-3		3.76	1.70	1.70	1.70	7.58	5.20	5.20	5.20	375.20	267.00	0.45	0.45	0.45	0.07	0.07	0.07
ACS		2.43	1.57	1.57	1.57	16.34	5.48	5.48	5.48	225.48	154.58	1.37	1.37	1.37	0.39	0.39	0.39
DP-1C		3.27	2.52	2.52	2.52	11.77	6.96	6.96	6.96	255.00	222.74	0.12	0.12	0.12	0.03	0.03	0.02
DP-1E		2.93	1.55	1.55	1.55	14.54	3.20	3.20	3.20	267.75	198.50	0.04	0.04	0.04	0.02	0.02	0.02
DP-1W		3.60	1.60	1.60	1.60	12.43	3.67	3.67	3.67	236.75	113.93	0.09	0.09	0.09	+	+	+
DP-2		3.35	3.10	3.10	3.10	8.00	3.86	3.86	3.86	286.44	341.60	0.06	0.05	0.05	0.02	0.02	0.02
DP-3		3.03	1.50	1.50	1.50	8.12	1.50	1.50	1.50	218.74	124.50	0.03	0.03	0.03	+	+	+
DP-4		2.50	1.65	1.65	1.65	4.66	2.39	2.39	2.39	254.71	185.40	0.03	0.02	0.02	0.02	0.02	0.01
LA-1C		2.68	-	-	-	4.54	-	-	-	270.80	-	0.07	0.05	0.04	-	-	-
LA-1E		2.80	-	-	-	6.33	-	-	-	246.00	-	0.08	0.07	0.06	-	-	-
LA-1FW		2.10	0.88	0.88	0.88	3.45	+	+	+	201.00	124.00	0.01	0.01	0.01	+	+	+
LA-1W		2.93	-	-	-	4.44	-	-	-	254.13	-	0.07	0.05	0.04	-	-	-
LA-1W+		2.48	0.81	0.81	0.81	5.03	2.30	2.30	2.30	224.50	103.00	0.04	0.04	0.04	+	+	+
LA-2E		2.20	1.65	1.65	1.65	13.85	5.50	5.50	5.50	292.17	285.50	0.07	0.05	0.03	+	+	+
LA-2FE		2.52	-	-	-	9.22	-	-	-	266.00	-	0.07	0.07	0.07	-	-	-
LA-2W		2.43	1.50	1.50	1.50	11.50	4.40	4.40	4.40	279.00	217.00	0.16	0.15	0.13	+	+	+
LA-3E		2.62	1.60	1.60	1.60	6.62	2.20	2.20	2.20	255.40	181.00	0.07	0.05	0.03	+	+	+
LA-3FE	Yes	4.97	0.79	0.79	0.79	7.76	1.40	1.40	1.40	1055.89	125.25	0.06	0.06	0.05	+	+	+
LA-3W		2.22	-	-	-	6.17	-	-	-	240.00	-	0.04	0.04	0.04	-	-	-
LA-4E		2.82	1.52	1.52	1.52	3.57	2.37	1.65	0.93	259.75	162.33	0.02	0.02	0.01	+	+	+
LA-4FE	Yes	4.00	2.93	2.93	2.93	5.49	3.77	3.77	3.77	541.00	287.00	0.03	0.03	0.03	+	+	+

Table D-1.6-1 (continued)

Reach	Fire-Impacted?	Cobalt				Chromium				Manganese		Mercury					
		Fine Facies	Coarse Facies			Fine Facies	Coarse Facies			Fine Facies	Coarse Facies	Fine Facies			Coarse Facies		
		Average (mg/kg)	Upper Bound on Mean (mg/kg)	Mid-Point of Range (mg/kg)	Lower Bound on Mean (mg/kg)	Average (mg/kg)	Upper Bound on Mean (mg/kg)	Mid-Point of Range (mg/kg)	Lower Bound on Mean (mg/kg)	Average (mg/kg)	Average (mg/kg)	Upper Bound on Mean (mg/kg)	Mid-Point of Range (mg/kg)	Lower Bound on Mean (mg/kg)	Upper Bound on Mean (mg/kg)	Mid-Point of Range (mg/kg)	Lower Bound on Mean (mg/kg)
LA-4W		2.22	-	-	-	3.66	-	-	-	202.20	-	0.03	0.03	0.03	-	-	-
LA-5		2.88	0.57	0.57	0.57	8.74	3.10	3.10	3.10	243.40	121.00	+	+	+	+	+	+
LA-5E	Yes	3.20	0.73	0.73	0.73	3.67	1.12	1.12	1.12	485.00	56.55	0.02	0.01	0.01	+	+	+
P-1E		3.11	1.30	1.30	1.30	7.36	4.00	4.00	4.00	359.71	297.00	0.25	0.25	0.25	0.06	0.06	0.06
P-1E	Yes	3.27	0.97	0.97	0.97	4.10	2.00	2.00	2.00	510.00	170.00	0.02	0.02	0.02	+	+	+
P-1FW		4.00	4.20	4.20	4.20	6.16	1.50	1.50	1.50	426.00	340.00	0.01	0.01	0.01	+	+	+
P-1W		2.64	1.90	1.90	1.90	6.60	2.80	2.80	2.80	355.71	240.00	0.26	0.26	0.26	+	+	+
P-1W	Yes	4.02	-	-	-	4.95	-	-	-	808.33	-	0.02	0.02	0.02	-	-	-
P-2W		2.52	1.45	1.45	1.45	3.93	2.50	2.50	2.50	269.17	150.50	0.13	0.09	0.05	+	+	+
P-2W	Yes	4.57	1.40	1.40	1.40	5.74	2.00	2.00	2.00	694.43	160.00	0.04	0.04	0.03	0.04	0.04	0.04
P-3E	Yes	4.85	-	-	-	6.28	-	-	-	775.00	-	0.04	0.04	0.04	-	-	-
P-3W		2.14	1.07	0.72	0.37	3.12	1.33	1.33	1.33	233.40	181.67	+	+	+	+	+	+
P-3W	Yes	5.02	0.98	0.98	0.98	6.80	1.20	1.20	1.20	640.20	120.00	0.05	0.05	0.05	+	+	+
P-4E		2.55	1.52	1.52	1.52	7.55	5.13	5.13	5.13	306.50	476.33	0.04	0.03	0.03	+	+	+
P-4E	Yes	5.68	1.20	1.20	1.20	6.75	1.40	1.40	1.40	978.33	145.00	0.05	0.05	0.05	+	+	+
P-4W		3.21	1.70	1.70	1.70	6.86	3.60	3.60	3.60	334.60	301.00	0.07	0.05	0.03	+	+	+
WC		2.95	2.00	2.00	2.00	3.38	2.00	2.00	2.00	357.50	245.00	0.01	0.01	0.01	+	+	+
Baseline	Yes	4.20				8.18				986.70		0.02	0.02	0.02			
Garcia Cyn	Yes	6.10				6.07				700.00		0.05	0.04	0.04			
Guaje Cyn	Yes	3.48				4.22				709.00		0.01	0.01	0.01			
Rendija Cyn	Yes	4.56				4.93				682.86		0.02	0.02	0.02			

Table D-1.6-1 (continued)

Reach	Fire-Impacted?	Selenium						Silver						Zinc	
		Fine Facies			Coarse Facies			Fine Facies			Fine Facies			Coarse Facies	Fine Facies
		Upper Bound on Mean (mg/kg)	Mid-Point of Range (mg/kg)	Lower Bound on Mean (mg/kg)	Upper Bound on Mean (mg/kg)	Mid-Point of Range (mg/kg)	Lower Bound on Mean (mg/kg)	Upper Bound on Mean (mg/kg)	Mid-Point of Range (mg/kg)	Lower Bound on Mean (mg/kg)	Upper Bound on Mean (mg/kg)	Mid-Point of Range (mg/kg)	Lower Bound on Mean (mg/kg)	Average (mg/kg)	Average (mg/kg)
AC-1		0.69	0.69	0.69	0.39	0.39	0.39	+	+	+	+	+	+	112.80	77.10
AC-2		0.71	0.71	0.71	0.22	0.22	0.22	+	+	+	+	+	+	126.60	51.70
AC-3		0.59	0.52	0.45	0.41	0.41	0.41	1.02	0.98	0.93	+	+	+	70.18	66.30
ACS		0.43	0.37	0.32	0.26	0.17	0.08	4.86	4.86	4.86	1.27	1.27	1.26	63.81	41.00
DP-1C		0.63	0.44	0.25	0.32	0.20	0.09	0.25	0.19	0.12	0.62	0.45	0.28	82.20	55.94
DP-1E		0.54	0.27	0.00	+	+	+	0.19	0.12	0.05	+	+	+	79.15	41.85
DP-1W		0.75	0.60	0.45	+	+	+	+	+	+	+	+	+	108.70	54.47
DP-2		0.62	0.45	0.29	+	+	+	0.45	0.42	0.38	0.30	0.25	0.20	66.08	38.50
DP-3		0.58	0.36	0.14	+	+	+	0.20	0.12	0.04	0.21	0.16	0.12	43.22	18.40
DP-4		+	+	+	+	+	+	+	+	+	+	+	+	44.31	31.13
LA-1C		+	+	+	-	-	-	0.41	0.40	0.38	-	-	-	32.48	-
LA-1E		+	+	+	-	-	-	0.61	0.60	0.58	-	-	-	35.80	-
LA-1FW		+	+	+	+	+	+	+	+	+	+	+	+	31.20	17.50
LA-1W		+	+	+	-	-	-	0.76	0.74	0.72	-	-	-	42.73	-
LA-1W+		+	+	+	+	+	+	+	+	+	+	+	+	39.20	14.10
LA-2E		0.53	0.39	0.26	+	+	+	+	+	+	+	+	+	62.40	56.10
LA-2FE		0.40	0.40	0.40	-	-	-	0.10	0.08	0.06	-	-	-	41.80	-
LA-2W		0.83	0.44	0.06	+	+	+	4.60	4.27	3.95	+	+	+	58.48	38.30
LA-3E		+	+	+	+	+	+	+	+	+	+	+	+	42.00	33.30
LA-3FE	Yes	0.97	0.97	0.97	0.32	0.24	0.17	0.09	0.07	0.05	+	+	+	93.47	22.35
LA-3W		0.28	0.22	0.16	-	-	-	+	+	+	-	-	-	41.83	-
LA-4E		+	+	+	+	+	+	+	+	+	+	+	+	24.75	16.77
LA-4FE	Yes	0.35	0.27	0.20	+	+	+	0.20	0.19	0.18	+	+	+	50.77	29.63

Table D-1.6-1 (continued)

Reach	Fire-Impacted?	Selenium						Silver						Zinc	
		Fine Facies			Coarse Facies			Fine Facies			Fine Facies			Coarse Facies	Fine Facies
		Upper Bound on Mean (mg/kg)	Mid-Point of Range (mg/kg)	Lower Bound on Mean (mg/kg)	Upper Bound on Mean (mg/kg)	Mid-Point of Range (mg/kg)	Lower Bound on Mean (mg/kg)	Upper Bound on Mean (mg/kg)	Mid-Point of Range (mg/kg)	Lower Bound on Mean (mg/kg)	Upper Bound on Mean (mg/kg)	Mid-Point of Range (mg/kg)	Lower Bound on Mean (mg/kg)	Average (mg/kg)	Average (mg/kg)
LA-4W		+	+	+	-	-	-	0.53	0.33	0.13	-	-	-	25.98	-
LA-5		0.58	0.37	0.15	+	+	+	+	+	+	+	+	+	34.70	15.90
LA-5E	Yes	0.46	0.39	0.33	+	+	+	0.06	0.05	0.03	+	+	+	32.22	11.10
P-1E		0.73	0.41	0.09	0.30	0.30	0.30	0.47	0.41	0.35	+	+	+	65.70	54.10
P-1E	Yes	0.57	0.57	0.57	0.45	0.45	0.45	+	+	+	+	+	+	33.43	19.00
P-1FW		0.47	0.39	0.31	0.35	0.35	0.35	+	+	+	+	+	+	49.00	34.00
P-1W		0.55	0.36	0.18	+	+	+	0.63	0.63	0.63	+	+	+	89.49	34.00
P-1W	Yes	0.75	0.72	0.69	-	-	-	+	+	+	-	-	-	39.50	-
P-2W		0.74	0.69	0.65	0.61	0.61	0.61	+	+	+	+	+	+	40.93	34.95
P-2W	Yes	0.40	0.37	0.34	+	+	+	1.18	0.68	0.18	+	+	+	38.31	28.30
P-3E	Yes	0.81	0.81	0.81	-	-	-	+	+	+	-	-	-	42.50	-
P-3W		0.62	0.38	0.14	0.54	0.36	0.18	+	+	+	+	+	+	32.24	20.20
P-3W	Yes	0.54	0.54	0.54	+	+	+	0.83	0.49	0.15	+	+	+	41.44	17.00
P-4E		+	+	+	+	+	+	0.32	0.32	0.32	0.11	0.08	0.05	47.50	98.00
P-4E	Yes	1.00	1.00	1.00	+	+	+	+	+	+	+	+	+	48.17	16.00
P-4W		+	+	+	+	+	+	0.59	0.45	0.30	+	+	+	42.74	60.70
WC		0.30	0.19	0.08	0.33	0.25	0.18	+	+	+	+	+	+	46.50	32.00
Baseline	Yes	0.67	0.38	0.08				0.11	0.09	0.07				55.12	
Garcia Cyn	Yes	0.89	0.89	0.89				1.33	1.33	1.33				43.67	
Guaje Cyn	Yes	0.78	0.73	0.67				+	+	+				39.08	
Rendija Cyn	Yes	0.64	0.57	0.49				+	+	+				36.57	

^a + = No detected results.^b - = No data.

Table D-1.6-2
Summary of Average Concentrations of Select PAHS in Sediment in the Los Alamos and Pueblo Watershed

Reach	Benz(a)anthracene						Benzo(a)pyrene						Benzo(b)fluoranthene					
	Fine Facies			Coarse Facies			Fine Facies			Fine Facies			Coarse Facies			Fine Facies		
	Upper Bound on Mean (mg/kg)	Mid-Point of Range (mg/kg)	Lower Bound on Mean (mg/kg)	Upper Bound on Mean (mg/kg)	Mid-Point of Range (mg/kg)	Lower Bound on Mean (mg/kg)	Upper Bound on Mean (mg/kg)	Mid-Point of Range (mg/kg)	Lower Bound on Mean (mg/kg)	Upper Bound on Mean (mg/kg)	Mid-Point of Range (mg/kg)	Lower Bound on Mean (mg/kg)	Upper Bound on Mean (mg/kg)	Mid-Point of Range (mg/kg)	Lower Bound on Mean (mg/kg)	Upper Bound on Mean (mg/kg)	Mid-Point of Range (mg/kg)	Lower Bound on Mean (mg/kg)
AC-1	2.104	2.104	2.104	0.460	0.460	0.460	2.276	2.276	2.276	0.450	0.450	0.450	3.052	3.052	3.052	0.710	0.710	0.710
AC-2	1.714	1.714	1.714	0.270	0.270	0.270	1.836	1.836	1.836	0.260	0.260	0.260	3.174	3.174	3.174	0.370	0.370	0.370
AC-3	0.712	0.599	0.486	0.079	0.079	0.079	0.604	0.491	0.378	0.110	0.110	0.110	1.006	0.893	0.780	0.150	0.150	0.150
ACS	1.008	0.527	0.047	0.254	0.149	0.044	0.851	0.443	0.034	0.258	0.153	0.048	0.869	0.461	0.054	0.256	0.151	0.046
DP-1W	1.213	1.213	1.213	1.607	1.007	0.407	2.173	1.685	1.198	2.580	1.413	0.247	1.623	1.623	1.623	1.827	1.227	0.627
DP-1C	0.397	0.350	0.302	1.725	0.902	0.079	1.343	0.765	0.188	1.862	0.933	0.003	1.348	0.770	0.193	1.762	0.930	0.098
DP-1E	1.170	0.769	0.368	1.945	1.045	0.145	1.130	0.699	0.268	1.930	1.030	0.130	1.232	0.831	0.430	1.940	1.040	0.140
DP-2	0.315	0.315	0.315	0.318	0.213	0.108	0.333	0.333	0.333	0.815	0.460	0.105	0.461	0.428	0.395	0.440	0.287	0.135
DP-3	1.184	0.693	0.202	0.198	0.106	0.013	1.408	0.844	0.280	^a	+	+	0.695	0.644	0.593	0.204	0.111	0.019
DP-4	1.119	0.601	0.082	1.054	0.540	0.026	1.140	0.622	0.104	1.058	0.544	0.030	0.933	0.564	0.196	1.063	0.549	0.035
LA-0	0.760	0.387	0.014	^b	-	-	0.761	0.388	0.015	-	-	-	0.758	0.385	0.012	-	-	-
LA-1FW	0.745	0.411	0.076	-	-	-	0.743	0.408	0.074	-	-	-	0.724	0.390	0.056	-	-	-
LA-1W+	0.320	0.195	0.070	-	-	-	0.330	0.205	0.080	-	-	-	0.333	0.208	0.083	-	-	-
LA-1W	0.304	0.167	0.031	-	-	-	0.189	0.124	0.059	-	-	-	+	+	+	-	-	-
LA-1C	0.262	0.198	0.133	-	-	-	0.253	0.189	0.125	-	-	-	0.245	0.181	0.117	-	-	-
LA-1E	0.353	0.218	0.083	-	-	-	0.345	0.210	0.075	-	-	-	0.335	0.200	0.065	-	-	-
LA-2W	0.206	0.147	0.087	-	-	-	0.204	0.145	0.085	-	-	-	0.206	0.146	0.087	-	-	-
LA-2E	0.224	0.224	0.224	0.225	0.144	0.064	0.302	0.302	0.302	0.225	0.145	0.064	0.403	0.403	0.403	0.248	0.168	0.087
LA-2FE	0.158	0.158	0.158	-	-	-	0.157	0.157	0.157	-	-	-	0.140	0.140	0.140	-	-	-
LA-3W	0.285	0.178	0.071	-	-	-	0.226	0.159	0.091	-	-	-	0.248	0.181	0.113	-	-	-
LA-3E	0.366	0.205	0.044	+	+	+	0.378	0.217	0.056	+	+	+	0.386	0.225	0.064	+	+	+

Table D-1.6-2 (continued)

Reach	Benz(a)anthracene						Benzo(a)pyrene						Benzo(b)fluoranthene					
	Fine Facies			Coarse Facies			Fine Facies			Coarse Facies			Coarse Facies			Fine Facies		
	Upper Bound on Mean (mg/kg)	Mid-Point of Range (mg/kg)	Lower Bound on Mean (mg/kg)	Upper Bound on Mean (mg/kg)	Mid-Point of Range (mg/kg)	Lower Bound on Mean (mg/kg)	Upper Bound on Mean (mg/kg)	Mid-Point of Range (mg/kg)	Lower Bound on Mean (mg/kg)	Upper Bound on Mean (mg/kg)	Mid-Point of Range (mg/kg)	Lower Bound on Mean (mg/kg)	Upper Bound on Mean (mg/kg)	Mid-Point of Range (mg/kg)	Lower Bound on Mean (mg/kg)	Upper Bound on Mean (mg/kg)	Mid-Point of Range (mg/kg)	Lower Bound on Mean (mg/kg)
LA-3FE	0.425	0.275	0.125	-	-	-	0.430	0.280	0.130	-	-	0.465	0.315	0.165	-	-	-	-
LA-4FE	0.039	0.025	0.011	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
LA-5	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
P-1FW	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
P-1W	0.356	0.264	0.172	+	+	+	0.358	0.266	0.174	+	+	0.378	0.378	0.378	+	+	+	+
P-1E	0.546	0.478	0.410	+	+	+	0.738	0.670	0.602	0.602	0.052	0.960	0.892	0.824	0.070	0.070	0.070	0.070
P-4W	+	+	+	0.609	0.609	0.609	+	+	+	+	0.675	0.239	0.128	0.017	0.910	0.910	0.910	0.910
P-4E	0.190	0.104	0.018	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
WC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Baseline	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Rendija Cyn	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+

Table D-1.6-2 (continued)

Reach	Dibenz(a,h)anthracene						Indeno(1,2,3-cd)pyrene						Naphthalene					
	Fine Facies			Coarse Facies			Fine Facies			Fine Facies			Coarse Facies			Fine Facies		
	Upper Bound on Mean (mg/kg)	Mid-Point of Range (mg/kg)	Lower Bound on Mean (mg/kg)	Upper Bound on Mean (mg/kg)	Mid-Point of Range (mg/kg)	Lower Bound on Mean (mg/kg)	Upper Bound on Mean (mg/kg)	Mid-Point of Range (mg/kg)	Lower Bound on Mean (mg/kg)	Upper Bound on Mean (mg/kg)	Mid-Point of Range (mg/kg)	Lower Bound on Mean (mg/kg)	Upper Bound on Mean (mg/kg)	Mid-Point of Range (mg/kg)	Lower Bound on Mean (mg/kg)	Upper Bound on Mean (mg/kg)	Mid-Point of Range (mg/kg)	Lower Bound on Mean (mg/kg)
AC-1	0.576	0.329	0.082	+	+	+	0.952	0.917	0.882	+	+	+	0.890	0.855	0.820	+	+	+
AC-2	+	+	+	+	+	+	0.842	0.805	0.768	+	+	+	0.766	0.549	0.332	+	+	+
AC-3	+	+	+	+	+	+	0.394	0.281	0.168	+	+	+	0.460	0.311	0.162	+	+	+
ACS	+	+	+	+	+	+	0.856	0.430	0.005	+	+	+	0.862	0.438	0.015	+	+	+
DP-1W	3.220	1.733	0.245	+	+	+	3.153	2.153	1.153	2.517	1.350	0.183	3.180	1.668	0.155	+	+	+
DP-1C	+	+	+	+	+	+	+	+	+	+	+	+	1.240	0.663	0.085	1.884	0.964	0.044
DP-1E	+	+	+	+	+	+	2.464	1.253	0.042	1.920	1.020	0.120	2.439	1.228	0.017	+	+	+
DP-2	0.609	0.330	0.050	+	+	+	0.298	0.267	0.236	0.980	0.510	0.040	+	+	+	0.733	0.376	0.018
DP-3	+	+	+	+	+	+	2.163	1.111	0.060	+	+	+	+	+	+	+	+	+
DP-4	+	+	+	+	+	+	1.110	0.592	0.073	1.122	0.574	0.026	1.187	0.601	0.014	+	+	+
LA-0	+	+	+	-	-	-	+	+	+	-	-	-	+	+	+	-	-	-
LA-1FW	+	+	+	-	-	-	+	+	+	-	-	-	+	+	+	-	-	-
LA-1W+	+	+	+	-	-	-	0.310	0.185	0.060	-	-	-	+	+	+	-	-	-
LA-1W	+	+	+	-	-	-	+	+	+	-	-	-	0.302	0.165	0.028	-	-	-
LA-1C	+	+	+	-	-	-	0.283	0.182	0.080	-	-	-	+	+	+	-	-	-
LA-1E	+	+	+	-	-	-	0.312	0.177	0.042	-	-	-	0.383	0.208	0.032	-	-	-
LA-2W	+	+	+	-	-	-	0.302	0.181	0.060	-	-	-	0.354	0.194	0.033	-	-	-
LA-2E	0.283	0.144	0.005	+	+	+	0.231	0.203	0.176	+	+	+	0.297	0.158	0.018	+	+	+
LA-2FE	+	+	+	-	-	-	0.240	0.161	0.082	-	-	-	+	+	+	-	-	-
LA-3W	+	+	+	-	-	-	0.293	0.186	0.079	-	-	-	+	+	+	-	-	-
LA-3E	+	+	+	+	+	+	0.362	0.201	0.040	+	+	+	+	+	+	+	+	+
LA-3FE	+	+	+	-	-	-	+	+	+	-	-	-	0.425	0.275	0.125	-	-	-

Table D-1.6-2 (continued)

Reach	Dibenz(a,h)anthracene						Indeno(1,2,3-cd)pyrene						Naphthalene					
	Fine Facies			Coarse Facies			Fine Facies			Coarse Facies			Coarse Facies			Fine Facies		
	Upper Bound on Mean (mg/kg)	Mid-Point of Range (mg/kg)	Lower Bound on Mean (mg/kg)	Upper Bound on Mean (mg/kg)	Mid-Point of Range (mg/kg)	Lower Bound on Mean (mg/kg)	Upper Bound on Mean (mg/kg)	Mid-Point of Range (mg/kg)	Lower Bound on Mean (mg/kg)	Upper Bound on Mean (mg/kg)	Mid-Point of Range (mg/kg)	Lower Bound on Mean (mg/kg)	Upper Bound on Mean (mg/kg)	Mid-Point of Range (mg/kg)	Lower Bound on Mean (mg/kg)	Upper Bound on Mean (mg/kg)	Mid-Point of Range (mg/kg)	Lower Bound on Mean (mg/kg)
LA-4FE	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
LA-5	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
P-1FW	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
P-1W	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
P-1E	0.318	0.184	0.050	+	+	+	0.349	0.183	0.017	0.232	0.300	0.291	0.232	0.164	0.035	+	+	+
P-4W	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	0.374	0.374	0.374
P-4E	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
WC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Baseline	+	+	+	+	+	+	+	+	+	+	+	0.558	0.505	0.452	+	+	+	+
Rendija Cyn	+	+	+	+	+	+	+	+	+	+	+	0.365	0.215	0.065	+	+	+	+

a + = No detected results.

b - = No data.

Table D-1.6-3
Summary of Average Concentrations of
Select PCBs in Sediment in the Los Alamos and Pueblo Watershed

Reach	Aroclor-1254						Aroclor-1260					
	Fine Facies			Coarse Facies			Fine Facies			Coarse Facies		
	Mid-Point of Range (mg/kg)	Upper Bound on Mean (mg/kg)	Lower Bound on Mean (mg/kg)	Mid-Point of Range (mg/kg)	Upper Bound on Mean (mg/kg)	Lower Bound on Mean (mg/kg)	Mid-Point of Range (mg/kg)	Upper Bound on Mean (mg/kg)	Lower Bound on Mean (mg/kg)	Mid-Point of Range (mg/kg)	Upper Bound on Mean (mg/kg)	Lower Bound on Mean (mg/kg)
AC-1	+ ^a	+	+	+	+	+	0.082	0.131	0.033	+	+	+
AC-2	+	+	+	+	+	+	0.051	0.080	0.022	+	+	+
AC-3	1.110	1.115	1.106	+	+	+	0.168	0.315	0.021	+	+	+
ACS	1.032	1.075	0.989	0.170	0.170	0.169	0.336	0.481	0.190	0.054	0.079	0.030
DP-1C	+	+	+	+	+	+	0.347	0.361	0.333	+	+	+
DP-1E	+	+	+	- ^b	-	-	0.047	0.047	0.047	-	-	-
DP-1W	+	+	+	+	+	+	+	+	+	+	+	+
DP-2	+	+	+	+	+	+	0.101	0.137	0.064	+	+	+
DP-3	+	+	+	+	+	+	0.064	0.099	0.029	+	+	+
DP-4	+	+	+	+	+	+	0.026	0.037	0.015	+	+	+
LA-0	+	+	+	-	-	-	0.042	0.055	0.030	-	-	-
LA-1C	0.071	0.089	0.052	-	-	-	0.298	0.304	0.291	-	-	-
LA-1E	+	+	+	-	-	-	0.137	0.142	0.132	-	-	-
LA-1FW	+	+	+	+	+	+	0.031	0.047	0.014	+	+	+
LA-1W	0.229	0.236	0.222	-	-	-	0.032	0.054	0.011	-	-	-
LA-1W+	0.177	0.192	0.163	+	+	+	0.095	0.101	0.089	+	+	+
LA-2E	+	+	+	+	+	+	0.148	0.148	0.148	+	+	+
LA-2FE	+	+	+	-	-	-	0.294	0.294	0.294	-	-	-
LA-2W	+	+	+	-	-	-	0.236	0.236	0.236	-	-	-
LA-3E	+	+	+	+	+	+	0.052	0.056	0.049	+	+	+
LA-3W	+	+	+	-	-	-	0.144	0.144	0.144	-	-	-
LA-4E	+	+	+	+	+	+	+	+	+	+	+	+
LA-4W	+	+	+	-	-	-	+	+	+	-	-	-
LA-5	+	+	+	+	+	+	+	+	+	+	+	+
P-1E	0.063	0.067	0.059	+	+	+	0.051	0.055	0.046	+	+	+
P-1FW	+	+	+	0.015	0.015	0.015	0.033	0.047	0.020	+	+	+
P-1W	+	+	+	+	+	+	0.093	0.093	0.093	+	+	+
P-2W	+	+	+	+	+	+	0.035	0.045	0.025	+	+	+
P-3W	+	+	+	+	+	+	+	+	+	+	+	+
P-4E	+	+	+	+	+	+	+	+	+	+	+	+
P-4W	+	+	+	+	+	+	+	+	+	+	+	+
WC	+	+	+	+	+	+	+	+	+	+	+	+
Baseline	+	+	+				+	+	+			

^a + = No detected results.^b - = No data.

Table D-1.6-4

Summary of Average Concentrations of Select Pesticides in Sediment in the Los Alamos and Pueblo Watershed

Reach	DDE[4,4'-]						DDT[4,4'-]						Endrin Aldehyde					
	Fine Facies			Coarse Facies			Fine Facies			Fine Facies			Coarse Facies			Fine Facies		
	Upper Bound on Mean (mg/kg)	Mid-Point of Range (mg/kg)	Lower Bound on Mean (mg/kg)	Upper Bound on Mean (mg/kg)	Mid-Point of Range (mg/kg)	Lower Bound on Mean (mg/kg)	Upper Bound on Mean (mg/kg)	Mid-Point of Range (mg/kg)	Lower Bound on Mean (mg/kg)	Upper Bound on Mean (mg/kg)	Mid-Point of Range (mg/kg)	Lower Bound on Mean (mg/kg)	Upper Bound on Mean (mg/kg)	Mid-Point of Range (mg/kg)	Lower Bound on Mean (mg/kg)	Upper Bound on Mean (mg/kg)	Mid-Point of Range (mg/kg)	Lower Bound on Mean (mg/kg)
AC-1	0.019	0.014	0.008	+	+	+	0.047	0.047	0.047	+	+	+	+	+	+	+	+	+
AC-2	0.011	0.007	0.002	+	+	+	0.030	0.030	0.030	+	+	+	+	+	+	+	+	+
AC-3	0.020	0.012	0.004	+	+	+	0.035	0.035	0.035	0.006	0.006	0.006	+	+	+	+	+	+
ACS	0.027	0.024	0.022	+	+	+	0.059	0.056	0.054	0.037	0.037	0.037	+	+	+	+	+	+
DP-1W	+	+	+	- ^b	-	-	0.080	0.060	0.040	-	-	-	+	+	+	-	-	-
DP-1E	-	-	-	-	-	-	0.021	0.021	0.021	-	-	-	-	-	-	-	-	-
DP-2	+	+	+	+	+	+	0.057	0.056	0.054	0.005	0.003	0.001	+	+	+	+	+	+
DP-3	+	+	+	+	+	+	0.020	0.020	0.020	+	+	+	+	+	+	+	+	+
DP-4	0.008	0.004	0.001	0.004	0.003	0.002	0.014	0.013	0.013	0.006	0.005	0.005	+	+	+	+	+	+
LA-0	0.010	0.010	0.010	-	-	-	0.023	0.023	0.023	-	-	-	+	+	+	-	-	-
LA-1FW	0.004	0.003	0.002	+	+	+	0.013	0.013	0.012	+	+	+	+	+	+	+	+	+
LA-1W+	0.004	0.003	0.001	+	+	+	0.014	0.013	0.013	+	+	+	+	+	+	+	+	+
LA-1W	+	+	+	-	-	-	0.008	0.007	0.006	-	-	-	+	+	+	-	-	-
LA-1C	0.008	0.005	0.002	-	-	-	0.061	0.061	0.061	-	-	-	0.018	0.016	0.015	-	-	-
LA-1E	0.005	0.003	0.002	-	-	-	0.010	0.010	0.010	-	-	-	0.005	0.003	0.002	-	-	-
LA-2W	0.071	0.036	0.002	-	-	-	0.077	0.044	0.010	-	-	-	0.071	0.036	0.002	-	-	-
LA-2E	0.009	0.008	0.007	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
LA-2FE	0.013	0.009	0.005	-	-	-	0.033	0.033	0.033	-	-	-	+	+	+	-	-	-
LA-3W	+	+	+	-	-	-	0.025	0.022	0.020	-	-	-	+	+	+	-	-	-
LA-3E	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+

Table D-1.6-4 (continued)

Reach	DDE[4,4']						DDT[4,4']						Endrin Aldehyde					
	Fine Facies			Coarse Facies			Fine Facies			Coarse Facies			Coarse Facies			Fine Facies		
	Upper Bound on Mean (mg/kg)	Mid-Point of Range (mg/kg)	Lower Bound on Mean (mg/kg)	Upper Bound on Mean (mg/kg)	Mid-Point of Range (mg/kg)	Lower Bound on Mean (mg/kg)	Upper Bound on Mean (mg/kg)	Mid-Point of Range (mg/kg)	Lower Bound on Mean (mg/kg)	Upper Bound on Mean (mg/kg)	Mid-Point of Range (mg/kg)	Lower Bound on Mean (mg/kg)	Upper Bound on Mean (mg/kg)	Mid-Point of Range (mg/kg)	Lower Bound on Mean (mg/kg)	Upper Bound on Mean (mg/kg)	Mid-Point of Range (mg/kg)	Lower Bound on Mean (mg/kg)
LA-4W	+	+	+	+	+	+	0.005	0.004	0.003	+	+	+	+	+	+	+	+	+
LA-4E	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
LA-5	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
P-1E	+	+	+	+	+	+	0.004	0.003	0.003	0.005	0.005	0.005	+	+	+	+	+	+
P-1FW	0.003	0.002	0.002	+	+	+	0.009	0.009	0.008	0.002	0.002	0.002	+	+	+	+	+	+
P-1W	0.003	0.003	0.002	+	+	+	0.012	0.012	0.012	0.003	0.003	0.003	+	+	+	+	+	+
P-2W	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
P-3W	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
P-4W	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
P-4E	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
WC	0.003	0.002	0.001	+	+	+	0.002	0.002	0.002	0.001	0.001	0.001	+	+	+	+	+	+
Baseline	0.006	0.006	0.006				0.007	0.007	0.007				+	+	+			

a + = No detected results.

b - = No data.

Appendix E

Statistics and Risk Information

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Table E-5.3-21	Residential RME Multimedia Sums with Filtered Water Data, Arsenic Removed, by Reach and Sampling Station.....	E-346
Table E-5.3-22	Residential RME Multimedia Sums for Unfiltered Water Data, Arsenic Removed, by Reach and Sampling Station.....	E-346

E-1.0 TABLES SUPPORTING ECOLOGICAL AND HUMAN HEALTH RISK ASSESSMENT

This appendix contains tables supporting the ecological and human health screening assessments discussed in Section 6. The tables are organized as follows:

Determination of Chemicals of Potential Concern (COPCs)

Sediment

- Table E-1.0-1 Organic chemicals
- Table E-1.0-2 Radionuclides
- Table E-1.0-3 Inorganic chemicals

Water

- Table E-1.0-15 Organic chemicals
- Table E-1.0-16 Radionuclides
- Table E-1.0-17 Inorganic chemicals

Screening Values

Sediment

- Table E-1.0-4 Soil ecological screening levels (ESLs)
- Table E-1.0-7 Sediment ESLs
- Table E-1.0-10 Sediment human health screening action levels (SALs)

Water

- Table E-1.0-18 Water ESLs
- Table E-1.0-21 Water human health SALs (either the US Environmental Protection Agency [EPA] tap water values or the US Department of Energy- [DOE-] derived concentration guidelines [DCGs])

Ecological Screening

Sediment (Terrestrial)

- Table E-1.0-5 Screening summary
- Table E-1.0-6 Final chemicals of potential ecological concern (COPECs)

Sediment (Aquatic)

- Table E-1.0-8 Screening summary
- Table E-1.0-9 Final COPECs

Water

- Table E-1.0-19 Screening summary
- Table E-1.0-20 Final COPECs

Human Health Screening

Sediment

- Tier 1
 - ◆ Table E-1.0-11 Screening summary
 - ◆ Table E-1.0-12 Final Tier 1 COPCs
- Tier 2
 - ◆ Table E-1.0-13 Screening summary
 - ◆ Table E-1.0-14 Final Tier 2 COPCs

Water

- Tier 1
 - ◆ Table E-1.0-22 Screening summary
 - ◆ Table E-1.0-23 Final Tier 1 COPCs
- Tier 2
 - ◆ Table E-1.0-24 Screening summary
 - ◆ Table E-1.0-25 Final Tier 2 COPCs

E-2.0 REPRESENTATIVE CONCENTRATIONS

E-2.1 Statistical Methods to Support Data Evaluation and COPC Selection

This section provides information on the statistical methods used to calculate contaminant exposure point concentrations (EPCs) for human health screening assessments (screening assessments) and the site-specific human health risk assessment. As described in Section 6.1, the data for Los Alamos and Pueblo Canyons are divided into subsets representing reaches, hydrosegments, and individual water-monitoring points. Contaminant EPCs are estimated for COPCs in reaches and for individual water-monitoring points.

The process for identifying the subset of COPCs to be addressed in the human health risk assessment consists of developing EPCs to compare to human health risk SALs in the screening assessments. The sources of SALs and their application are provided in Section 6.2.3. The Tier 1 screen compares maximum values for COPCs to SALs and the data are used to calculate the 95% upper confidence limits (UCLs) on the average contaminant concentration. The Tier 2 screen compares the UCLs to SALs to identify the COPCs that warrant consideration in the human health assessment.

The nondetected sample results for COPCs fall into three general categories. The first consists of COPCs detected in all of the investigation samples for a data subset. The second includes COPCs for which the data are a mixture of detected and nondetected values for a data subset. These data are *censored* at the detection limits for the nondetect values for inorganic and organic chemicals but are not censored for radionuclides. The difference is that censored values are reported as the detection limit with a nondetect qualifier. Uncensored nondetects are reported as the actual measurement value from the instrument with a nondetect qualifier. For inorganic and organic chemicals, an approach to representing the censored nondetect values in the UCL calculation is needed. Uncensored nondetect data are treated the same way as COPCs in the first category that have detected values. The third category is either an extreme case of

the second category where the number of nondetects (the rate of censorship) is so high that methods for the second category are unreliable, or the data set is too small to calculate a UCL. Section E-2.1.1 describes the methods used to analyze data that fall into the above three categories.

Data for radionuclides are a special case in calculating UCLs. Radionuclide analytical methods report the actual measurement value and a detection qualifier for the result. The radionuclide data are not censored at their detection limits. Thus, for radionuclide data the UCLs are calculated with methods for all detected data using the reported values for the results that are qualified as nondetects.

E-2.1.1 Calculating UCLs

The statistical methods used to calculate UCLs are generally consistent with EPA guidance (EPA 1989, 8021) and ProUCL (EPA 2003, 84461), the EPA public-domain software provided for estimating UCLs to use as EPCs in risk assessments. Many of the data sets for sediment investigation reaches and water sampling locations are censored at the detection limits, but the ProUCL software does not include methods for censored data. Consequently, methods for calculating 95% UCLs deviated from ProUCL when professional judgment indicated that the ProUCL methods were inadequate for the data.

The first step in calculating a UCL is to determine whether the data fit a probability distribution. The ProUCL software assesses normal and lognormal distributions. The probability plot correlation coefficient (PPCC) test is used to compare the data for an analyte from a sediment investigation reach or a water sampling location to normal and log normal distributions. The possible outcomes and UCL calculation approaches are as follows:

- The data show a normal distribution; normal distribution methods are used.
- The data show a lognormal distribution; lognormal distribution methods are used.
- The data are not different from either distribution; normal distribution methods are used.
- The data are different from both distributions; the Chebyshev method is used.
- Insufficient data are available to evaluate the distribution; nonparametric methods are used.

When the calculated UCLs exceed the maximum value for the data, then the maximum value is used instead of the UCL. This approach is consistent with EPA guidance (EPA 1989, 8021).

The normal distribution method is a UCL calculated using the arithmetic average, the standard error of the mean, and the Student's t-value for $n-1$ degrees of freedom (e.g., Gilbert 1987, 56179).

The lognormal UCL method used is from Gilbert (1987, 56179, pp. 169–170). This method has been criticized for providing large values for UCLs when the data are from a mixture of distributions or the data set has numerous outlier values (EPA 2003, 84461). However, in this report this method was used because it tends to generate larger UCLs when the data do not fit a lognormal distribution very well. Therefore, the outcome overestimates risk.

The Chebyshev method is recommended in the ProUCL manual for data that do not fit a normal or lognormal distribution. The standard error of the mean is multiplied by a value that is related to the confidence level for the interval. The methodology is documented in the ProUCL user's guide (EPA 2003, 84461).

Nonparametric methods to estimate the UCL on the median are used when the data set consists of less than three values, or the data set is larger but there are fewer than three detected values. This method

employs ranks of the data and probabilities associated with the binomial distribution (Gilbert 1987, 56179, pp. 141–142). If the UCL on the median is a nondetect value, the next highest detected value is used for the UCL. Often the next highest detected value is also the maximum detected value.

E-2.1.2 Calculating UCLs with Uncensored Data

Calculating UCLs when all data are detected or when nondetects are not censored requires using the PPCC test to determine whether the data fit a normal or lognormal probability distribution and then calculating the appropriate UCL. The application of methods for calculating a UCL in this report has been constrained to data sets with at least three values. In cases where only one or two values exist, the maximum value is used as the EPC.

E.2.1-3 Calculating UCLs with Censored Data

If nondetect values are part of the environmental data set and the detection limits of the analytical method were sufficiently low, a detected result may be produced. The analytical method does not report these lower concentrations but reports the detection limit. All approaches to working with nondetect values in a data set estimate what the real value might have been if the analytical method had a detection limit low enough to quantify the concentration.

A variety of methods can be used to address nondetect values in a data set. Some of the most widely used are substitutions of the nondetects with the detection limit, half the detection limit, or zero. While these substitution methods are simple, they do not have a statistical basis and can provide erroneous results. The most serious errors with substitution methods are in biasing the estimate of the variance, which can result in a low-biased UCL. Helsel and Cohn (1988, 82912) conducted simulation studies to compare the results of substitution methods against probability plotting methods and maximum likelihood methods for estimating values to replace the nondetects. Their results indicate that probability plotting methods provide the most accurate data summaries for typical environmental data with characteristics such as outliers and skewed distributions.

In this report, the probability plotting method of Helsel and Cohn (1988, 82912) was selected for working with censored data. It provides the best overall performance in estimating fill-in values for nondetects in simulation studies, especially when there is information on the data distribution. It also performs well when the parent distributions of the simulation data sets are very different from the lognormal distribution used to estimate the values for the nondetect values. Another important attribute of the method is that it accommodates data with multiple detection limits. Finally, even when the detected data are highly variable, including outliers, and are not associated with any particular distribution, the estimated nondetect values are constrained to fall between the detection limit and zero. The estimated nondetect values may not always be optimal, but they are also not likely to cause large biases in the estimates of the average and variance for the data set.

The conceptual approach for the probability plotting method starts by assigning exceedence probabilities to each of the detected values based upon its relative magnitude, after which the nondetect values are assigned exceedence probabilities between zero and the detection limit. If each detection limit has a single value, then the assigned probability is half of the detection limit probability. For example, if there are three detection limits with the same value, then the x-axis from zero to the detection limit probability is divided into four segments, and each detection limit is assigned a value at one of the three break points ($1/4$, $1/2$, and $3/4$ of the detection limit probability). The spreading of nondetects over a probability range is how the probability plotting method differs from simple substitution methods, where the detection limit, half the detection limit, or zero would be used for all three values. The exceedence probabilities for the

data and nondetect values are converted to proportions of the normal distribution, or z-scores. A regression analysis is performed on the log transformed detected data versus their z-scores. The regression line fit is used to estimate log-concentration values for the nondetect z-scores. These values are back-transformed to original units and combined with the detected values in original units for estimating summary statistics and UCLs.

The extrapolated nondetect values distribute estimates for the detection limits over a range of exceedence probabilities. The values are not intended to be specific estimates for what the sample concentration should have been. The assigned values can be used for summary statistics, such as averages and UCLs, but not as individual replacement values for sample results. The method is considered to be semi-nonparametric because the detected values are used without making an assumption about the data distribution. The nondetect values are assumed to come from a lognormal distribution.

Once the nondetect data are replaced with estimated values from the probability plotting method, the combined data set of original detected values and estimates for the nondetects are evaluated with the PPCC test for their fit to a normal or lognormal distribution. Normal distribution methods are used to estimate the average and UCL for data that fit a normal distribution. The method described by Gilbert (1987, 56179) is used for data that are distributed lognormally. When the data fit neither of these distributions, the method based upon the Chebyshev theorem is used to estimate a UCL (EPA 2003, 84461).

E-2.1.3.1 Example of Calculating UCLs with Censored Data

The first two columns of Table E-2.1-1 show the concentrations and detect status for benzo(b)fluoranthene in sediments for reach DP-2. Four out of 12 samples yielded nondetect results. Modern analytical methods typically produce sample-specific detection limits for each sample. Such is the case for these data, which have unique values for each nondetect.

Figure E-2.1-1 shows the log transformed data plotted against two x-axes. The upper x-axis shows the cumulative probabilities for the data, and the lower x-axis shows the normal distribution plotting positions or z-scores that correspond to the cumulative probabilities. For example, the cumulative probability of 0.5 corresponds to the z-score of 0.0. The cumulative probability of 0.5 means that half the data distribution is at or below this value. The standardized normal distribution has an average of zero, which is the middle of the normal distribution. The z-score of zero, which represents the average, has a cumulative probability of 0.5, indicating that half the data are smaller and half the data are larger than this value. The solid diamonds in Figure E-2.1-1 are the eight detected values for benzo(b)fluoranthene. A regression line is fitted to these eight points and plotted on the graph, and the regression equation is used to estimate log transformed concentrations for the z-scores associated with the nondetect values, which are plotted on the regression line with open diamonds.

The estimated nondetect values are back-transformed to the original units of the data. These values are provided in the third column of Table E-2.1-1. All twelve values, the eight detects and the four estimated values for the nondetects, are used for estimating the benzo(b)fluoranthene average and the UCL. These combined data are shown in column four of Table E-2.1-1.

Inspecting the estimated values for the detection limits in column three and the detection limit values in column one reveals a nuance of the technique. As described above, the estimated values have exceedence probabilities that are one-half the exceedence probabilities for the detection limits. Halving the exceedence probabilities does not result in halving the detection limit values because the x-axis of normal probability plotting positions is collapsed in the middle and expanded on the ends to make

normally distributed data plot on a straight line. The cumulative probability axis in Figure E-2.1-1 shows values along equally spaced intervals. The intervals on either side of 0.5 are 19 units (0.31 to 0.5 and 0.5 to 0.69) and the interval furthest to the right is 9 units (0.84 to 0.93). The distance between two probabilities on the graph depends upon where those probabilities occur. The PPCC test for determining whether the data fit a normal or lognormal distribution is conducted on the combined data in column four of Table E-2.1-1. The data fit a lognormal distribution and fail to fit a normal distribution. The log-average and 95% log UCL were calculated. The log-average is 0.367 µg/L and the 95% log UCL is 0.591 µg/L.

The censored data method described above depends upon a regression of the log transformed data to fill in nondetect values. The simulations by Helsel and Cohn (1988, 82912) show this method to be reliable with data censorship as high as 80% for data sets with 25 values, resulting in 5 values for the regression and 20 values to be estimated from the regression. In this study, the probability plotting method for nondetects was used if the data set had at least three detected values. For sediment data, the maximum censor rate was 80%, while the next highest censor rate was 57%. For the water data, the maximum censor rate was 66%.

E.2.1-4 Severely Censored and Limited Data

A nonparametric method for identifying the UCL of the median using ranks was used for all data sets when the combinations of reaches and COPCs or water sampling locations and COPCs had fewer than three detected values or fewer than four total values. This method is described in Gilbert (1987 56179, p. 141) and has been recommended in guidance from the EPA (EPA 1989, 72731). ProUCL does not address this method because that software does not include methods for censored data.

The value selected as the UCL on the median for a data set was assessed for its detection status. If the UCL was a nondetect, then the nearest larger detected value was used for the UCL. The sediment and water data sets that met the criteria for severely censored data all defaulted to their maximum detected values because the rank UCLs were all nondetect values. Consequently, the EPCs for these combinations of reaches and COPCs or water sampling locations and COPCs remain the same for the risk screening described in Section 6.2.3.2 and the baseline human health assessment discussed in Section 8.2.

E.2.2 Calculating Weighted Averages and Weighted UCLs for COPCs in Sediments

The geomorphic approach to sampling in the investigation reaches provides data that are derived from specific geomorphic units and sediment facies. The methodology and rationale are described in Section B-1.0 of Appendix B. In this report, statistical methods are employed to estimate averages and UCLs that are consistent with this investigation approach.

Each sediment facies within each geomorphic unit also contains a population of COPC concentrations. The averages and variances of these populations of COPC concentrations are combined to estimate an overall average COPC concentration and a 95% UCL on that average for the reach. The COPC averages and the UCLs at the reach scale are necessary for the site-specific human health risk assessment in Section 8.2 because the exposure scenarios are intended to integrate exposure to COPCs over the whole reach. The statistical methods for estimating the averages and 95% UCLs across more than one population are associated with stratified random sampling methods. This section describes how concentration weighting was performed and identifies the statistical methods used to calculate weighted averages and their 95% UCLs.

E-2.2.1 Weighted Averages

The average of a group of measurements is calculated by adding the values together and dividing the sum by n , the number of measurements. This is equivalent to multiplying each measurement by a weight of $1/n$ and summing those products. The following example illustrates the calculation:

Four sediment samples are collected from four geomorphic units and analyzed for strontium-90. The measurement results are 4, 7, 9, and 15 pCi/g.

The usual method for calculating the average of the four values is

$$\begin{aligned}\text{Average} &= (4+7+9+15)/4 \\ &= 8.75 .\end{aligned}$$

An alternative method of calculating the average is to assign the values equal weights. Since there are four measurements, the weights are $1/4 = 0.25$,

$$\begin{aligned}\text{where} \quad \text{Average} &= (4 \times 0.25) + (7 \times 0.25) + (9 \times 0.25) + (15 \times 0.25), \\ &= 1 + 1.75 + 2.25 + 3.75, \text{ and} \\ &= 8.75 .\end{aligned}$$

Figure E-2.2-1(a and b) illustrates this method spatially. Figure E-2.2-1a shows the example above with equal weights, which is equivalent to four measurements of a COPC from four geomorphic units with equal areas. Figure E-2.2-1b shows the calculation for four measurements from four geomorphic units with unequal areas.

Geomorphic mapping and measurements of sediment thickness in each investigation reach provide data on the area of each geomorphic unit and the volume of sediment for each facies in each geomorphic unit, as discussed in Section B-1.0 of Appendix B. The areas of each geomorphic unit and the total area of each investigation reach were used to calculate weights for area-weighted averages of the COPCs, which are presented in Section D-1.3 of Appendix D. The thicknesses of each sediment facies in each geomorphic unit were used to obtain the volumes and the volume weights. The calculation of volume-weighted averages proceeds in the same manner as for area-weighted averages, using volumes for geomorphic units and sediment facies and the total volume in a reach to calculate fractional volume weights. The binning of COPC results by geomorphic unit and sediment facies to support calculations of weighted averages, 95% UCLs, and COPC inventory is presented in Section D-1.3 of Appendix D.

Both area-weighted and volume-weighted COPC averages were calculated in this study. The trail user and extended backyard exposure scenarios use EPCs based on area-weighted averages because exposures are from the upper parts of the sediment deposits. The thickness of the sediment represented by the area-weighted average and area-weighted 95% UCL depends upon the thickness of the uppermost sediment facies in each geomorphic unit. The construction worker, resource user, and residential exposure scenarios use volume-weighted averages to integrate concentrations with depth because these exposure scenarios include direct and indirect exposures to subsurface sediments.

Most geomorphic units have sample results for both coarse and fine facies sediment. The average concentration is calculated for each sediment facies in each geomorphic unit or each set of binned units, after which the area or volume weights are used to estimate the weighted averages for a reach. Where both coarse and fine facies sediment occur in a geomorphic unit, the fine facies, which typically has the highest COPC concentrations, is used in the area-weighted calculations because it generally overlies

coarse facies sediment. Results from both coarse and fine facies in a geomorphic unit are used in the volume-weighted calculations. Weighted averages can be calculated with as few as one sample per bin. Estimates of variances and 95% UCLs require at least two samples for each bin.

E-2.2.2 Weighted UCLs

The calculation of a 95% UCL on the weighted average requires deriving a standard error of the weighted average and estimating the degrees of freedom to be used in selecting the t-value from a Student's t-table. Once these quantities are estimated, the 95% UCL is the weighted average plus the standard error of the mean times the t-value. The weighted standard error of the mean is calculated using the variances, the squared area or volume weights, and the number of samples in each bin. Gilbert (1987, 56179, pp. 45–50) provides the equations for this calculation. The degrees of freedom for the estimate of the 95% UCL on the average is approximated according to the method developed by Satterthwaite and described in Cochran (1977, 84462). The calculation uses the variances and the actual areas or volumes of the geomorphic units and sediment facies in a bin. The estimated degrees of freedom fall between the smallest number of degrees of freedom for a single bin and sum of all the degrees of freedom for all the bins.

E-2.2.3 Applying Weighting Methods to Sediment Data

Reach investigations were conducted in multiple phases, and the sampling design was modified before each subsequent phase. Sampling was generally biased towards geomorphic units and sediment facies with higher concentrations of COPCs, because these sediments are important for estimating potential risk. For this reason, some geomorphic units and sediment facies, such as coarse sediment in the active channel (coarse facies of c1 unit), yield fewer samples because the active channel typically has lower concentrations of COPCs. Additionally, the analytical suites were biased towards COPCs expected to be present in the reach or identified as potential risk contributors in the initial phases of sampling. Consequently, a geomorphic unit or sediment facies may have more samples that characterize the major COPCs in the reach and fewer samples that characterize COPCs not identified as risk drivers or as COPCs related to Los Alamos National Laboratory operations. Where there is only one sample result in a bin, it is used to calculate the weighted average and the variance is set to zero.

The averages and variances for each bin in a reach are calculated according to the rules and methods outlined in Section E-2.1.1, with one exception. When the data fit neither a normal nor lognormal distribution, the approach in Section E-2.1.1 estimates the 95% UCL using the Chebyshev method, which calculates the UCL directly without providing interim results for the average and variance. Since the average and variance for each bin are needed to estimate weighted averages and weighted UCLs, the Chebyshev method must be replaced with another method that provides estimates of these statistics. Bootstrapping is used to estimate the average and variance in this situation. This is a Monte Carlo technique that samples the data set many times and estimates the average and variance each time. The average of the averages and the average of variances from the Monte Carlo results are used for the calculating weighted averages and weighted UCLs

Table E-2.2-1a presents the results for calculating the area-weighted average and 95% UCL of cesium-137 in reach DP-2 as an example of the methodology. This reach has a total of seven bins. The area-weighted statistics use the coarse facies of the c1 unit (the active channel, which only has coarse facies sediment) and fine facies sediment in the remaining geomorphic units (four units subdivided into three bins). The three bins missing from Table E-2.2-1 are coarse facies sediment in the units that contain fine facies sediment. The c1 unit has one sample. The single c1 cesium-137 value is used for the weighted average, and the weighted variance is calculated with no contribution from the c1 unit.

The estimated unweighted average and 95% UCL for cesium-137 in the reach is also provided in Table E-2.2-1b. A comparison of the weighed average with the unweighted average shows that weighting reduces the effect of the high concentrations in the c3b unit because the fractional weight of the c3b unit is 0.14. If all the weights were equal, then the c3b weight would be 0.25. The weighted 95% UCL is also lower primarily because the weighted average is lower and because the weighted standard error of the mean is smaller than the unweighted standard error of the mean. These results indicate that the variances within each bin are more homogeneous than the variance across all the bins.

The practical value of using weighted averages and 95% UCLs is that the EPCs correspond to an exposure scenario where the individual has an equal likelihood of being at any particular location in the investigation reach. In this example, a trail user visiting this reach many times comes in contact with the c3b geomorphic unit 14% of the time because it is 14% of the reach surface area. Thus, weighting the average provides a more representative estimate of COPC concentrations for exposure.

E-3.0 ECOLOGICAL SCOPING CHECKLIST

This section contains the ecological scoping checklist for the Acid Canyon sediment investigation reaches.

E-3.1 Part A—Scoping Meeting Documentation

Site ID	Acid Canyon – Reaches AC-1, AC-2, AC-3, and ACS; and reach P-1E in Pueblo Canyon
Form of site releases (solid, liquid, vapor). Describe all relevant known or suspected mechanisms of release (spills, dumping, material disposal, outfall, explosive testing, etc.) and describe potential areas of release. Reference locations on a map as appropriate.	Primarily concerned about liquid releases from former Technical Area (TA-) 1 and TA-45 and septic systems – notably SWMU 0-030(g). Potential for nonpoint source releases of polycyclic aromatic hydrocarbons (PAHs) and pesticides from the townsite.
List of Primary Impacted Media (Indicate all that apply.)	Surface soil – yes, in the floodplains and abandoned channels Surface water/sediment – yes, active channels Subsurface – possibly impacted if alluvial groundwater contaminated Groundwater – possibly alluvial groundwater Other, explain –
FIMAD vegetation class based on Arcview vegetation coverage (Indicate all that apply.)	Water – Bare Ground/Unvegetated – Spruce/fir/aspen/mixed conifer – yes Ponderosa pine – yes Piñon juniper/juniper savannah – Grassland/shrubland – Developed –
Is T&E Habitat Present? If applicable, list species known or suspected to use the site for breeding or foraging.	Potential Mexican spotted owl foraging and nesting habitat based on assessment of downstream reaches in Pueblo Canyon.
Provide list of Neighboring/ Contiguous/ Upgradient sites, includes a brief summary of COPCs and the form of releases for relevant sites and reference a map as appropriate. (Use this information to evaluate the need to aggregate sites for screening.)	Notable sites include TA-1, TA-45, and SWMU 0-030(g).
Surface Water Erosion Potential Information Summarize information from SOP 2.01, including the run-off subscore (maximum of 46); terminal point of surface water transport; slope; and surface water runoff sources.	Not applicable because Acid Canyon is not a SWMU.
Other Scoping Meeting Notes	Purpose of visit was to provide information on the adequacy of existing data for a screening-level ecological risk assessment. Another objective was to document the presence and likelihood of aquatic receptors in Acid Canyon.

E-3.2 Part B—Site Visit Documentation

Site ID	Acid Canyon – Reaches AC-1, AC-2, AC-3, and ACS; and reach P-1E in Pueblo Canyon
Date of Site Visit	8/3/00
Site Visit Conducted by	R. Ryti, S. Reneau, D. Katzman

Receptor Information:

Estimate cover	Relative vegetative cover (high, medium, low, none) = high Relative wetland cover (high, medium, low, none) = low [active channel] Relative structures/asphalt, etc. cover (high, medium, low, none) = none
Field notes on the FIMAD vegetation class to assist in ground-truthing the Arcview information	Some riparian vegetation noted near the active channel. High grass cover exists over much of the floodplain [especially in the upper part of Acid Canyon].
Field notes on T&E Habitat, if applicable. Consider the need for a site visit by a T&E subject matter expert to support the use of the site by T&E receptors.	These reaches provide potential Mexican spotted owl foraging and nesting habitat.
Are ecological receptors present at the site? (yes/no/uncertain) Describe the general types of receptors present at the site (terrestrial and aquatic), and make notes on the quality of habitat present at the site.	Yes, both terrestrial and aquatic. Although aquatic communities noted during the site visit were simple and primarily consisted of algae covering rocks in the stream channel.

Contaminant Transport Information:

Surface water transport Field notes on the erosion potential, including a discussion of the terminal point of surface water transport (if applicable).	Erosion potential is moderate in most of the canyon, and the terminal point of surface water transport is typically within the canyon (based on notes from Reneau).
Are there any off-site transport pathways (surface water, air, or groundwater)? (yes/no/uncertain) Provide explanation	Yes, surface water is an obvious pathway to Pueblo Canyon and beyond. Transport to alluvial groundwater is also possible based on observation flow in various reaches of Acid Canyon. Water appears to be recharging the shallow alluvium and leaking out as downstream surface water in days to weeks (based on comments by Reneau).
Interim action needed to limit off-site transport? (yes/no/uncertain) Provide explanation/recommendation to project lead for IA SMDP.	No, there is no imminent threat to off-site transport in this canyon. The floodplains and abandoned channel surface are well vegetated throughout the canyon.

Ecological Effects Information:

Physical Disturbance (Provide list of major types of disturbances, including erosion and construction activities, review historical aerial photos where appropriate.)	Minimal disturbance noted in the canyon. However, some debris in the canyon was noted downstream of the former location of the Peggy Sue Bridge.
Are there obvious ecological effects? (yes/no/uncertain) Provide explanation and apparent cause (e.g., contamination, physical disturbance, other).	No.
Interim action needed to limit apparent ecological effects? (yes/no/uncertain) Provide explanation and recommendations to mitigate apparent exposure pathways to project lead for IA SMDP.	No.

No Exposure/Transport Pathways:

If there are no complete exposure pathways to ecological receptors onsite and no transport pathways to offsite receptors, the remainder of the checklist should not be completed. Stop here and provide additional explanation/justification for proposing an ecological No Further Action recommendation (if needed). At a minimum, the potential for future transport should include likelihood that future construction activities could make contamination more available for exposure or transport.
Not applicable.

Adequacy of Site Characterization:

Do existing or proposed data provide information on the nature, rate and extent of contamination? (yes/no/uncertain) Provide explanation (Consider if the maximum value was captured by existing sample data.)	Yes. Additional sediment characterization was conducted in 2000, 2001, and 2002. Surface water data for Acid Canyon were collected in 2001 and 2002. Biological data were collected in 2002.
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<p>Do existing or proposed data for the site address potential transport pathways of site contamination? (yes/no/uncertain) Provide explanation (Consider if other sites should aggregated to characterize potential ecological risk.)</p>	Yes.
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Additional Field Notes:**Provide additional field notes on the site setting and potential ecological receptors.**

Reach AC-1: Noted algae covering rocks. There was continuous surface water flow through reach AC-1. Dense, tall grasses noted on floodplains, and perhaps ornamental grass species associated with nutrient-laden townsite runoff.

Reach AC-2: Noted algae covering rocks. There was continuous surface water flow through reach AC-2. Some grass was noted over the floodplains and abandoned channel deposits.

Reach AC-3: Water flowed up to 400 m from the Pueblo Canyon confluence, and downstream there were only limited surface water expressions. Abundant debris noted downstream of the former location of the Peggy Sue Bridge. Observed a pair of red foxes near the Pueblo Canyon confluence. Raspberry plants were growing along the active channel on contaminated sediments starting at AC-3 @ 143m and continuing to the Pueblo Canyon confluence. Noted filamentous "worms" in a permanent pool near the Pueblo Canyon confluence, and subsequent research suggests that these creatures were Nematophora or horsehair worms (positive identification would require a hand lens). These creatures were 15 and 30 cm in length and were between 1 and 2 mm in diameter.

Reach P-1: Investigated "muck" (mixture of ash, soil and sediment) from upper watershed. Muck extended beyond the former floodplain boundary. Muck was observed in the terminal end of reach AC-3. Noted animal tracks (raccoon, bear, and unknown small mammals) in the muck.

Reach ACS: Noted hummingbird bathing and drinking from water flowing near confluence with main Acid Canyon. Persistent pool near confluence with main Acid Canyon was too turbid to evaluate presence of aquatic life. Flow down ACS was intermittent and covered less than one-half of the reach length.

Notes from Reneau on occurrence of surface water: Reaches AC-1, -2, -3 had water 83% of time (5 out of 6 months in 2000). In reaches AC-1, AC-2 usually isolated bedrock pools were noted, but sometimes flowing townsite runoff was also seen. Reach AC-3 has a mixture of townsite runoff, isolated alluvial pools, and "alluvial reaches" fed by water emerging from alluvium (e.g., horsehair worm pool). Any given spot with water <83% of time (e.g., period with runoff to west, infiltrating into alluvium but not emerging downstream; or emerging downstream but dry upstream). Reach ACS always had water during the six-month observation period, as either isolated bedrock pools or townsite runoff (but reach ACS was dry in fall 1999 during field sampling campaign).

E-3.3 Part C—Ecological Pathways Conceptual Exposure Model

Provide answers to Questions A to V to develop the Ecological Pathways Conceptual Exposure Model

Question A:

Could soil contaminants reach receptors via vapors?

- Volatility of the hazardous substance (volatile chemicals generally have Henry's Law constant $>10^{-5}$ atm-m³/mol and molecular weight <200 g/mol).

Answer (likely/unlikely/uncertain): Unlikely

Provide explanation: No volatile organic compounds are present in active sediment deposits.

Question B:

Could the soil contaminants reach receptors through fugitive dust carried in air?

- Soil contamination would have to be on the actual surface of the soil to become available for dust.
- In the case of dust exposures to burrowing animals, the contamination would have to occur in the depth interval where these burrows occur.

Answer (likely/unlikely/uncertain): Likely

Provide explanation: Importance of pathway is minimized by high vegetative cover and buried position of contaminated sediment deposits.

Question C:

Can contaminated soil be transported to aquatic ecological communities (use SOP 2.01 run-off score and terminal point of surface water runoff to help answer this question)?

- If the SOP 2.01 run-off score* for each SWMU included in the site is equal to zero, this suggests that erosion at the site is not a transport pathway. (* note that the runoff score is not the entire erosion potential score, rather it is a subtotal of this score with a maximum value of 46 points).
- If erosion is a transport pathway, evaluate the terminal point to see if aquatic receptors could be affected by contamination from this site.

Answer (likely/unlikely/uncertain): Likely

Provide explanation: Some contamination is already in aquatic environs.

Question D:

Is contaminated groundwater potentially available to biological receptors through seeps or springs or shallow groundwater?

Known or suspected presence of contaminants in groundwater.

- The potential for contaminants to migrate via groundwater and discharge into habitats and/or surface waters.
- Contaminants may be taken up by terrestrial and rooted aquatic plants whose roots are in contact with groundwater present within the root zone (~1 m depth).

- **Terrestrial wildlife receptors generally will not contact groundwater unless it is discharged to the surface.**

Answer (likely/unlikely/uncertain): Uncertain

Provide explanation: There is some evidence (from Reneau) of shallow alluvial recharge. Do not know how much of the contamination exists in surface water that potentially recharges this shallow aquifer.

Question E:

Is infiltration/percolation from contaminated subsurface material a viable transport and exposure pathway?

- **Suspected ability of contaminants to migrate to groundwater.**
- **The potential for contaminants to migrate via groundwater and discharge into habitats and/or surface waters.**
- **Contaminants may be taken up by terrestrial and rooted aquatic plants whose roots are in contact with groundwater present within the root zone (~1 m depth).**
- **Terrestrial wildlife receptors generally will not contact groundwater unless it is discharged to the surface.**

Answer (likely/unlikely/uncertain): Unlikely

Provide explanation: Most COPECs are not soluble; therefore, minimal contaminant transport through water into the shallow aquifer are expected.

Question F:

Might erosion or mass wasting events be a potential release mechanism for contaminants from subsurface materials or perched aquifers to the surface?

- **This question is only applicable to release sites located on or near the mesa edge.**
- **Consider the erodability of surficial material and the geologic processes of canyon/mesa edges.**

Answer (likely/unlikely/uncertain): Unlikely

Provide explanation: More likely scenario is burial of canyon-bottom sediments from mass wasted material.

Question G:

Could airborne contaminants interact with receptors through respiration of vapors?

- Contaminants must be present as volatiles in the air.
- Consider the importance of inhalation of vapors for burrowing animals.
- Foliar uptake of organic vapors is typically not a significant exposure pathway.

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Terrestrial Plants: 0

Terrestrial Animals: 0

Provide explanation: No VOCs in sediments.

Question H:

Could airborne contaminants interact with plants through deposition of particulates or with animals through inhalation of fugitive dust?

- Contaminants must be present as particulates in the air or as dust for this exposure pathway to be complete.
- Exposure via inhalation of fugitive dust is particularly applicable to ground-dwelling species that would be exposed to dust disturbed by their foraging or burrowing activities or by wind movement.

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Terrestrial Plants: 2

Terrestrial Animals: 2

Provide explanation: Pathway limited by high plant cover and buried position of contaminated sediments.

Question I:

Could contaminants interact with plants through root uptake or rain splash from surficial soils?

- Contaminants in bulk soil may partition into soil solution, making them available to roots.
- Exposure of terrestrial plants to contaminants present in particulates deposited on leaf and stem surfaces by rain striking contaminated soils (i.e., rain splash).

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Terrestrial Plants: 2

Provide explanation: Most COPCs are not readily transferred to plants (isoPu, metals, SVOCs).

Question J:

Could contaminants interact with receptors through food web transport from surficial soils?

- The chemicals may bioaccumulate in animals.
- Animals may ingest contaminated food items.

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Terrestrial Animals: 3

Provide explanation: Some COPCs (PAHs and pesticides) bioaccumulate in animals.

Question K:

Could contaminants interact with receptors via incidental ingestion of surficial soils?

- Incidental ingestion of contaminated soil could occur while animals grub for food resident in the soil, feed on plant matter covered with contaminated soil or while grooming themselves clean of soil.

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Terrestrial Animals: 3

Provide explanation: Pathway is complete and importance will vary with COPC.

Question L:

Could contaminants interact with receptors through dermal contact with surficial soils?

- Significant exposure via dermal contact would generally be limited to organic contaminants that are lipophilic and can cross epidermal barriers.

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Terrestrial Animals: 2

Provide explanation: Some COPCs are lipophilic, but dermal contact is expected to be a less important exposure pathway than diet or incidental soil ingestion.

Question M:

Could contaminants interact with plants or animals through external irradiation?

- External irradiation effects are most relevant for gamma emitting radionuclides.
- Burial of contamination attenuates radiological exposure.

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Terrestrial Plants: 2

Terrestrial Animals: 2

Provide explanation: Gamma-emitting radionuclides are not dominant in Acid Canyon (isoPu, primarily an alpha emitter, is a more notable radionuclide COPC).

Question N:

Could contaminants interact with plants through direct uptake from water and sediment or sediment rain splash?

- Contaminants may be taken-up by terrestrial plants whose roots are in contact with surface waters.
- Terrestrial plants may be exposed to particulates deposited on leaf and stem surfaces by rain striking contaminated sediments (i.e., rain splash) in an area that is only periodically inundated with water.
- Contaminants in sediment may partition into soil solution, making them available to roots.

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Terrestrial Plants: 2

Provide explanation: Some COPCs are water soluble [e.g., Sr-90] and will be taken up by roots but most are not very soluble [e.g., isoPu].

Question O:

Could contaminants interact with receptors through food web transport from water and sediment?

- The chemicals may bioconcentrate in food items.
- Animals may ingest contaminated food items.

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Terrestrial Animals: 2

Provide explanation: Concentrations in sediment [active channel sands] are typically low and the food chain is simple or possibly incomplete for transport to higher trophic levels.

Question P:

Could contaminants interact with receptors via ingestion of water and suspended sediments?

- If sediments are present in an area that is only periodically inundated with water, terrestrial receptors may incidentally ingest sediments.
- Terrestrial receptors may ingest water-borne contaminants if contaminated surface waters are used as a drinking water source.

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Terrestrial Animals: 2

Provide explanation: Concentrations of COPCs in water and sediments are expected to be low compared to other media and pathways.

Question Q:

Could contaminants interact with receptors through dermal contact with water and sediment?

- If sediments are present in an area that is only periodically inundated with water, terrestrial species may be dermally exposed during dry periods.
- Terrestrial organisms may be dermally exposed to water-borne contaminants as a result of wading or swimming in contaminated waters.

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Terrestrial Animals: 2

Provide explanation: Concentrations of COPCs in water and sediments are expected to be low compared to other media and pathways.

Question R:

Could contaminants interact with plants or animals through external irradiation?

- External irradiation effects are most relevant for gamma emitting radionuclides.
- Burial of contamination attenuates radiological exposure.

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Terrestrial Plants: 2

Terrestrial Animals: 2

Provide explanation: Gamma-emitting radionuclides are at low concentrations relative to other radionuclides, and concentrations of COPCs in water and sediments are expected to be low compared to other media and pathways.

Question S:

Could contaminants bioconcentrate in free floating aquatic, attached aquatic plants, or emergent vegetation?

- **Aquatic plants are in direct contact with water.**
- **Contaminants in sediment may partition into pore water, making them available to submerged roots.**

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Aquatic Plants/Emergent Vegetation: 3

Provide explanation: Algae are the major aquatic receptors noted during the Acid Canyon site visit.

Question T:

Could contaminants bioconcentrate in sedimentary or water column organisms?

- **Aquatic receptors may actively or incidentally ingest sediment while foraging.**
- **Aquatic receptors may be directly exposed to contaminated sediments or may be exposed to contaminants through osmotic exchange, respiration, or ventilation of sediment pore waters.**
- **Aquatic receptors may be exposed through osmotic exchange, respiration, or ventilation of surface waters.**

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Aquatic Animals: 1

Provide explanation: Animal aquatic life is either absent or uncommon in Acid Canyon.

Question U:

Could contaminants bioaccumulate in sedimentary or water column organisms?

- **Lipophilic organic contaminants and some metals may concentrate in an organism's tissues**
- **Ingestion of contaminated food items may result in contaminant bioaccumulation through the food web.**

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Aquatic Animals: 1

Provide explanation: Animal aquatic life is either absent or uncommon in Acid Canyon.

Question V:

Could contaminants interact with aquatic plants or animals through external irradiation?

- **External irradiation effects are most relevant for gamma emitting radionuclides.**
- **The water column acts to absorb radiation, thus external irradiation is typically more important for sediment dwelling organisms.**

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

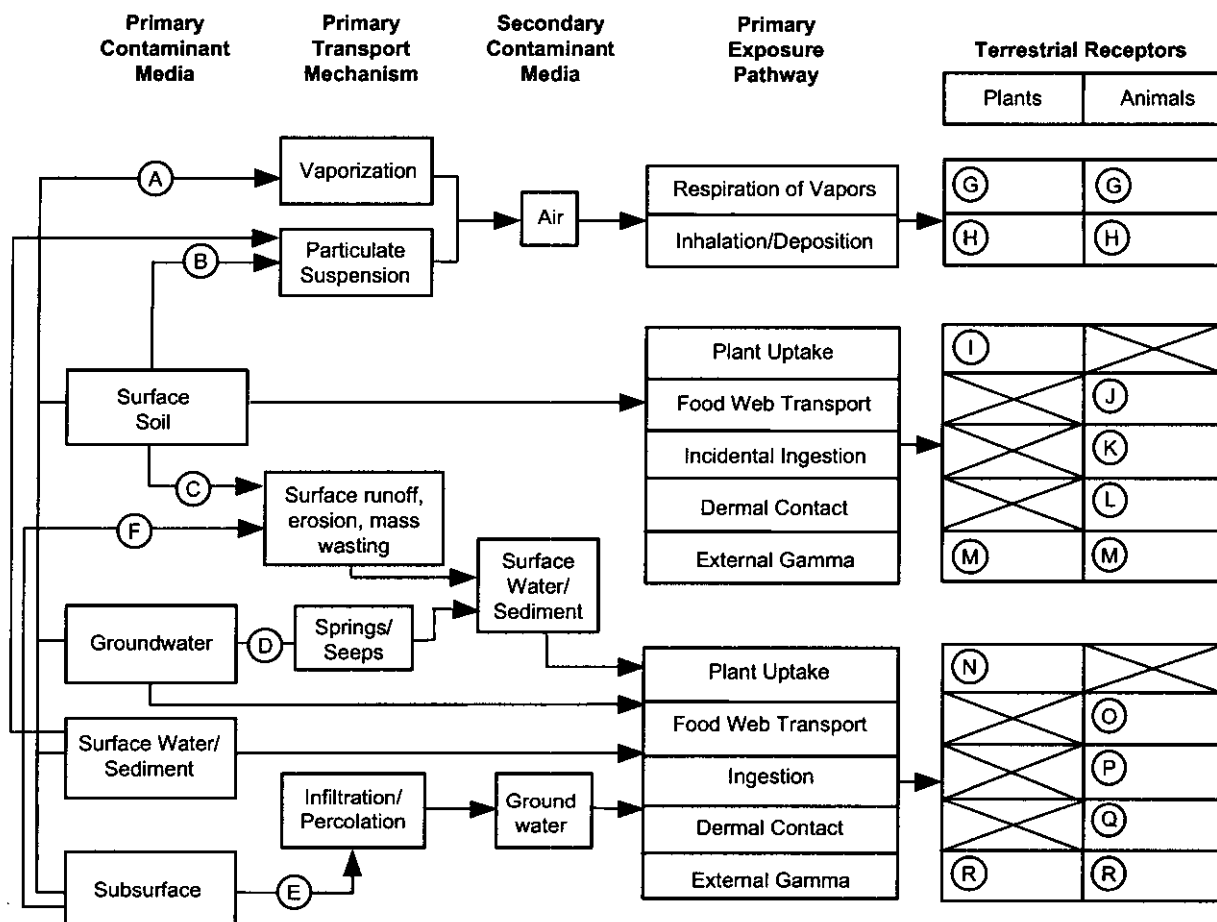
Aquatic Plants: 2

Aquatic Animals: 2

Provide explanation: Gamma-emitting radionuclides are at low concentrations relative to other radionuclides, and concentrations of COPCs in water and sediments are expected to be low compared to other media and pathways.

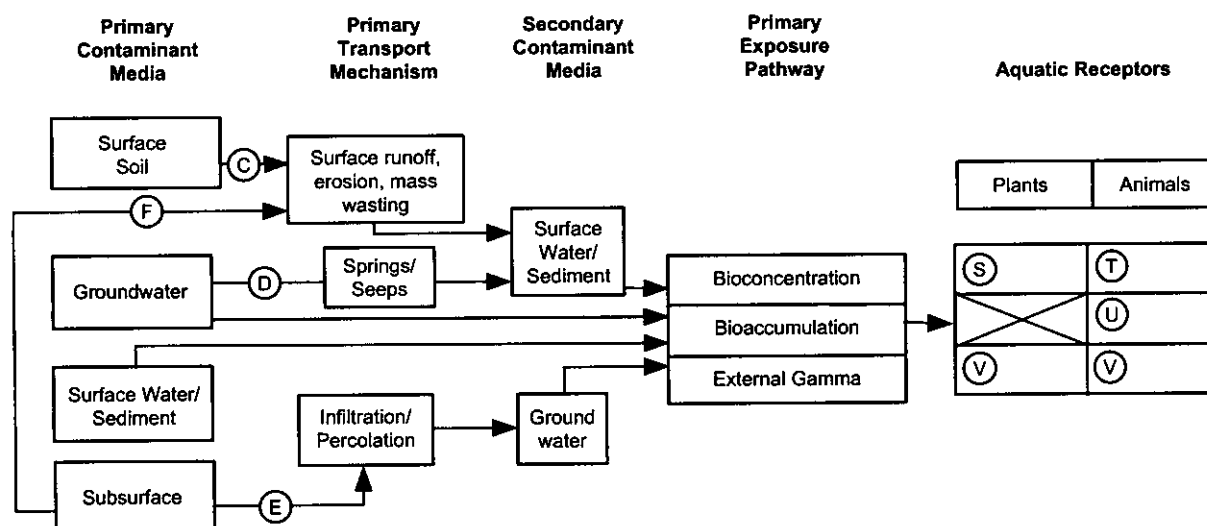
Ecological Scoping Checklist **Terrestrial Receptors** **Ecological Pathways Conceptual Exposure Model**

NOTE:
 Letters in circles
 refer to questions
 on the Scoping
 Checklist



Ecological Scoping Checklist **Aquatic Receptors** **Ecological Pathways Conceptual Exposure Model**

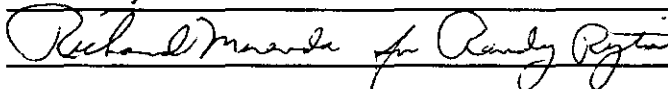
NOTE:
 Letters in circles
 refer to questions
 on the Scoping
 Checklist



Signatures and certifications:

Checklist completed by (provide name, organization and phone number):

Name (printed): Randall Rytli

Name (signature): 

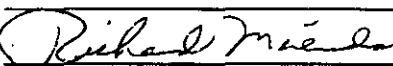
Organization: Neptune and Company, Inc.

Phone number: 505.662.0707, x12

Date completed: 8/4/2000; updated 4/12/2004

Verification by a member of ER Project Ecological Risk Task Team (provide name, organization and phone number):

Name (printed): Rich Mirenda

Name (signature): 

Organization: Los Alamos National Laboratory, RRES-ECR

Phone number: 505.665.6953

E-4.0 PLOTS SUPPORTING ECOLOGICAL RISK ASSESSMENTS

This appendix contains information that supports the ecological risk assessments in Section 8.

E-4.1 Small Mammal Bioaccumulation Plots

To evaluate the relationship between small-mammal whole-body COPC concentrations and soil concentrations, scatter plots were prepared showing the average concentration in soil for the trapping array on the x-axis and the small-mammal body-burden concentrations on the y-axis (Figures E-4.1-1 to E-4.1-36). (It should be noted that the term "soil" is used in this section to be consistent with the literature on terrestrial ecological risk assessments, although the data consist of results from sediment samples as discussed in other sections of this investigation report.) Data are presented for all COPCs measured in small mammals and include inorganic chemicals, some of which are essential nutrients. Essential nutrient data are provided as one measure of the quality of the sample results. For example, calcium is a regulated essential nutrient as well as an important component of the skeleton, and a narrow calcium concentration range is expected. It is useful to evaluate all COPCs and not to limit the evaluation to COPECs or study-design COPECs to provide a more complete test of bioaccumulation in small mammals with these data. Small-mammal concentrations are based on analysis of the entire animal, and soil adhering to the pelt was incorporated in the homogenized tissue sample prepared for chemical analysis. Average soil concentrations better represent the spatial area associated with small mammal home ranges and dispersal distances; the deer mouse range is up 1280 m² (13,779 ft²) (EPA 1993, 59384, p. 2-298), median dispersal distance is 100 m (328 ft) (Sutherland et al. 2000, 73460), and most of the trapping arrays cover about 40 by 90 m (131 by 295 ft) or 3600 m² (38,754 ft²).

Scatter plots are used to relate data for one variable (whole-body concentrations on the y-axis) versus data for a second variable (average of composite soil concentrations on the x-axis). The average sediment background concentration (McDonald et al. 2003, 76084, Table 10, p. 47) is plotted as a vertical line for each inorganic chemical, and the average of the small-mammal whole-body results is plotted as a horizontal line. Average values are plotted as reference lines because the composite samples represent the average concentrations within the trapping array. Composite soil concentrations can be compared with the average background concentrations to determine if the soil COPC concentrations within the array are significantly above background or similar to background concentrations.

The four small mammal species analyzed are distinguished by different symbols on the scatter plots. Each point represents the results for the two variables. An association or correlation between the two variables is indicated if the points on the scatter plot follow (approximately) a positive or negative sloped straight line. A horizontal line indicates no relationship between the variables. Linear regression is used as the statistical model to relate small-mammal concentrations to soil concentrations. It yields a model with a slope and intercept. The fit of the data to the model is calculated as the coefficient of determination (also known as r^2 or the explained variance of the model). A coefficient of determination of 1 occurs when a perfect fit occurs (the errors are all zero). A coefficient of determination of 0 means that the model predicts the small-mammal concentrations no better than the overall response mean (the regression would have a slope of zero in this case).

Six COPCs (beryllium, chromium, mercury, sodium, dieldrin, and plutonium-239,240) have statistically significant relationships ($p < 0.05$) between small-mammal concentrations and soil concentrations. However, these regression models have very low predictive ability within the range of soil concentrations measured (maximum r^2 is < 0.11). Three COPCs (beryllium, mercury, and plutonium-239,240) have positive relationships (slope > 0 [Figures E-4.1-5, E-4.1-15, and E-4.1-35]), and three COPCs (chromium,

sodium, and dieldrin) have negative relationships (slope <0 [Figures E-4.1-8, E-4.1-20, and E-4.1-30]). Analytes with negative slopes have a relationship counter to that predicted by simple bioaccumulation (i.e., higher soil concentrations should be associated with higher diet concentrations and, therefore, with greater bioaccumulation).

Of the COPCs with positive relationships between small mammal concentrations and soil concentrations, concentrations of beryllium in soil are similar to average background concentrations (and less than the background value [BV] of 1.31 mg/kg) and thus do not represent a potential source for contaminant bioaccumulation (Figure E-4.1-5). However, concentrations of mercury and plutonium-239,240 are greater than background concentrations in some trapping arrays and represent a potential source for bioaccumulation. Because the small-mammal analyses of the whole animal includes soil in the pelt, these minimal positive relationships may indicate somewhat greater pelt concentrations and thus not reflect greater internal concentrations in small mammals. It is also possible that mercury and plutonium-239,240 are bioaccumulating in small mammals. However, because of the low r^2 values for the regressions and the analysis of whole animal (including soil residues in the pelt), little evidence exists to support bioaccumulation of COPCs in small mammals. The regression models¹ for six COPCs with statistically significant relationships between small mammal and soil concentrations are listed below.

- Beryllium: Mammal = $-0.00150 + 0.0129 * \text{Soil}$, $r^2 = 0.106$, $n = 96$, $p = 0.001$
- Chromium: Mammal = $0.848 - 0.0483 * \text{Soil}$, $r^2 = 0.045$, $n = 96$, $p = 0.038$
- Mercury: Mammal = $0.0135 + 0.0363 * \text{Soil}$, $r^2 = 0.066$, $n = 96$, $p = 0.011$
- Sodium: Mammal = $1510 - 3.47 * \text{Soil}$, $r^2 = 0.083$, $n = 96$, $p = 0.004$
- Dieldrin: Mammal = $0.00179 - 0.143 * \text{Soil}$, $r^2 = 0.0727$, $n = 98$, $p = 0.007$
- Plutonium-239,240: Mammal = $0.000716 + 0.000804 * \text{Soil}$, $r^2 = 0.102$, $n = 92$, $p = 0.002$

The regression models for the other 30 COPCs with no statistically significant relationships ($p > 0.05$) between small mammal and soil concentrations are listed below.

- Aluminum: Mammal = $27.4 + 0.000732 * \text{Soil}$, $r^2 = 0.001$, $n = 96$, $p = 0.75$
- Antimony: Mammal = $-0.748 + 2.33 * \text{Soil}$, $r^2 = 0.021$, $n = 75$, $p = 0.22$
- Arsenic: Mammal = $0.177 - 0.0144 * \text{Soil}$, $r^2 < 0.001$, $n = 96$, $p = 0.80$
- Barium: Mammal = $4.88 - 0.00631 * \text{Soil}$, $r^2 = 0.004$, $n = 96$, $p = 0.54$
- Cadmium: Mammal = $0.00999 - 0.000992 * \text{Soil}$, $r^2 < 0.001$, $n = 96$, $p = 0.89$
- Calcium: Mammal = $11400 - 0.272 * \text{Soil}$, $r^2 = 0.006$, $n = 96$, $p = 0.47$
- Cobalt: Mammal = $0.0292 + 0.00196 * \text{Soil}$, $r^2 = 0.006$, $n = 96$, $p = 0.45$
- Copper: Mammal = $2.89 - 0.0401 * \text{Soil}$, $r^2 = 0.011$, $n = 96$, $p = 0.30$
- Iron: Mammal = $71.7 + 0.000715 * \text{Soil}$, $r^2 < 0.001$, $n = 96$, $p = 0.79$
- Lead: Mammal = $28.1 - 0.389 * \text{Soil}$, $r^2 = 0.020$, $n = 96$, $p = 0.17$
- Magnesium: Mammal = $380 - 0.000952 * \text{Soil}$, $r^2 < 0.001$, $n = 96$, $p = 0.94$

¹ All regressions are based on fresh-weight concentrations in the small mammals and dry-weight concentrations in the soil.

- Manganese: Mammal = $2.74 + 0.000704 * \text{Soil}$, $r^2 = 0.002$, $n = 96$, $p = 0.68$
- Nickel: Mammal = $0.0705 + 0.0181 * \text{Soil}$, $r^2 = 0.009$, $n = 96$, $p = 0.35$
- Potassium: Mammal = $2520 - 0.0411 * \text{Soil}$, $r^2 = 0.007$, $n = 96$, $p = 0.41$
- Selenium: Mammal = $0.397 - 0.0624 * \text{Soil}$, $r^2 = 0.003$, $n = 96$, $p = 0.59$
- Silver: Mammal = $0.0184 - 0.00614 * \text{Soil}$, $r^2 = 0.012$, $n = 96$, $p = 0.28$
- Thallium: Mammal = $0.00338 + 0.00407 * \text{Soil}$, $r^2 = 0.003$, $n = 96$, $p = 0.59$
- Vanadium: Mammal = $0.0411 + 0.000088 * \text{Soil}$, $r^2 < 0.001$, $n = 96$, $p = 0.96$
- Zinc: Mammal = $59.1 + 0.254 * \text{Soil}$, $r^2 = 0.006$, $n = 96$, $p = 0.44$
- Aroclor-1254: Mammal = $0.0168 - 0.00147 * \text{Soil}$, $r^2 = 0.002$, $n = 98$, $p = 0.63$
- Aroclor-1260: Mammal = $0.0198 + 0.0153 * \text{Soil}$, $r^2 < 0.001$, $n = 98$, $p = 0.77$
- Chlordane[alpha-]: Mammal = $0.00169 - 0.0220 * \text{Soil}$, $r^2 = 0.005$, $n = 98$, $p = 0.51$
- Chlordane[gamma-]: Mammal = $0.00168 - 0.00804 * \text{Soil}$, $r^2 = 0.003$, $n = 98$, $p = 0.57$
- Dichlorodiphenyltrichlorethylene [4,4'-] (DDE): Mammal = $0.00158 + 0.00744 * \text{Soil}$, $r^2 = 0.002$, $n = 98$, $p = 0.67$
- Dichlorodiphenyltrichloroethane [4,4'-] (DDT): Mammal = $0.00163 + 0.00584 * \text{Soil}$, $r^2 = 0.003$, $n = 98$, $p = 0.59$
- Endrin: Mammal = $0.00170 - 0.0138 * \text{Soil}$, $r^2 = 0.009$, $n = 98$, $p = 0.37$
- Americium-241: Mammal = $0.189 + 0.0746 * \text{Soil}$, $r^2 < 0.001$, $n = 92$, $p = 0.84$
- Cesium-137: Mammal = $-0.338 + 0.553 * \text{Soil}$, $r^2 = 0.012$, $n = 92$, $p = 0.31$
- Plutonium-238: Mammal = $0.000914 + 0.00290 * \text{Soil}$, $r^2 < 0.001$, $n = 92$, $p = 0.87$
- Strontium-90: Mammal = $0.176 - 0.130 * \text{Soil}$, $r^2 = 0.011$, $n = 92$, $p = 0.33$

E-4.2 Nest Box Monitoring Network Plots

Scatter plots and box plots were prepared to evaluate differences in nest success (e.g., hatch date, clutch size, number of eggs hatched, percentage of eggs hatched, number of fledglings, percentage of eggs that fledge) and sex ratio of fledglings. Scatter plots were used for some variables (year, easting, and elevation), and box plots were used for the others (location, burned or unburned, watershed, and species). Box plots comparing differences between locations were prepared only for the western bluebird nests in the Los Alamos and Pueblo watershed. Scatter plots show the data for one variable (nest success or sex ratio on the y-axis) plotted against data from a second variable (year, easting, or elevation on the x-axis). Box plots are used to show differences between two or more categories of data (location, burn status, watershed, and species) and summarize information about the shape and spread of the distribution of results. The box plots consist of a box and a line (the median value) across the box. The y-axis displays the observed values in the reported units. The area enclosed by the box shows the range containing the middle half of the data; that is, the lower box edge is at the 25th percentile, and the upper box edge is at the 75th percentile. The horizontal line above each box represents the 90th percentile, and the line beneath the box represents the 10th percentile of the sample results. The height of the box is a measure of the spread of the results. The horizontal line across the box represents the median (50th percentile) of the data, a measure of the center of the distribution. If the median line divides the box into two approximately equal parts, the shape of the distribution of results could be symmetric; if not, the

distribution is skewed or asymmetric. Thus, each box indicates values for the central half of the data, and comparing the location of boxes can readily assess shifts in the results.

Figures E-4.2-1 through E-4.2-35 provide a synopsis of nest box monitoring network results for western bluebirds in the Los Alamos and Pueblo watershed. No notable trends in nest success or fledgling sex ratio are evident in these plots.

E-4.3 Egg Thickness and Volume Plots

Scatter plots and box plots were prepared to evaluate differences in eggshell thickness and egg volume. Scatter plots were used for some variables (year, easting, and elevation), and box plots were used for the other categorical variables (burned or unburned, watershed, and species). Scatter plots show the data for one variable (eggshell thickness or volume on the y-axis) plotted against data from a second variable (year, easting, or elevation on the x-axis). Box plots are used to show differences between two or more categories of data (burn status, watershed, or species). Box plots summarize information about the shape and spread of the distribution of concentrations for an analyte. They consist of a box and a line (the median value) across the box. The y-axis shows the observed values in the reported units. The area enclosed by the box shows the concentration range containing the middle half of the data; that is, the lower box edge is at the 25th percentile, and the upper box edge is at the 75th percentile. The horizontal line above each box represents the 90th percentile, and the line beneath the box represents the 10th percentile of the sample results. The height of the box is a measure of the spread of the results. The horizontal line across the box represents the median (50th percentile) of the data, a measure of the center of the distribution. If the median line divides the box into two approximately equal parts, the shape of the distribution of results could be symmetric; if not, the distribution is skewed or asymmetric. Thus, each box indicates results for the central half of the data, and comparing the location of boxes can readily assess shifts in the results.

Figures E-4.3-1 through E-4.3-8 provide a synopsis of eggshell thickness and volume for western bluebird nests in the Los Alamos and Pueblo watershed. No notable trends in eggshell thickness and volume are evident in these plots.

E-4.4 Earthworm Bioaccumulation Scatter Plots

To evaluate the relationship between earthworm metal concentrations and soil concentrations, scatter plots were prepared showing the concentration in soil on the x-axis and the earthworm measurements on the y-axis (Figures E-4.4-1 to E-4.4-23). (It should be noted that the term "soil" is used in this section to be consistent with the literature on terrestrial ecological risk assessments, although the data consist of results from sediment samples as discussed in other sections of this investigation report.) Because earthworms may have significant amounts of soil in their gut, the earthworms were depurated (cleansed of internal matter) before they were prepared for chemical analysis so concentrations reflect what was in the earthworm tissue and not in its gut. Data are presented for all metal COPCs measured in earthworms; some of these metals are essential nutrients, and these data are provided as one measure of the quality of the sample results. It is useful to evaluate all metal COPCs and not limit the evaluation to COPECs or study-design COPECs to provide a more complete test of bioaccumulation in earthworms with these data.

Scatter plots are used to relate data for one variable (y-axis) versus data from a second variable (x-axis). The average sediment background concentration (McDonald et al. 2003, 76084, Table 10, p. 47) is plotted as a vertical line for the inorganic chemicals, and the average of the earthworm results is plotted as a horizontal line. Soil concentrations may be compared to the average background concentrations to determine if the concentrations in the sample are above or similar to background concentrations. Each

point on the scatter plots represents the results for the two variables. An association or correlation between the two variables is indicated if the points on the scatter plot follow (approximately) a sloped straight line. Linear regression was used as the statistical model to relate earthworm concentrations to soil concentrations. It yields a model with a slope and an intercept. The fit of the data to the model is calculated as the coefficient of determination (also known as r^2 or the explained variance of the model). A coefficient of determination of 1 occurs when a perfect fit occurs (the errors are all zero). A coefficient of determination of 0 means the model predicts the measurements no better than the overall response mean (in this case, the regression would have a slope of zero).

Three metals (cadmium, lead, and mercury) have significant relationships between earthworm concentrations and soil concentrations ($r^2 > 0.9$, $p < 0.0001$). The maximum cadmium, lead, and mercury earthworm concentrations are from a sample collected in reach AC-3, and the significance of these relationships may be overstated by an influential value or statistical outlier (the reach AC-3 sample). Prior to using these data to develop bioaccumulation models, the impact of outliers should be evaluated. The regression models² for cadmium, lead, and mercury are listed below, with mercury as a study-design COPEC.

- Cadmium: Worm = $0.748 + 2.27 * \text{Soil}$, $r^2 = 0.903$, $n = 14$, $p < 0.0001$
- Lead: Worm = $-0.537 + 0.0844 * \text{Soil}$, $r^2 = 0.967$, $n = 14$, $p < 0.0001$
- Mercury: Worm = $0.021 + 0.442 * \text{Soil}$, $r^2 = 0.987$, $n = 13$, $p < 0.0001$

Five metals (calcium, chromium, copper, manganese, and silver) have significant relationships between earthworm concentrations and soil concentrations ($0.4 < r^2 < 0.9$, $p < 0.02$). Although these regressions have lesser r^2 values, they are useful for estimating exposure concentrations in invertebrate food. However, soil concentrations for most of these analytes differ little from background levels (except for silver). The regression models for calcium, chromium, copper, manganese, and silver are listed below, with chromium and silver as the study-design COPECs.

- Calcium: Worm = $495 + 0.0751 * \text{Soil}$, $r^2 = 0.533$, $n = 14$, $p = 0.003$
- Chromium: Worm = $0.160 + 0.163 * \text{Soil}$, $r^2 = 0.706$, $n = 14$, $p = 0.0002$
- Copper: Worm = $1.83 + 0.0822 * \text{Soil}$, $r^2 = 0.481$, $n = 14$, $p = 0.006$
- Manganese: Worm = $10.5 + 0.0333 * \text{Soil}$, $r^2 = 0.526$, $n = 14$, $p = 0.003$
- Silver: Worm = $0.055 + 0.207 * \text{Soil}$, $r^2 = 0.432$, $n = 14$, $p = 0.011$

Four metals (arsenic, barium, vanadium, and zinc) have significant relationships between earthworm and soil concentrations, but the regression models have smaller coefficients of determination ($0.2 < r^2 < 0.4$, $p < 0.05$). These regressions have lesser r^2 values and, therefore, are of lesser utility for estimating exposure concentrations in invertebrate food. In addition, concentrations in soil for most of these analytes differ little from background concentrations (except for zinc). The regression models for arsenic, barium, vanadium, and zinc are listed below, with arsenic, barium, and zinc as the study-design COPECs.

- Arsenic: Worm = $0.398 + 0.273 * \text{Soil}$, $r^2 = 0.327$, $n = 13$, $p = 0.041$
- Barium: Worm = $2.98 + 0.0269 * \text{Soil}$, $r^2 = 0.322$, $n = 14$, $p = 0.035$

² All regressions are based on fresh-weight concentrations in the earthworms and dry-weight concentrations in the soil.

- Vanadium: Worm = $-0.050 + 0.0591 * \text{Soil}$, $r^2 = 0.293$, $n = 14$, $p = 0.045$
- Zinc: Worm = $18.2 + 0.0639 * \text{Soil}$, $r^2 = 0.321$, $n = 14$, $p = 0.035$

The other metals do not have a significant relationship ($r^2 < 0.2$, $p > 0.05$) between earthworm and soil concentrations. The regression models for these metals are listed below.

- Aluminum: Worm = $182 + 0.00738 * \text{Soil}$, $r^2 = 0.050$, $n = 14$, $p = 0.44$
- Antimony: Worm = $0.013 + 0.000427 * \text{Soil}$, $r^2 < 0.001$, $n = 12$, $p = 0.96$
- Beryllium: Worm = $0.035 - 0.00199 * \text{Soil}$, $r^2 = 0.002$, $n = 14$, $p = 0.89$
- Cobalt: Worm = $0.530 + 0.0278 * \text{Soil}$, $r^2 = 0.070$, $n = 14$, $p = 0.36$
- Iron: Worm = $509 - 0.00177 * \text{Soil}$, $r^2 < 0.001$, $n = 14$, $p = 0.96$
- Magnesium: Worm = $162 + 0.00996 * \text{Soil}$, $r^2 = 0.024$, $n = 14$, $p = 0.60$
- Nickel: Worm = $0.395 + 0.0252 * \text{Soil}$, $r^2 = 0.0402$, $n = 14$, $p = 0.49$
- Potassium: Worm = $1380 - 0.0117 * \text{Soil}$, $r^2 < 0.001$, $n = 14$, $p = 0.96$
- Selenium: Worm = $0.726 + 0.226 * \text{Soil}$, $r^2 = 0.057$, $n = 14$, $p = 0.41$
- Sodium: Worm = $680 - 0.0142 * \text{Soil}$, $r^2 < 0.001$, $n = 14$, $p = 0.97$
- Thallium: Worm = $0.020 + 0.120 * \text{Soil}$, $r^2 = 0.151$, $n = 14$, $p = 0.17$

E-4.5 Earthworm Survival and Growth Versus Invertebrate HQ Scatter Plots

To evaluate the relationship of invertebrate COPEC concentrations and earthworm survival and growth data, scatter plots were prepared showing COPEC hazard quotient (HQ) values on the x-axis and survival or growth on the y-axis (Figures E-4.5-1 through E-4.5-10). HQ/hazard index (HI) values greater than 1 may be associated with adverse effects, and the plots may be examined for trends versus HQ/HI values. The COPEC HQs plotted on the x-axis were for chromium, mercury, and plutonium-239,240, because these analytes were identified as study-design COPECs for invertebrates (see Section 8.1.1). These COPECs also contributed the majority of the HQ to the invertebrate HI (see supporting materials for Katzman 2002, 73667). HI (or sum of HQ values) for radionuclides and nonradionuclides (inorganic and organic COPECs) were also plotted on the x-axis. Scatter plots are used to relate data for one variable (y-axis) versus data from a second variable (x-axis). The reference site (Guaje Canyon) is plotted as a “*” symbol to distinguish results for this location. Sample ID CALA-02-47891 in reach LA-1W is plotted as a filled circle, because this sample had high mortality and, as discussed in Section 8.1, earthworm mortality was probably the result of microbes and not related to COPECs; these plots provide additional supporting information to help evaluate this hypothesis. An association or correlation between the two variables is indicated if the points on the scatter plot follow (approximately) a sloped straight line. Other than low survival and growth in sample ID CALA-02-47891, no trends are evident in survival or growth across a gradient of invertebrate COPEC concentrations. The plots illustrate that COPEC concentrations are low for the reference location (Guaje Canyon) and are also low for sample ID CALA-02-47891, which supports the hypothesis that the high mortality for this sample was not related to COPECs. These plots are adequate to conclude that no relationship exists between COPEC concentrations and earthworm toxicity.

E-4.6 Seedling Germination Measures Versus Plant HQ Scatter Plots

To evaluate the relationship of plant COPEC concentrations and seedling germination test results (i.e., mortality, mean shoot height, mean root length, shoot wet weight, root wet weight, total wet weight, shoot dry weight, root dry weight, and total dry weight per replicate), scatter plots were prepared showing COPEC HQ values on the x-axis and seedling germination test results on the y-axis (Figures E-4.6-1 through E-4.6-80). HQ/HI values greater than 1 may be associated with adverse effects, and the plots may be examined for trends versus HQ/HI values. The COPECs plotted on x-axis included antimony, chromium, manganese, selenium, silver, thallium, and zinc, because these analytes were identified as study-design COPECs for plants (see Section 8.1.1), and these COPECs also contributed the majority of the HQ to the plant HI (see supporting materials for Katzman 2002, 73667). Radionuclides were eliminated as COPECs for the plant because the HIs were less than 0.3 (Katzman 2002, 73667). Endrin aldehyde was also identified as a key plant COPEC, but this analyte was not detected in the associated sediment samples. HI (or sum of HQ values) for nonradionuclides (inorganic and organic COPECs) were also plotted on the x-axis. Scatter plots are used to relate data for one variable (y-axis) versus data from a second variable (x-axis). The reference site (Guaje Canyon) is plotted as a "*" symbol to distinguish results for this location. The HQ values in these plots are based on the standardized sample result from the ERDB and do not distinguish detected from nondetected sample results. An association or correlation between the two variables is indicated if the points on the scatter plot follow (approximately) a sloped straight line. No trends are evident, implying COPECs have no effect on seedling germination test results across a gradient of plant COPEC concentrations. The plots illustrate that COPEC concentrations are low to intermediate for the reference location (Guaje Canyon). These plots are adequate to conclude that no relationship exists between COPEC concentrations and plant toxicity.

E-4.7 Plant Species Diversity Plots

Scatter plots and box plots were prepared to evaluate differences in plant species diversity (number of tree, shrub, grass, and total species). Scatter plots were used for some variables (easting, elevation, element occurrence [EO] score, and plant HI values), and box plots were used for the other categorical variables (EO score category). An "element" for calculating EO scores is defined as a plant or animal population or stands of a plant community where only one occurrence of a population is considered at a site. The EO ranking of a plant community within a site focuses on three sets of factors: condition, landscape, and size. The Nature Conservancy uses these factors extensively (Marsh 2003, 82661). The element is given ranks between 1.0 and 4.0 for each category and subset, where 1.0 is highly degraded and 4.0 is nearly "pristine." Further information on the EO score is provided in Marsh (2003, 82661). Scatter plots show the data for one variable (easting, elevation, EO score, or plant HI values on the y-axis) plotted against data from a second variable (plant species diversity measures on x-axis). The reference site (Guaje Canyon) is plotted as a circle symbol to distinguish results for this location. The data for reach LA-0 is plotted as a "*" symbol, because this location had the greatest plant species diversity (Marsh 2003, 82661).

Box plots are used to show differences between two or more categories of data (EO score category). They summarize information about the shape and spread of the distribution of concentrations for an analyte. Box plots consist of a box and a line (the median value) across the box. The y-axis shows the observed values in the reported units. The area enclosed by the box shows the range containing the middle half of the data; that is, the lower box edge is at the 25th percentile, and the upper box edge is at the 75th percentile. The horizontal line above each box represents the 90th percentile, and the line beneath the box represents the 10th percentile of the sample results. The height of the box is a measure of the spread of the results. The horizontal line across the box represents the median (50th percentile) of the data, a measure of the center of the distribution. If the median line divides the box into two

approximately equal parts, the shape of the distribution of results could be symmetric; if not, the distribution is skewed or asymmetric. Thus, each box indicates results for the central half of the data, and comparing the location of boxes can readily assess shifts in the results.

Figures E-4.7-1 through E-4.7-30 show that reach LA-0 has a greater diversity of plant species than other sites, and a trend toward greater plant species diversity occurs with increasing elevation for these sites (Figures E-4.7-7 to E-4.7-11). Because of this trend in diversity with elevation, the residuals from a linear regression of total plant species diversity versus elevation were also evaluated (Figures E-4.7-6, E-4.7-12, E-4.7-18, E-4.7-24, and E-4.7-30). Residuals are the difference between the number of species measured for a site and the predicted number of species based on elevation. Residuals may be either positive (more species than predicted for the elevation) or negative (fewer species than predicted for the elevation). No trends are evident in plant species diversity or the residuals in plant species diversity across a gradient of plant COPEC concentrations, which supports the conclusion that no adverse effect on diversity occurs as a result of COPECs in the investigation area.

E-4.8 *Chironomus tentans* Survival and Growth Versus Aquatic Community HQ

To evaluate the correlation of sediment COPEC concentrations and *Chironomus tentans* survival and growth results, scatter plots were prepared showing COPEC HQs on the x-axis and survival or growth on the y-axis (Figures E-4.8-1 through E-4.8-16). The COPECs plotted on the x-axis included sum(polycyclic aromatic hydrocarbons [PAHs]), sum(DDE and DDT [DDX]), plutonium-239,240, and total organic carbon. The HI and HI subset (without anthracene and metals) were also plotted on the x-axis. The sum of PAHs was selected because PAHs comprised the majority of the study design organic COPECs for the aquatic community (see Section 8.1.1) and these COPECs also contributed the majority of the HQ to the aquatic community HI (see supporting materials for Katzman 2002, 73667). DDT and metabolites were selected because they were the most frequently detected organic chemicals in these samples. The HI for the COPEC subset (without anthracene and metals) was calculated because the aquatic community ESLs for anthracene and some of the metals are low, and relatively small concentrations of these COPECs lead to large HQ and HI values. The contaminant load was also calculated (Henne and Rytı 2004, 85533) and plotted on the x-axis as a measure of contaminant concentrations independent of toxicity data. To calculate contaminant load, contaminant concentrations were standardized by dividing the concentration of individual compounds at each site by the average concentration of that compound for all sites. The standardized values for the different contaminants were then summed for each site to arrive at a contaminant load value.

Scatter plots are used to relate data for one variable (COPEC HQ values on the y-axis) versus data from a second variable (survival or growth on the x-axis). Results for reach LA-0 are plotted as an "*" that is highlighted because reach LA-0 had the highest concentrations of PAHs and is upstream of Laboratory effluent releases into Los Alamos Canyon. Results for reach P1-FW are plotted as an "x" that is highlighted because this location is upstream of Laboratory and Los Alamos County effluent releases in Pueblo Canyon. Results for reach AC-3 are plotted as a circle that is highlighted because reach AC-3 had the highest concentrations of Laboratory-associated COPECs (e.g., plutonium-239,240; see Section 7.1 for discussion of contaminant sources). An association or correlation between the two variables is indicated if the points on the scatter plot follow (approximately) a sloped straight line. No trends are evident, and thus no effects on *C. tentans* survival or growth results were found across a gradient of COPEC sediment concentrations. The plots illustrate that COPEC concentrations are low to intermediate for the reference location (LA-0 and P1-FW). These plots are adequate to conclude that no relationship exists between COPEC concentrations and toxicity to aquatic invertebrates.

E-5.0 HUMAN HEALTH RISK ASSESSMENT

The site-specific risk assessment in Section 8.2 evaluates five land use scenarios: trail user, extended backyard, residential, resource user, and construction worker. Scenario descriptions and results are presented in Section 8.2 for the scenarios that apply in the watershed. Resource user, residential, and construction worker scenarios are not realistic across the entire watershed, but the calculations have been performed and the results presented in this appendix to provide a context for and give support to comparisons of areas within the watershed.

The resource-user scenario assumes exposure to unfiltered surface water, and the residential scenario assumes exposure to filtered alluvial groundwater. Both unfiltered and filtered data, HIs, and HQs are presented in tables in Section E-5.3 to support comparisons to areas where the resource-user scenario applies. Additionally, arsenic is a key contributor to carcinogenic risks from water ingestion. Tables for the residential scenario and groundwater pathway are provided with and without arsenic as a COPC. These tables can be used to evaluate the risk consequences of the other COPCs.

The risk assessment approach used for this report was to calculate the risk-based concentration (RBC) and ratios of EPCs to RBCs. The ratios were then summed within the carcinogen, noncarcinogen, and radionuclide classes to generate an HI. The tables presented in Section 8.2 and in this appendix give the summed HIs with subsequent tables that provide the individual COPC contributions to those HIs. Calculations were performed separately for sediments and water. Where water sampling locations are proximate to sediment reaches, the HIs are combined to provide a multimedia HIs. Many of the water sampling locations appear multiple times in the multimedia tables because they are matched to more than one sediment reach.

Section E.5-1 presents the equations used for the risk calculations, except for radionuclides in sediment. Section E.5-2 presents the approach to using RESRAD for radionuclide dose and risk calculations for sediments. Section E.5-3 is a series of tables that document the exposure parameters, toxicity values, and the results for supplemental exposure scenarios that are not presented in Section 8.2.

E-5.1 Equations for RBCs

An RBC represents the concentration of a chemical or radionuclide in an exposure medium that will not pose unacceptable human health impacts under site-specific exposure conditions. The equations for calculating RBCs for chemical carcinogens and noncarcinogens are derived from basic equations that contain parameters addressing toxicity and exposure intensity.

The basic equation for calculating an RBC for a chemical carcinogen is

$$RBC = \frac{TR \times AT \times BW}{CR \times SF \times EF \times ED} \quad \text{Equation 1}$$

where RBC = chemical concentration in exposure medium (e.g., mg/kg soil),

TR = target incremental cancer risk (e.g., 1×10^{-5}),

AT = time over which exposure is averaged for experiencing adverse effects (d),

BW = body weight (kg),

CR = contact rate (e.g., mg soil/d for soil ingestion),

SF = chemical-specific slope factor (mg/kg body weight/d)⁻¹,

EF = exposure frequency (d/yr), and

ED = exposure duration (yr).

For a noncarcinogen, the basic equation for calculation of an RBC is

$$RBC = \frac{HQ \times RfD \times AT \times BW}{CR \times EF \times ED} \quad \text{Equation 2}$$

where RBC = chemical concentration in exposure medium (e.g., mg/kg soil),

HQ = target hazard quotient (e.g., 1),

RfD = chemical-specific reference dose (mg/kg body weight/d),

AT = time over which exposure is averaged for experiencing adverse effects (d),

BW = body weight (kg),

CR = contact rate (e.g., mg soil/d for soil ingestion),

EF = exposure frequency (d/yr), and

ED = exposure duration (yr).

RBCs for individual radionuclides in soil were calculated using RESRAD, Version 6.21. The RESRAD computer code was developed by Argonne National Laboratory for the DOE and is prescribed in DOE Order 5400.5, "Radiation Protection of the Public and the Environment" for evaluating radioactively contaminated sites. Section 5.1.3 describes how RBCs for exposure to radionuclides in water were calculated.

The RBCs for each individual exposure pathway are combined to calculate an RBC for each COPC and individual exposure scenario as the inverse of the sum of the reciprocals. For example, for a scenario having two exposure pathways

$$RBC_s = \frac{1}{\frac{1}{P_1} + \frac{1}{P_2}} \quad \text{Equation 3}$$

where RBC_s = site-specific risk criterion for scenario "s,"

P₁ = RBC for exposure pathway 1, and

P₂ = RBC for exposure pathway 2.

Additive effects across two or more exposure media for a given exposure scenario are calculated in the following manner:

$$MMS = \frac{C_1}{RBC_1} + \frac{C_2}{RBC_2} \quad \text{Equation 4}$$

where MMS = multimedia sum,

C₁ = COPC concentration in exposure medium 1,

C₂ = COPC concentration in exposure medium 2,

RBC₁ = RBC for exposure medium 1, and

RBC₂ = RBC for exposure medium 2.

E-5.1.1 Chemical Hazard

Chemical hazard for an individual chemical is defined by the HQ, which is calculated as the ratio of the exposure level to a single chemical (i) to the toxicity reference dose for that chemical. Separate calculations are performed for adult and child receptors for incidental soil ingestion, dust inhalation, and dermal absorption exposure pathways, using the input parameters provided in Table E-5.3-1, and the larger of the result of the adult or child calculations is used in the risk assessment. In almost all cases, the calculated health effects correspond to a smaller risk criterion for the child receptor because of the smaller body size. Calculations for plant and meat ingestion pathways pertain to a general population of both adults and children because the ingestion rate information is based on survey data across all ages.

Soil Ingestion

$$RBC_{s,i} = \frac{HQ \times RfD_{ing,i} \times AT_{nc} \times BW}{IR_s \times EF \times ED \times 10^{-6} \text{ kg/mg}} \quad \text{Equation 5}$$

where $RBC_{s,i}$ = site-specific risk criterion for contaminant i in soil (mg/kg soil),

HQ = target hazard quotient,

IR_s = soil ingestion rate (mg of soil/d),

EF = exposure frequency (d/y),

ED = exposure duration (y),

BW = body weight (kg),

AT_{nc} = averaging time for noncarcinogenic effects (d), and

$RfD_{ing,i}$ = ingestion reference dose, contaminant i (mg/kg-d).

Dust Inhalation

$$RBC_{s,i} = \frac{HQ \times RfD_{inh,i} \times AT_{nc} \times BW \times PEF}{Inh \times ET \times EF \times ED} \quad \text{Equation 6}$$

where $RBC_{s,i}$ = site-specific risk criterion for contaminant i in soil (mg/kg soil),

HQ = target hazard quotient,

Inh = inhalation rate (m^3/h),

ET = exposure time (h/d),

EF = exposure frequency (d/y),

ED = exposure duration (y),

PEF = particulate emission factor (m^3/kg),

BW = body weight (kg),

AT_{nc} = averaging time for noncarcinogenic effects (d), and

$RfD_{inh,i}$ = inhalation reference dose, contaminant i (mg/kg-d).

When the particulate emission factor is calculated,

$$PEF = \frac{Q}{C} \times \frac{3600 \text{ sec/hr}}{0.036 \times (1 - V) \times (U_m / U_{1.7})^3 \times F(x)} \quad \text{Equation 7}$$

where PEF = particulate emission factor ($1 \times 10^7 \text{ m}^3/\text{kg}$),

Q/C = inverse of the mean concentration at the center of a 30-acre square source ($46.84 \text{ g/m}^2\text{-s}$ per kg/m^3),

V = fraction of vegetative cover (0.1),

U_m = mean annual windspeed (3 m/s),

$U_{1.7}$ = equivalent threshold value of windspeed at 7m (4.124 m/s), and

$F(x)$ = function dependent on $U_m/U_{1.7}$ (1.31).

and

$$U_{1.7} = U_t / 0.4 \times \ln(Z/Z_0) \quad \text{Equation 8}$$

where U_t = threshold friction velocity (0.625 m/s),

Z = height above surface (700 cm), and

Z_0 = surface roughness height (50 cm).

Dermal Absorption from Soil

$$RBC_{s,i} = \frac{HQ \times (RfD_{ing,i} \times GI_{abs,i}) \times AT_{nc} \times BW}{SA \times AF \times ABS_i \times EF \times ED \times 10^{-6} \text{ kg/mg}} \quad \text{Equation 9}$$

where $RBC_{s,i}$ = site-specific risk criterion for contaminant i in soil (mg/kg soil),

HQ = target hazard quotient,

SA = exposed surface area (cm^2),

AF = adherence factor ($\text{mg/cm}^2\text{-d}$),

ABS_i = skin absorption factor, contaminant i (unitless),

EF = exposure frequency (d/y),

ED = exposure duration (y),

BW = body weight (kg),

AT_{nc} = averaging time for noncarcinogenic effects (d),

$RfD_{ing,i}$ = ingestion reference dose, contaminant i (mg/kg-d), and

$GI_{abs,i}$ = gastrointestinal absorption fraction, contaminant i (unitless).

Plant Ingestion

$$RBC_{s,i} = \frac{HQ \times RfD_{ing,i} \times AT_{nc}}{(IR_{veg} \times CvF_v \times fract_{veg} + IR_{fruit} \times CvF_f \times fract_{fruit}) \times K_{p-s,i} \times \left(\frac{depth_{cz}}{depth_{root}} \right) \times EF_{plant} \times ED \times 10^{-3} \text{ g/kg}}$$

Equation 10

where $RBC_{s,i}$ = site-specific risk criterion for contaminant i in soil (mg/kg soil),

HQ = target hazard quotient,

$K_{p-s,i}$ = plant to soil concentration ratio for produce, contaminant i (mg/kg dry plant per mg/kg soil),

IR_{veg} = ingestion rate of vegetables; wet weight (g/kg-d),

$Fract_{veg}$ = fraction of vegetables in diet from site,

CvF_v = dry-to-wet weight conversion factor for vegetables,

IR_{fruit} = ingestion rate of fruits; wet weight (g/kg-d),

$Fract_{fruit}$ = fraction of fruit in diet from site,

CvF_f = dry-to-wet weight conversion factor for fruits,

$Depth_{cz}$ = depth of soil contamination,

$Depth_{root}$ = rooting depth of plants,

EF_{plant} = exposure frequency for plant ingestion pathway (d/y),

ED = exposure duration (y),

AT_{nc} = averaging time for noncarcinogenic effects (d), and

$RfD_{ing,i}$ = ingestion reference dose, contaminant i (mg/kg-d).

Meat Ingestion

$$RBC_{s,i} = \frac{HQ \times RfD_{ing,i} \times AT_{nc}}{IR_{meat} \times fract_{meat} \times fract_{range} \times EF_{meat} \times ED \times [TF_{meat} \times (UR_{fodder} \times CvF_{fod} \times K_{f-s,i} + UR_{soil})] \times 10^{-3} \text{ g/kg}}$$

Equation 11

where $RBC_{s,i}$ = site-specific risk criterion for contaminant i in soil (mg/kg soil),

HQ = target hazard quotient,

IR_{meat} = ingestion rate of meat; wet weight (g/kg-d),

$Fract_{meat}$ = fraction of meat in diet from site,

$Fract_{range}$ = fraction of animal foraging range represented by site,

TF_{meat} = soil-to-meat transfer factor (mg/kg_{meat} per mg/d),

UR_{fodder} = uptake rate of fodder by animal (kg/d),

CvF_{fod} = dry-to-wet weight conversion factor for fodder,

$K_{f-s,i}$ = plant to soil concentration ratio for fodder, contaminant i (mg/kg dry plant per mg/kg soil),

UR_{soil} = uptake rate of soil by animal during foraging (kg/d),

EF_{meat} = exposure frequency for meat ingestion pathway (d/y),

ED = exposure duration (y),

AT_nc = averaging time for noncarcinogenic effects (d), and

RfD_{ing,i} = ingestion reference dose, contaminant i (mg/kg-d).

Water Ingestion

Although the equation is provided with groundwater parameters, the equation is identical for surface water exposure:

$$RBC_{w,i} = \frac{HQ \times RfD_{ing,i} \times AT_{gw_nc} \times BW_{gw}}{GWIng \times EF_{gw} \times ED_{gw}} \quad \text{Equation 12}$$

where RBC_{w,i} = site-specific risk criterion for contaminant i in water (mg/L water),

HQ = target hazard quotient,

GWIng = water ingestion rate (L of water/d),

EF_{gw} = exposure frequency (d/y),

ED_{gw} = exposure duration (y),

BW_{gw} = body weight (kg),

AT_{gw_nc} = averaging time for noncarcinogenic effects (d), and

RfD_{ing,i} = ingestion reference dose, contaminant i (mg/kg-d).

Dermal Absorption from Water, Inorganic Chemicals

Although the equation is provided with groundwater parameters, the equation is identical for surface water exposure:

$$RBC_{w,i} = \frac{HQ \times (RfD_{ing,i} \times GI_{abs}) \times AT_{gw_nc} \times BW_{gw}}{SA_{gw} \times Kp_i \times ET_{gw} \times EF_{gw} \times ED_{gw} \times 0.001 \text{ L/cm}^3} \quad \text{Equation 13}$$

where RBC_{w,i} = site-specific risk criterion for contaminant i in water (mg/L water),

HQ = target hazard quotient,

SA_{gw} = skin surface area exposed to water (cm²),

Kp_i = skin permeability coefficient for contaminant i in water (cm/hr),

ET_{gw} = exposure time to groundwater (hr/d),

EF_{gw} = exposure frequency (d/y),

ED_{gw} = exposure duration (y),

BW_{gw} = body weight (kg),

AT_{gw_nc} = averaging time for noncarcinogenic effects (d),

RfD_{ing,i} = ingestion reference dose, contaminant i (mg/kg-d), and

GI_{abs,i} = gastrointestinal absorption fraction, contaminant i (unitless).

Dermal Absorption from Water, Organic Chemicals

Although the equation is provided with groundwater parameters, the equation is identical for surface water exposure:

$$RBC_{w,i} = \frac{HQ \times (RfD_{ing,i} \times GI_{abs}) \times AT_{gw_nc} \times BW_{gw}}{2 \times F_{abs,i} \times Kp_i \times SA_{gw} \times 0.001 \text{ L/cm}^3 \times \sqrt{\frac{6 \times T_{event,i} \times ET_{gw}}{\pi}} \times EF_{gw} \times ED_{gw}} \quad \text{Equation 14}$$

where $RBC_{w,i}$ = site-specific risk criterion for contaminant i in water (mg/L water),

HQ = target hazard quotient,

$F_{abs,i}$ = fraction absorbed for contaminant i in water,

Kp_i = skin permeability coefficient for contaminant i in water (cm/hr),

SA_{gw} = skin surface area exposed to water (cm²),

$T_{event,i}$ = absorption lag time for contaminant i in water (hr/event),

ET_{gw} = exposure time (hr/event),

EF_{gw} = exposure frequency (events/y),

ED_{gw} = exposure duration (y),

BW_{gw} = body weight (kg),

AT_{gw_nc} = averaging time for noncarcinogenic effects (d), and

$RfD_{ing,i}$ = ingestion reference dose, contaminant i (mg/kg-d).

E-5.1.2 Incremental Cancer Risk

Cancer risk for an individual chemical is defined by the incremental cancer risk (ICR), which is calculated as the product of exposure to a single chemical (i) and the cancer slope factor for that chemical. Lifetime cancer risk is considered to be additive over time; therefore, exposures during childhood and adulthood are summed to calculate the ICR. As with the HQ calculations, the plant and meat ingestion pathways pertain to a general population of both adults and children because the ingestion rate information is based on survey data across all ages.

Soil Ingestion

$$RBC_{s,i} = \frac{AT_{canc} \times TR}{\left[(IR_{s,a} \times EF_a \times ED_a / BW_a) + (IR_{s,c} \times EF_c \times ED_c / BW_c) \right] \times SF_{ing,i} \times 10^{-6} \text{ kg/mg}} \quad \text{Equation 15}$$

where $RBC_{s,i}$ = site-specific risk criterion for contaminant i in soil (mg/kg soil),

TR = target incremental cancer risk,

$IR_{s,c}$ = child soil ingestion rate (mg of soil/d),

EF_c = child exposure frequency (d/y),

ED_c = child exposure duration (y),

BW_c = child body weight (kg),

$IR_{s,a}$ = adult soil ingestion rate (mg of soil/d),

EF_a = adult exposure frequency (d/y),
 ED_a = adult exposure duration (y),
 BW_a = adult body weight (kg),
 $SF_{ing,i}$ = ingestion slope factor, contaminant i (mg/kg-d)⁻¹, and
 AT_{carc} = averaging time for carcinogenic effects (d).

Dust Inhalation

$$RBC_{s,i} = \frac{AT_{carc} \times PEF \times TR}{[(Inh_a \times ET_a \times EF_a \times ED_a / BW_a) + (Inh_c \times ET_c \times EF_c \times ED_c / BW_c)] \times SF_{inh,i}} \quad \text{Equation 16}$$

where $RBC_{s,i}$ = site-specific risk criterion for contaminant i in soil (mg/kg soil),

TR = target incremental cancer risk,
 Inh_c = child inhalation rate (m³/h),
 ET_c = child exposure time (h/d),
 EF_c = child exposure frequency (d/y),
 ED_c = child exposure duration (y),
 BW_c = child body weight (kg),
 Inh_a = adult inhalation rate (m³/h),
 ET_a = adult exposure time (h/d),
 EF_a = adult exposure frequency (d/y),
 ED_a = adult exposure duration (y),
 BW_a = adult body weight (kg),
 PEF = particulate emission factor (m³/kg) (see Equation 8),
 $SF_{inh,i}$ = slope factor for inhalation, contaminant i (mg/kg-d)⁻¹, and
 AT_{carc} = averaging time for carcinogenic effects (d).

Dermal Absorption from Soil

$$RBC_{s,i} = \frac{AT_{carc} \times TR}{[(SA_a \times AF_a \times EF_a \times ED_a / BW_a) + (SA_c \times AF_c \times EF_c \times ED_c / BW_c)] \times (SF_{ing,i} / GI_{abs,i}) \times ABS_i \times 10^{-6} \text{ kg/mg}} \quad \text{Equation 17}$$

where $RBC_{s,i}$ = site-specific risk criterion for contaminant i in soil (mg/kg soil),

TR = target incremental cancer risk,
 SA_c = child exposed surface area (cm²),
 EF_c = child exposure frequency (d/y),
 AF_c = child adherence factor (mg/cm²-d),
 ED_c = child exposure duration (y),
 BW_c = child body weight (kg),

SA_a = adult exposed surface area (cm^2),
 EF_a = adult exposure frequency (d/y),
 AF_a = adult adherence factor (mg/cm^2 -d),
 ED_a = adult exposure duration (y),
 BW_a = adult body weight (kg),
 ABS_i = skin absorption factor, contaminant i (unitless),
 $SF_{ing,i}$ = ingestion slope factor, contaminant i (mg/kg -d) $^{-1}$,
 $GI_{abs,i}$ = gastrointestinal absorption fraction, contaminant i (unitless), and
 AT_{carc} = averaging time for carcinogenic effects (d).

Plant Ingestion

$$RBC_{s,i} = \frac{TR \times AT_{carc}}{(IR_{veg} \times CvF_v \times fract_{veg} + IR_{fruit} \times CvF_f \times fract_{fruit}) \times K_{p-s,i} \times \left(\frac{depth_{cz}}{depth_{root}} \right) \times EF_{plant} \times ED \times SF_{ing,i} \times 10^{-3} \text{ g/kg}}$$

Equation 18

where $RBC_{s,i}$ = site-specific risk criterion for contaminant i in soil (mg/kg soil),

TR = target incremental cancer risk,

$K_{p-s,i}$ = plant to soil concentration ratio for produce, contaminant i (mg/kg dry plant per mg/kg soil),

IR_{veg} = ingestion rate of vegetables; wet weight (g/kg-d),

$Fract_{veg}$ = fraction of vegetables in diet from site,

CvF_v = dry-to-wet weight conversion factor for vegetables,

IR_{fruit} = ingestion rate of fruits; wet weight (g/kg-d),

$Fract_{fruit}$ = fraction of fruit in diet from site,

CvF_f = dry-to-wet weight conversion factor for fruits,

$Depth_{cz}$ = depth of soil contamination,

$Depth_{root}$ = rooting depth of plants,

EF_{plant} = exposure frequency for plant ingestion pathway (d/y),

ED = exposure duration (y),

AT_{carc} = averaging time for carcinogenic effects (d), and

$SF_{ing,i}$ = ingestion slope factor, contaminant i (mg/kg -d) $^{-1}$.

Meat Ingestion

$$RBC_{s,i} = \frac{TR \times AT_{carc}}{IR_{meat} \times fract_{meat} \times fract_{range} \times EF_{meat} \times ED \times [TF_{meat} \times (UR_{fodder} \times CvF_{fod} \times K_{f-s,i} + UR_{soil})] \times SF_{ing,i} \times 10^{-3} \text{ g/kg}}$$

Equation 19

where $RBC_{s,i}$ = site-specific risk criterion for contaminant i in soil (mg/kg soil),

TR = target incremental cancer risk,

IR_meat = ingestion rate of meat; wet weight (g/kg-d),
 Fract_meat = fraction of meat in diet from site,
 Fract_range = fraction of animal foraging range represented by site,
 TF_meat = soil-to-meat transfer factor (mg/kg_{meat} per mg/d),
 UR_fodder = uptake rate of fodder by animal (kg/d),
 CvF_{fod} = dry-to-wet weight conversion factor for fodder,
 K_{r-s,i} = plant to soil concentration ratio for fodder, contaminant i (mg/kg dry plant per mg/kg soil),
 UR_soil = uptake rate of soil by animal during foraging (kg/d),
 EF_meat = exposure frequency for meat ingestion pathway (d/y),
 ED = exposure duration (y),
 AT_carc = averaging time for carcinogenic effects (d), and
 SF_{ing,i} = ingestion slope factor, contaminant i (mg/kg-d)⁻¹.

Water Ingestion

Although the equation is provided with groundwater parameters, the equation is identical for surface water exposure:

$$RBC_{w,i} = \frac{TR \times AT_{gw_carc}}{\left[(GWIng_a \times EF_{a_gw} \times ED_{a_gw} / BW_{a_gw}) + (GWIng_c \times EF_{c_gw} \times ED_{c_gw} / BW_{c_gw}) \right] \times SF_{ing,i}}$$

Equation 20

where RBC_{w,i} = site-specific risk criterion for contaminant i in water (mg/L water),
 TR = target incremental cancer risk,
 GWIng_a = adult water ingestion rate (L of water/d),
 EF_{a_gw} = adult exposure frequency (d/y),
 ED_{a_gw} = adult exposure duration (y),
 BW_{a_gw} = adult body weight (kg),
 GWIng_c = child water ingestion rate (L of water/d),
 EF_{c_gw} = child exposure frequency (d/y),
 ED_{c_gw} = child exposure duration (y),
 BW_{c_gw} = child body weight (kg),
 AT_{gw_carc} = averaging time for carcinogenic effects (d), and
 SF_{ing,i} = ingestion slope factor, contaminant i (mg/kg-d)⁻¹.

Dermal Absorption from Water, Inorganic Chemicals

Although the equation is provided with groundwater parameters, the equation is identical for surface water exposure:

$$RBC_{w,i} = \frac{TR \times AT_{gw_canc}}{\left[(SA_{a_gw} \times ET_{a_gw} \times EF_{a_gw} \times ED_{a_gw} / BW_{a_gw}) + (SA_{c_gw} \times ET_{c_gw} \times EF_{c_gw} \times ED_{c_gw} / BW_{c_gw}) \right] \times Kp_i \times 0.001 \text{ L/cm}^3 \times (SF_{ing,i} / GI_{abs,i})}$$

Equation 21

where $RBC_{w,i}$ = site-specific risk criterion for contaminant i in water (mg/L water),

TR = target incremental cancer risk,

SA_{a_gw} = adult skin surface area exposed to water (cm^2),

ET_{a_gw} = adult exposure time to groundwater (hr/d),

EF_{a_gw} = adult exposure frequency (d/y),

ED_{a_gw} = adult exposure duration (y),

BW_{a_gw} = adult body weight (kg),

SA_{c_gw} = child skin surface area exposed to water (cm^2),

ET_{c_gw} = child exposure time to groundwater (hr/d),

EF_{c_gw} = child exposure frequency (d/y),

ED_{c_gw} = child exposure duration (y),

BW_{c_gw} = child body weight (kg),

Kp_i = skin permeability coefficient for contaminant i in water (cm/hr),

AT_{gw_canc} = averaging time for carcinogenic effects (d),

$SF_{ing,i}$ = ingestion slope factor, contaminant i (mg/kg-d^{-1}),

Dermal Absorption from Water, Organic Chemicals

Although the equation is provided with groundwater parameters, the equation is identical for surface water exposure:

$$RBC_{w,i} = \frac{TR \times AT_{gw_canc}}{A \times [B + C]}$$

Equation 22

where $A = 2 \times F_{abs,i} \times Kp_i \times 0.001 \text{ L/cm}^3 \times (SF_{ing,i} / GI_{abs,i})$

$$B = \left(\sqrt{\frac{6 \times T_{event,i} \times ET_{a_gw}}{\pi}} \times SA_{a_gw} \times EF_{a_gw} \times ED_{a_gw} / BW_{a_gw} \right)$$

$$C = \left(\sqrt{\frac{6 \times T_{event,i} \times ET_{c_gw}}{\pi}} \times SA_{c_gw} \times EF_{c_gw} \times ED_{c_gw} / BW_{c_gw} \right)$$

where $RBC_{w,i}$ = site-specific risk criterion for contaminant i in water (mg/L water),

TR = target incremental cancer risk,

AT_{gw_nc} = averaging time for noncarcinogenic effects (d),
 $RfD_{ing,i}$ = ingestion reference dose, contaminant i (mg/kg-d),
 BW_{gw} = body weight (kg),
 $F_{abs,i}$ = fraction absorbed for contaminant i in water,
 Kp_i = skin permeability coefficient for contaminant i in water (cm/hr),
 SA_{gw} = skin surface area exposed to water (cm²),
 $T_{event,i}$ = absorption lag time for contaminant i in water (hr/event),
 ET_{gw} = exposure time (hr/event),
 EF_{gw} = exposure frequency (events/y), and
 ED_{gw} = exposure duration (y).

E-5.1.3 Radiation Dose

The radiation dose associated with the EPA dose conversion factors used in the calculations in this investigation report is the annual committed effective dose equivalent (internal) or annual effective dose equivalent (external), expressed in units of millirems per year (mrem/yr). The dose is calculated as the product of the exposure level to a single radionuclide (i) and the dose conversion factor for that radionuclide. Although the dose-conversion factors apply to adults and not children, exposure parameters for children were used in the calculations if a higher rate of exposure resulted. This calculation is analogous to selecting the smaller of the RBCs for child or adult for calculating the HQ, as discussed above. As with the HQ and ICR calculations, values of produce and meat ingestion rates pertain to a general population of both adults and children because the ingestion rate information is based on survey data across all ages. Consistent with EPA guidance (EPA 1989, 8021), dose via dermal absorption is not quantified since it is probably negligible compared with the other exposure pathways. Radiation dose pertaining to exposure to radionuclides in soil were calculated with the RESRAD computer code. For exposure to radionuclides in water, the Equation 23 was employed to calculate an RBC.

Water Ingestion

$$RBC_{w,i} = \frac{DL}{GW_{ing} \times EF \times DCF_{ing,i}} \quad \text{Equation 23}$$

where $RBC_{w,i}$ = site-specific risk criterion for contaminant i in water (pCi/L water),
 DL = target dose limit (mrem/y),
 GW_{ing} = water ingestion rate (L of water/d),
 EF_{gw} = exposure frequency (d/y), and
 $DCF_{ing,i}$ = dose conversion factor for ingestion, contaminant i (mrem/pCi).

E.5-2 RESRAD Results

RESRAD runs are carried out to 1000 years. The minimum soil screening level within the 1000-yr time period is tabulated, consistent with protocol for calculating radionuclide SALs (LANL 2001, 69683). Soil screening levels are recorded with two significant figures. The radiation dose limit is 15 mrem/yr.

The following RESRAD input parameters are varied to differentiate the exposure scenarios: inhalation rate, mass loading for inhalation, indoor time fraction, outdoor time fraction, fruit/vegetable/grain consumption rate, fraction of contaminated produce grown on-site, meat and poultry consumption, fraction of contaminated meat grown on-site, and soil ingestion rate.

The RESRAD input values for the nine parameters described above are consistent with the analogous parameter values used in the nonradiological hazard and risk assessment. When necessary, values were processed to accommodate differences in units (i.e., mg soil ingested per day versus grams soil ingested per year). Site soil ingestion rates were also modified to protectively assume that more soil ingestion occurred on-site than would be the case if soil ingestion were simply pro-rated by the fraction of time spent on-site. Certain RESRAD exposure rate variables are predicated on the site area, while nonradiological calculations do not take the site area into account; therefore, using identical exposure values will not necessarily ensure parity in the radiological and nonradiological exposure models.

The evapotranspiration rate is set to the maximum of 0.999 (per radionuclide SAL protocol) to maximize retention of radionuclides in the contaminated zone. Los Alamos values for wind speed (3 m/s) and annual precipitation (0.476 m/yr) are used to calculate radionuclide SAL values. It is assumed that the contaminated zone has no cover, and the contaminated zone erosion rate is set to zero. The dose reduction factor for indoor exposure to gamma radiation is 0.7 (LANL 2001, 69683), but indoor dust is assumed to have the same contaminant concentrations as ambient soil. Contaminated zone parameters for area and thickness are set at RESRAD default values of 10,000 m² and 2 m, respectively. Hydrogeologic parameters for the saturated zone and unsaturated zone are also set at RESRAD default values, but these values are not pertinent to calculating the soil screening levels because aquatic food ingestion and drinking water pathways are not activated in the scenario and because irrigation and contaminated water fractions are set at zero when applicable to a scenario.

E-5.3 Risk Equation Parameters and Ancillary Risk Results

The first five tables in this section provide the exposure scenario parameters and toxicity values for noncarcinogens, carcinogens, and radionuclides. The next two tables list the exposure scenario RBCs for sediments and water. The remaining tables present risk assessment results that are ancillary to the those presented in Section 8.2. Specifically, construction worker, resource user, and residential land-use scenarios are applied to all reaches and water sampling locations in the watershed. As described in Section 8.2, these scenarios are not feasible for many of these locations because of topographic constraints or present-day land-use restrictions. The residential scenario results can be used for standardized comparisons to other assessments, and the construction worker and resource user results can be used for comparisons to areas where those scenarios are applicable.

E-6.0 REFERENCES

The following list includes all documents cited in this report. Parenthetical information following each reference provides the author, publication date, and ER ID number. This information is also included in text citations. ER ID numbers are assigned by the RRES-RS Records Processing Facility (RPF) and are used to locate the document at the RPF and, where applicable, in the RRES-RS project reference set titled "Reference Set for Canyons Investigations."

Copies of the reference sets are maintained at the NMED Hazardous Waste Bureau; the DOE Los Alamos Site Office; US Environmental Protection Agency, Region 6; and RRES-RS project. The sets were developed to ensure that the administrative authority has all material needed to review this document, and they are updated periodically as needed. Documents previously submitted to the administrative authority are not included.

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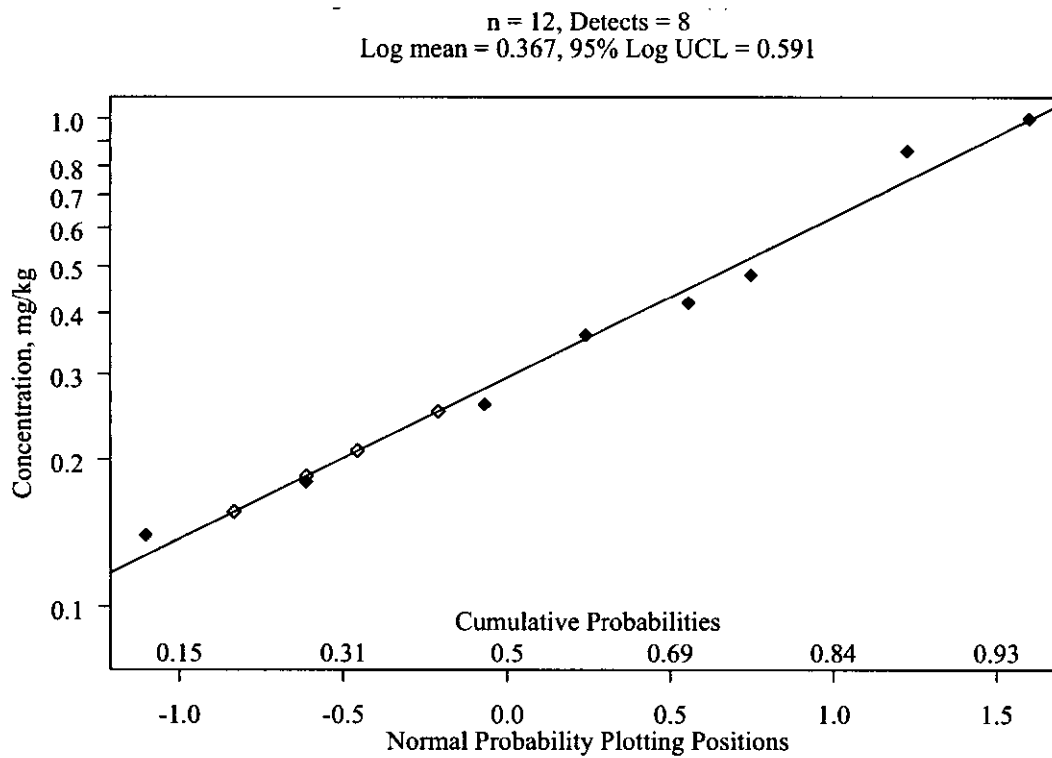


Figure E-2.1-1. DP-2 sediment—benzo(b)fluoranthene

a. Area weights are equal

4 pCi/g weight = 0.25	7 pCi/g weight = 0.25
9 pCi/g weight = 0.25	15 pCi/g weight = 0.25

$$\text{Average} = (4 \times 0.25) + (7 \times 0.25) + (9 \times 0.25) + (15 \times 0.25)$$

$$\text{Average} = 8.75$$

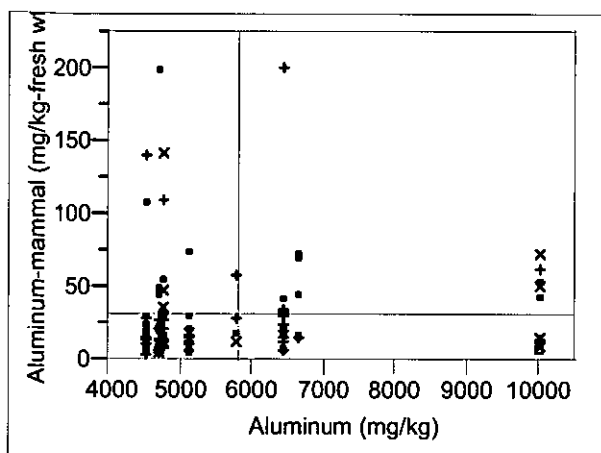
b. Area weights are unequal

4 pCi/g weight = 0.5	7 pCi/g weight = 0.25	
	9 pCi/g weight = 0.125	15 pCi/g weight = 0.125

$$\text{Average} = (4 \times 0.5) + (7 \times 0.25) + (9 \times 0.125) + (15 \times 0.125)$$

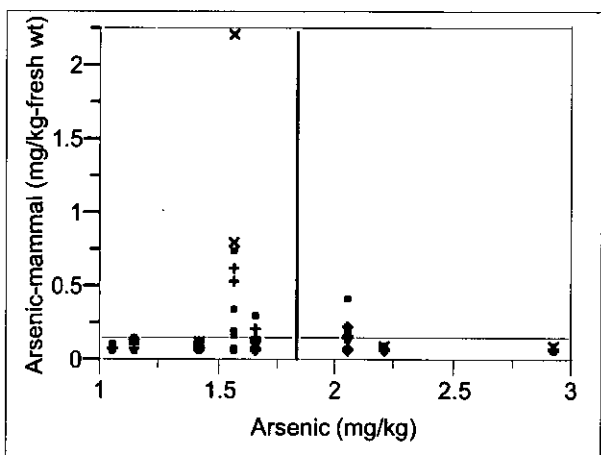
$$\text{Average} = 6.75$$

Figure E-2.2-1. Area-weighted averages



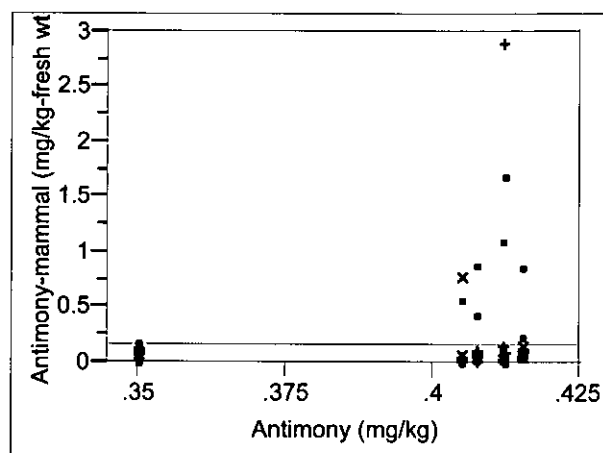
Notes: ■ = brush mouse, + = deer mouse, x = piñon mouse,
□ = western harvest mouse.

Figure E-4.1-1. Scatter plot of aluminum concentrations in small mammals (fresh weight) versus sediment concentrations



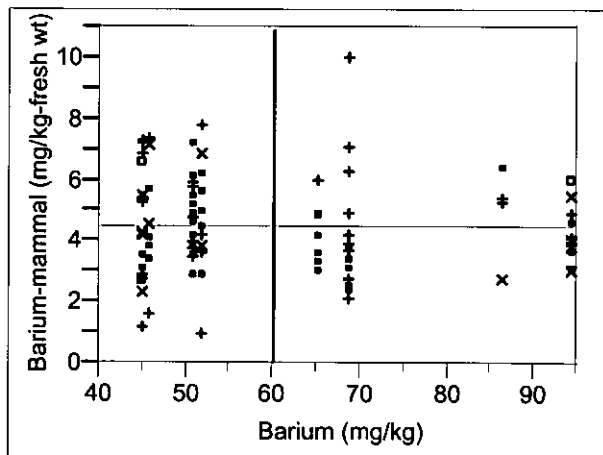
Notes: ■ = brush mouse, + = deer mouse, x = piñon mouse,
□ = western harvest mouse.

Figure E-4.1-3. Scatter plot of arsenic concentrations in small mammals (fresh weight) versus sediment concentrations



Notes: ■ = brush mouse, + = deer mouse, x = piñon mouse,
□ = western harvest mouse.

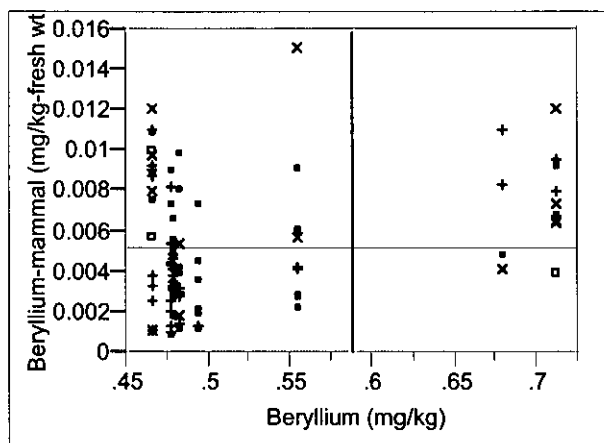
Figure E-4.1-2. Scatter plot of antimony concentrations in small mammals (fresh weight) versus sediment concentrations



Notes: ■ = brush mouse, + = deer mouse, x = piñon mouse,
□ = western harvest mouse.

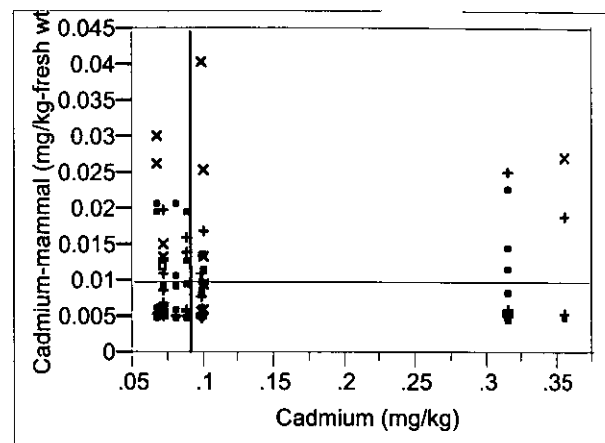
Figure E-4.1-4. Scatter plot of barium concentrations in small mammals (fresh weight) versus sediment concentrations

April 2004



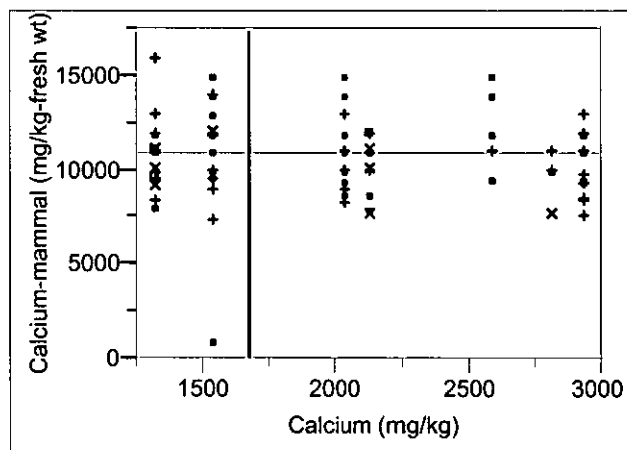
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Figure E-4.1-5. Scatter plot of beryllium concentrations in small mammals (fresh weight) versus sediment concentrations



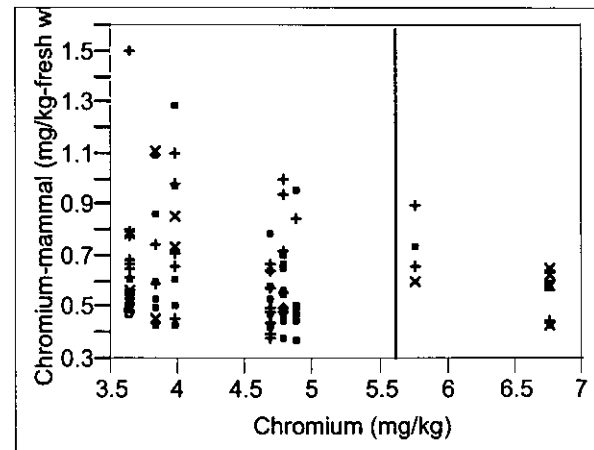
Notes: ■ = brush mouse, + = deer mouse, x = piñon mouse, □ = western harvest mouse.

Figure E-4.1-6. Scatter plot of cadmium concentrations in small mammals (fresh weight) versus sediment concentrations



Notes: ■ = brush mouse, + = deer mouse, x = piñon mouse, □ = western harvest mouse.

Figure E-4.1-7. Scatter plot of calcium concentrations in small mammals (fresh weight) versus sediment concentrations

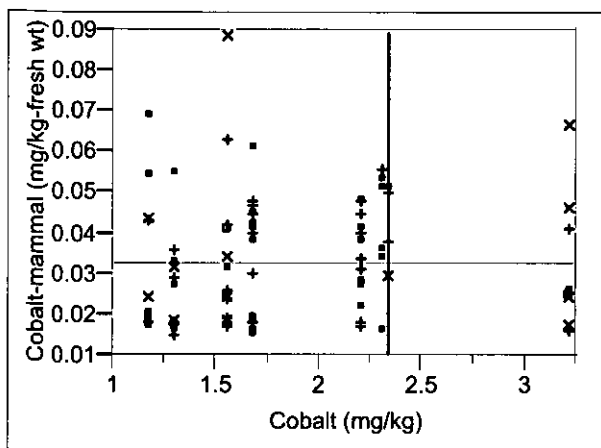


Notes: ■ = brush mouse, + = deer mouse, x = piñon mouse, □ = western harvest mouse.

Figure E-4.1-8. Scatter plot of chromium concentrations in small mammals (fresh weight) versus sediment concentrations

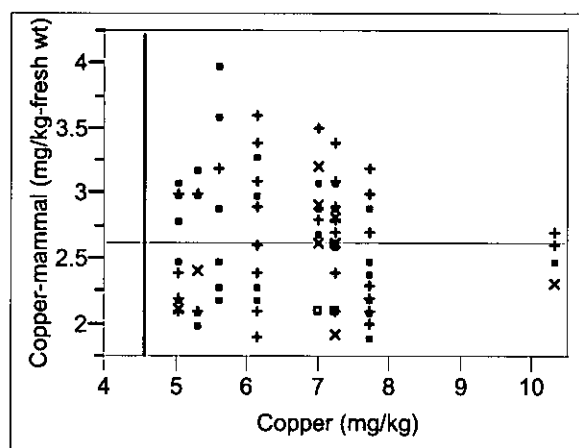
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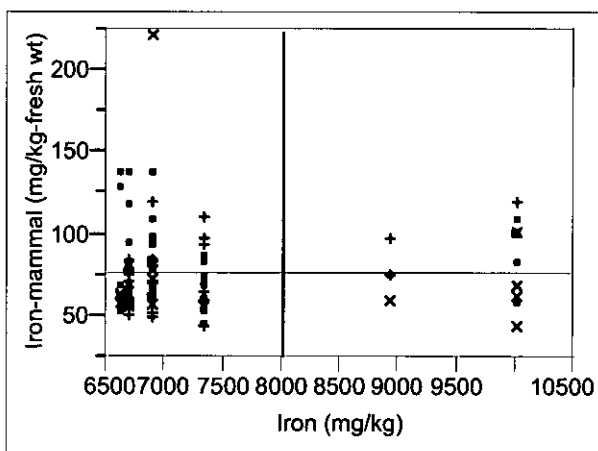
Notes: ■ = brush mouse, + = deer mouse, x = piñon mouse,
□ = western harvest mouse.

Figure E-4.1-9. Scatter plot of cobalt concentrations in small mammals (fresh weight) versus sediment concentrations



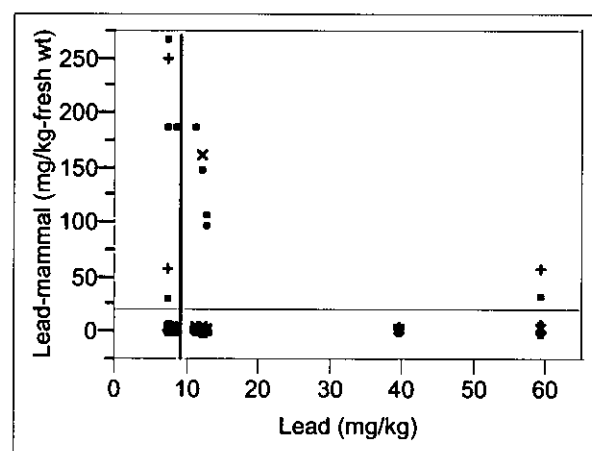
Notes: ■ = brush mouse, + = deer mouse, x = piñon mouse,
□ = western harvest mouse.

Figure E-4.1-10. Scatter plot of copper concentrations in small mammals (fresh weight) versus sediment concentrations



Notes: ■ = brush mouse, + = deer mouse, x = piñon mouse,
□ = western harvest mouse.

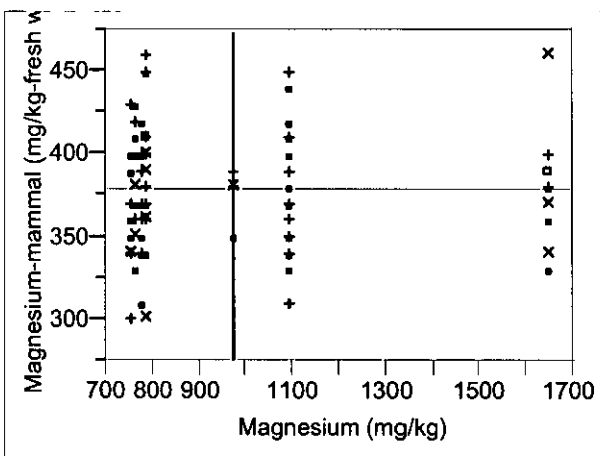
Figure E-4.1-11. Scatter plot of iron concentrations in small mammals (fresh weight) versus sediment concentrations



Notes: ■ = brush mouse, + = deer mouse, x = piñon mouse,
□ = western harvest mouse.

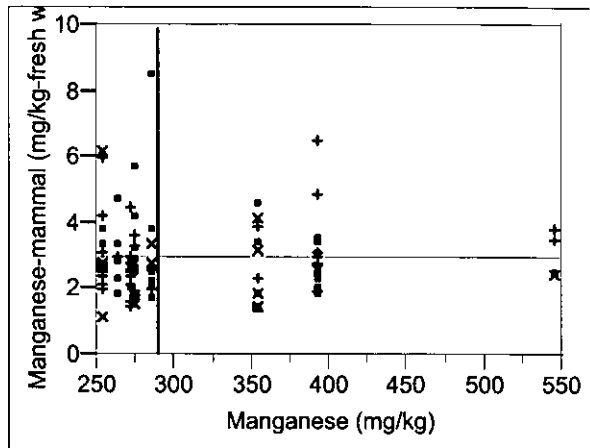
Figure E-4.1-12. Scatter plot of lead concentrations in small mammals (fresh weight) versus sediment concentrations

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Notes: ■ = brush mouse, + = deer mouse, x = piñon mouse, □ = western harvest mouse.

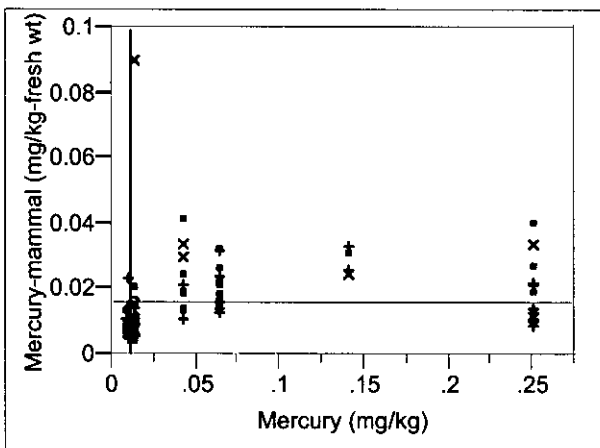
Figure E-4.1-13. Scatter plot of magnesium concentrations in small mammals (fresh weight) versus sediment concentrations



Notes: ■ = brush mouse, + = deer mouse, x = piñon mouse, □ = western harvest mouse.

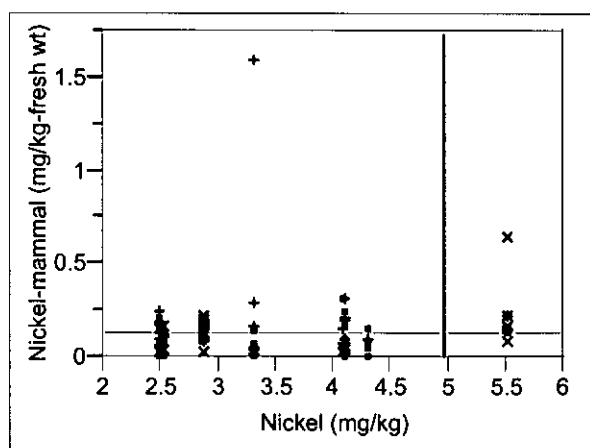
Figure E-4.1-14. Scatter plot of manganese concentrations in small mammals (fresh weight) versus sediment concentrations

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Notes: ■ = brush mouse, + = deer mouse, x = piñon mouse, □ = western harvest mouse.

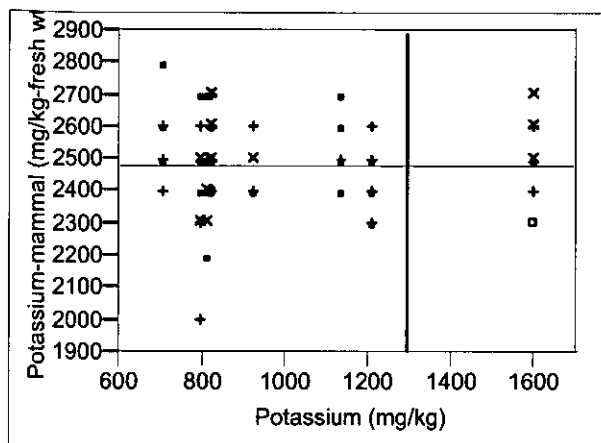
Figure E-4.1-15. Scatter plot of mercury concentrations in small mammals (fresh weight) versus sediment concentrations



Notes: ■ = brush mouse, + = deer mouse, x = piñon mouse, □ = western harvest mouse.

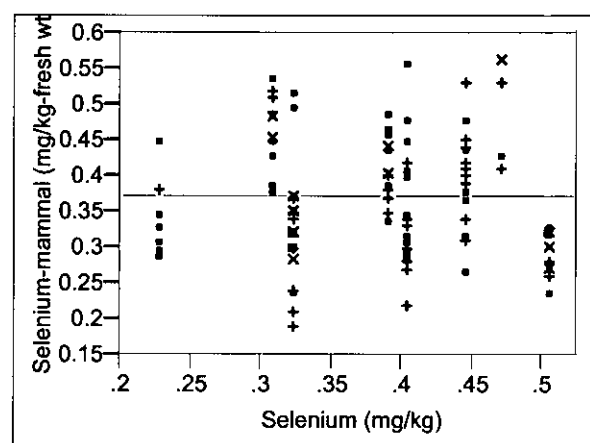
Figure E-4.1-16. Scatter plot of nickel concentrations in small mammals (fresh weight) versus sediment concentrations

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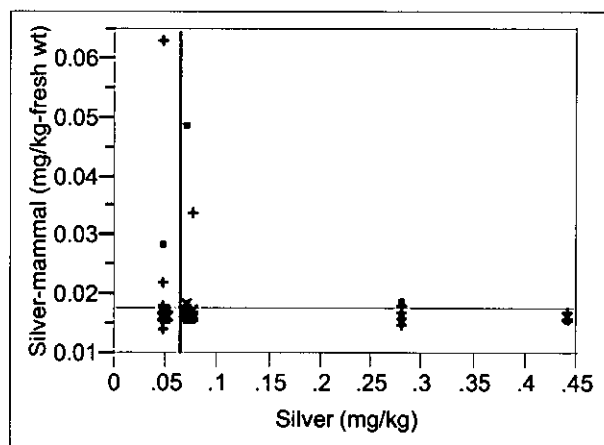
Notes: ■ = brush mouse, + = deer mouse, x = piñon mouse, □ = western harvest mouse.

Figure E-4.1-17. Scatter plot of potassium concentrations in small mammals (fresh weight) versus sediment concentrations



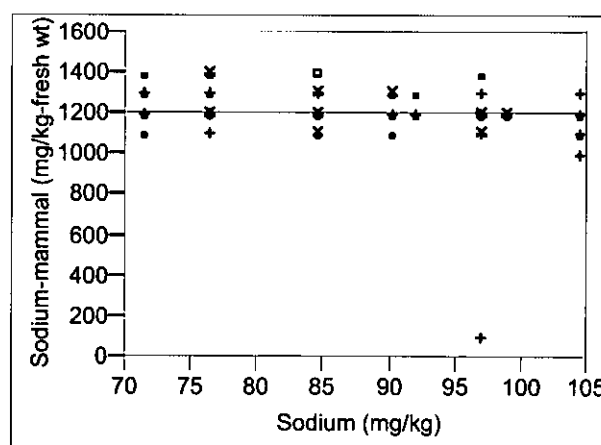
Notes: ■ = brush mouse, + = deer mouse, x = piñon mouse, □ = western harvest mouse.

Figure E-4.1-18. Scatter plot of selenium concentrations in small mammals (fresh weight) versus sediment concentrations



Notes: ■ = brush mouse, + = deer mouse, x = piñon mouse, □ = western harvest mouse.

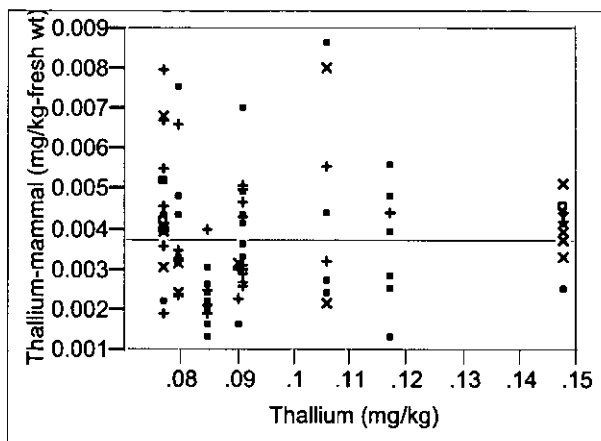
Figure E-4.1-19. Scatter plot of silver concentrations in small mammals (fresh weight) versus sediment concentrations



Notes: ■ = brush mouse, + = deer mouse, x = piñon mouse, □ = western harvest mouse.

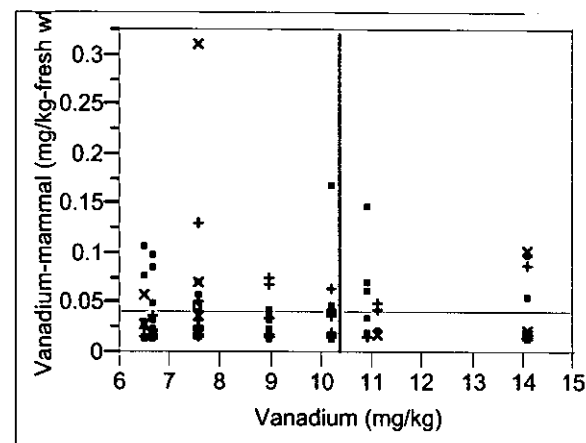
Figure E-4.1-20. Scatter plot of sodium concentrations in small mammals (fresh weight) versus sediment concentrations

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Notes: ■ = brush mouse, + = deer mouse, x = piñon mouse, □ = western harvest mouse.

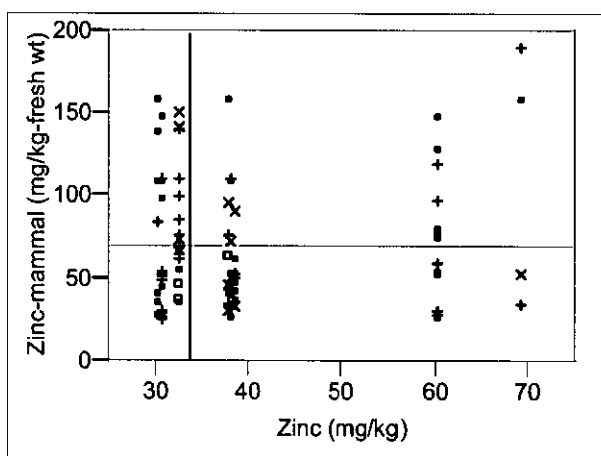
Figure E-4.1-21. Scatter plot of thallium concentrations in small mammals (fresh weight) versus sediment concentrations



Notes: ■ = brush mouse, + = deer mouse, x = piñon mouse, □ = western harvest mouse.

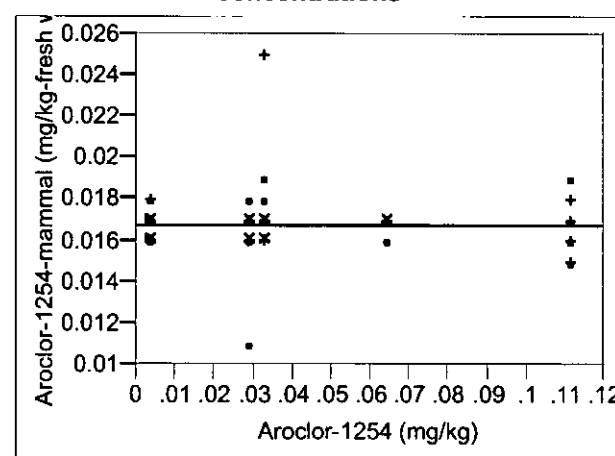
Figure E-4.1-22. Scatter plot of vanadium concentrations in small mammals (fresh weight) versus sediment concentrations

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Notes: ■ = brush mouse, + = deer mouse, x = piñon mouse, □ = western harvest mouse.

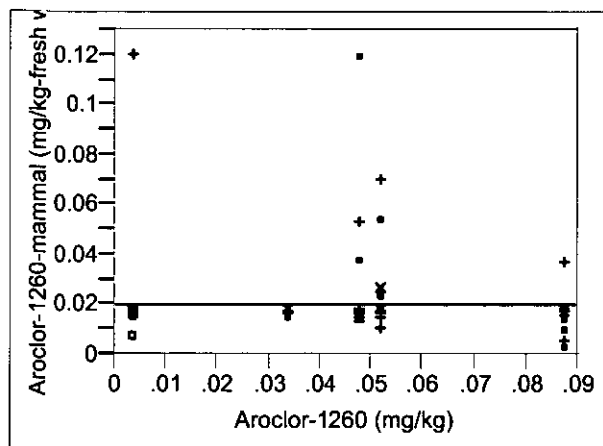
Figure E-4.1-23. Scatter plot of zinc concentrations in small mammals (fresh weight) versus sediment concentrations



Notes: ■ = brush mouse, + = deer mouse, x = piñon mouse, □ = western harvest mouse.

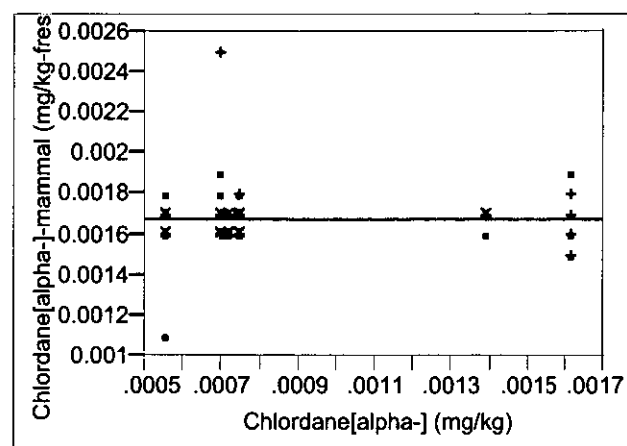
Figure E-4.1-24. Scatter plot of Aroclor-1254 concentrations in small mammals (fresh weight) versus sediment concentrations

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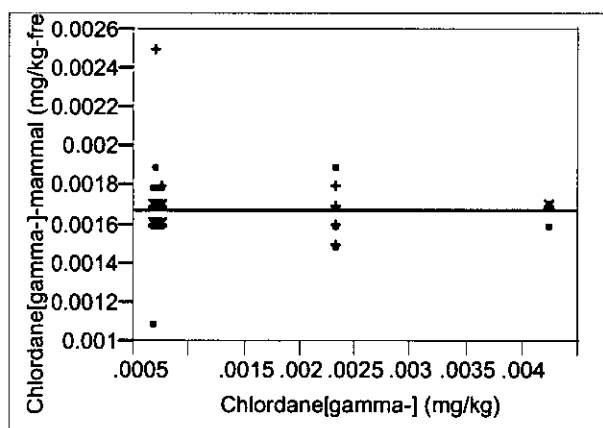
Notes: ■ = brush mouse, + = deer mouse, x = piñon mouse, □ = western harvest mouse.

Figure E-4.1-25. Scatter plot of Aroclor-1260 concentrations in small mammals (fresh weight) versus sediment concentrations



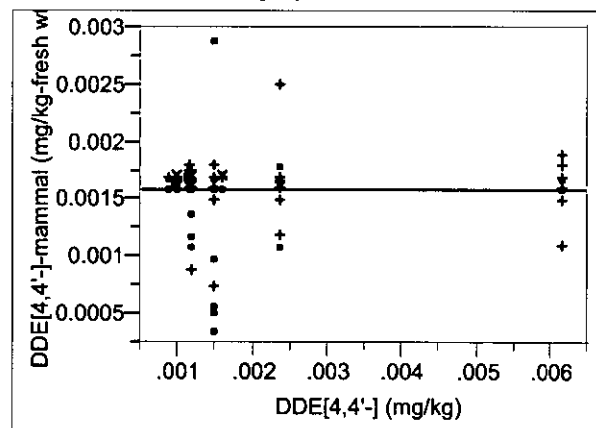
Notes: ■ = brush mouse, + = deer mouse, x = piñon mouse, □ = western harvest mouse.

Figure E-4.1-26. Scatter plot of Chlordane[alpha-] concentrations in small mammals (fresh weight) versus sediment concentrations



Notes: ■ = brush mouse, + = deer mouse, x = piñon mouse, □ = western harvest mouse.

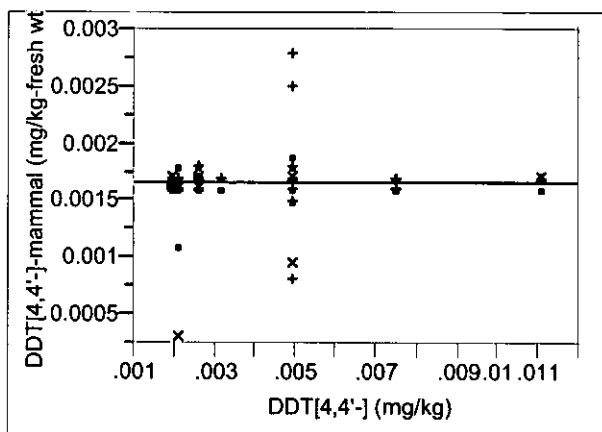
Figure E-4.1-27. Scatter plot of Chlordane[gamma-] concentrations in small mammals (fresh weight) versus sediment concentrations



Notes: ■ = brush mouse, + = deer mouse, x = piñon mouse, □ = western harvest mouse.

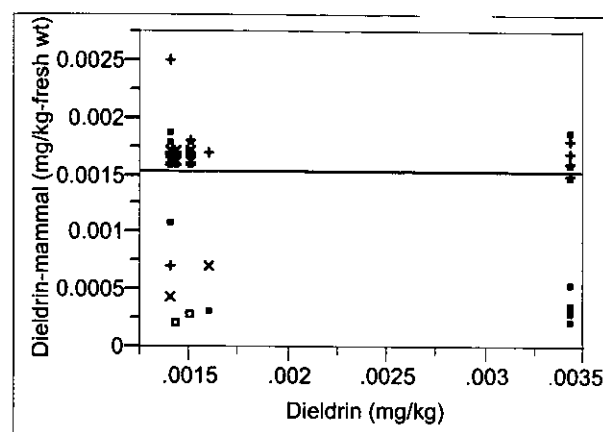
Figure E-4.1-28. Scatter plot of DDE[4,4'-] concentrations in small mammals (fresh weight) versus sediment concentrations

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Notes: ■ = brush mouse, + = deer mouse, x = piñon mouse, □ = western harvest mouse.

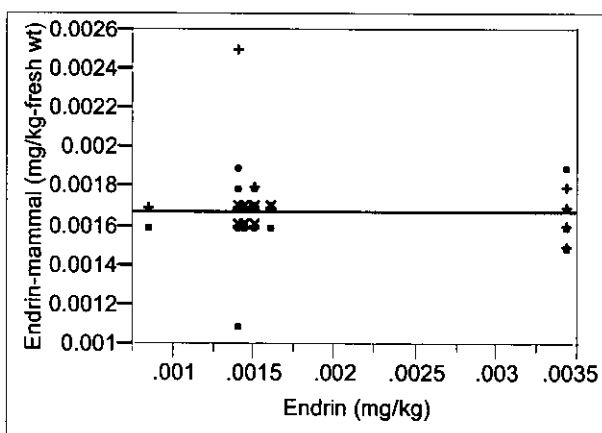
Figure E-4.1-29. Scatter plot of DDT[4,4'-] concentrations in small mammals (fresh weight) versus sediment concentrations



Notes: ■ = brush mouse, + = deer mouse, x = piñon mouse, □ = western harvest mouse.

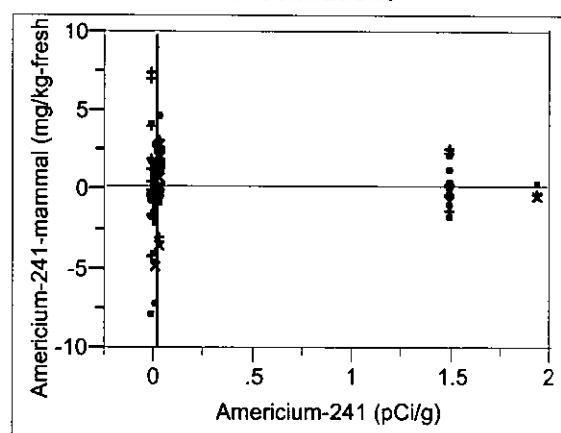
Figure E-4.1-30. Scatter plot of Dieldrin concentrations in small mammals (fresh weight) versus sediment concentrations

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Notes: ■ = brush mouse, + = deer mouse, x = piñon mouse, □ = western harvest mouse.

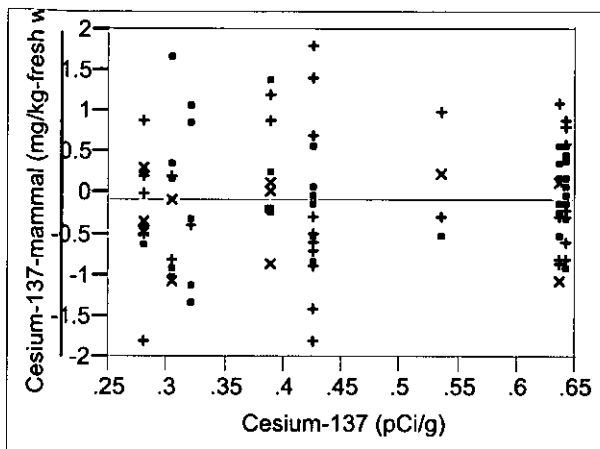
Figure E-4.1-31. Scatter plot of Endrin concentrations in small mammals (fresh weight) versus sediment concentrations



Notes: ■ = brush mouse, + = deer mouse, x = piñon mouse, □ = western harvest mouse.

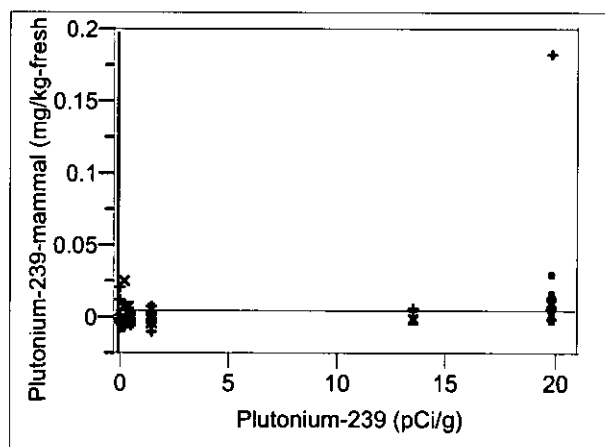
Figure E-4.1-32. Scatter plot of americium-241 concentrations in small mammals (fresh weight) versus sediment concentrations

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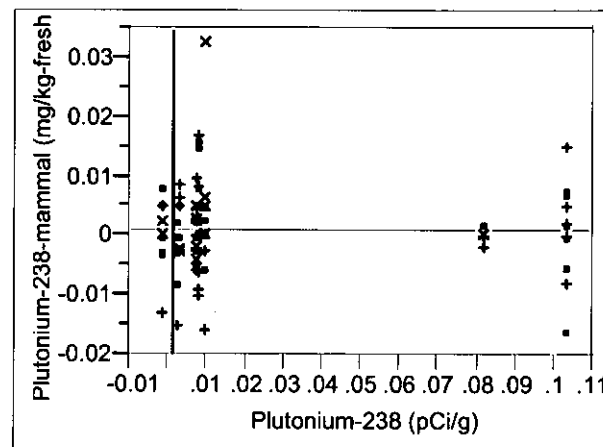
Notes: ■ = brush mouse, + = deer mouse, x = piñon mouse,
□ = western harvest mouse.

Figure E-4.1-33. Scatter plot of cesium-137 concentrations in small mammals (fresh weight) versus sediment concentrations



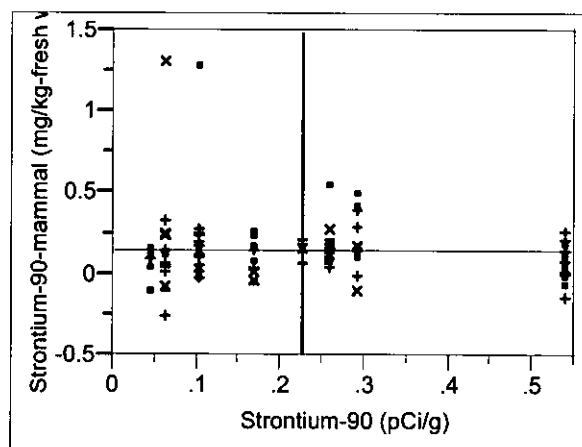
Notes: ■ = brush mouse, + = deer mouse, x = piñon mouse,
□ = western harvest mouse.

Figure E-4.1-35. Scatter plot of plutonium-239 concentrations in small mammals (fresh weight) versus sediment concentrations



Notes: ■ = brush mouse, + = deer mouse, x = piñon mouse,
□ = western harvest mouse.

Figure E-4.1-34. Scatter plot of plutonium-238 concentrations in small mammals (fresh weight) versus sediment concentrations



Notes: ■ = brush mouse, + = deer mouse, x = piñon mouse,
□ = western harvest mouse.

Figure E-4.1-36. Scatter plot of strontium-90 concentrations in small mammals (fresh weight) versus sediment concentrations

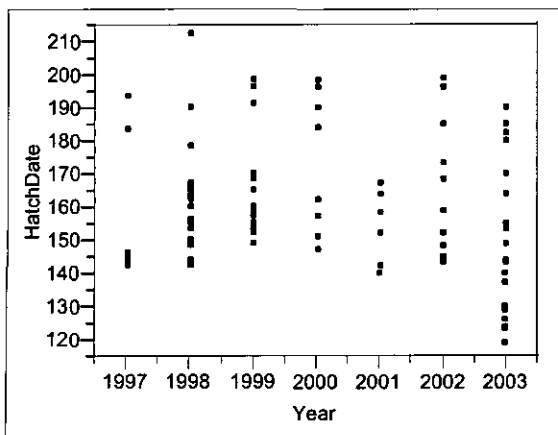


Figure E-4.2-1. Scatter plot of hatch date versus year for western bluebirds in Los Alamos/Pueblo Canyons

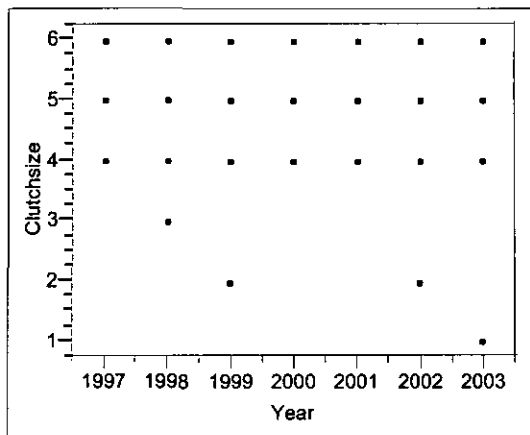


Figure E-4.2-2. Scatter plot of clutch size versus year for western bluebirds in Los Alamos/Pueblo Canyons

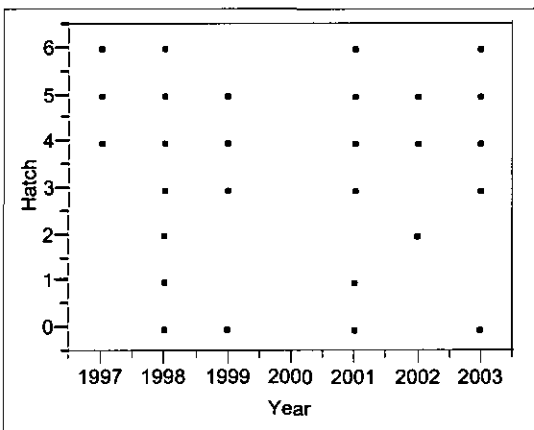


Figure E-4.2-3. Scatter plot of hatch number versus year for western bluebirds in Los Alamos/Pueblo Canyons

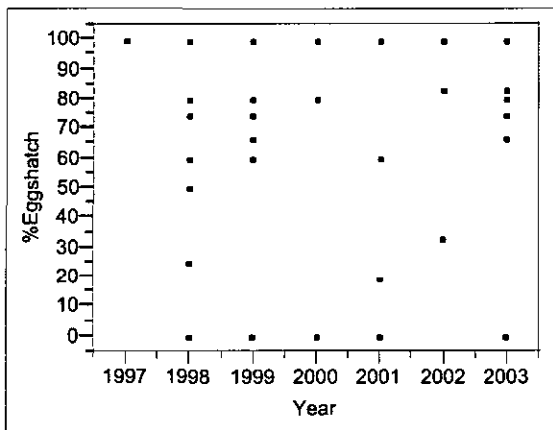


Figure E-4.2-4. Scatter plot of % eggs hatch versus year for western bluebirds in Los Alamos/Pueblo Canyons

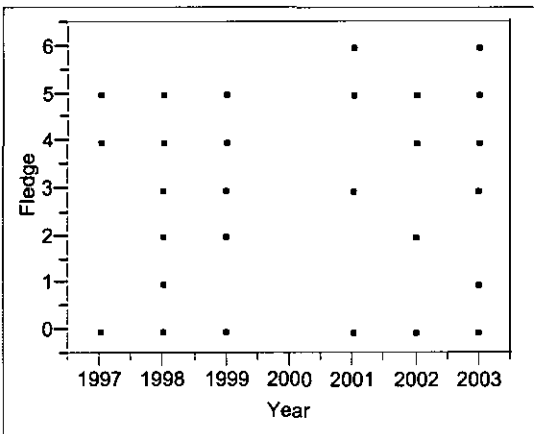


Figure E-4.2-5. Scatter plot of fledge number versus year for western bluebirds in Los Alamos/Pueblo Canyons

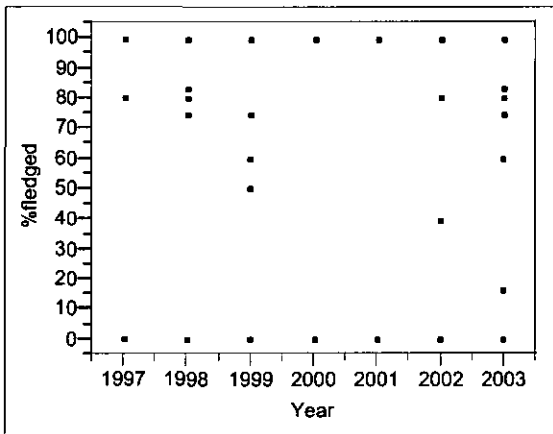


Figure E-4.2-6. Scatter plot of % fledged versus year for western bluebirds in Los Alamos/Pueblo Canyons

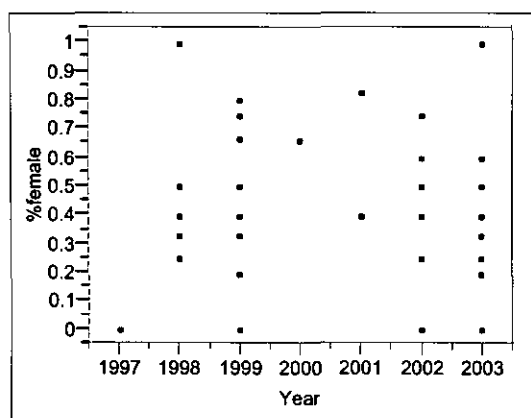


Figure E-4.2-7. Scatter plot of % female fledglings versus year for western bluebirds in Los Alamos/Pueblo Canyons

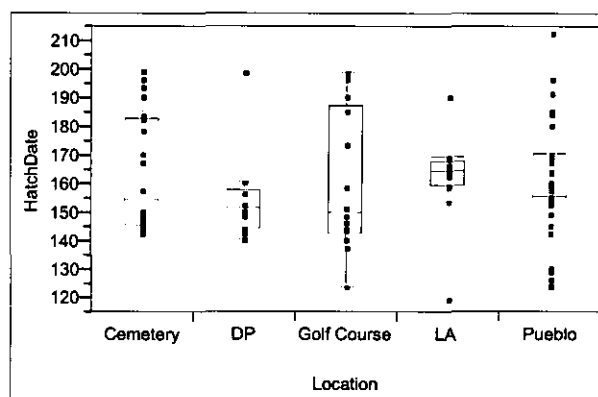


Figure E-4.2-8. Box plot of hatch date versus location groups for western bluebirds in Los Alamos/Pueblo Canyons

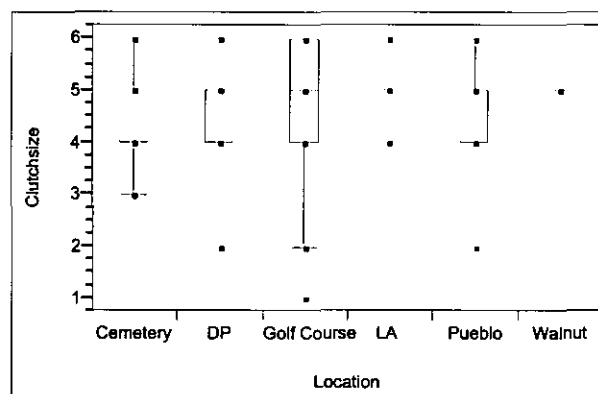


Figure E-4.2-9. Box plot of clutch size versus location groups for western bluebirds in Los Alamos/Pueblo Canyons

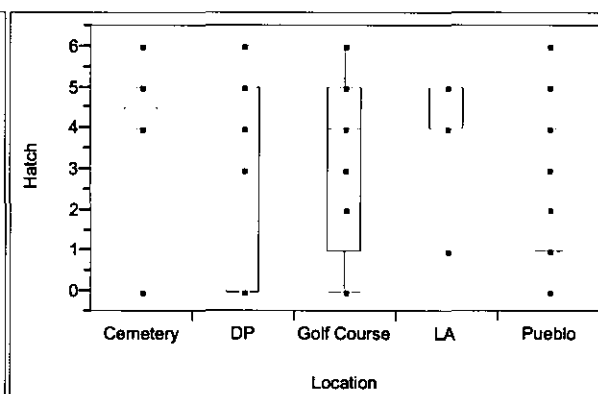


Figure E-4.2-10. Box plot of hatch number versus location groups for western bluebirds in Los Alamos/Pueblo Canyons

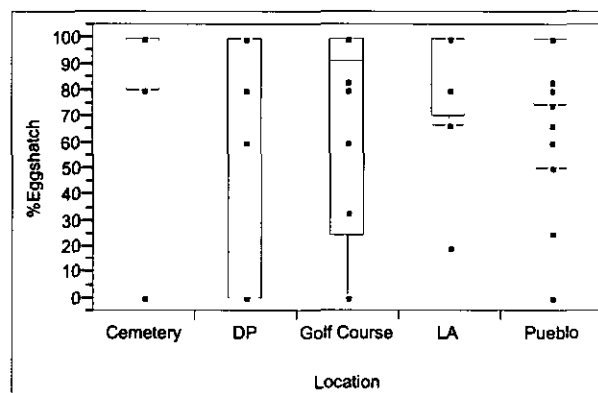


Figure E-4.2-11. Box plot of % eggs hatch versus location groups for western bluebirds in Los Alamos/Pueblo Canyons

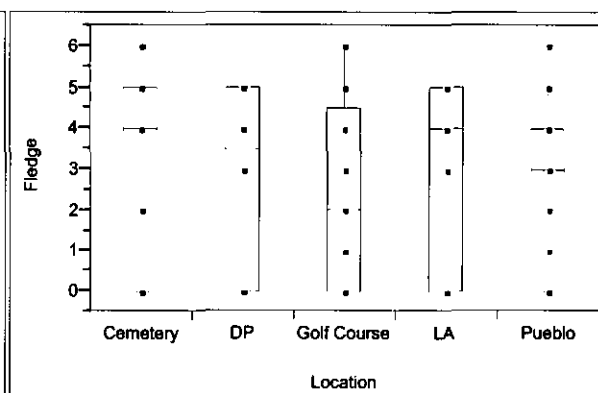


Figure E-4.2-12. Box plot of fledge number versus location groups for western bluebirds in Los Alamos/Pueblo Canyons

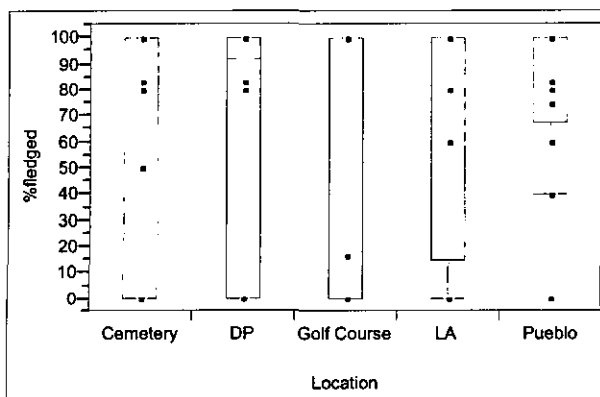


Figure E-4.2-13. Box plot of % fledged versus location groups for western bluebirds in Los Alamos/Pueblo Canyons

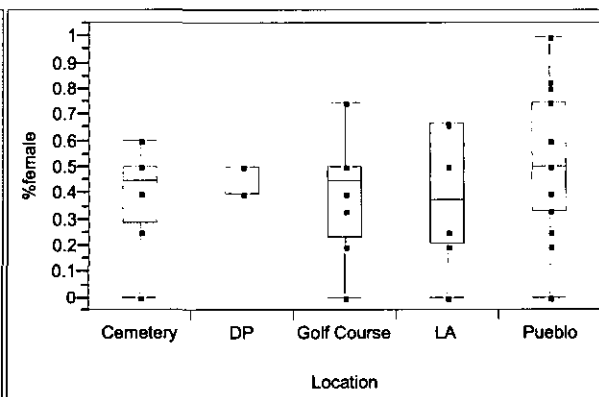


Figure E-4.2-14. Box plot of % female fledglings versus location groups for western bluebirds in Los Alamos/Pueblo Canyons

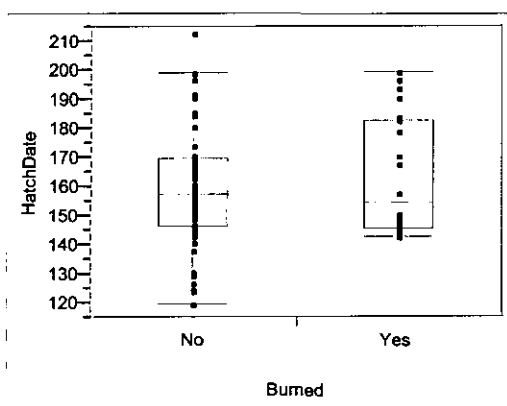


Figure E-4.2-15. Box plot of hatch date versus burned groups for western bluebirds in Los Alamos/Pueblo Canyons

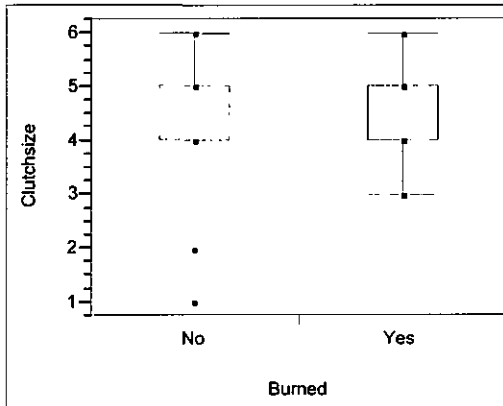


Figure E-4.2-16. Box plot of clutch size versus burned groups for western bluebirds in Los Alamos/Pueblo Canyons

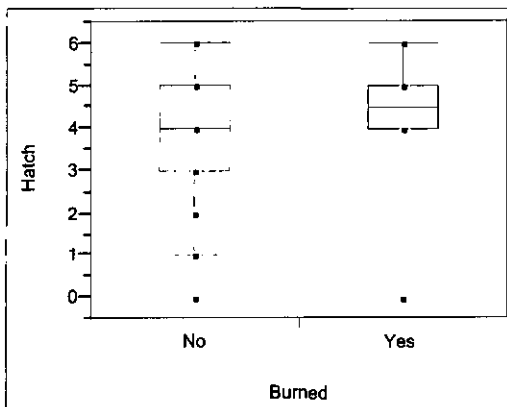


Figure E-4.2-17. Box plot of hatch number versus burned groups for western bluebirds in Los Alamos/Pueblo Canyons

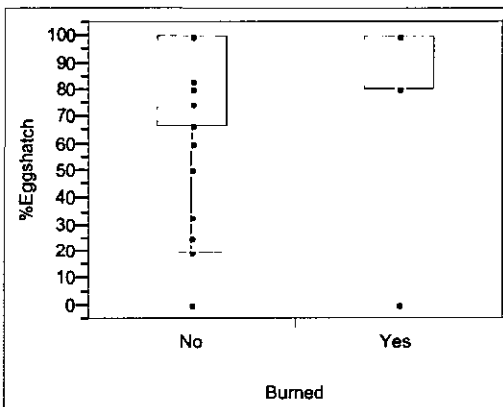


Figure E-4.2-18. Box plot of % eggs hatch versus burned groups for western bluebirds in Los Alamos/Pueblo Canyons

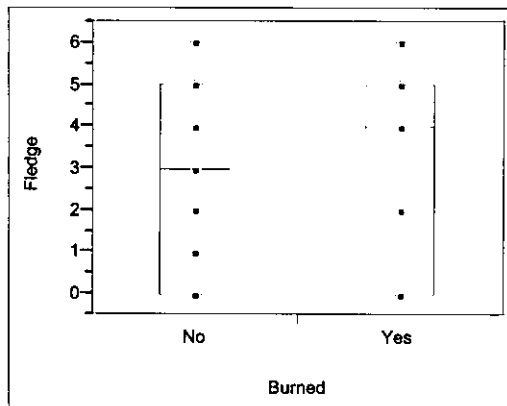


Figure E-4.2-19. Box plot of fledge number versus burned groups for western bluebirds in Los Alamos/Pueblo Canyons

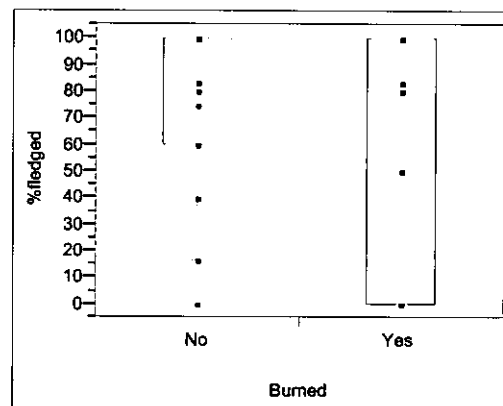


Figure E-4.2-20. Box plot of % fledged versus burned groups for western bluebirds in Los Alamos/Pueblo Canyons

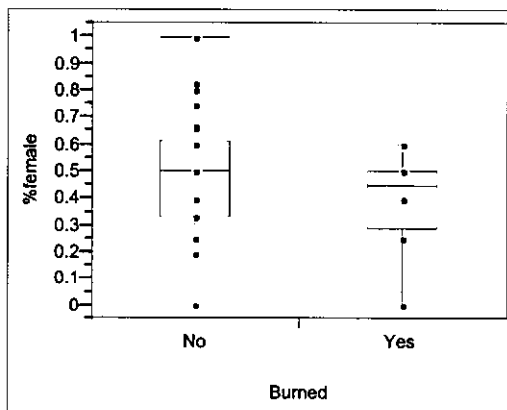


Figure E-4.2-21. Box plot of % female fledglings versus burned groups for western bluebirds in Los Alamos/Pueblo Canyons

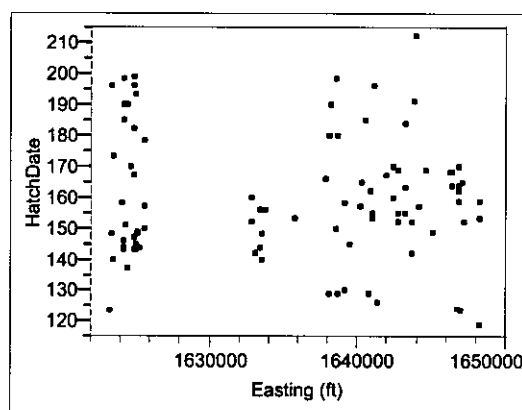


Figure E-4.2-22. Scatter plot of hatch date versus easting (ft) for western bluebirds in Los Alamos/Pueblo Canyons

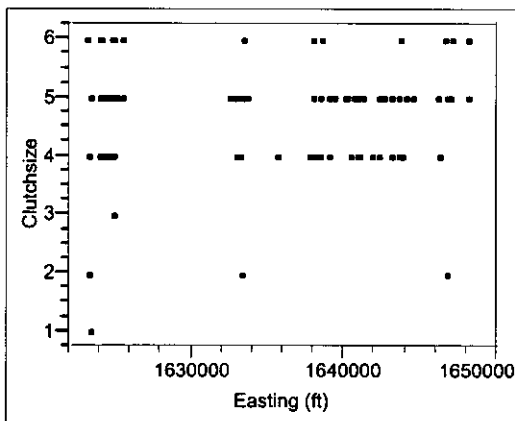


Figure E-4.2-23. Scatter plot of clutch size versus easting (ft) for western bluebirds in Los Alamos/Pueblo Canyons

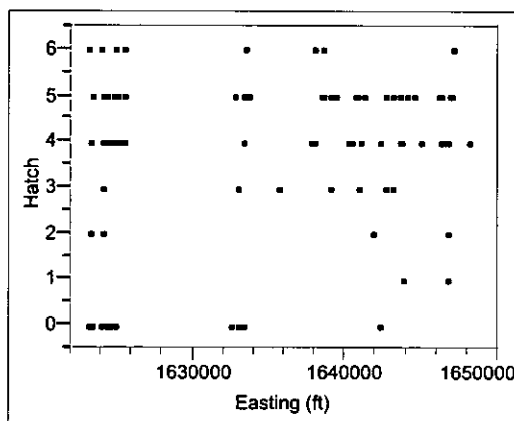


Figure E-4.2-24. Scatter plot of hatch number versus easting (ft) for western bluebirds in Los Alamos/Pueblo Canyons

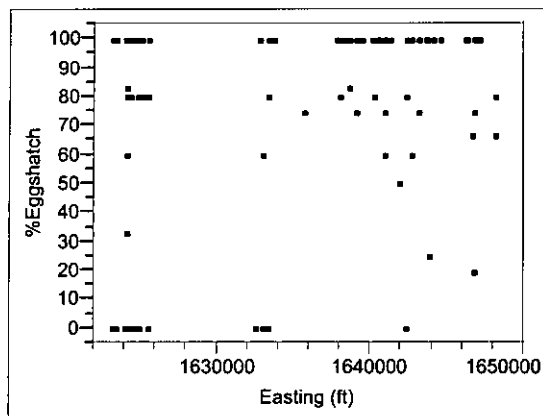


Figure E-4.2-25. Scatter plot of % eggs hatch versus easting (ft) for western bluebirds in Los Alamos/Pueblo Canyons

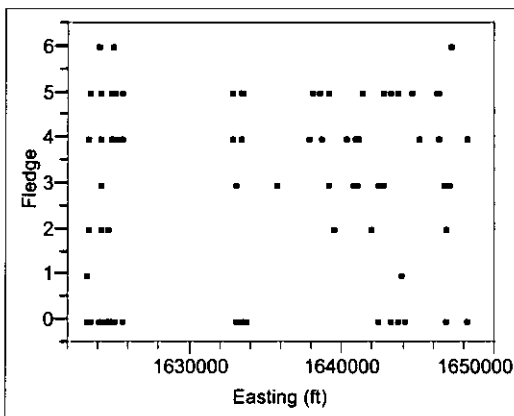


Figure E-4.2-26. Scatter plot of fledge number versus easting (ft) for western bluebirds in Los Alamos/Pueblo Canyons

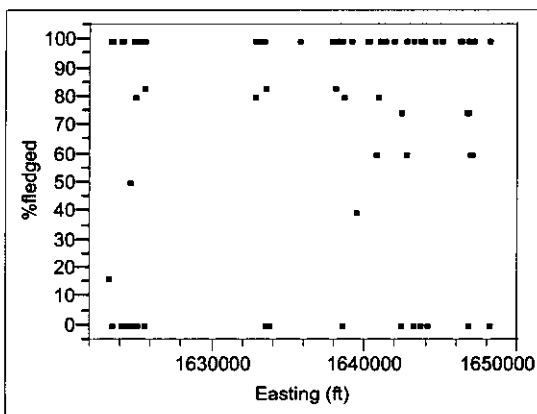


Figure E-4.2-27. Scatter plot of % fledged versus easting (ft) for western bluebirds in Los Alamos/Pueblo Canyons

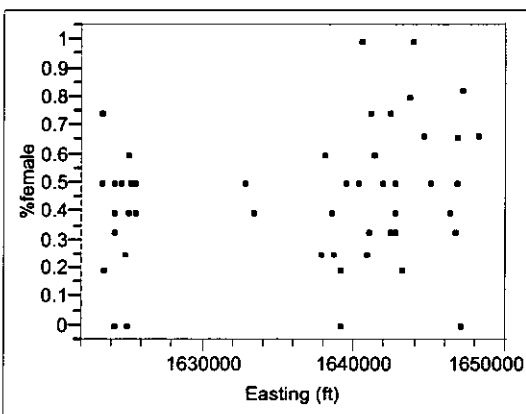


Figure E-4.2-28. Scatter plot of % female versus easting (ft) for western bluebirds in Los Alamos/Pueblo Canyons

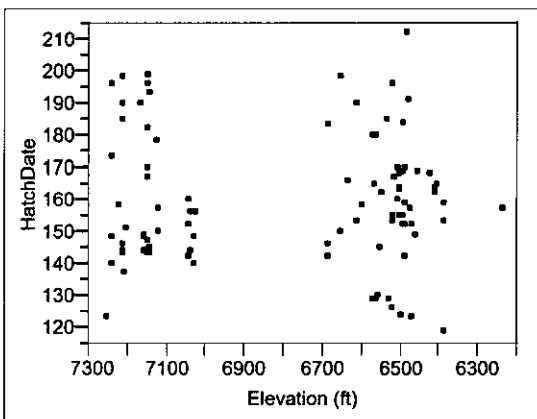


Figure E-4.2-29. Scatter plot of hatch date versus easting (ft) for western bluebirds in Los Alamos/Pueblo Canyons

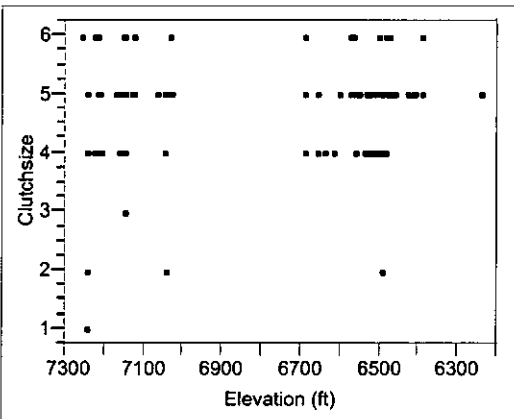


Figure E-4.2-30. Scatter plot of clutch size versus elevation (ft) for western bluebirds in Los Alamos/Pueblo Canyons

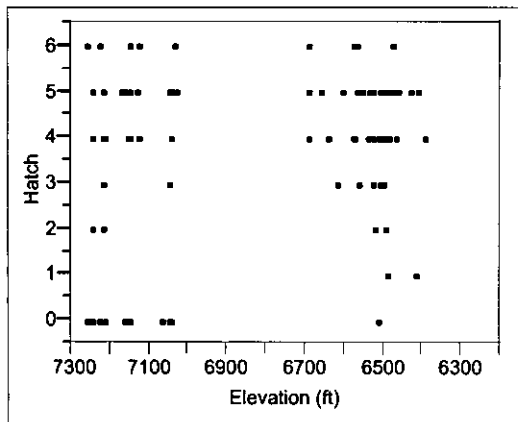


Figure E-4.2-31. Scatter plot of hatch number versus elevation (ft) for western bluebirds in Los Alamos/Pueblo Canyons

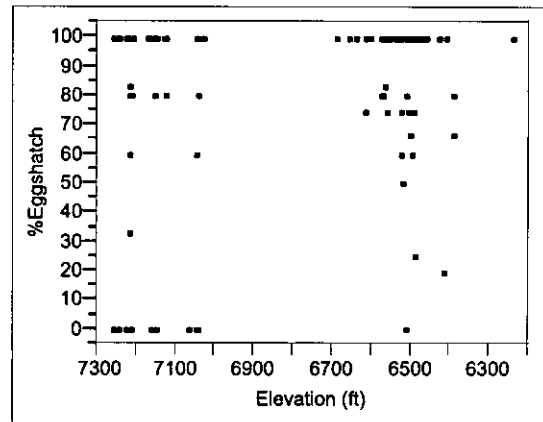


Figure E-4.2-32. Scatter plot of % eggs hatch versus elevation (ft) for western bluebirds in Los Alamos/Pueblo Canyons

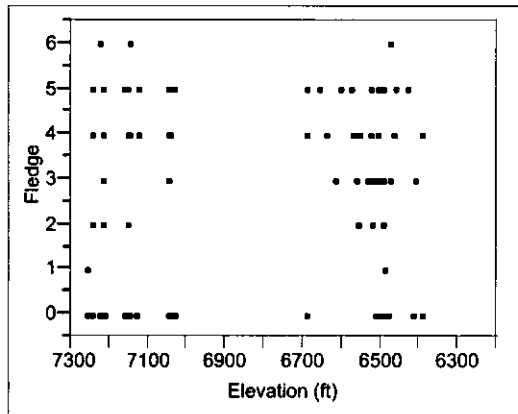


Figure E-4.2-33. Scatter plot of fledge number versus elevation (ft) for western bluebirds in Los Alamos/Pueblo Canyons

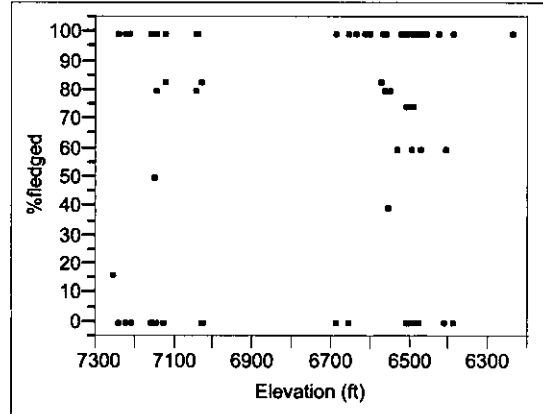


Figure E-4.2-34. Scatter plot of % fledged versus elevation (ft) for western bluebirds in Los Alamos/Pueblo Canyons

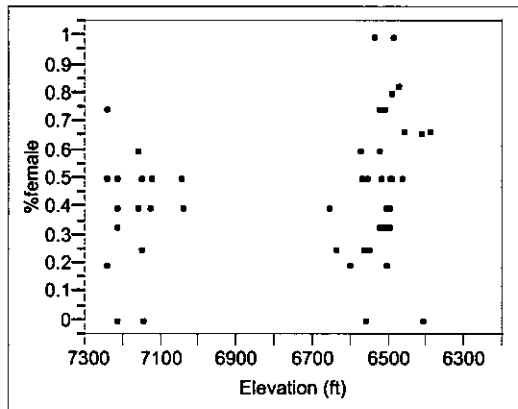


Figure E-4.2-35. Scatter plot of % female versus elevation (ft) for western bluebirds in Los Alamos/Pueblo Canyons

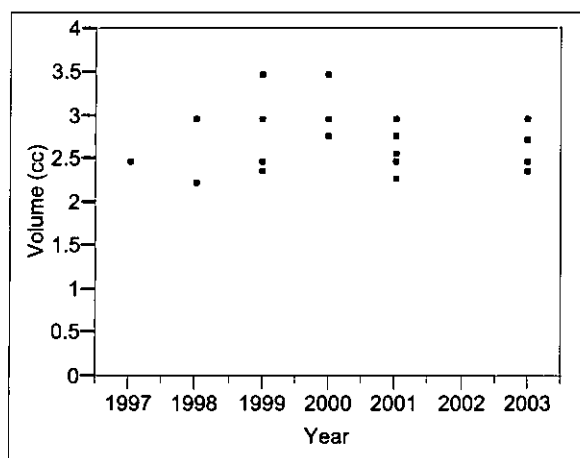


Figure E-4.3-1. Scatter plot of volume (cc) versus year for western bluebirds in Los Alamos/Pueblo Canyons

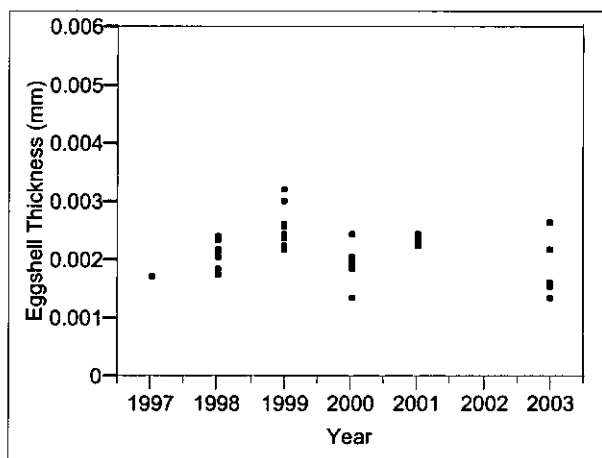


Figure E-4.3-2. Scatter plot of eggshell thickness (mm) versus year for western bluebirds in Los Alamos/Pueblo Canyons

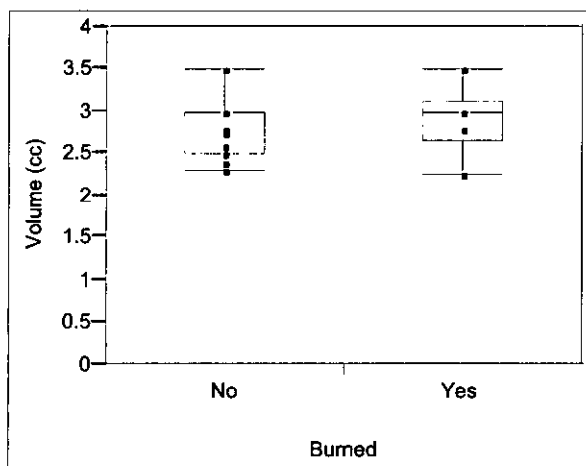


Figure E-4.3-3. Box plot of volume (cc) versus burned groups for western bluebirds in Los Alamos/Pueblo Canyons

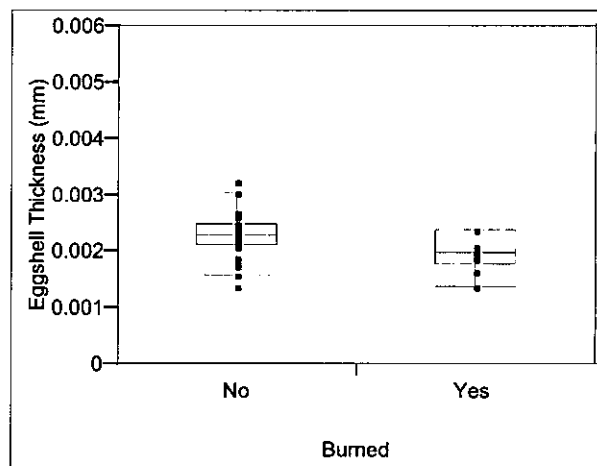


Figure E-4.3-4. Box plot of eggshell thickness (mm) versus burned groups for western bluebirds in Los Alamos/Pueblo Canyons

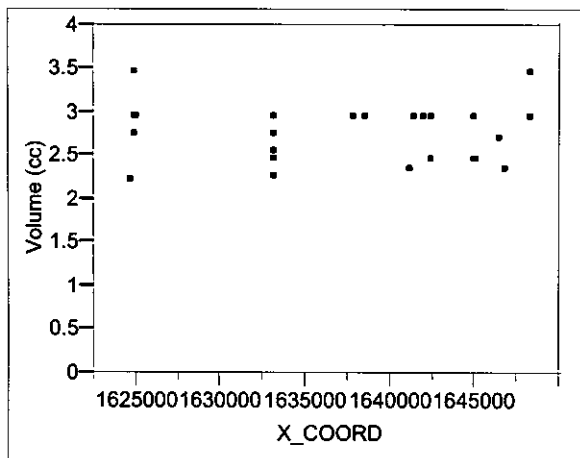


Figure E-4.3-5. Scatter plot of volume (cc) versus X_COORD (easting in ft) for western bluebirds in Los Alamos/Pueblo Canyons

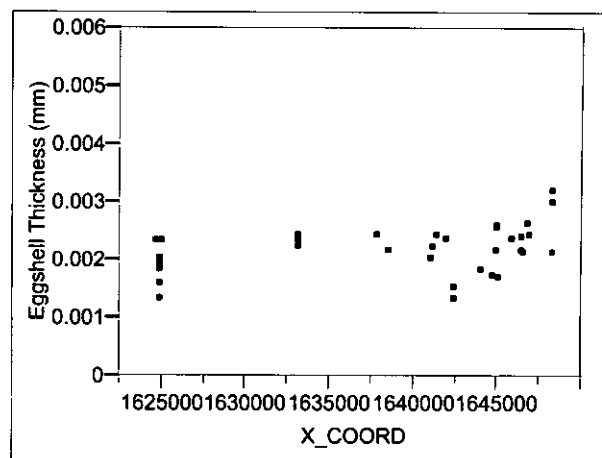


Figure E-4.3-6. Scatter plot of eggshell thickness (mm) versus X_COORD (easting in ft) for western bluebirds in Los Alamos/Pueblo Canyons

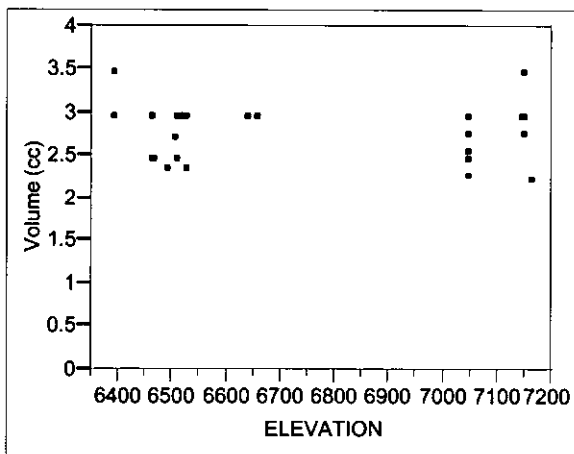


Figure E-4.3-7. Scatter plot of volume (cc) versus elevation (ft) for western bluebirds in Los Alamos/Pueblo Canyons

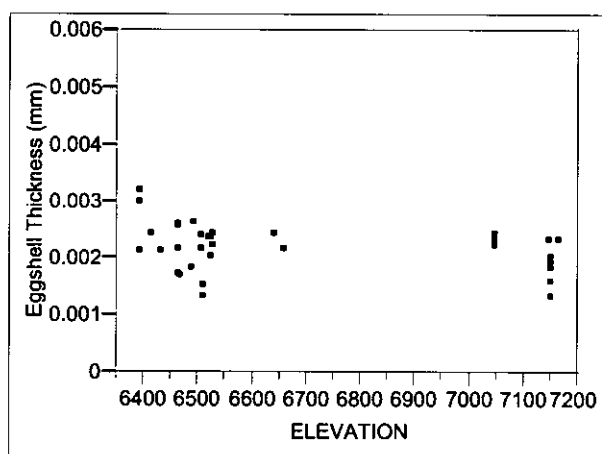


Figure E-4.3-8. Scatter plot of eggshell thickness (mm) versus elevation (ft) for western bluebirds in Los Alamos/Pueblo Canyons

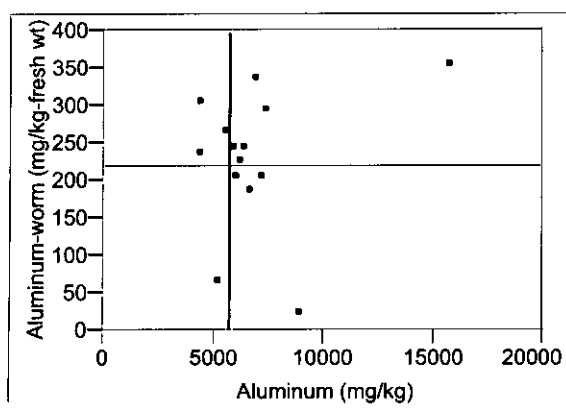


Figure E-4.4-1. Scatter plot of aluminum concentrations in worms (fresh weight) versus sediment concentrations

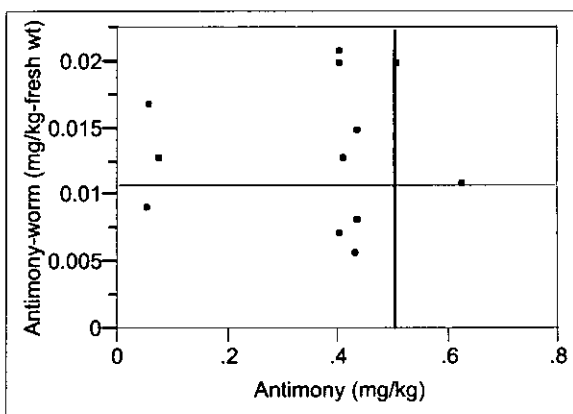


Figure E-4.4-2. Scatter plot of antimony concentrations in worms (fresh weight) versus sediment concentrations

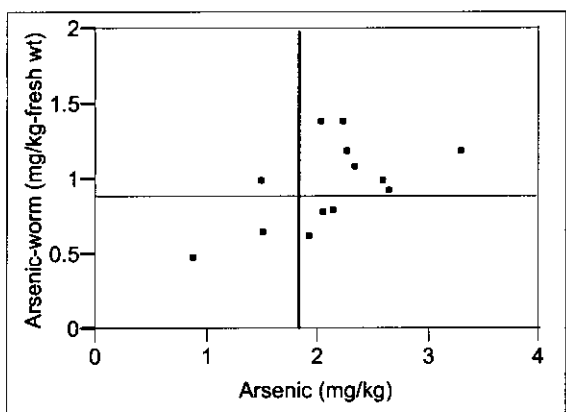


Figure E-4.4-3. Scatter plot of arsenic concentrations in worms (fresh weight) versus sediment concentrations

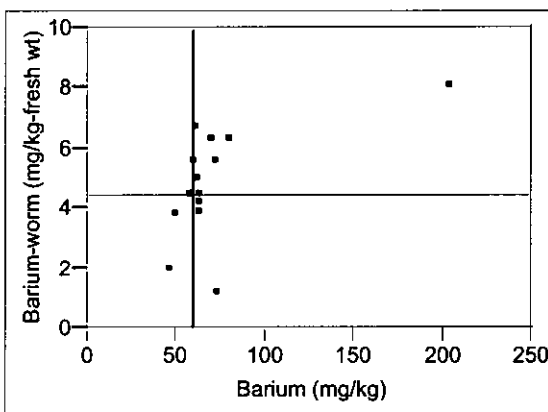


Figure E-4.4-4. Scatter plot of barium concentrations in worms (fresh weight) versus sediment concentrations

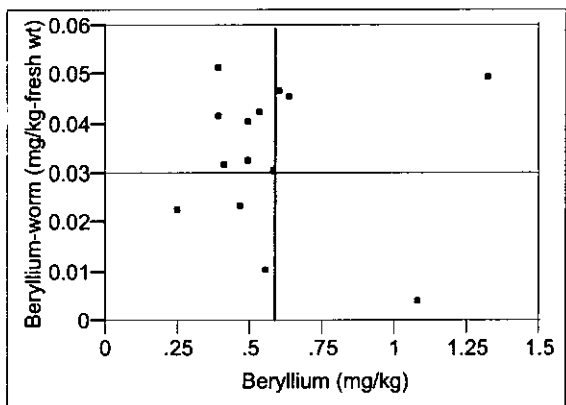


Figure E-4.4-5. Scatter plot of beryllium concentrations in worms (fresh weight) versus sediment concentrations

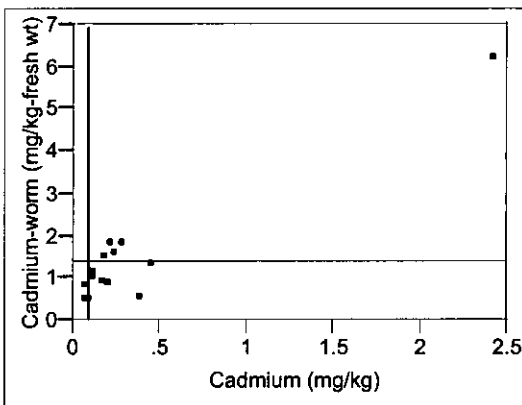


Figure E-4.4-6. Scatter plot of cadmium concentrations in worms (fresh weight) versus sediment concentrations

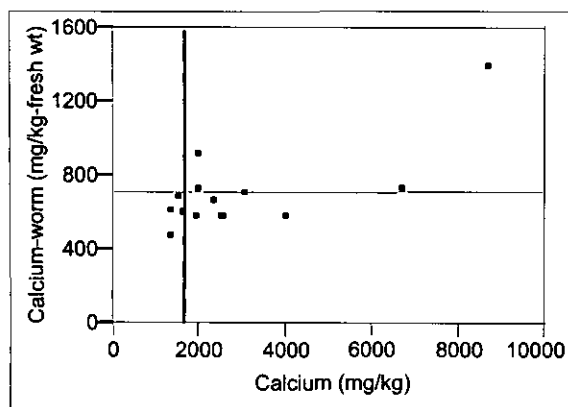


Figure E-4.4-7. Scatter plot of calcium concentrations in worms (fresh weight) versus sediment concentrations

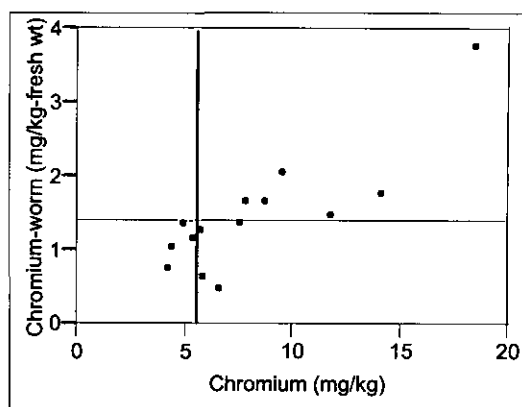


Figure E-4.4-8. Scatter plot of chromium concentrations in worms (fresh weight) versus sediment concentrations

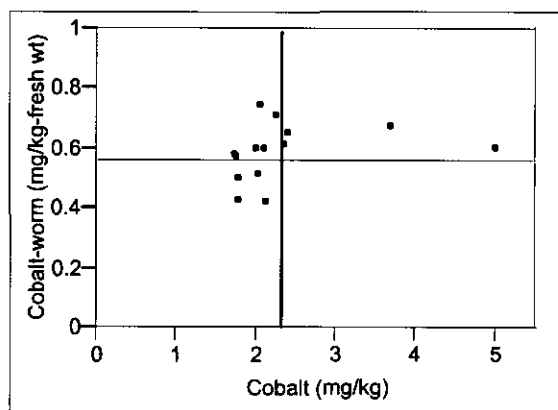


Figure E-4.4-9. Scatter plot of cobalt concentrations in worms (fresh weight) versus sediment concentrations

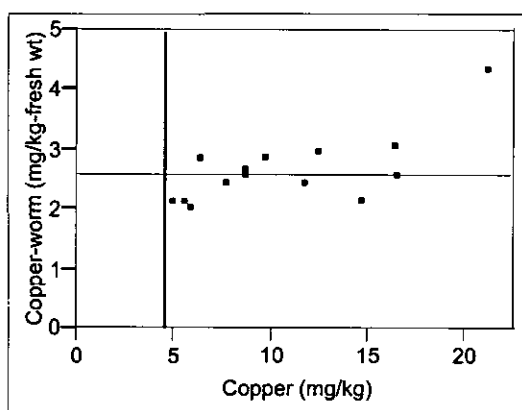


Figure E-4.4-10. Scatter plot of copper concentrations in worms (fresh weight) versus sediment concentrations

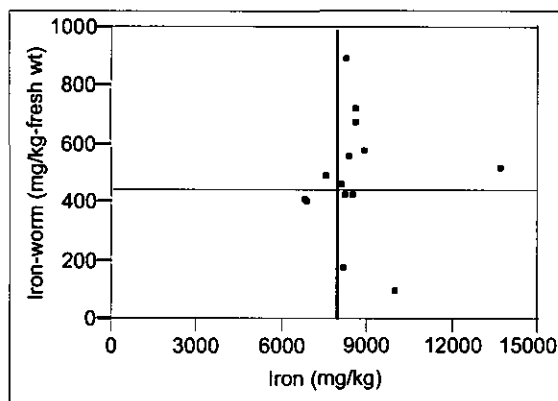


Figure E-4.4-11. Scatter plot of iron concentrations in worms (fresh weight) versus sediment concentrations

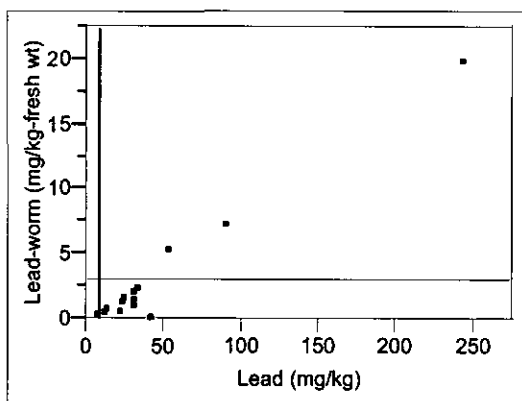


Figure E-4.4-12. Scatter plot of lead concentrations in worms (fresh weight) versus sediment concentrations

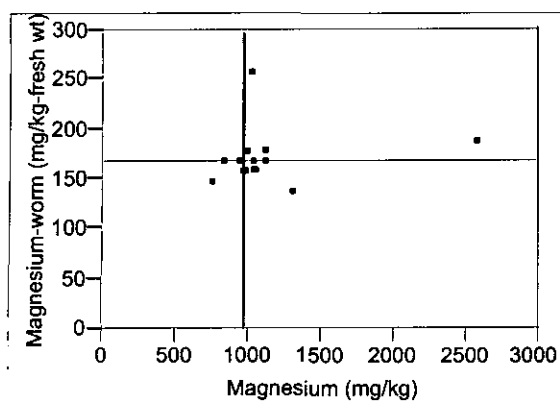


Figure E-4.4-13. Scatter plot of magnesium concentrations in worms (fresh weight) versus sediment concentrations

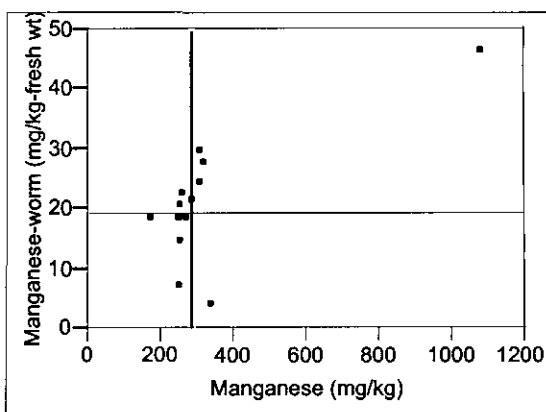


Figure E-4.4-14. Scatter plot of manganese concentrations in worms (fresh weight) versus sediment concentrations

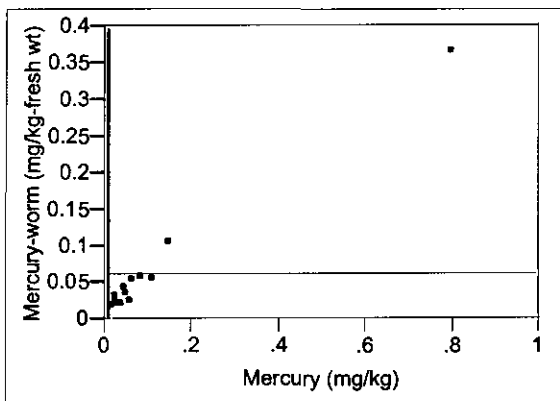


Figure E-4.4-15. Scatter plot of mercury concentrations in worms (fresh weight) versus sediment concentrations

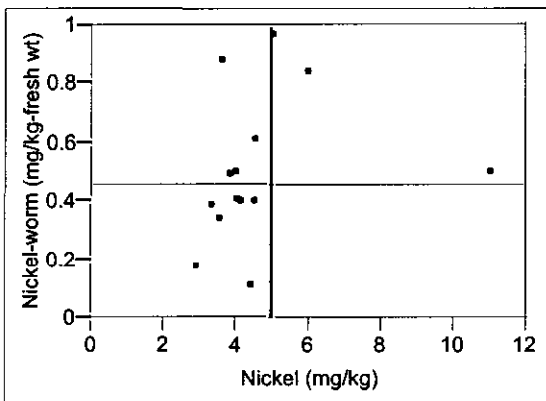


Figure E-4.4-16. Scatter plot of nickel concentrations in worms (fresh weight) versus sediment concentrations

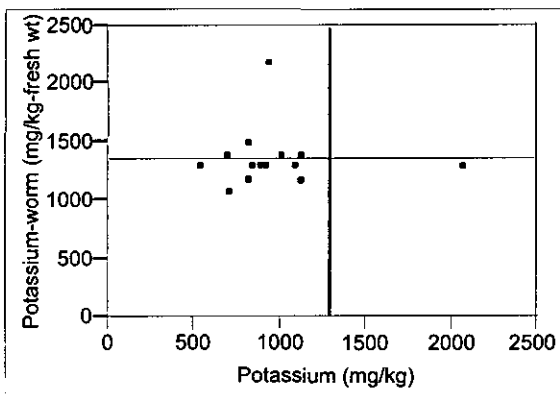


Figure E-4.4-17. Scatter plot of potassium concentrations in worms (fresh weight) versus sediment concentrations

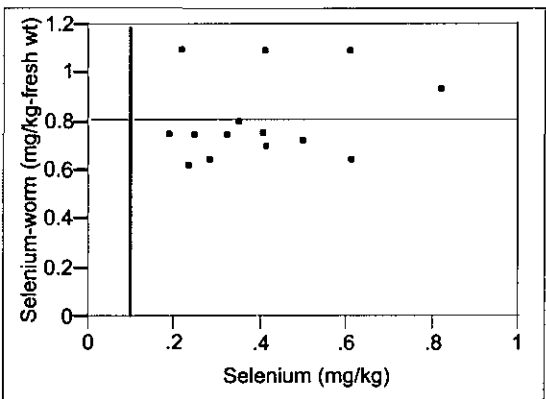


Figure E-4.4-18. Scatter plot of selenium concentrations in worms (fresh weight) versus sediment concentrations

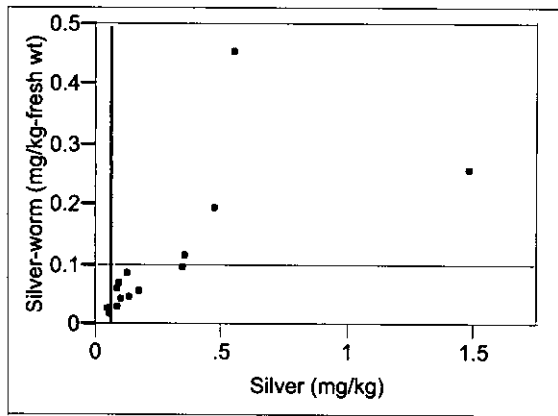


Figure E-4.4-19. Scatter plot of silver concentrations in worms (fresh weight) versus sediment concentrations

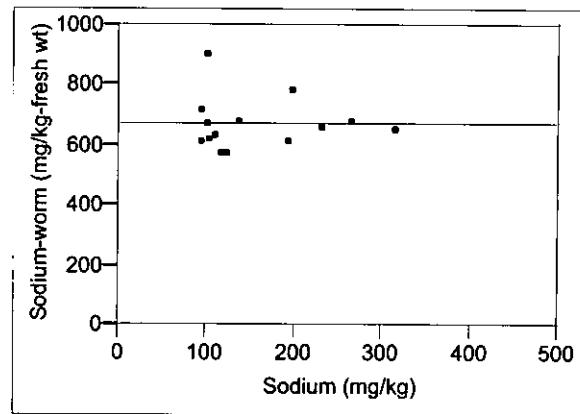


Figure E-4.4-20. Scatter plot of sodium concentrations in worms (fresh weight) versus sediment concentrations

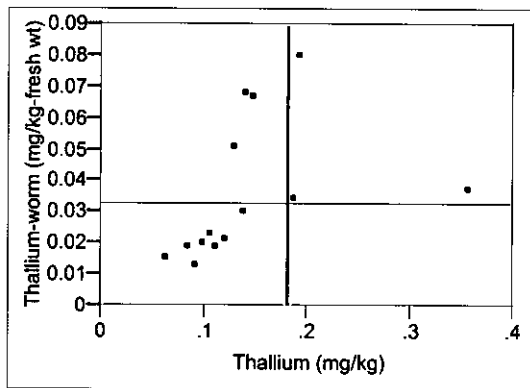


Figure E-4.4-21. Scatter plot of thallium concentrations in worms (fresh weight) versus sediment concentrations

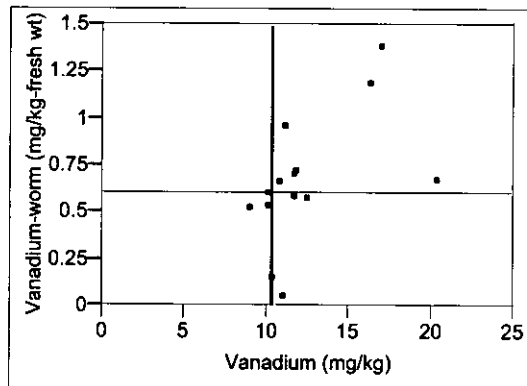


Figure E-4.4-22. Scatter plot of vanadium concentrations in worms (fresh weight) versus sediment concentrations

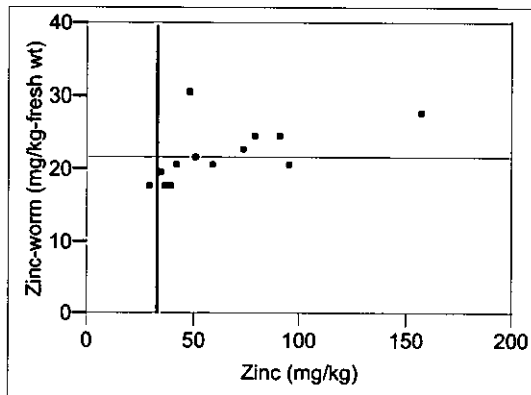
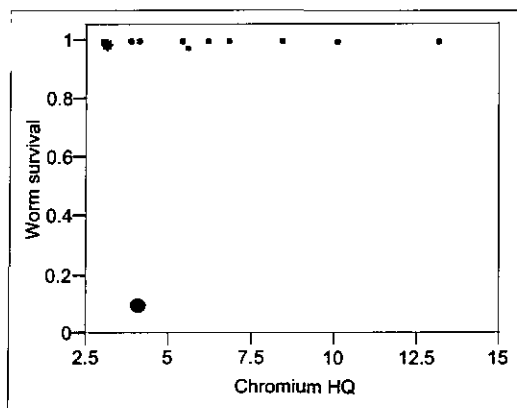
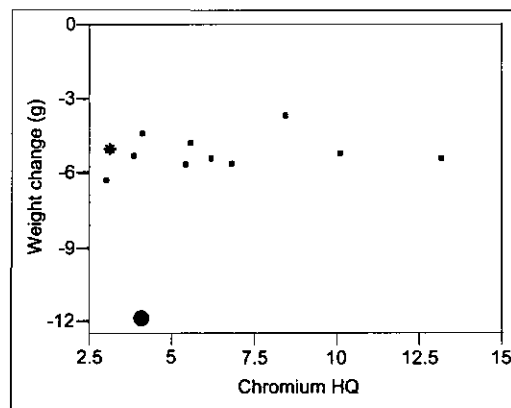


Figure E-4.4-23. Scatter plot of zinc concentrations in worms (fresh weight) versus sediment concentrations



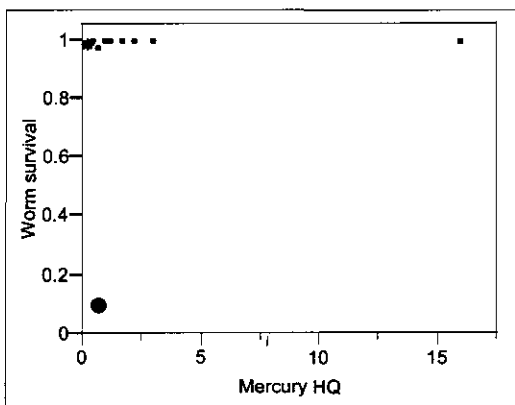
Notes: * = The reference site Guaje Canyon,
● = sample ID CALA-02-47891.

Figure E-4.5-1. Scatter plot of worm survival versus chromium HQ



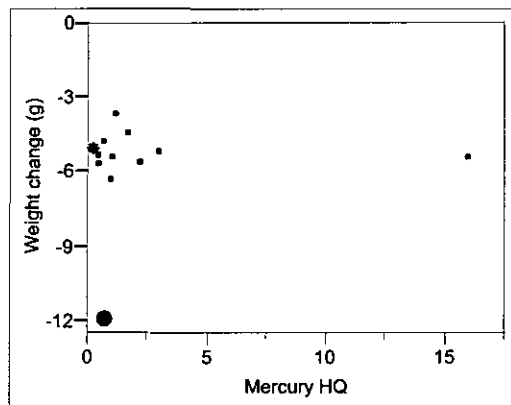
Notes: * = The reference site Guaje Canyon,
● = sample ID CALA-02-47891.

Figure E-4.5-2. Scatter plot of weight change (g) versus chromium HQ



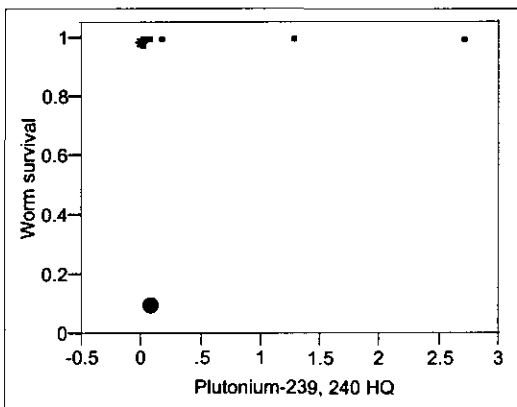
Notes: * = The reference site Guaje Canyon,
● = sample ID CALA-02-47891.

Figure E-4.5-3. Scatter plot of worm survival versus mercury HQ



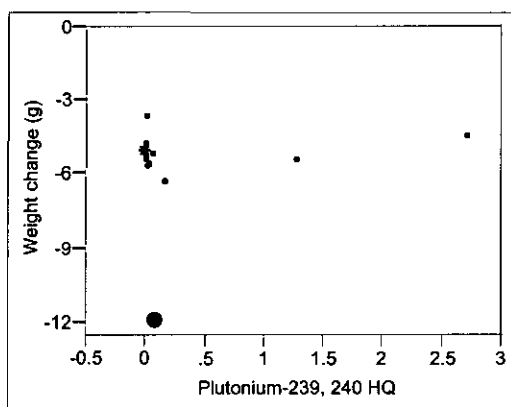
Notes: * = The reference site Guaje Canyon,
● = sample ID CALA-02-47891.

Figure E-4.5-4. Scatter plot of weight change (g) versus mercury HQ



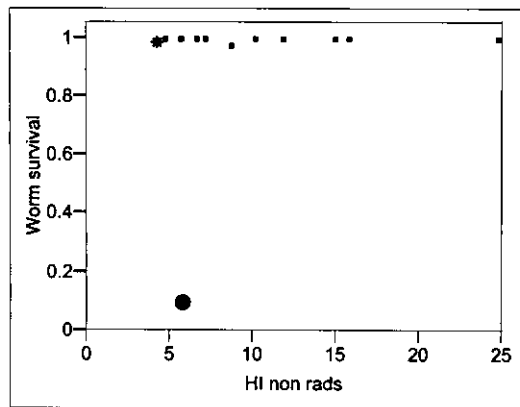
Notes: * = The reference site Guaje Canyon,
● = sample ID CALA-02-47891.

Figure E-4.5-5. Scatter plot of worm survival versus plutonium-239,240 HQ



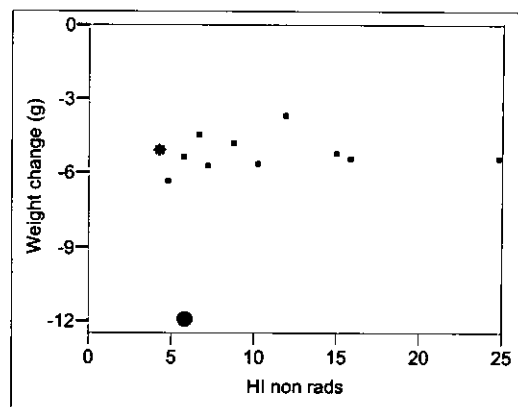
Notes: * = The reference site Guaje Canyon,
● = sample ID CALA-02-47891.

Figure E-4.5-6. Scatter plot of weight change (g) versus plutonium-239,240 HQ



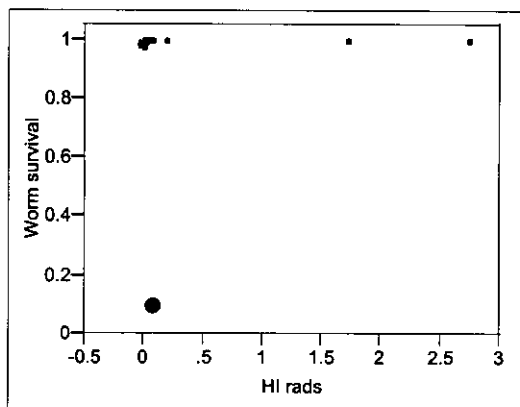
Notes: * = The reference site Guaje Canyon,
● = sample ID CALA-02-47891.

Figure E-4.5-7. Scatter plot of worm survival versus HI for nonradionuclides



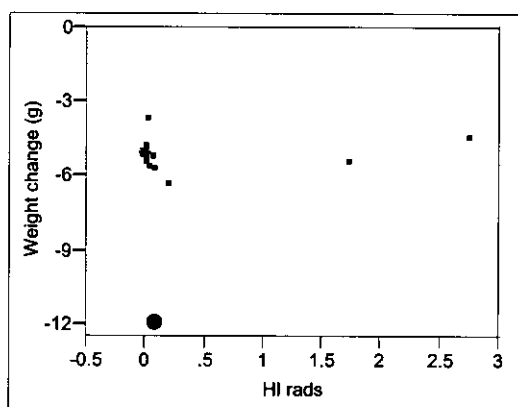
Notes: * = The reference site Guaje Canyon,
● = sample ID CALA-02-47891.

Figure E-4.5-8. Scatter plot of weight change (g) versus HI for nonradionuclides



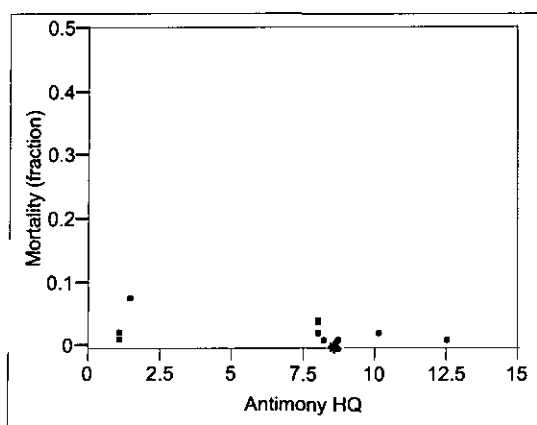
Notes: * = The reference site Guaje Canyon,
● = sample ID CALA-02-47891.

Figure E-4.5-9. Scatter plot of worm survival versus HI for nonradionuclides



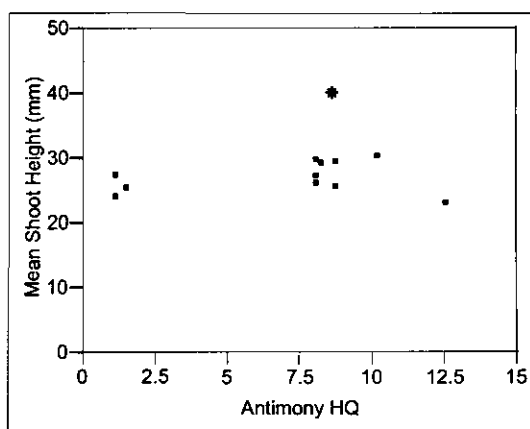
Notes: * = The reference site Guaje Canyon,
● = sample ID CALA-02-47891.

Figure E-4.5-10. Scatter plot of weight change (g) versus HI for nonradionuclides



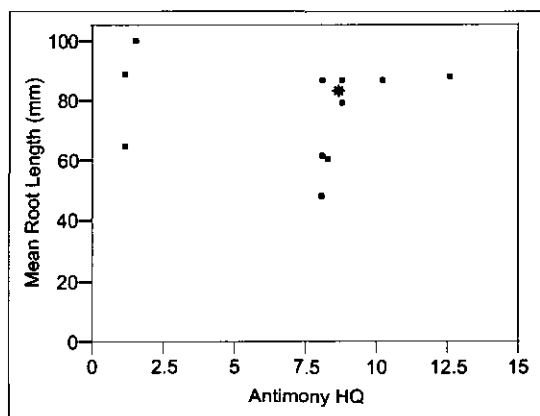
Note: * = The reference site Guaje Canyon.

Figure E-4.6-1. Scatter plot of mortality (fraction) versus antimony HQ



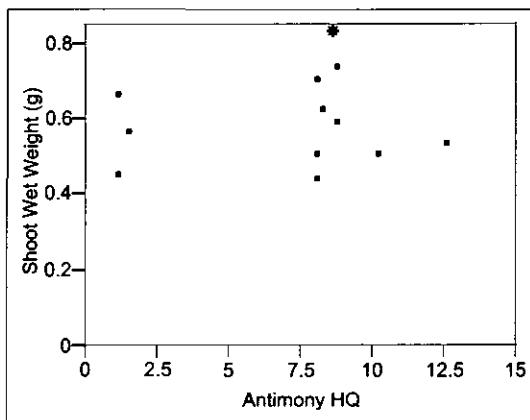
Note: * = The reference site Guaje Canyon.

Figure E-4.6-2. Scatter plot of mean shoot height (mm) versus antimony HQ



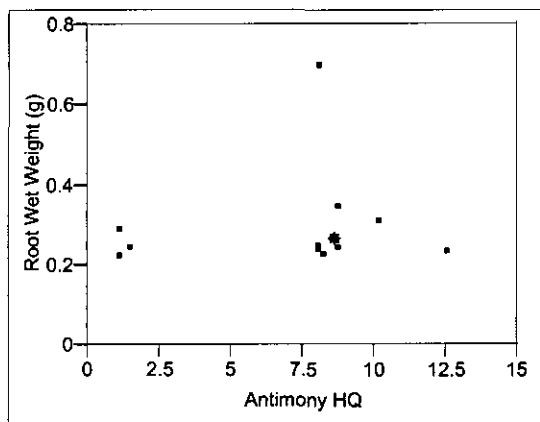
Note: * = The reference site Guaje Canyon.

Figure E-4.6-3. Scatter plot of mean root length (mm) versus antimony HQ



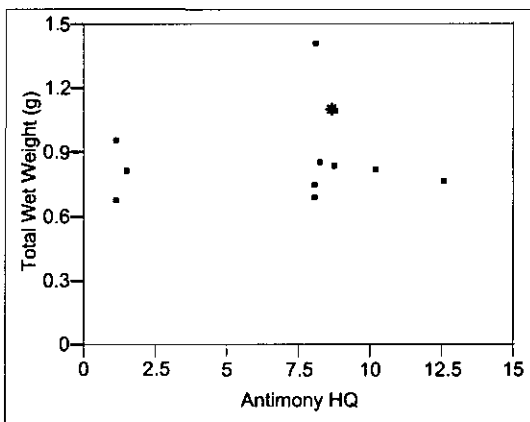
Note: * = The reference site Guaje Canyon.

Figure E-4.6-4. Scatter plot of shoot wet weight (g) versus antimony HQ



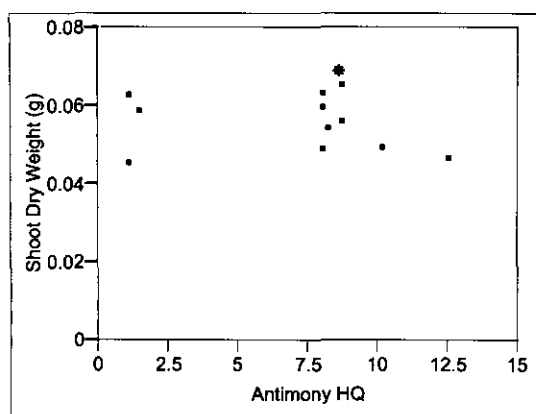
Note: * = The reference site Guaje Canyon.

Figure E-4.6-5. Scatter plot of root wet weight (g) versus antimony HQ



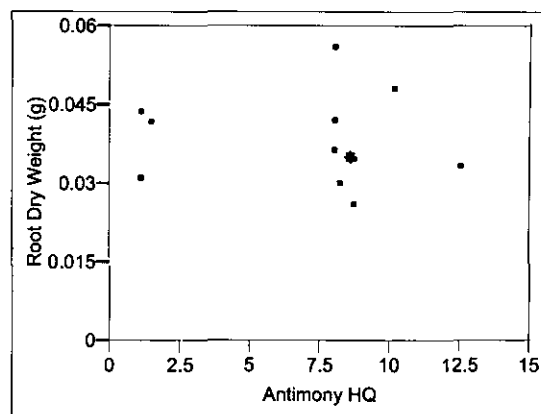
Note: * = The reference site Guaje Canyon.

Figure E-4.6-6. Scatter plot of total wet weight (g) versus antimony HQ



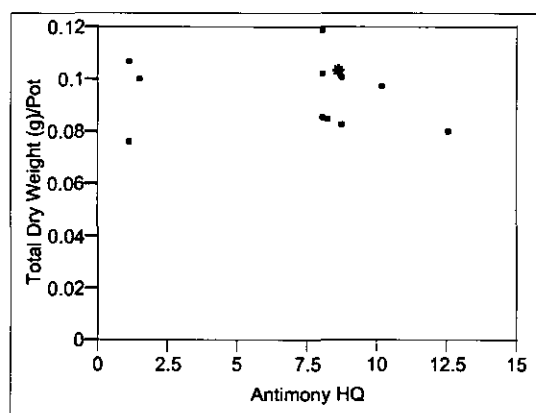
Note: * = The reference site Guaje Canyon.

Figure E-4.6-7. Scatter plot of shoot dry weight (g) versus antimony HQ



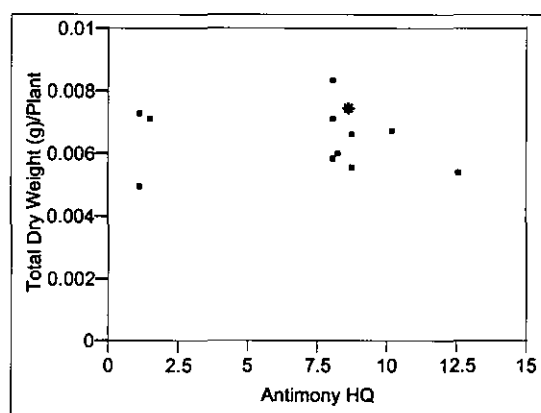
Note: * = The reference site Guaje Canyon.

Figure E-4.6-8. Scatter plot of root dry weight (g) versus antimony HQ



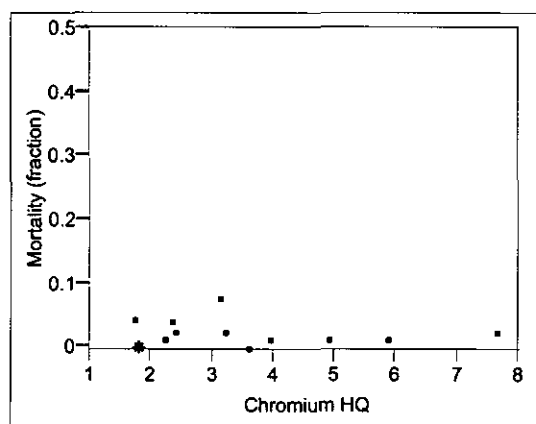
Note: * = The reference site Guaje Canyon.

Figure E-4.6-9. Scatter plot of total dry weight (g/pot) versus antimony HQ



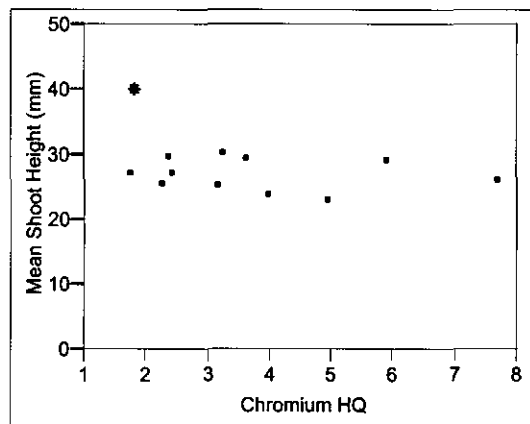
Note: * = The reference site Guaje Canyon.

Figure E-4.6-10. Scatter plot of total dry weight (g/plant) versus antimony HQ



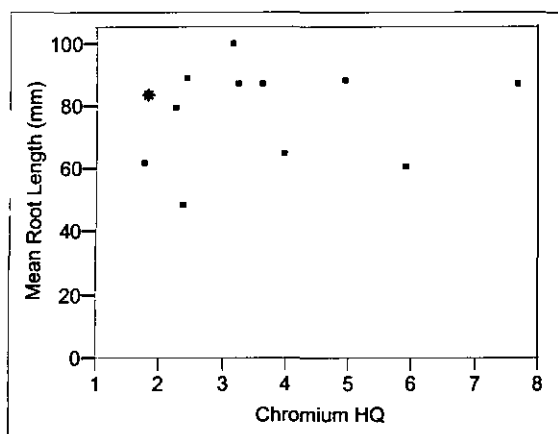
Note: * = The reference site Guaje Canyon.

Figure E-4.6-11. Scatter plot of mortality (fraction) versus chromium HQ



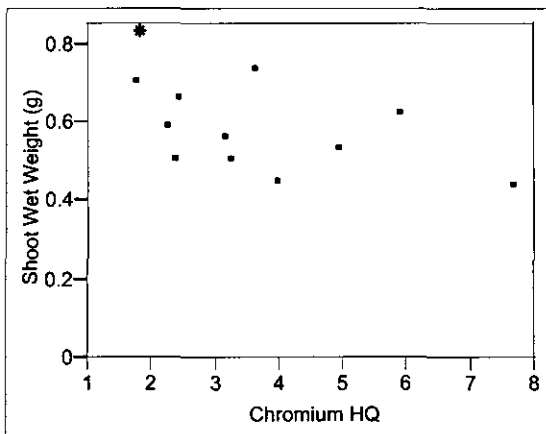
Note: * = The reference site Guaje Canyon.

Figure E-4.6-12. Scatter plot of mean shoot height (mm) versus chromium HQ



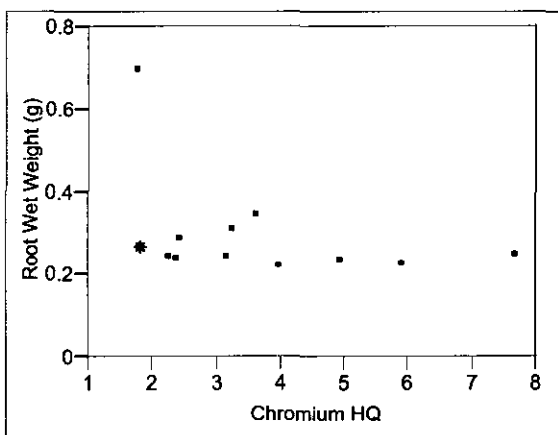
Note: * = The reference site Guaje Canyon.

Figure E-4.6-13. Scatter plot of mean root length (mm) versus chromium HQ



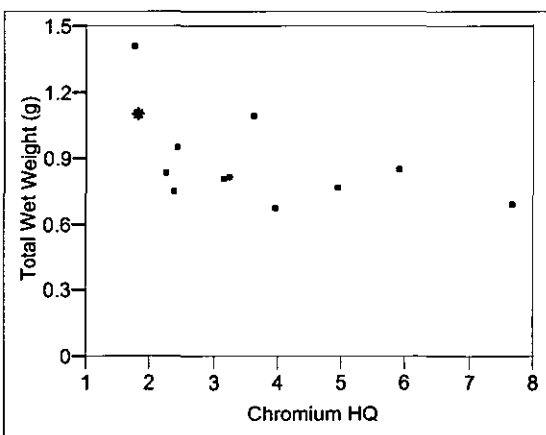
Note: * = The reference site Guaje Canyon.

Figure E-4.6-14. Scatter plot of shoot wet weight (g) versus chromium HQ



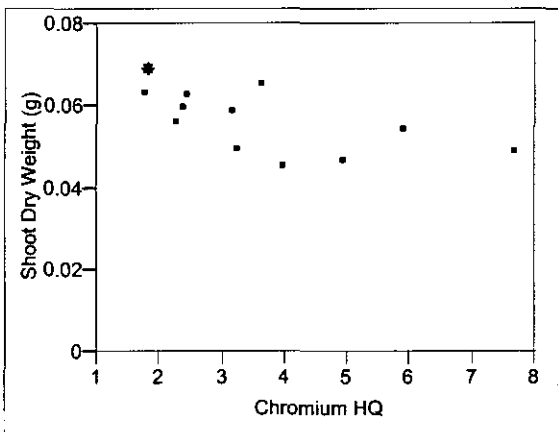
Note: * = The reference site Guaje Canyon.

Figure E-4.6-15. Scatter plot of root wet weight (g) versus chromium HQ



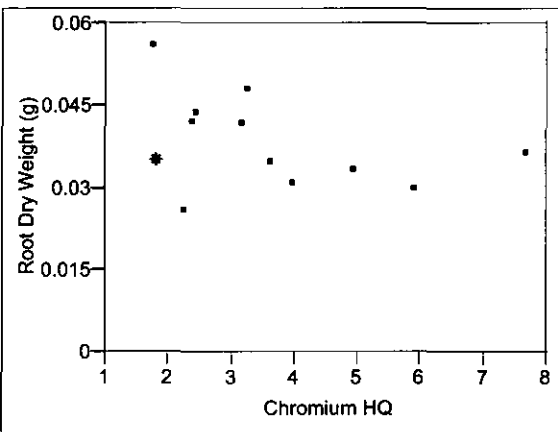
Note: * = The reference site Guaje Canyon.

Figure E-4.6-16. Scatter plot of total wet weight (g) versus chromium HQ



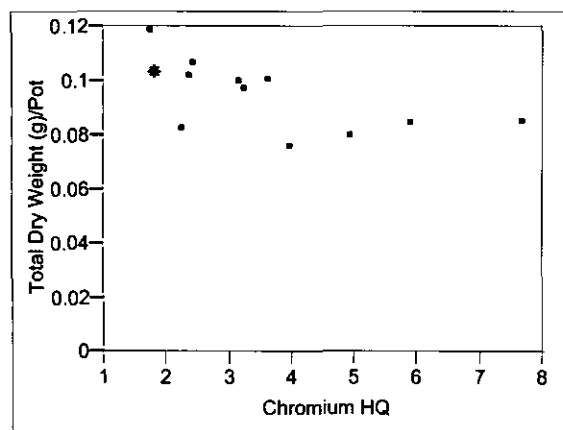
Note: * = The reference site Guaje Canyon.

Figure E-4.6-17. Scatter plot of shoot dry weight (g) versus chromium HQ



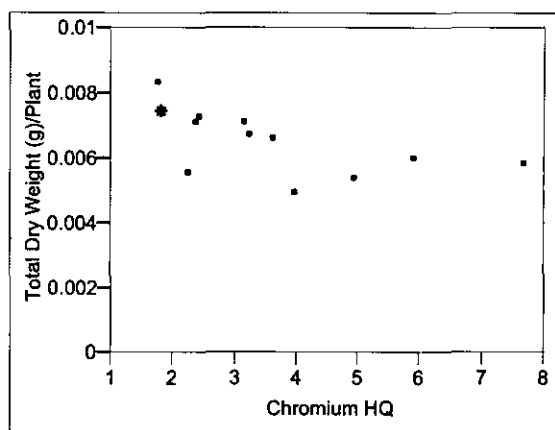
Note: * = The reference site Guaje Canyon.

Figure E-4.6-18. Scatter plot of root dry weight (g) versus chromium HQ



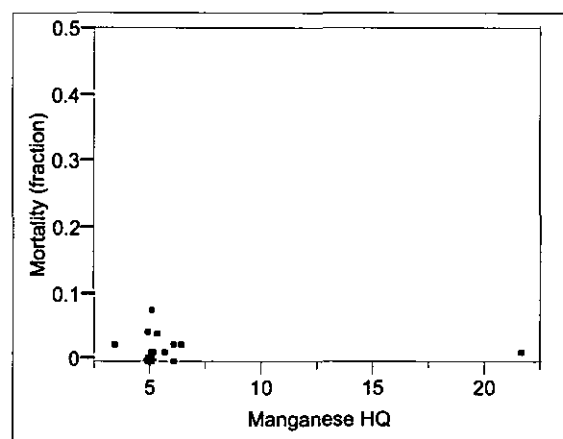
Note: * = The reference site Guaje Canyon.

Figure E-4.6-19. Scatter plot of total dry weight (g/pot) versus chromium HQ



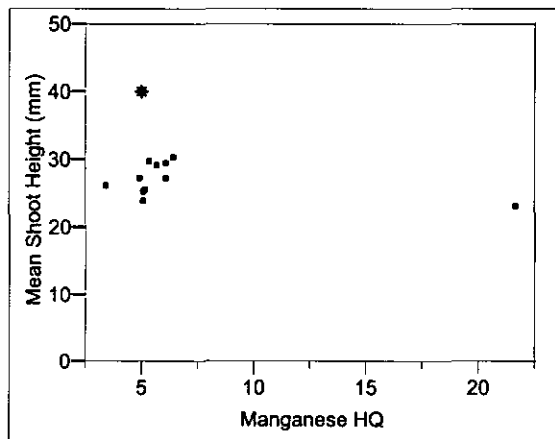
Note: * = The reference site Guaje Canyon.

Figure E-4.6-20. Scatter plot of total dry weight (g/plant) versus chromium HQ



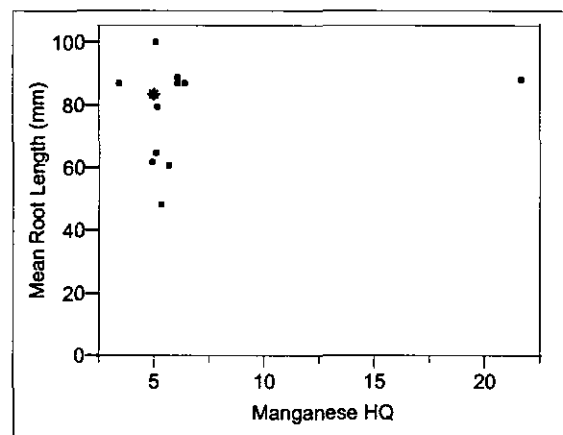
Note: * = The reference site Guaje Canyon.

Figure E-4.6-21. Scatter plot of mortality (fraction) versus manganese HQ



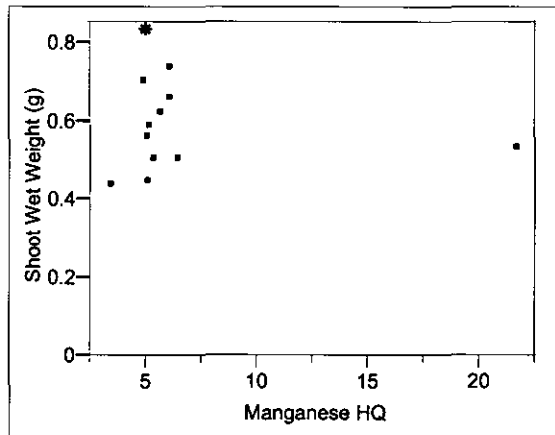
Note: * = The reference site Guaje Canyon.

Figure E-4.6-22. Scatter plot of mean shoot height (mm) versus manganese HQ



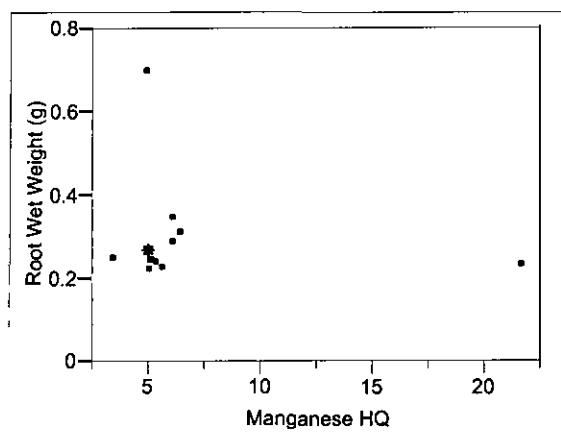
Note: * = The reference site Guaje Canyon.

Figure E-4.6-23. Scatter plot of mean root length (mm) versus manganese HQ



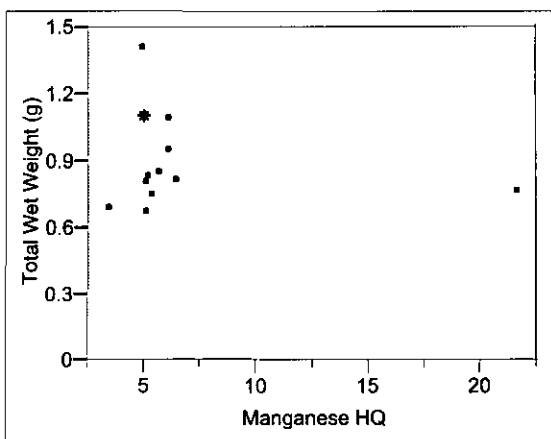
Note: * = The reference site Guaje Canyon.

Figure E-4.6-24. Scatter plot of shoot wet weight (g) versus manganese HQ



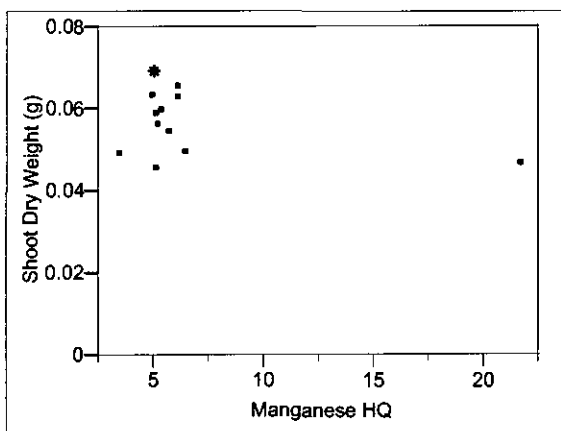
Note: * = The reference site Guaje Canyon.

Figure E-4.6-25. Scatter plot of root wet weight (g) versus manganese HQ



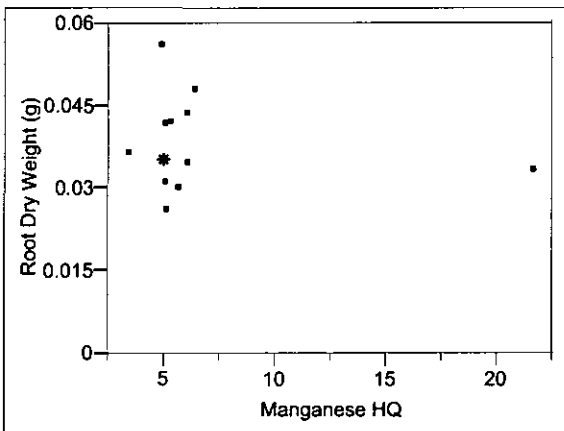
Note: * = The reference site Guaje Canyon.

Figure E-4.6-26. Scatter plot of total wet weight (g) versus manganese HQ



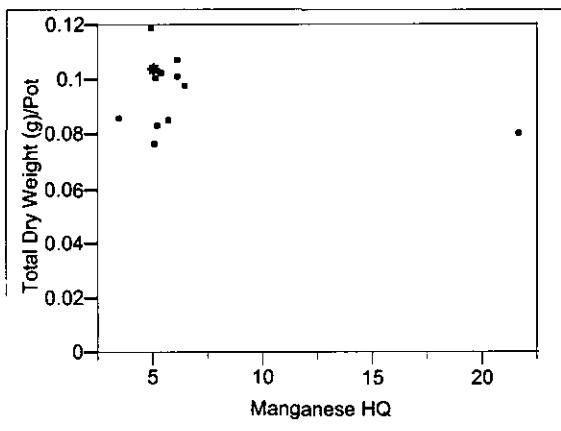
Note: * = The reference site Guaje Canyon.

Figure E-4.6-27. Scatter plot of shoot dry weight (g) versus manganese HQ



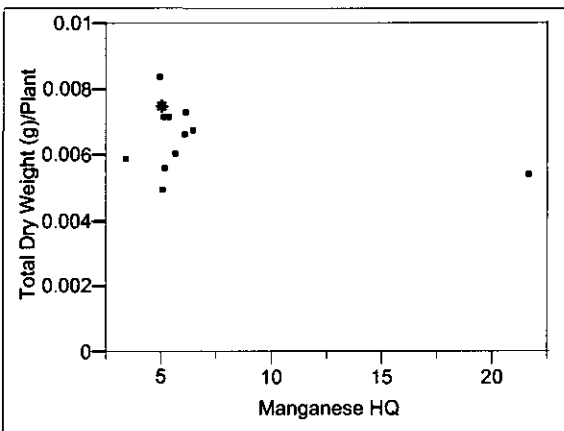
Note: * = The reference site Guaje Canyon.

Figure E-4.6-28. Scatter plot of root dry weight (g) versus manganese HQ



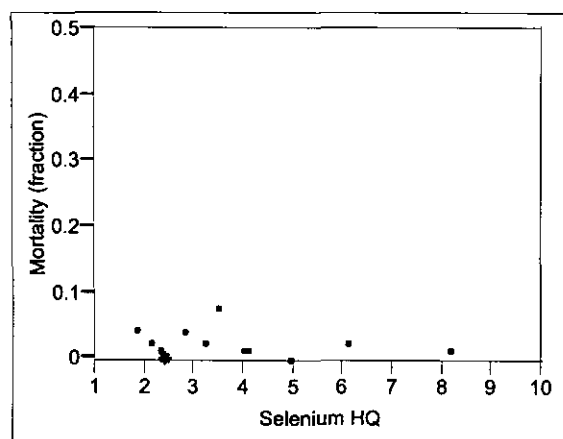
Note: * = The reference site Guaje Canyon.

Figure E-4.6-29. Scatter plot of total dry weight (g/pot) versus manganese HQ



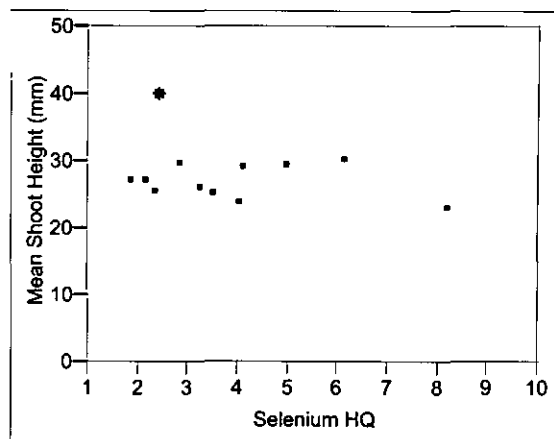
Note: * = The reference site Guaje Canyon.

Figure E-4.6-30. Scatter plot of total dry weight (g/plant) versus manganese HQ



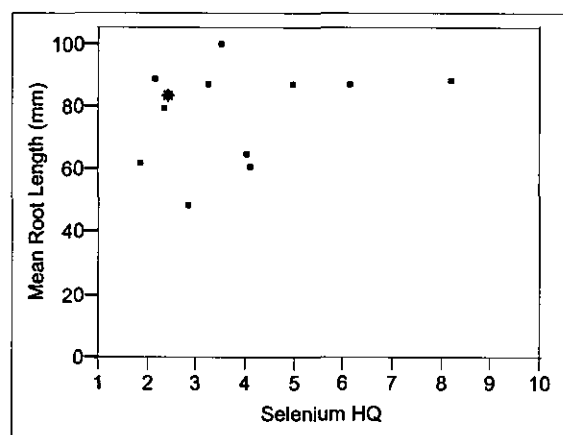
Note: * = The reference site Guaje Canyon.

Figure E-4.6-31. Scatter plot of mortality (fraction) versus selenium HQ



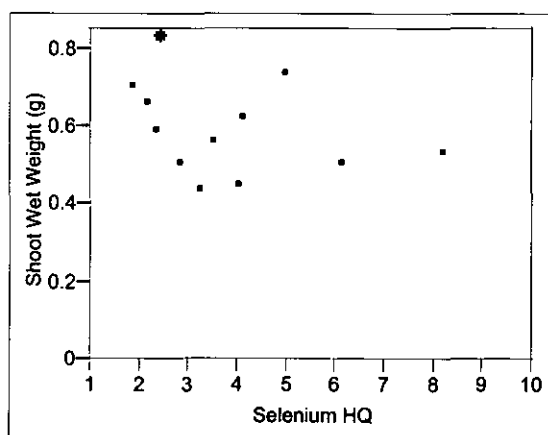
Note: * = The reference site Guaje Canyon.

Figure E-4.6-32. Scatter plot of mean shoot height (mm) versus selenium HQ



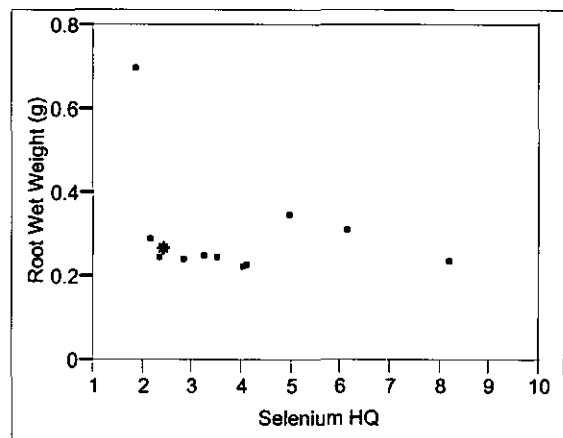
Note: * = The reference site Guaje Canyon.

Figure E-4.6-33. Scatter plot of mean root length (mm) versus selenium HQ



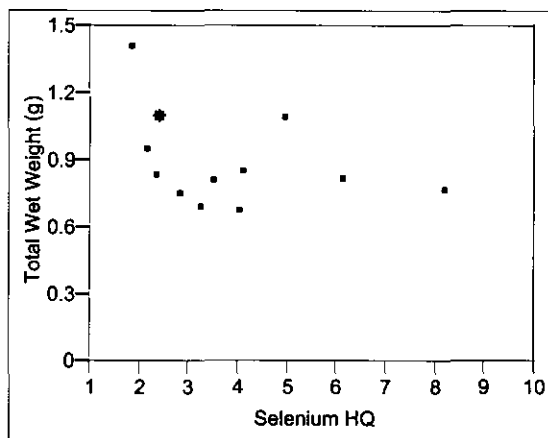
Note: * = The reference site Guaje Canyon.

Figure E-4.6-34. Scatter plot of shoot wet weight (g) versus selenium HQ



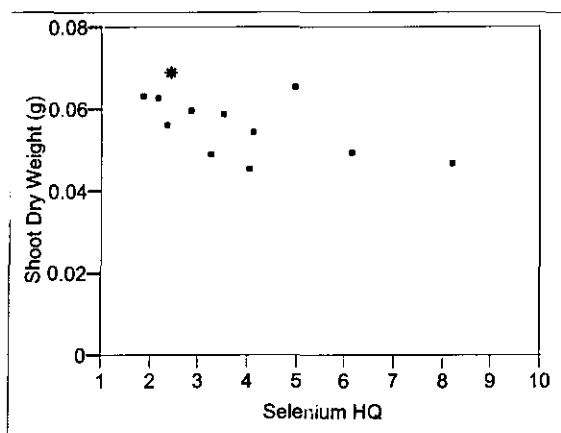
Note: * = The reference site Guaje Canyon.

Figure E-4.6-35. Scatter plot of root wet weight (g) versus selenium HQ



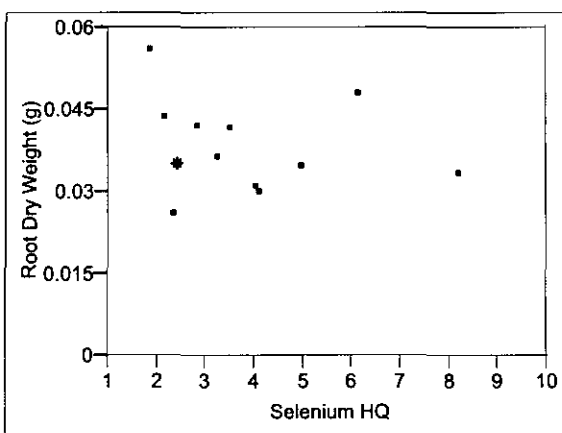
Note: * = The reference site Guaje Canyon.

Figure E-4.6-36. Scatter plot of total wet weight (g) versus selenium HQ



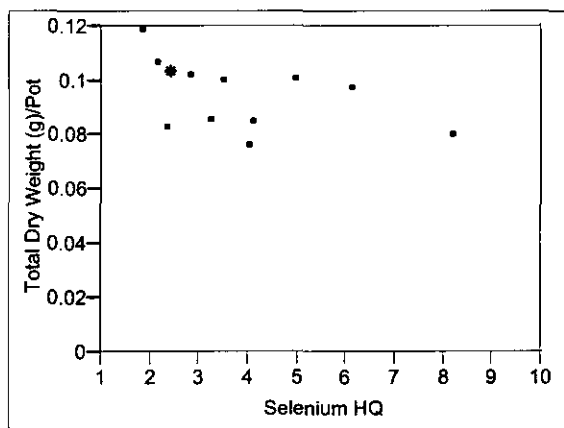
Note: * = The reference site Guaje Canyon.

Figure E-4.6-37. Scatter plot of shoot dry weight (g) versus selenium HQ



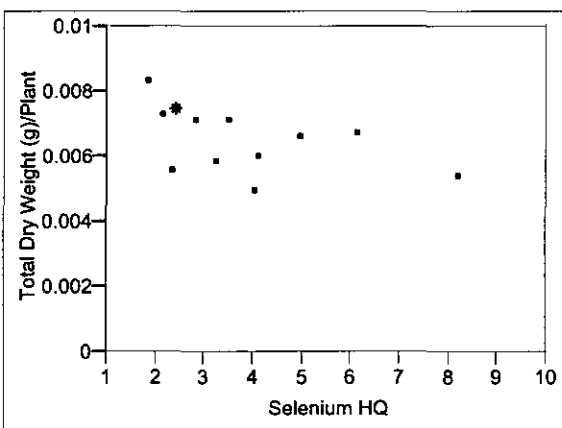
Note: * = The reference site Guaje Canyon.

Figure E-4.6-38. Scatter plot of root dry weight (g) versus selenium HQ



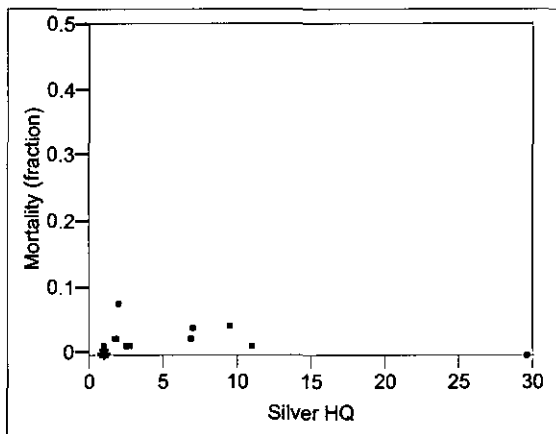
Note: * = The reference site Guaje Canyon.

Figure E-4.6-39. Scatter plot of total dry weight (g/pot) versus selenium HQ



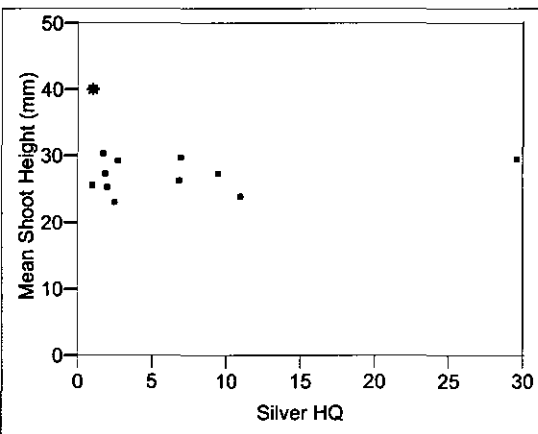
Note: * = The reference site Guaje Canyon.

Figure E-4.6-40. Scatter plot of total dry weight (g/plant) versus selenium HQ



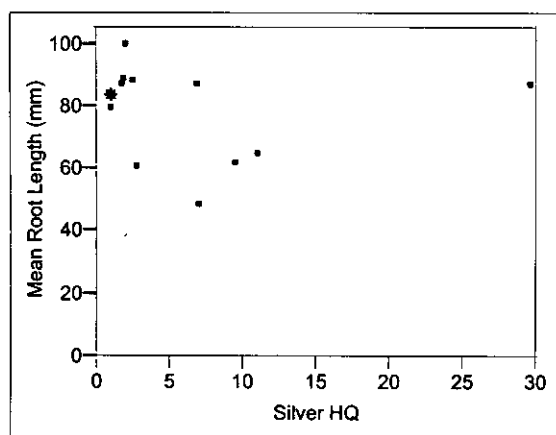
Note: * = The reference site Guaje Canyon.

Figure E-4.6-41. Scatter plot of mortality (fraction) versus silver HQ



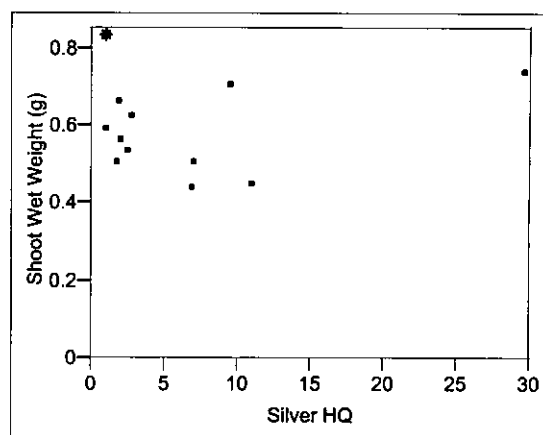
Note: * = The reference site Guaje Canyon.

Figure E-4.6-42. Scatter plot of mean shoot height (mm) versus silver HQ



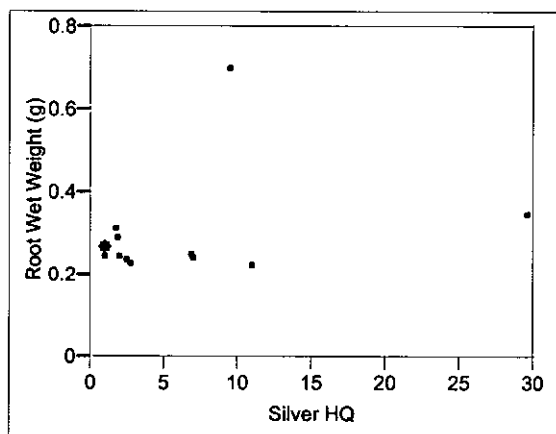
Note: * = The reference site Guaje Canyon.

Figure E-4.6-43. Scatter plot of mean root length (mm) versus silver HQ



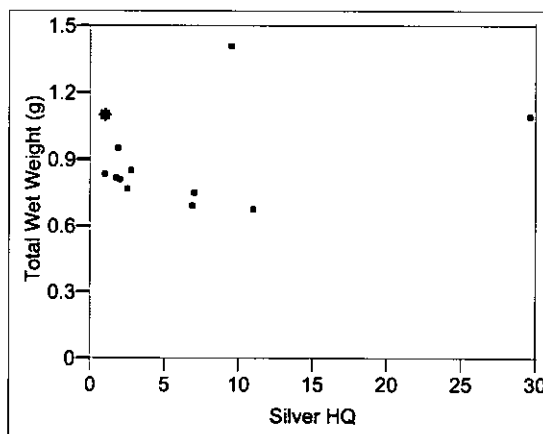
Note: * = The reference site Guaje Canyon.

Figure E-4.6-44. Scatter plot of shoot wet weight (g) versus silver HQ



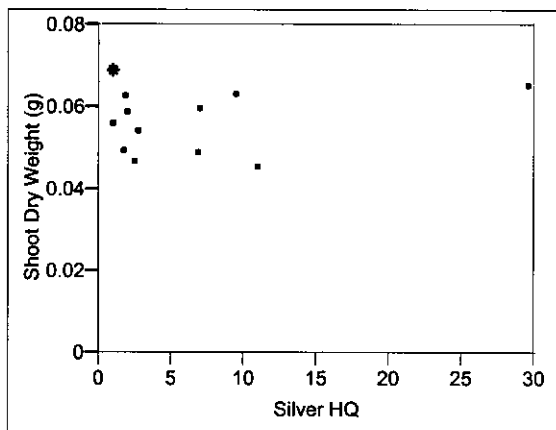
Note: * = The reference site Guaje Canyon.

Figure E-4.6-45. Scatter plot of root wet weight (g) versus silver HQ



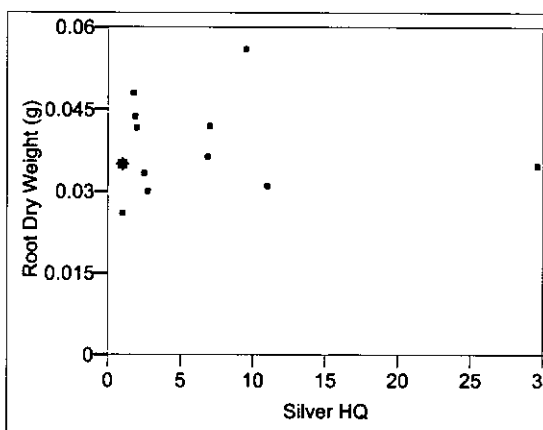
Note: * = The reference site Guaje Canyon.

Figure E-4.6-46. Scatter plot of total wet weight (g) versus silver HQ



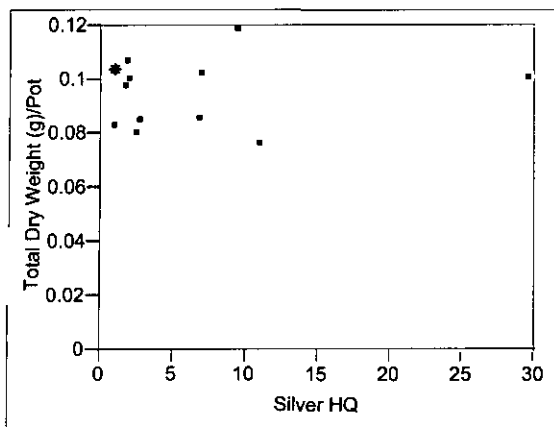
Note: * = The reference site Guaje Canyon.

Figure E-4.6-47. Scatter plot of shoot dry weight (g) versus silver HQ



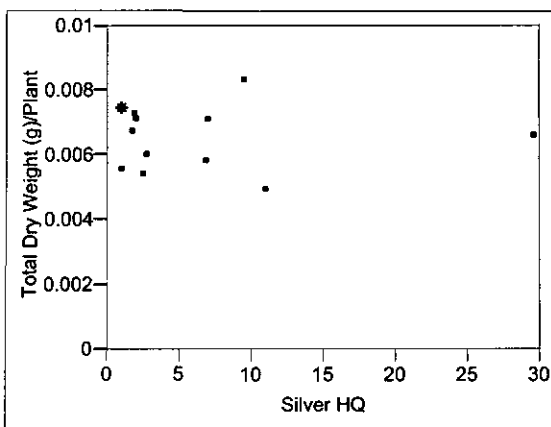
Note: * = The reference site Guaje Canyon.

Figure E-4.6-48. Scatter plot of root dry weight (g) versus silver HQ



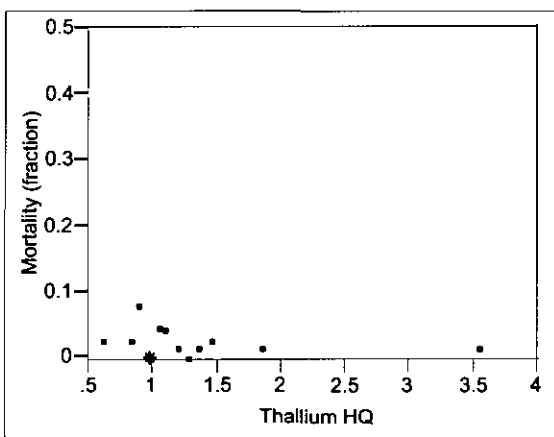
Note: * = The reference site Guaje Canyon.

Figure E-4.6-49. Scatter plot of total dry weight (g/pot) versus silver HQ



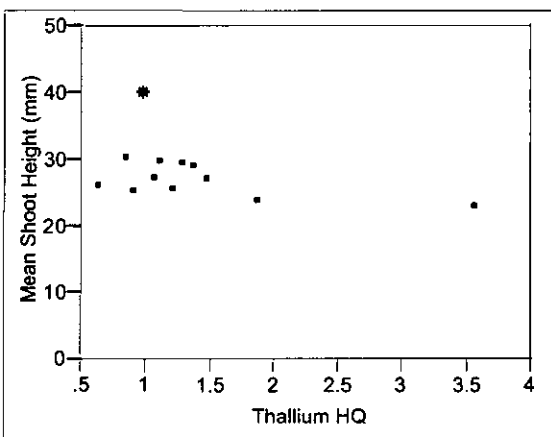
Note: * = The reference site Guaje Canyon.

Figure E-4.6-50. Scatter plot of total dry weight (g/plant) versus silver HQ



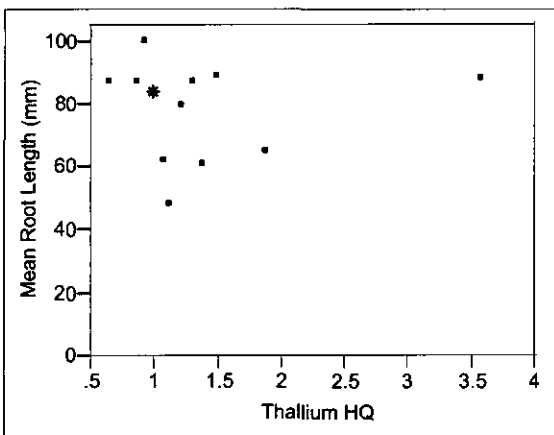
Note: * = The reference site Guaje Canyon.

Figure E-4.6-51. Scatter plot of mortality (fraction) versus thallium HQ



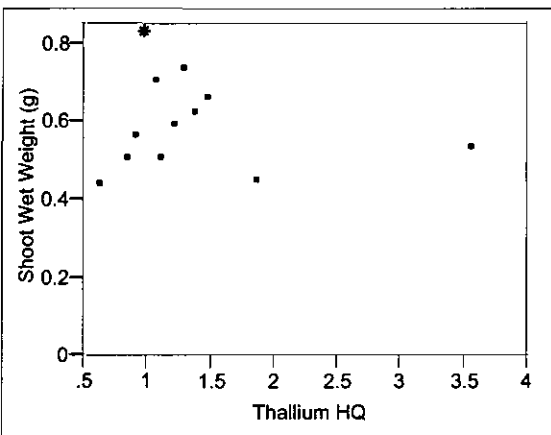
Note: * = The reference site Guaje Canyon.

Figure E-4.6-52. Scatter plot of mean shoot height (mm) versus thallium HQ



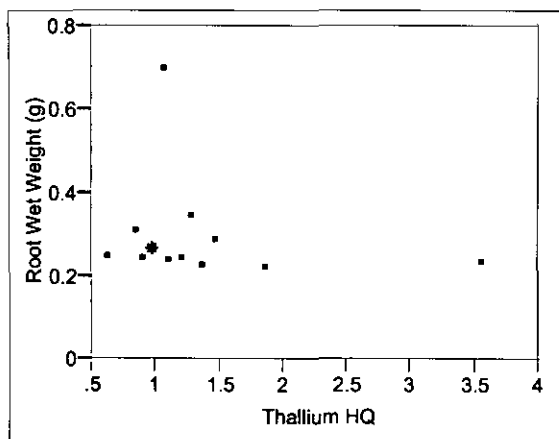
Note: * = The reference site Guaje Canyon.

Figure E-4.6-53. Scatter plot of mean root length (mm) versus thallium HQ



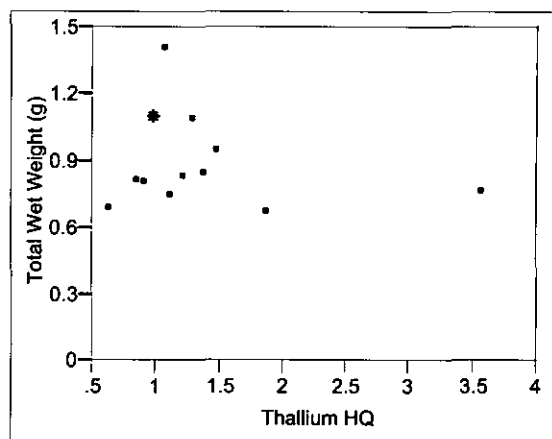
Note: * = The reference site Guaje Canyon.

Figure E-4.6-54. Scatter plot of shoot wet weight (g) versus thallium HQ



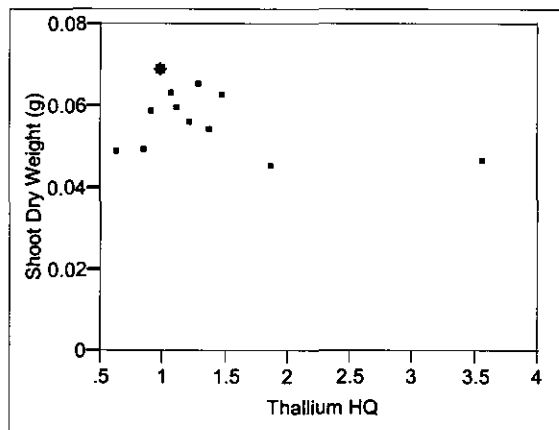
Note: * = The reference site Guaje Canyon.

Figure E-4.6-55. Scatter plot of root wet weight (g) versus thallium HQ



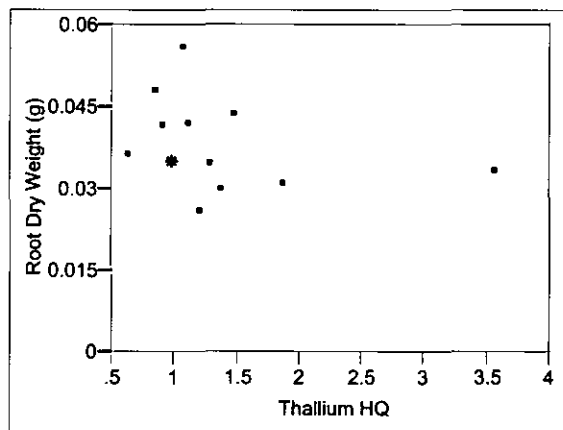
Note: * = The reference site Guaje Canyon.

Figure E-4.6-56. Scatter plot of total wet weight (g) versus thallium HQ



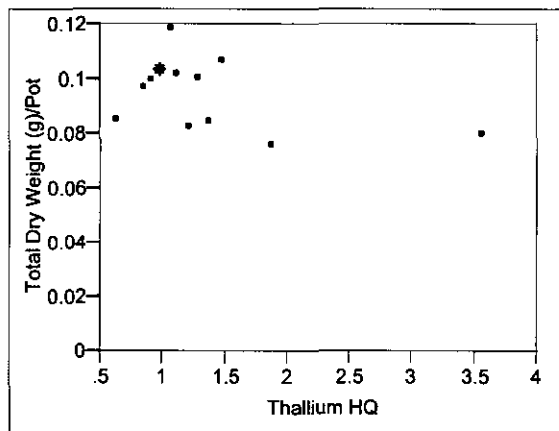
Note: * = The reference site Guaje Canyon.

Figure E-4.6-57. Scatter plot of shoot dry weight (g) versus thallium HQ



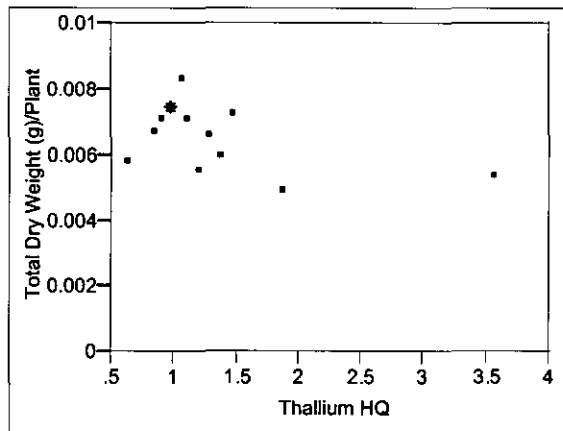
Note: * = The reference site Guaje Canyon.

Figure E-4.6-58. Scatter plot of root dry weight (g) versus thallium HQ



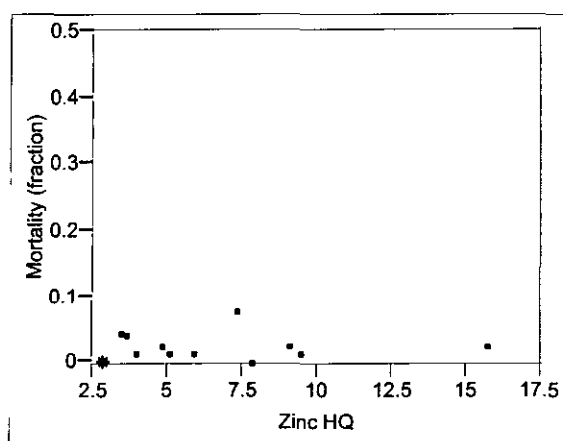
Note: * = The reference site Guaje Canyon.

Figure E-4.6-59. Scatter plot of total dry weight (g/pot) versus thallium HQ



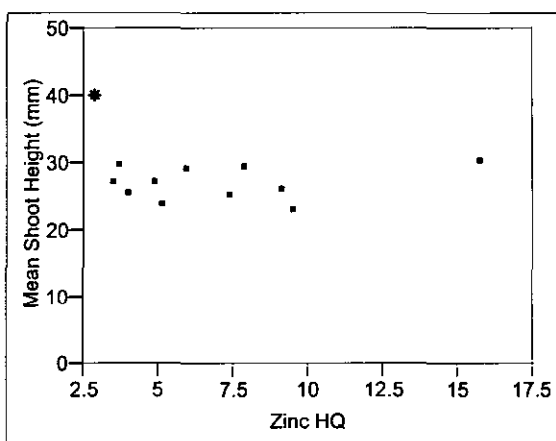
Note: * = The reference site Guaje Canyon.

Figure E-4.6-60. Scatter plot of total dry weight (g/plant) versus thallium HQ



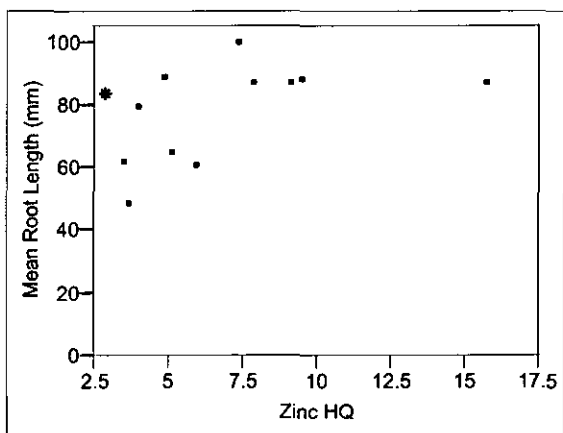
Note: * = The reference site Guaje Canyon.

Figure E-4.6-61. Scatter plot of mortality (fraction) versus zinc HQ



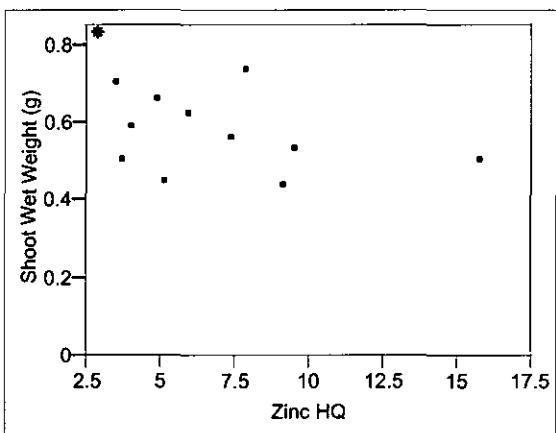
Note: * = The reference site Guaje Canyon.

Figure E-4.6-62. Scatter plot of mean shoot height (mm) versus zinc HQ



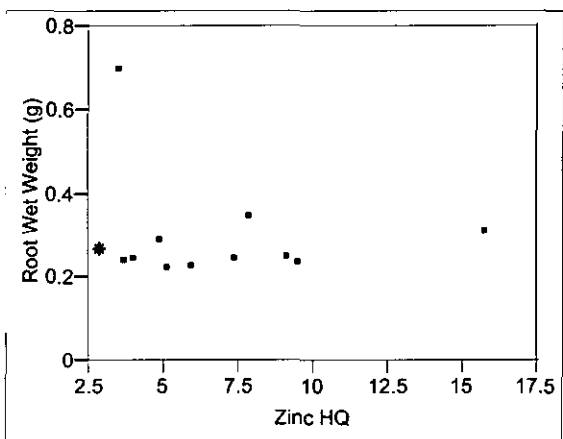
Note: * = The reference site Guaje Canyon.

Figure E-4.6-63. Scatter plot of mean root length (mm) versus zinc HQ



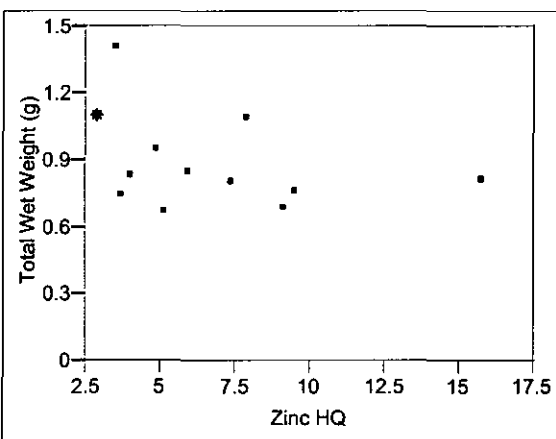
Note: * = The reference site Guaje Canyon.

Figure E-4.6-64. Scatter plot of shoot dry weight (g) versus zinc HQ



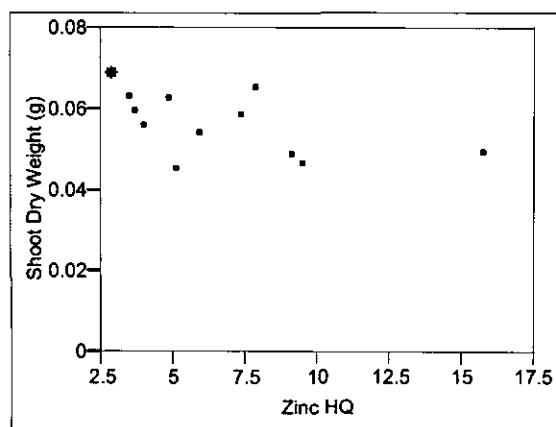
Note: * = The reference site Guaje Canyon.

Figure E-4.6-65. Scatter plot of root wet weight (g) versus zinc HQ



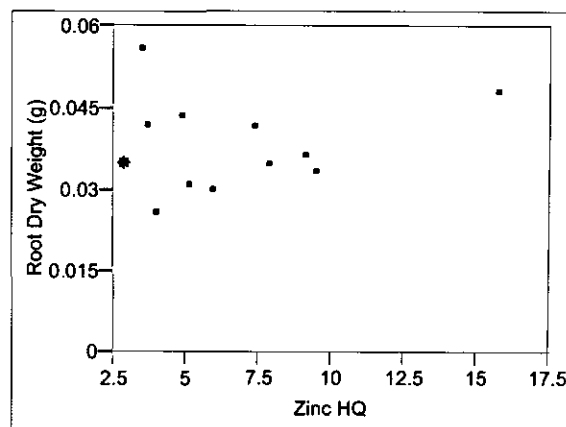
Note: * = The reference site Guaje Canyon.

Figure E-4.6-66. Scatter plot of total dry weight (g) versus zinc HQ



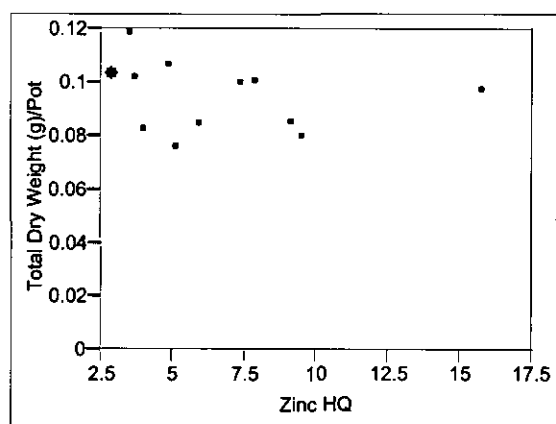
Note: * = The reference site Guaje Canyon.

Figure E-4.6-67. Scatter plot of shoot dry weight (g) versus zinc HQ



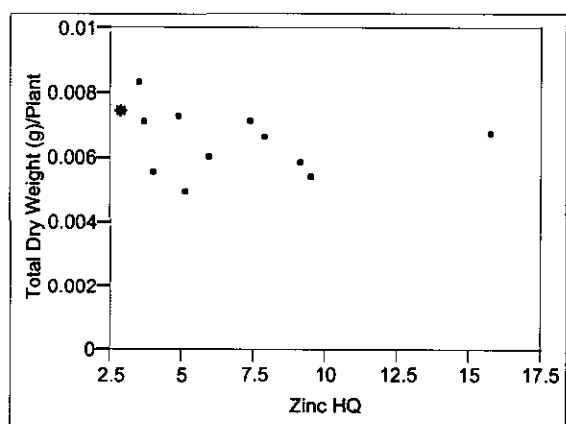
Note: * = The reference site Guaje Canyon.

Figure E-4.6-68. Scatter plot of root dry weight (g) versus zinc HQ



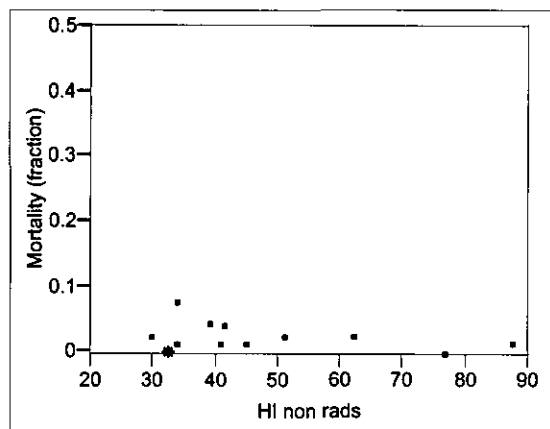
Note: * = The reference site Guaje Canyon.

Figure E-4.6-69. Scatter plot of total dry weight (g/pot) versus zinc HQ



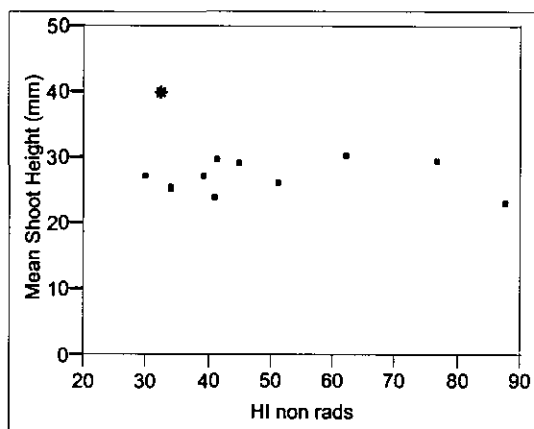
Note: * = The reference site Guaje Canyon.

Figure E-4.6-70. Scatter plot of total dry weight (g/plant) versus zinc HQ



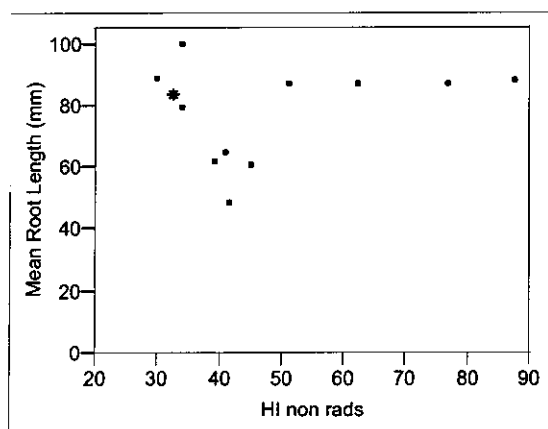
Note: * = The reference site Guaje Canyon.

Figure E-4.6-71. Scatter plot of mortality (fraction) versus HI for nonradionuclides



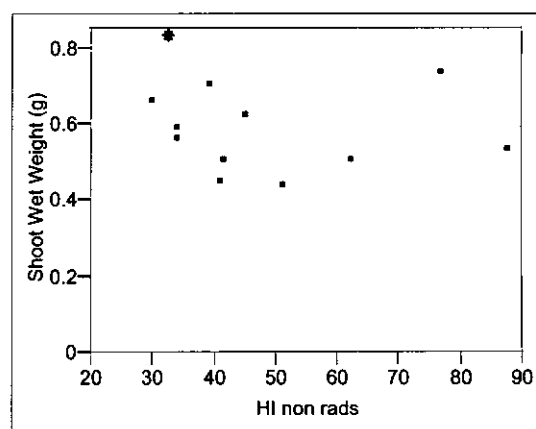
Note: * = The reference site Guaje Canyon.

Figure E-4.6-72. Scatter plot of mean shoot length (mm) versus HI for nonradionuclides



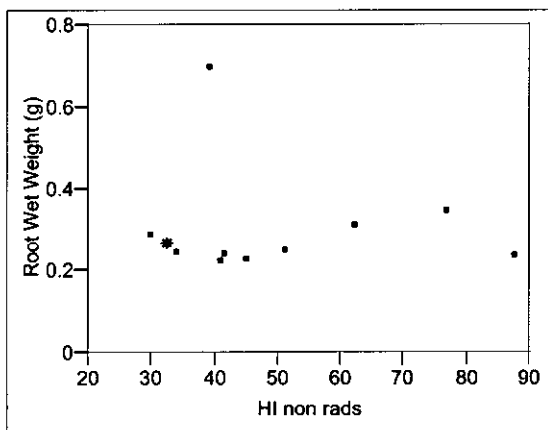
Note: * = The reference site Guaje Canyon.

Figure E-4.6-73. Scatter plot of mean root length (mm) versus HI for nonradionuclides



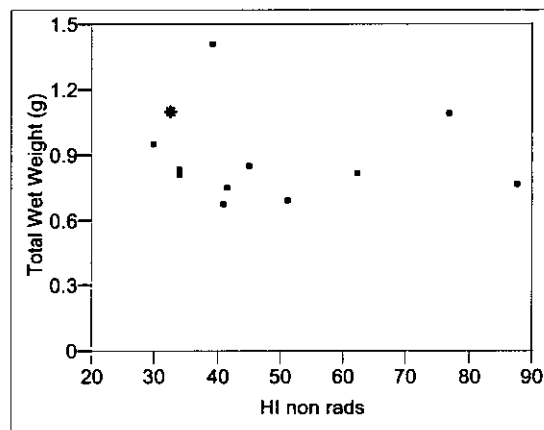
Note: * = The reference site Guaje Canyon.

Figure E-4.6-74. Scatter plot of shoot wet weight (g) versus HI for nonradionuclides



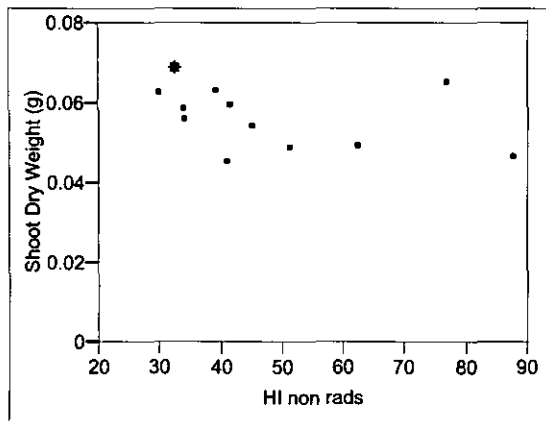
Note: * = The reference site Guaje Canyon.

Figure E-4.6-75. Scatter plot of root wet weight (g) versus HI for nonradionuclides



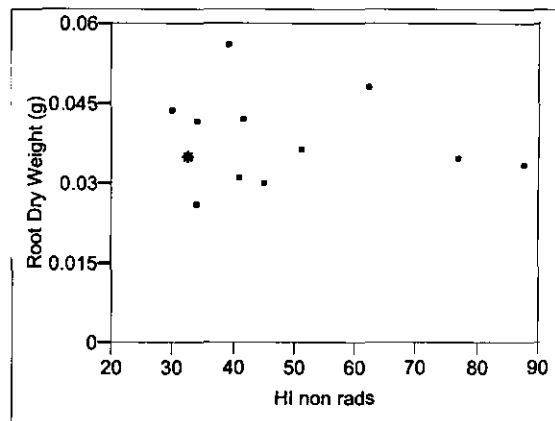
Note: * = The reference site Guaje Canyon.

Figure E-4.6-76. Scatter plot of total wet weight (g) versus HI for nonradionuclides



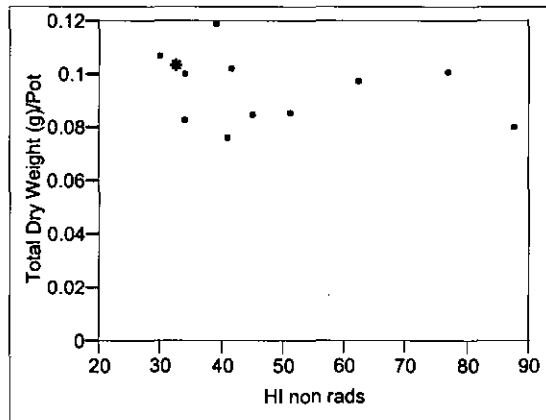
Note: * = The reference site Guaje Canyon.

Figure E-4.6-77. Scatter plot of shoot dry weight (g) versus HI for nonradionuclides



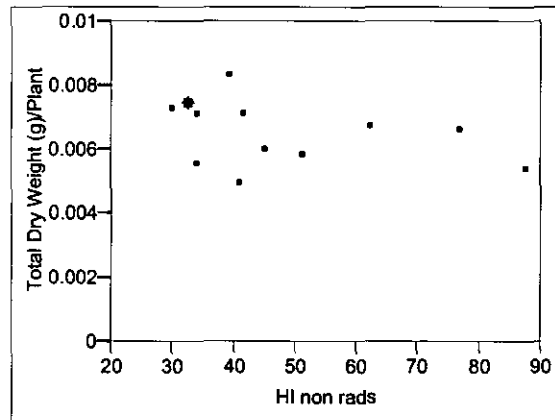
Note: * = The reference site Guaje Canyon.

Figure E-4.6-78. Scatter plot of root dry weight (g) versus HI for nonradionuclides



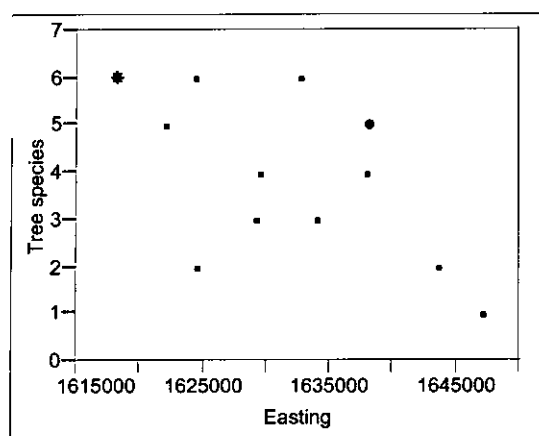
Note: * = The reference site Guaje Canyon.

Figure E-4.6-79. Scatter plot of total dry weight (g/pot) versus HI for nonradionuclides



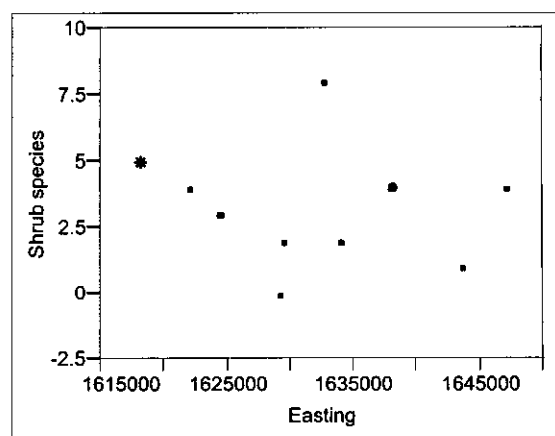
Note: * = The reference site Guaje Canyon.

Figure E-4.6-80. Scatter plot of total dry weight (g/plant) versus HI for nonradionuclides



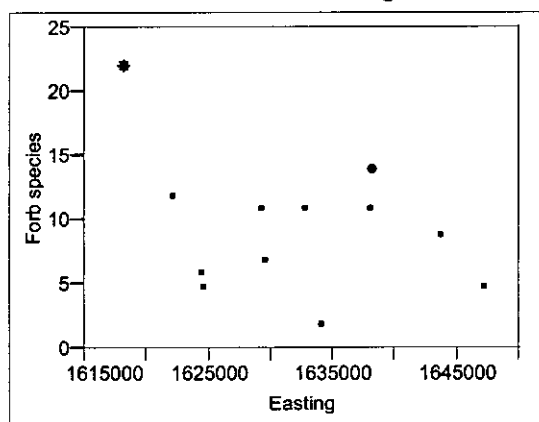
Notes: * = Reach LA-0,
• = the reference site Guaje Canyon.

Figure E-4.7-1. Scatter plot of tree species versus easting



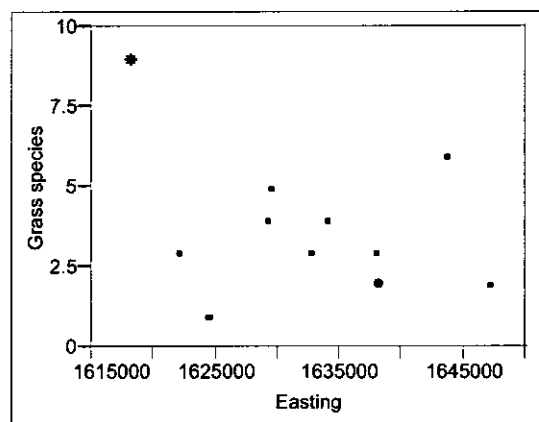
Notes: * = Reach LA-0,
• = the reference site Guaje Canyon.

Figure E-4.7-2. Scatter plot of shrub species versus easting



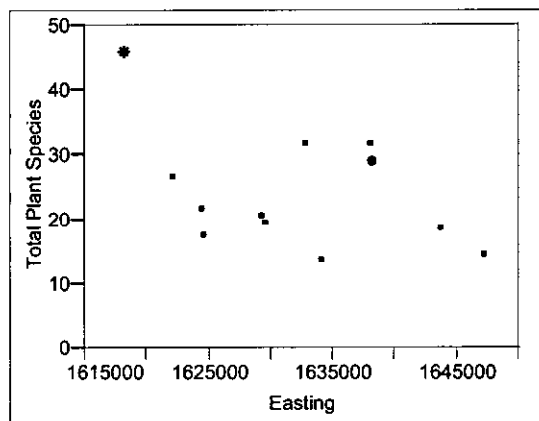
Notes: * = Reach LA-0,
• = the reference site Guaje Canyon.

Figure E-4.7-3. Scatter plot of forb species versus easting



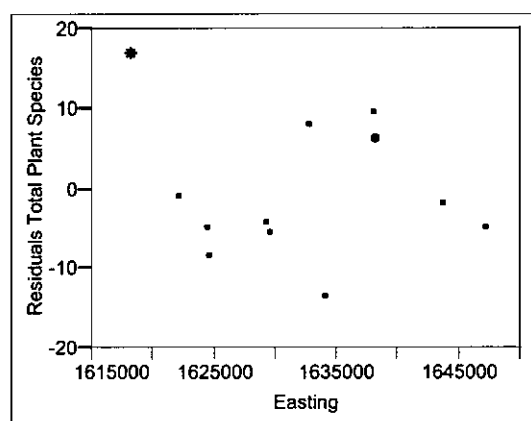
Notes: * = Reach LA-0,
• = the reference site Guaje Canyon.

Figure E-4.7-4. Scatter plot of grass species versus easting



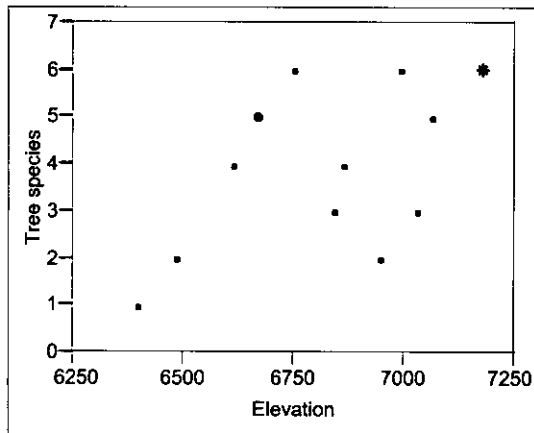
Notes: * = Reach LA-0,
• = the reference site Guaje Canyon.

Figure E-4.7-5. Scatter plot of total plant species versus easting



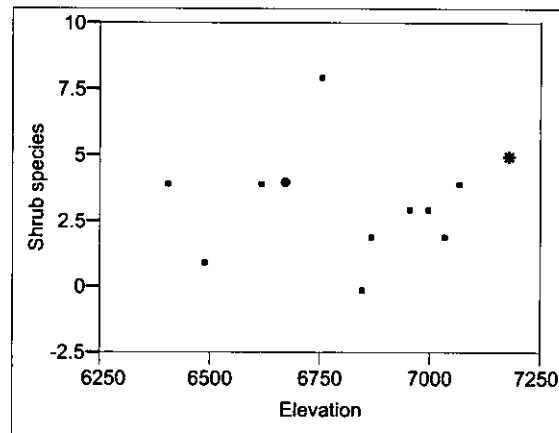
Notes: * = Reach LA-0,
• = the reference site Guaje Canyon.

Figure E-4.7-6. Scatter plot of residuals total plant species versus easting



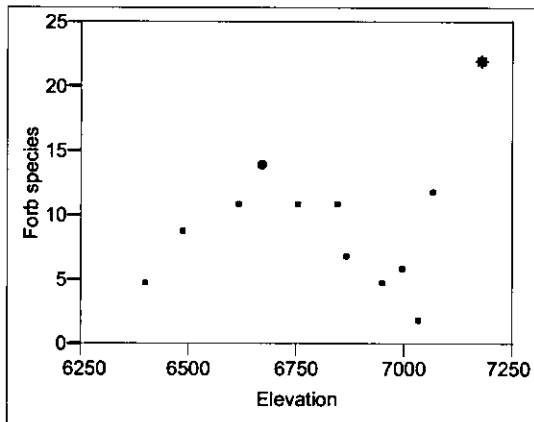
Notes: * = Reach LA-0,
• = the reference site Guaje Canyon.

Figure E-4.7-7. Scatter plot of tree species versus elevation



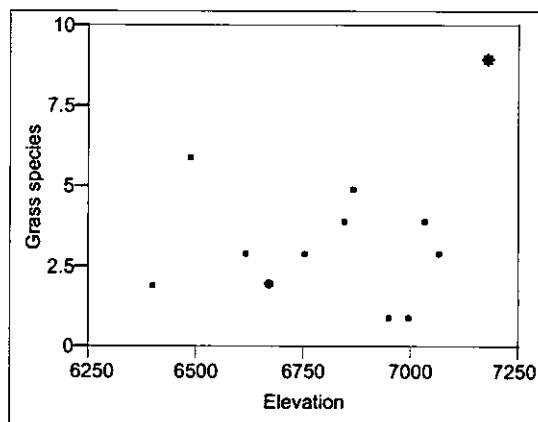
Notes: * = Reach LA-0,
• = the reference site Guaje Canyon.

Figure E-4.7-8. Scatter plot of shrub species versus elevation



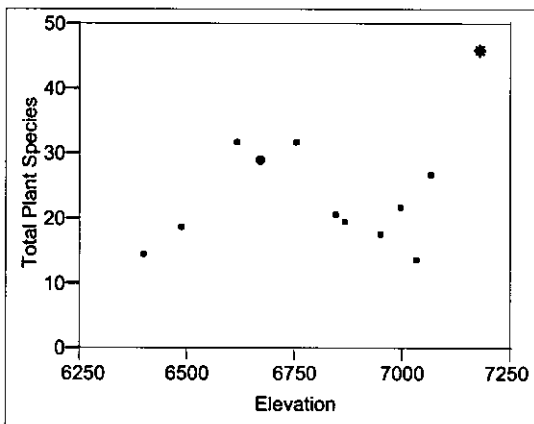
Notes: * = Reach LA-0,
• = the reference site Guaje Canyon.

Figure E-4.7-9. Scatter plot of forb species versus elevation



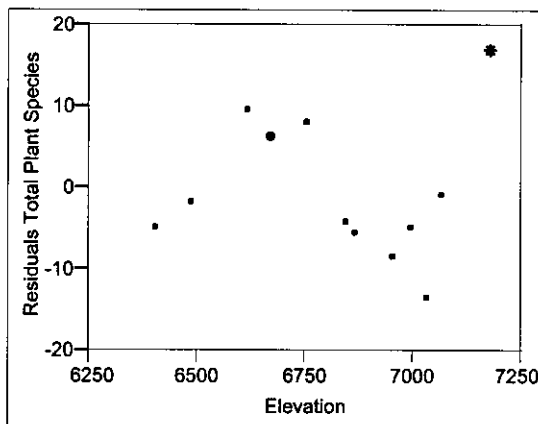
Notes: * = Reach LA-0,
• = the reference site Guaje Canyon.

Figure E-4.7-10. Scatter plot of grass species versus elevation



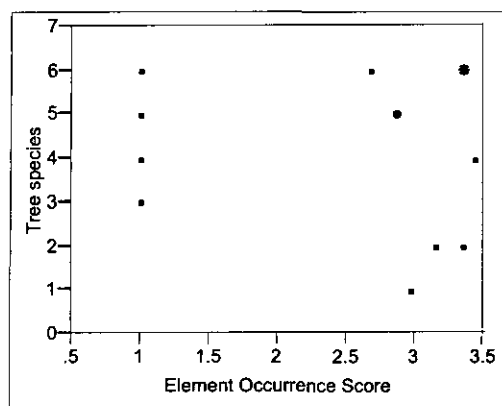
Notes: * = Reach LA-0,
• = the reference site Guaje Canyon.

Figure E-4.7-11. Scatter plot of total plant species versus elevation



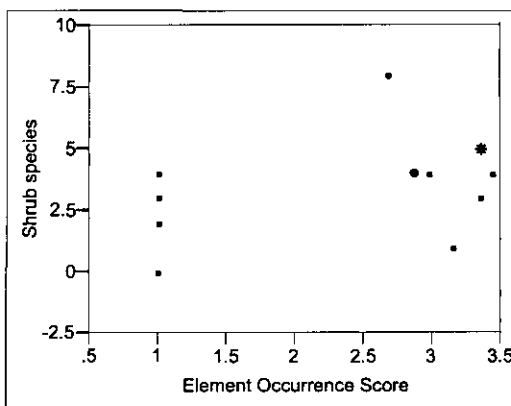
Notes: * = Reach LA-0,
• = the reference site Guaje Canyon.

Figure E-4.7-12. Scatter plot of residuals total plant species versus elevation



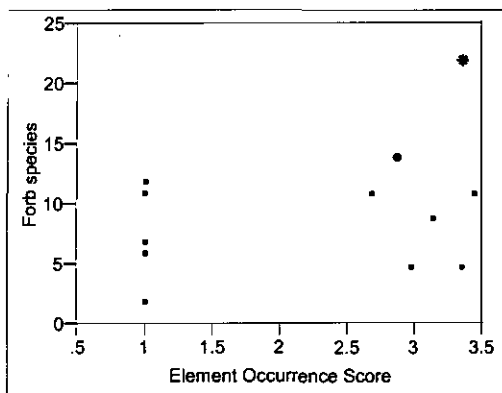
Notes: * = Reach LA-0,
• = the reference site Guaje Canyon.

Figure E-4.7-13. Scatter plot of tree species versus element occurrence score



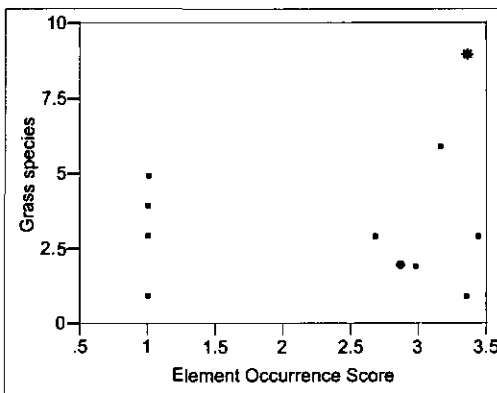
Notes: * = Reach LA-0,
• = the reference site Guaje Canyon.

Figure E-4.7-14. Scatter plot of shrub species versus element occurrence score



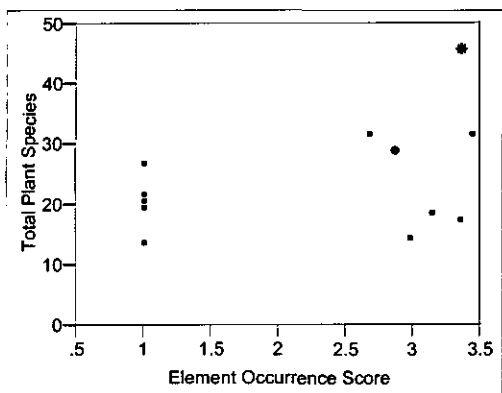
Notes: * = Reach LA-0,
• = the reference site Guaje Canyon.

Figure E-4.7-15. Scatter plot of forb species versus element occurrence score



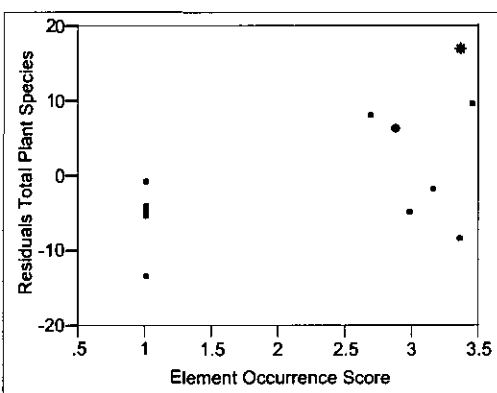
Notes: * = Reach LA-0,
• = the reference site Guaje Canyon.

Figure E-4.7-16. Scatter plot of grass species versus element occurrence score



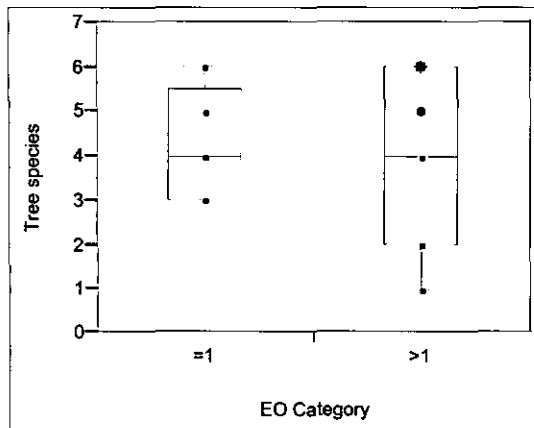
Notes: * = Reach LA-0,
• = the reference site Guaje Canyon.

Figure E-4.7-17. Scatter plot of total plant species versus element occurrence score



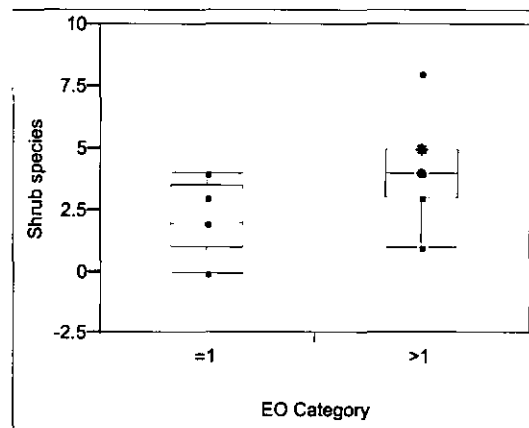
Notes: * = Reach LA-0,
• = the reference site Guaje Canyon.

Figure E-4.7-18. Scatter plot of residuals total plant species versus element occurrence score



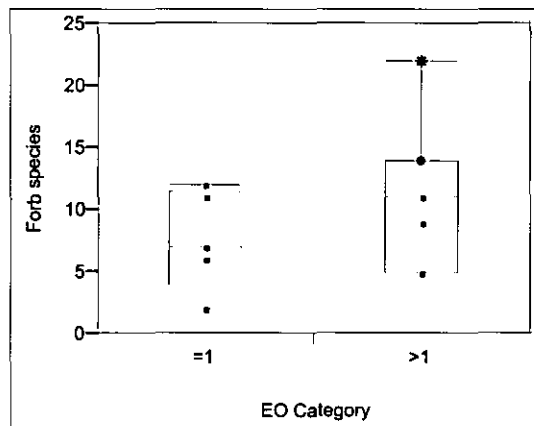
Notes: * = Reach LA-0,
• = the reference site Guaje Canyon.

Figure E-4.7-19. Box plot of tree species versus element occurrence (EO) groups



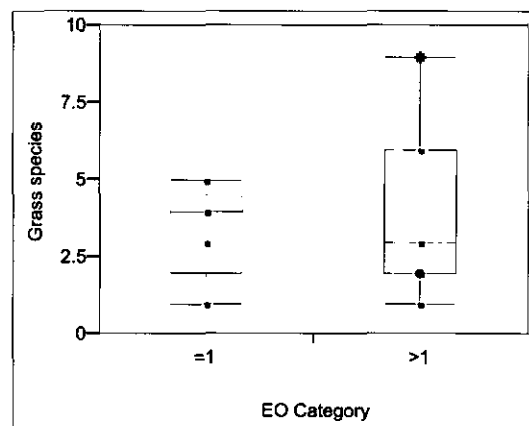
Notes: * = Reach LA-0,
• = the reference site Guaje Canyon.

Figure E-4.7-20. Box plot of shrub species versus EO groups



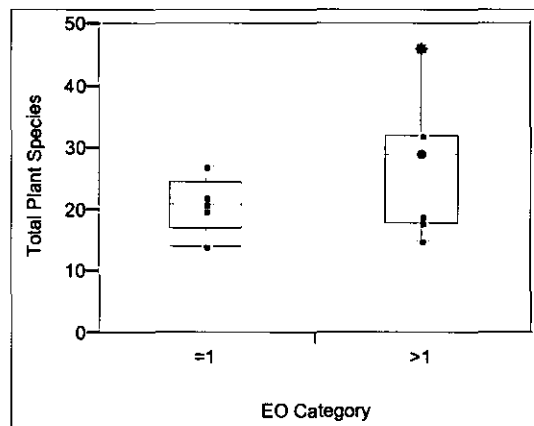
Notes: * = Reach LA-0,
• = the reference site Guaje Canyon.

Figure E-4.7-21. Box plot of forb species versus EO groups



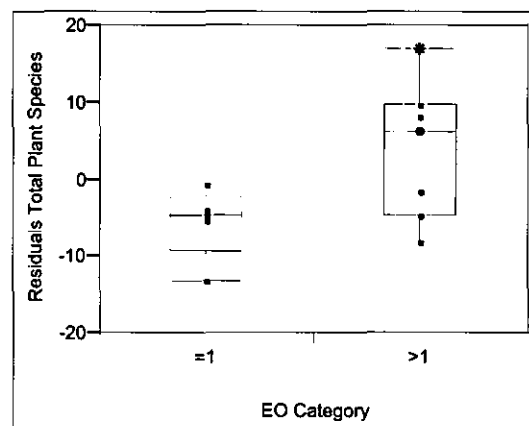
Notes: * = Reach LA-0,
• = the reference site Guaje Canyon.

Figure E-4.7-22. Box plot of grass species versus EO groups



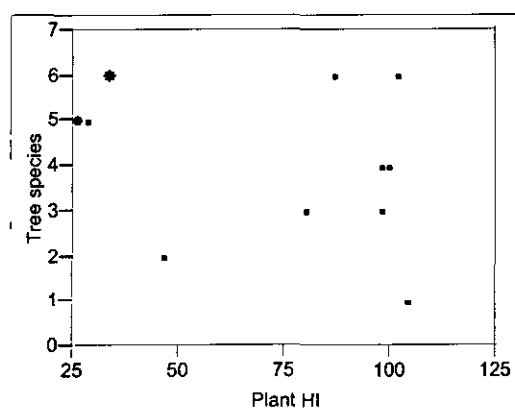
Notes: * = Reach LA-0,
• = the reference site Guaje Canyon.

Figure E-4.7-23. Box plot of total plant species versus EO groups



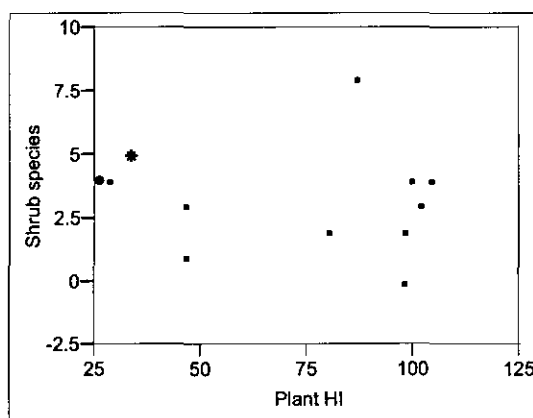
Notes: * = Reach LA-0,
• = the reference site Guaje Canyon.

Figure E-4.7-24. Box plot of residuals total plant species versus EO groups



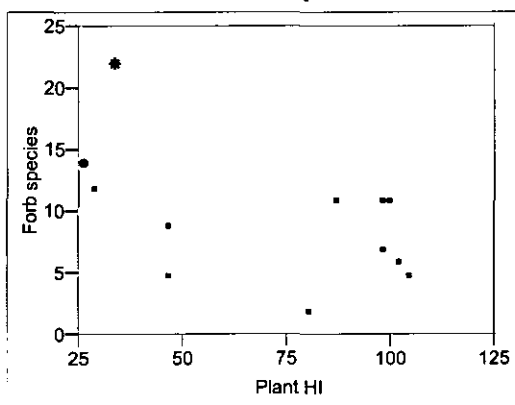
Notes: * = Reach LA-0,
• = the reference site Guaje Canyon.

Figure E-4.7-25. Scatter plot of tree species versus plant HI



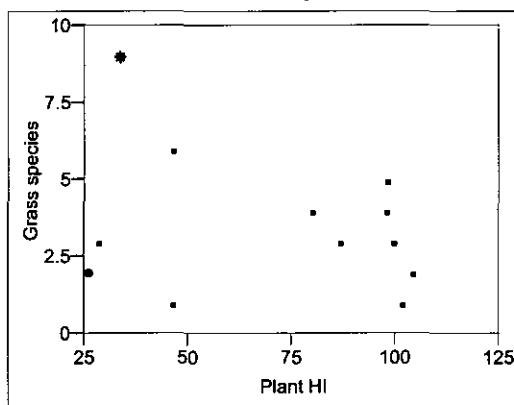
Notes: * = Reach LA-0,
• = the reference site Guaje Canyon.

Figure E-4.7-26. Scatter plot of shrub species versus plant HI



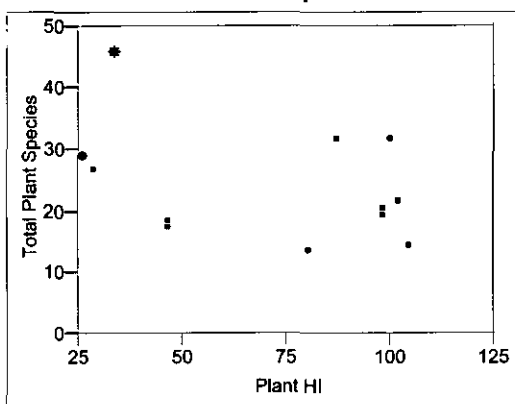
Notes: * = Reach LA-0,
• = the reference site Guaje Canyon.

Figure E-4.7-27. Scatter plot of forb species versus plant HI



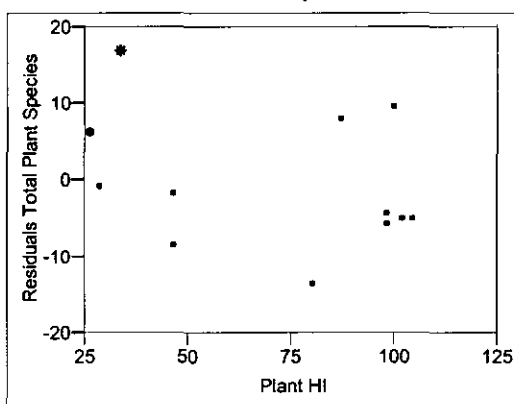
Notes: * = Reach LA-0,
• = the reference site Guaje Canyon.

Figure E-4.7-28. Scatter plot of grass species versus plant HI



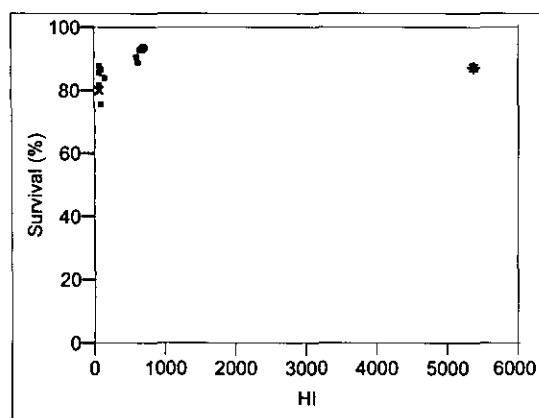
Notes: * = Reach LA-0,
• = the reference site Guaje Canyon.

Figure E-4.7-29. Scatter plot of total plant species versus plant HI



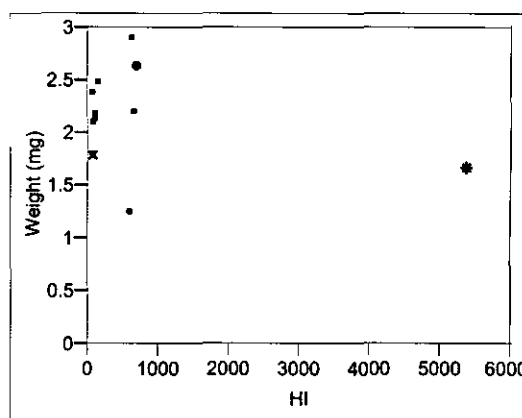
Notes: * = Reach LA-0,
• = the reference site Guaje Canyon.

Figure E-4.7-30. Scatter plot of residuals total plant species versus plant HI



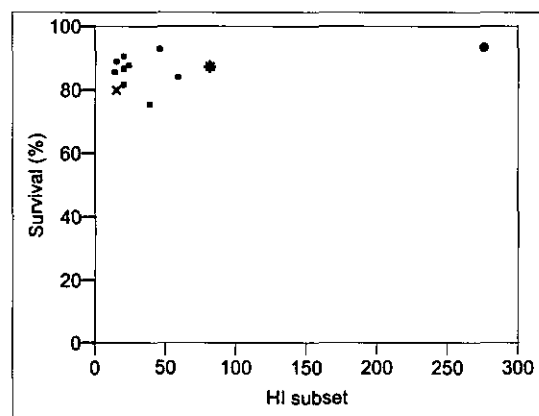
Notes: * = Reach LA-0, • = reach AC-3,
x = reach P-1FW.

Figure E-4.8-1. Scatter plot of survival (%) versus HI



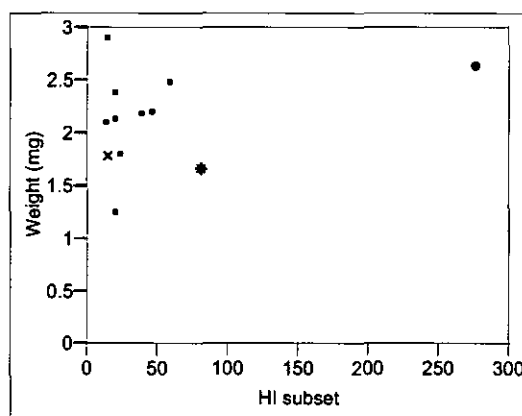
Notes: * = Reach LA-0, • = reach AC-3,
x = reach P-1FW.

Figure E-4.8-2. Scatter plot of weight (mg) versus HI



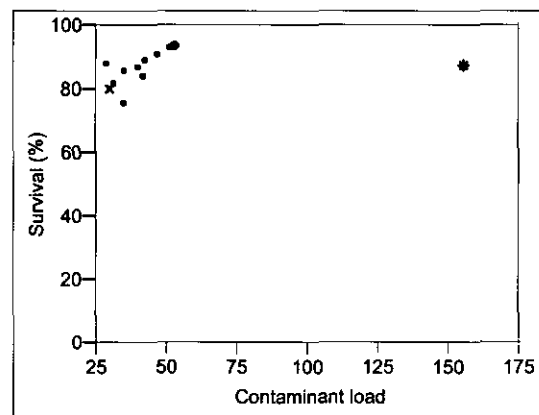
Notes: * = Reach LA-0, • = reach AC-3,
x = reach P-1FW.

Figure E-4.8-3. Scatter plot of survival (%) versus HI subset



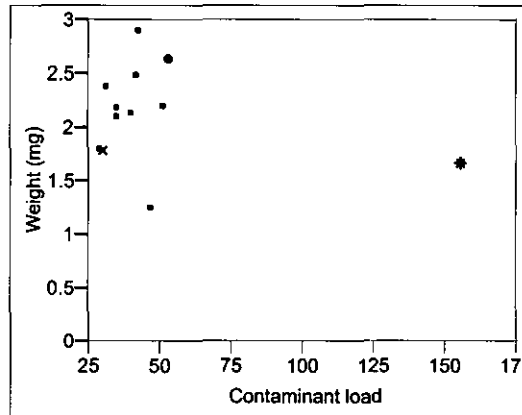
Notes: * = Reach LA-0, • = reach AC-3,
x = reach P-1FW.

Figure E-4.8-4. Scatter plot of weight (mg) versus HI subset



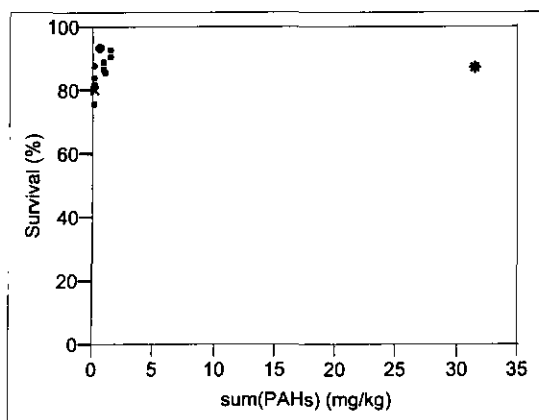
Notes: * = Reach LA-0, • = reach AC-3,
x = reach P-1FW.

Figure E-4.8-5. Scatter plot of survival (%) versus contaminant load



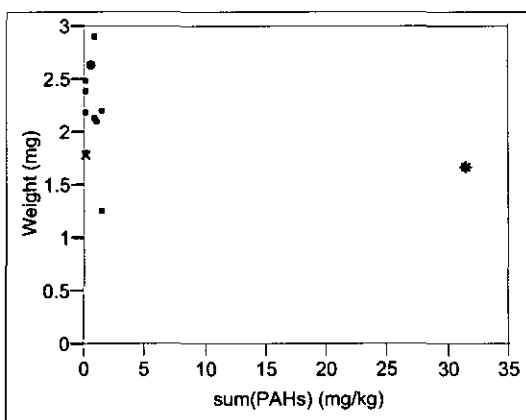
Notes: * = Reach LA-0, • = reach AC-3,
x = reach P-1FW.

Figure E-4.8-6. Scatter plot of weight (mg) versus contaminant load



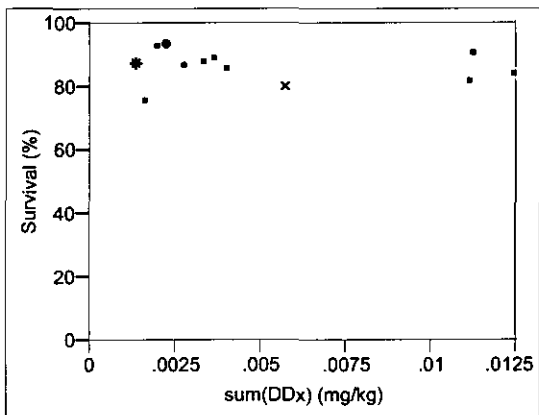
Notes: * = Reach LA-0, • = reach AC-3,
x = reach P-1FW.

Figure E-4.8-7. Scatter plot of survival (%) versus sum(PAHs) (mg/kg)



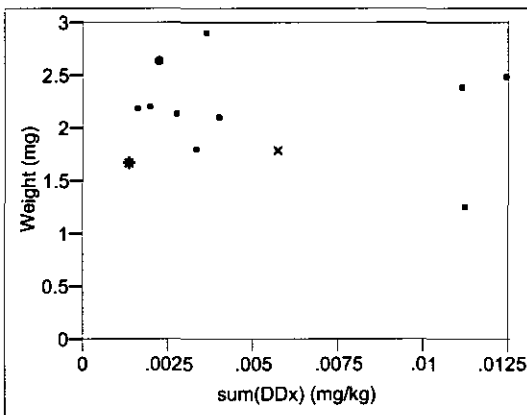
Notes: * = Reach LA-0, • = reach AC-3,
x = reach P-1FW.

Figure E-4.8-8. Scatter plot of weight (mg) versus sum(PAHs) (mg/kg)



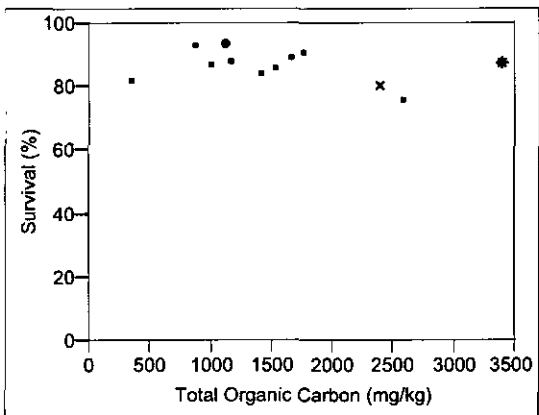
Notes: * = Reach LA-0, • = reach AC-3,
x = reach P-1FW.

Figure E-4.8-9. Scatter plot of survival (%) versus sum(DDx) (mg/kg)



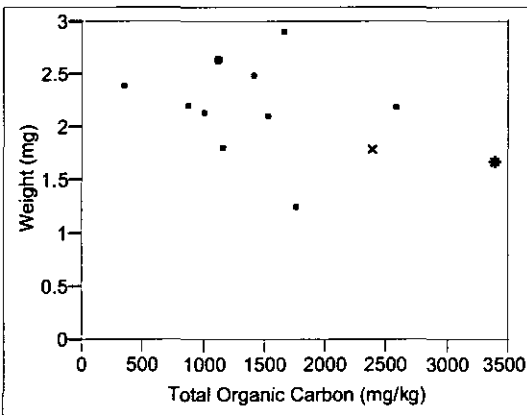
Notes: * = Reach LA-0, • = reach AC-3,
x = reach P-1FW.

Figure E-4.8-10. Scatter plot of weight (mg) versus sum(DDx) (mg/kg)



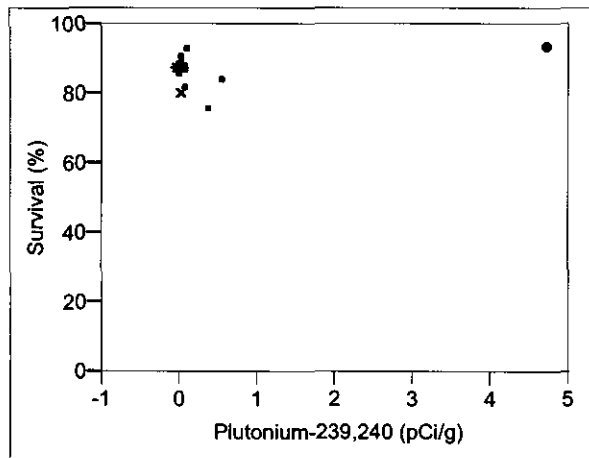
Notes: * = Reach LA-0, • = reach AC-3,
x = reach P-1FW.

Figure E-4.8-11. Scatter plot of survival (%) versus total organic carbon (mg/kg)



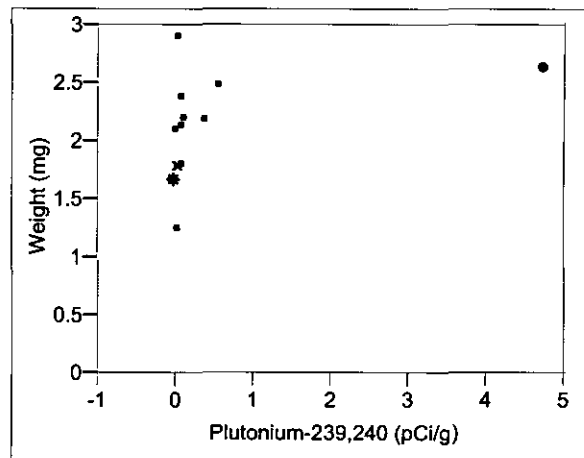
Notes: * = Reach LA-0, • = reach AC-3,
x = reach P-1FW.

Figure E-4.8-12. Scatter plot of weight (mg) versus total organic carbon (mg/kg)



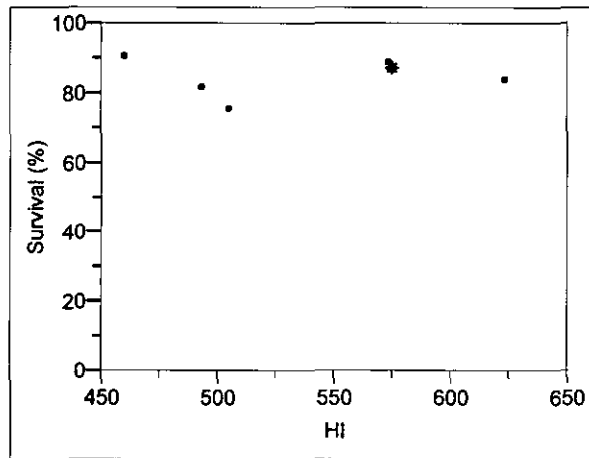
Notes: * = Reach LA-0, • = reach AC-3,
x = reach P-1FW.

Figure E-4.8-13. Scatter plot of survival (%) versus plutonium-239,240 (pCi/g)



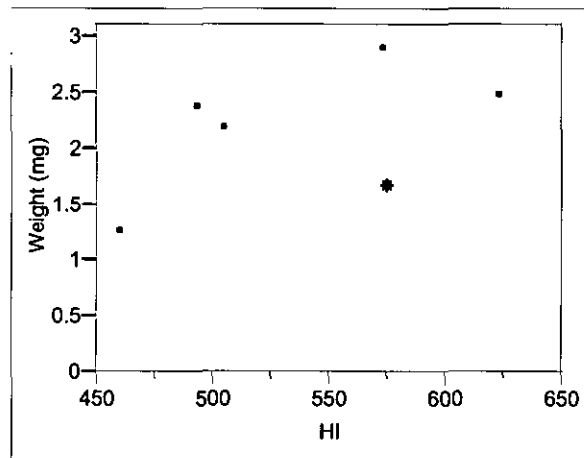
Notes: * = Reach LA-0, • = reach AC-3,
x = reach P-1FW.

Figure E-4.8-14. Scatter plot of weight (mg) versus plutonium-239,240 (pCi/g)



Notes: * = Reach LA-0, • = reach AC-3,
x = reach P-1FW.

Figure E-4.8-15. Scatter plot of survival (%) versus HI (water)



Notes: * = Reach LA-0, • = reach AC-3,
x = reach P-1FW.

Figure E-4.8-16. Scatter plot of weight (mg) versus HI (water)

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Table E-1.0-1
Sediment: Organic COPCs

Subwatershed	Reach	Status	Acenaphthene	Acetone	Aldrin	4-Amino-2,6-dinitrotoluene	2-Amino-4,6-dinitrotoluene	Anthracene	Aroclor-1248	Aroclor-1254	Aroclor-1260	Benzene	Benz(a)anthracene	Benzo(a)pyrene
Acid Canyon	AC-1		1.6	-	<	-	-	3	+	+	0.13	-	5.6	5.9
Acid Canyon	AC-2		0.58	-	<	-	-	1.1	+	+	0.069	-	2.6	3
Acid Canyon	AC-3		0.53	-	<	-	-	0.72	+	6.2	0.095	-	1.8	1.5
Acid Canyon	ACS		0.038	0.265	<	-	-	0.054	+	0.726	0.152	0.0012	0.15	0.17
Acid Canyon	ACS	ACS removed	+	-	<	-	-	+	5.1	5.6	3.3	-	0.35	0.31
Acid Canyon	ACS	ACS WC	-	+	-	-	-	-	-	-	-	+	-	-
DP Canyon	DP-1C		0.24	0.017	-	-	-	1.8	<	<	1	<	1.2	0.75
DP Canyon	DP-1E		0.087	+	-	-	-	0.11	<	<	0.077	<	0.96	0.83
DP Canyon	DP-1W		+	-	<	-	-	0.62	<	<	+	<	3	3.2
DP Canyon	DP-2		+	0.006	<	-	-	0.197	<	<	0.175	<	0.77	0.72
DP Canyon	DP-3		+	+	<	-	-	+	<	<	0.091	<	0.66	0.72
DP Canyon	DP-4		0.067	-	<	-	-	0.096	<	<	0.041	-	0.29	0.35
DP Canyon	DPTF		+	-	-	-	-	+	-	-	-	<	+	+
Lower Los Alamos Canyon	LA-4E		-	-	+	-	-	-	<	<	<	-	-	-
Lower Los Alamos Canyon	LA-4FE	Fire-impacted sediment	<	-	-	-	-	0.0116	-	-	-	-	0.0458	<
Lower Los Alamos Canyon	LA-4W		-	-	+	-	-	-	<	<	<	-	-	-
Lower Los Alamos Canyon	LA-5		<	-	0.00117	-	-	+	<	<	<	-	+	<
Post-Fire	Baseline	Fire-impacted sediment	<	-	<	0.86	0.4	<	<	<	<	-	<	<
Post-Fire	Rendija Cyn	Fire-impacted sediment	<	-	-	-	-	<	-	-	-	-	<	<
Pueblo Canyon	P-1E		0.17	-	0.00211	-	-	0.3	<	0.238	0.117	-	1	1.8
Pueblo Canyon	P-1FW		+	-	+	-	-	+	<	0.015	0.076	-	+	+

Table E-1.0-1 (continued)

Subwatershed	Reach	Status	Acenaphthene	Acetone	Aldrin	4-Amino-2,6-dinitrotoluene	2-Amino-4,6-dinitrotoluene	Anthracene	Aroclor-1248	Aroclor-1254	Aroclor-1260	Benzene	Benz(a)anthracene	Benzo(a)pyrene
Pueblo Canyon	P-1W		0.055	-	+	-	-	0.23	<	+	0.11	-	0.42	0.43
Pueblo Canyon	P-2W		-	-	+	-	-	-	<	+	0.055	-	-	-
Pueblo Canyon	P-3W		-	-	+	-	-	-	<	+	+	-	-	-
Pueblo Canyon	P-4E		+	-	+	-	-	+	<	+	+	-	0.035	+
Pueblo Canyon	P-4W		0.219	-	+	-	-	0.369	<	+	+	-	0.609	0.675
Pueblo Canyon	WC		+	-	+	-	-	+	<	+	+	-	+	+
Upper Los Alamos Canyon	LA-0		+	-	<	-	-	+	<	+	0.087	-	0.11	0.12
Upper Los Alamos Canyon	LA-1C		0.079	-	<	-	-	0.14	<	0.47	0.86	-	0.26	0.22
Upper Los Alamos Canyon	LA-1E		+	-	<	-	-	0.17	<	+	0.4	-	0.32	0.24
Upper Los Alamos Canyon	LA-1FW		+	-	<	-	-	0.27	<	+	0.14	-	0.32	0.32
Upper Los Alamos Canyon	LA-1W		+	-	<	-	-	+	<	0.54	0.066	-	0.092	0.09
Upper Los Alamos Canyon	LA-1W+		+	-	<	-	-	+	<	0.65	0.15	-	0.21	0.24
Upper Los Alamos Canyon	LA-2E		0.26	-	<	-	-	0.069	<	+	0.23	-	0.368	0.655
Upper Los Alamos Canyon	LA-2E	Removed	+	-	<	-	-	0.044	<	+	0.42	-	0.136	0.15
Upper Los Alamos Canyon	LA-2FE		0.087	-	<	-	-	0.14	<	+	0.58	-	0.29	0.28
Upper Los Alamos Canyon	LA-2W		0.23	-	<	-	-	0.03	<	+	0.34	-	0.27	0.24
Upper Los Alamos Canyon	LA-3E		+	-	<	-	-	+	<	+	0.11	-	0.22	0.28
Upper Los Alamos Canyon	LA-3FE	Fire-impacted sediment	+	-	-	-	-	+	-	-	-	-	0.25	0.26
Upper Los Alamos Canyon	LA-3W		+	-	<	-	-	0.099	<	+	0.34	-	0.2	0.19

Table E-1.0-1 (continued)

Subwatershed	Reach	Status	Benzo(b)fluoranthene	Benzo(g,h,i)perylene	Benzo(k)fluoranthene	Benzoic Acid	Benzyl Alcohol	Bis-2(ethylhexyl)phthalate	2-Butanone	Butylbenzylphthalate	Carbazole	alpha-Chlordane	gamma-Chlordane	Chlorobenzene
Acid Canyon	AC-1		6.7	1.4	3.4	+	<	2	-	<	1.4	0.031	0.034	-
Acid Canyon	AC-2		5.3	0.74	0.7	0.76	<	1.7	-	<	0.47	0.012	0.026	-
Acid Canyon	AC-3		2.9	+	0.059	1.8	<	0.18	-	<	0.44	0.0033	0.0064	-
Acid Canyon	ACS		0.13	+	0.22	0.431	<	0.24	0.021	<	+	0.0091	0.0076	0.00057
Acid Canyon	ACS	ACS removed	0.66	0.19	+	+	<	+	-	<	+	0.0015	0.013	-
Acid Canyon	ACS	ACS WC	-	-	-	-	-	-	+	-	-	-	-	+
DP Canyon	DP-1C		1.7	+	0.25	<	<	1.1	<	0.5	0.27	-	-	<
DP Canyon	DP-1E		1.2	0.27	0.39	<	<	0.46	<	0.45	0.045	0.00894	0.011	<
DP Canyon	DP-1W		3.8	5	1.4	<	<	1.7	-	0.32	0.5	0.25	0.18	-
DP Canyon	DP-2		1	0.7	0.4	<	<	0.84	<	0.39	0.13	0.031	0.0338	<
DP Canyon	DP-3		1.3	+	+	<	<	0.95	<	+	+	0.011	0.00898	<
DP Canyon	DP-4		0.62	0.33	0.059	<	<	0.073	-	0.17	+	0.024	0.017	-
DP Canyon	DPTF		+	+	+	<	<	+	-	+	+	-	-	-
Lower Los Alamos Canyon	LA-4E		-	-	-	-	-	-	-	-	-	<	<	-
Lower Los Alamos Canyon	LA-4FE	Fire-impacted sediment	<	<	<	<	<	0.14	-	<	-	-	-	-
Lower Los Alamos Canyon	LA-4W		-	-	-	-	-	-	-	-	-	<	<	-
Lower Los Alamos Canyon	LA-5		<	<	<	<	<	+	-	<	<	<	<	-
Post-Fire	Baseline	Fire-impacted sediment	<	<	<	3.5	+	<	-	<	<	<	<	-
Post-Fire	Rendija Cyn	Fire-impacted sediment	<	<	<	3.4	0.13	<	-	<	<	-	-	-
Pueblo Canyon	P-1E		2.5	0.69	1.1	0.24	<	+	-	<	0.17	0.00497	0.0033	-
Pueblo Canyon	P-1FW		+	0.14	+	0.2	<	0.34	-	<	+	0.0033	0.0044	-
Pueblo Canyon	P-1W		0.6	0.076	0.24	0.26	<	0.35	-	<	0.052	0.012	0.012	-
Pueblo Canyon	P-2W		-	-	-	-	-	-	-	-	-	+	+	-

Table E-1.0-1 (continued)

Subwatershed	Reach	Status	Benzo(b)fluoranthene	Benzo(g,h,i)perylene	Benzo(k)fluoranthene	Benzoic Acid	Benzyl Alcohol	Bis-2(ethylhexyl)phthalate	2-Butanone	Butylbenzylphthalate	Carbazole	alpha-Chlordane	gamma-Chlordane	Chlorobenzene
Pueblo Canyon	P-3W		-	-	-	-	-	-	-	-	-	+	+	-
Pueblo Canyon	P-4E		+	+	+	+	<	+	-	<	-	+	+	-
Pueblo Canyon	P-4W		0.91	0.473	0.114	+	<	+	-	<	-	+	+	-
Pueblo Canyon	WC		+	+	+	+	<	+	-	<	+	+	0.00083	-
Upper Los Alamos Canyon	LA-0		0.093	+	0.15	0.18	<	0.22	-	<	<	+	0.0015	-
Upper Los Alamos Canyon	LA-1C		0.21	+	0.17	0.16	<	1.3	-	<	-	+	0.021	-
Upper Los Alamos Canyon	LA-1E		0.21	+	0.2	+	<	0.53	-	<	-	+	0.0059	-
Upper Los Alamos Canyon	LA-1FW		0.24	+	0.42	0.19	<	0.16	-	<	<	0.0036	0.0047	-
Upper Los Alamos Canyon	LA-1W		+	+	0.088	+	<	0.1	-	<	-	0.0072	0.0068	-
Upper Los Alamos Canyon	LA-1W+		0.25	+	0.19	0.19	<	1.2	-	<	-	+	+	-
Upper Los Alamos Canyon	LA-2E		0.66	0.298	0.019	+	<	+	-	<	-	+	+	-
Upper Los Alamos Canyon	LA-2E	Removed	0.253	+	+	+	<	+	-	<	-	+	+	-
Upper Los Alamos Canyon	LA-2FE		0.23	+	0.34	+	<	0.11	-	<	-	0.023	0.02	-
Upper Los Alamos Canyon	LA-2W		0.26	+	0.21	0.14	<	0.4	-	<	-	+	+	-
Upper Los Alamos Canyon	LA-3E		0.32	0.21	0.17	+	<	0.34	-	<	-	0.0031	0.0031	-
Upper Los Alamos Canyon	LA-3FE	Fire-impacted sediment	0.33	0.16	+	+	<	+	-	<	<	-	-	-
Upper Los Alamos Canyon	LA-3W		0.25	+	0.27	+	<	0.27	-	<	-	+	+	-

Table E-1.0-1 (continued)

Subwatershed	Reach	Status	Chloromethane	Chrysene	4,4'-DDD	4,4'-DDE	4,4'-DDT	Dibenz(a,h)anthracene	Dibenzofuran	1,2-Dichlorobenzene	1,4-Dichlorobenzene	Dieldrin	2,4-Dimethylphenol	Diphenylamine
Acid Canyon	AC-1		-	5.3	0.013	0.03	0.08	<	1.1	+	+	0.025	<	-
Acid Canyon	AC-2		-	3.1	0.0066	0.0093	0.039	<	+	+	+	+	<	-
Acid Canyon	AC-3		-	1.6	+	0.014	0.1	<	+	+	+	+	<	-
Acid Canyon	ACS		0.0015	0.18	0.02	0.028	0.28	<	0.0673	0.0013	0.00098	0.0505	<	0.0103
Acid Canyon	ACS	ACS removed	-	0.3	+	0.2	0.23	<	+	+	+	+	<	-
Acid Canyon	ACS	ACS WC	+	-	-	-	-	-	-	+	+	-	-	-
DP Canyon	DP-1C		<	0.99	-	-	-	<	<	<	<	-	<	-
DP Canyon	DP-1E		<	0.9	-	-	0.0207	<	<	<	<	-	<	-
DP Canyon	DP-1W		-	3.3	<	+	0.12	<	<	<	<	<	<	-
DP Canyon	DP-2		<	0.83	<	+	0.119	<	<	<	<	<	<	-
DP Canyon	DP-3		<	0.66	<	+	0.056	<	<	<	<	<	<	-
DP Canyon	DP-4		-	0.37	<	0.0042	0.045	<	<	<	<	<	<	-
DP Canyon	DPTF		-	+	-	-	-	<	<	<	<	-	<	-
Lower Los Alamos Canyon	LA-4E		-	-	<	<	+	-	-	-	-	<	-	-
Lower Los Alamos Canyon	LA-4FE	Fire-impacted sediment	-	0.0465	-	-	-	<	0.0058	<	<	-	<	-
Lower Los Alamos Canyon	LA-4W		-	-	<	<	0.0051	-	-	-	-	<	-	-
Lower Los Alamos Canyon	LA-5		-	+	<	<	+	<	+	<	<	<	<	-
Post-Fire	Baseline	Fire-impacted sediment	-	<	<	0.0079	0.0092	<	<	<	<	<	0.46	-
Post-Fire	Rendija Cyn	Fire-impacted sediment	-	<	-	-	-	<	<	<	<	-	+	-
Pueblo Canyon	P-1E		-	1.2	+	0.0019	0.012	0.18	0.096	<	<	+	<	-
Pueblo Canyon	P-1FW		-	+	+	0.0039	0.026	+	+	<	<	0.0026	<	-
Pueblo Canyon	P-1W		-	0.39	0.0044	0.0037	0.016	+	+	<	<	+	<	-
Pueblo Canyon	P-2W		-	-	+	+	+	-	-	-	-	+	-	-
Pueblo Canyon	P-3W		-	-	+	+	+	-	-	-	-	+	-	-

Table E-1.0-1 (continued)

Subwatershed	Reach	Status	Chloromethane	Chrysene	4,4'-DDD	4,4'-DDE	4,4'-DDT	Dibenz(a,h)anthracene	Dibenzofuran	1,2-Dichlorobenzene	1,4-Dichlorobenzene	Dieldrin	2,4-Dimethylphenol	Diphenylamine
Pueblo Canyon	P-4E		-	0.034	+	+	+	+	+	<	<	+	<	-
Pueblo Canyon	P-4W		-	0.6	+	+	+	+	0.18	<	<	+	<	-
Pueblo Canyon	WC		-	+	+	0.0026	0.0048	+	+	<	<	+	<	-
Upper Los Alamos Canyon	LA-0		-	0.13	0.0056	0.023	0.061	<	<	<	<	+	<	-
Upper Los Alamos Canyon	LA-1C		-	0.26	0.092	0.0085	0.14	<	<	<	<	0.03	<	-
Upper Los Alamos Canyon	LA-1E		-	0.28	0.021	0.01	0.017	<	<	<	<	0.014	<	-
Upper Los Alamos Canyon	LA-1FW		-	2.3	+	0.0073	0.022	<	<	<	<	0.0018	<	-
Upper Los Alamos Canyon	LA-1W		-	0.12	+	+	0.017	<	<	<	<	+	<	-
Upper Los Alamos Canyon	LA-1W+		-	0.29	+	0.0055	0.026	<	<	<	<	+	<	-
Upper Los Alamos Canyon	LA-2E		-	0.41	+	+	+	<	<	<	<	+	<	-
Upper Los Alamos Canyon	LA-2E	Removed	-	0.164	+	0.033	+	<	<	<	<	+	<	-
Upper Los Alamos Canyon	LA-2FE		-	0.32	+	0.027	0.087	<	<	<	<	0.023	<	-
Upper Los Alamos Canyon	LA-2W		-	0.29	+	0.013	0.031	<	<	<	<	+	<	-
Upper Los Alamos Canyon	LA-3E		-	0.27	+	+	+	<	<	<	<	+	<	-
Upper Los Alamos Canyon	LA-3FE	Fire-impacted sediment	-	0.27	-	-	-	<	<	<	<	-	<	-
Upper Los Alamos Canyon	LA-3W		-	0.29	+	+	0.075	<	<	<	<	0.014	<	-

Table E-1.0-1 (continued)

Subwatershed	Reach	Status	Endrin	Endrin Aldehyde	Fluoranthene	Fluorene	HMX	Heptachlor Epoxide	Indeno(1,2,3-cd)pyrene	Iodomethane	Isopropylbenzene	4-Isopropyltoluene	4-Methyl-2-pentanone	Methylene Chloride
Acid Canyon	AC-1		+	+	12	1.8	-	0.0071	2.1	-	-	-	-	-
Acid Canyon	AC-2		+	+	6.3	0.56	-	0.0045	1.2	-	-	-	-	-
Acid Canyon	AC-3		+	+	3.7	0.49	-	0.0011	0.62	-	-	-	-	-
Acid Canyon	ACS		0.0033	0.0037	0.28	0.0657	-	0.0035	0.12	0.0046	0.0018	0.213	0.0124	<
Acid Canyon	ACS	ACS removed	+	+	0.64	+	-	+	+	-	-	-	-	-
Acid Canyon	ACS	ACS WC	-	-	-	-	-	-	-	+	0.005	+	0.005	<
DP Canyon	DP-1C		-	-	2.8	0.074	-	-	+	<	<	<	<	+
DP Canyon	DP-1E		-	-	1.7	0.09	-	-	0.24	<	<	<	<	+
DP Canyon	DP-1W		<	<	4.4	+	-	<	3.8	-	-	-	-	-
DP Canyon	DP-2		<	<	1.4	0.066	-	<	0.62	<	<	<	<	0.003
DP Canyon	DP-3		<	<	1.5	+	-	<	0.24	<	<	<	<	0.003
DP Canyon	DP-4		<	<	0.51	0.066	-	<	0.28	-	-	-	-	-
DP Canyon	DPTF		-	-	+	+	-	-	+	-	-	-	-	-
Lower Los Alamos Canyon	LA-4E		<	<	-	-	-	<	-	-	-	-	-	-
Lower Los Alamos Canyon	LA-4FE	Fire-impacted sediment	-	-	0.0827	0.0063	-	-	<	-	-	-	-	-
Lower Los Alamos Canyon	LA-4W		<	<	-	-	-	<	-	-	-	-	-	-
Lower Los Alamos Canyon	LA-5		<	<	+	+	-	<	<	-	-	-	-	-
Post-Fire	Baseline	Fire-impacted sediment	<	<	<	<	0.81	<	<	-	-	-	-	-
Post-Fire	Rendija Cyn	Fire-impacted sediment	-	-	<	<	-	-	<	-	-	-	-	-
Pueblo Canyon	P-1E		<	<	1.8	0.18	-	0.00097	0.66	-	-	-	-	-
Pueblo Canyon	P-1FW		<	<	0.22	+	-	+	+	-	-	-	-	-
Pueblo Canyon	P-1W		<	<	0.86	0.046	-	0.003	0.086	-	-	-	-	-
Pueblo Canyon	P-2W		<	<	-	-	-	+	-	-	-	-	-	-

Table E-1.0-1 (continued)

Subwatershed	Reach	Status	Endrin	Endrin Aldehyde	Fluoranthene	Fluorene	HMX	Heptachlor Epoxide	Indeno(1,2,3-cd)pyrene	Iodomethane	Isopropylbenzene	4-Isopropyltoluene	4-Methyl-2-pentanone	Methylene Chloride
Pueblo Canyon	P-3W		<	<	-	-	-	+	-	-	-	-	-	-
Pueblo Canyon	P-4E		<	<	0.059	+	-	+	+	-	-	-	-	-
Pueblo Canyon	P-4W		<	<	1.277	0.294	-	+	0.455	-	-	-	-	-
Pueblo Canyon	WC		<	<	+	+	-	+	+	-	-	-	-	-
Upper Los Alamos Canyon	LA-0		<	+	0.22	+	-	<	+	-	-	-	-	-
Upper Los Alamos Canyon	LA-1C		<	0.057	0.7	0.083	-	<	0.17	-	-	-	-	-
Upper Los Alamos Canyon	LA-1E		<	0.01	1.9	0.23	-	<	0.13	-	-	-	-	-
Upper Los Alamos Canyon	LA-1FW		<	+	0.9	+	-	<	+	-	-	-	-	-
Upper Los Alamos Canyon	LA-1W		<	+	0.27	+	-	<	+	-	-	-	-	-
Upper Los Alamos Canyon	LA-1W+		<	+	0.54	+	-	<	0.18	-	-	-	-	-
Upper Los Alamos Canyon	LA-2E		<	+	0.725	0.011	-	<	0.341	-	-	-	-	-
Upper Los Alamos Canyon	LA-2E	Removed	<	+	0.296	+	-	<	+	-	-	-	-	-
Upper Los Alamos Canyon	LA-2FE		<	+	0.79	0.079	-	<	0.18	-	-	-	-	-
Upper Los Alamos Canyon	LA-2W		<	0.013	0.73	0.01	-	<	0.19	-	-	-	-	-
Upper Los Alamos Canyon	LA-3E		<	+	0.41	+	-	<	0.2	-	-	-	-	-
Upper Los Alamos Canyon	LA-3FE	Fire-impacted sediment	-	-	0.52	+	-	-	+	-	-	-	-	-
Upper Los Alamos Canyon	LA-3W		<	+	0.42	+	-	<	0.23	-	-	-	-	-

Table E-1.0-1 (continued)

Subwatershed	Reach	Status	Methylmercury(+)(-) Ion	2-Methylnaphthalene	2-Methylphenol	4-Methylphenol	Naphthalene	Nitrobenzene	2-Nitrotoluene	Phenanthrene	Phenol	1-Propylbenzene	Pyrene	Pyridine
Acid Canyon	AC-1		-	0.73	<	<	2.4	<	-	11	<	-	11	<
Acid Canyon	AC-2		-	+	<	<	0.81	<	-	5.1	<	-	5.9	<
Acid Canyon	AC-3		-	+	<	<	0.81	<	-	3.5	<	-	3.2	<
Acid Canyon	ACS		0.002	0.0629	<	<	0.0306	<	-	0.31	<	<	0.36	<
Acid Canyon	ACS	ACS removed	0.00057	+	<	<	0.32	<	-	0.55	<	-	0.72	<
Acid Canyon	ACS	ACS WC	-	-	-	-	-	-	-	-	-	<	-	-
DP Canyon	DP-1C		-	<	<	<	0.71	<	-	2.7	<	0.003	3.6	<
DP Canyon	DP-1E		-	<	<	<	0.083	<	-	0.83	<	+	2.9	<
DP Canyon	DP-1W		-	<	<	<	0.62	<	-	3.2	<	-	12	<
DP Canyon	DP-2		-	<	<	<	0.071	<	-	0.79	<	+	2.5	<
DP Canyon	DP-3		-	<	<	<	+	<	-	0.8	<	+	1.6	<
DP Canyon	DP-4		-	<	<	<	0.083	<	-	0.432	<	-	1.1	<
DP Canyon	DPTF		-	<	<	<	+	<	-	+	<	-	+	<
Lower Los Alamos Canyon	LA-4E		-	-	-	-	-	-	-	-	-	-	-	-
Lower Los Alamos Canyon	LA-4FE	Fire-impacted sediment	-	0.0057	<	<	<	<	-	0.056	<	-	0.0872	<
Lower Los Alamos Canyon	LA-4W		-	-	-	-	-	-	-	-	-	-	-	-
Lower Los Alamos Canyon	LA-5		-	+	<	<	<	<	-	+	<	-	+	-
Post-Fire	Baseline	Fire-impacted sediment	-	<	0.96	2.2	0.76	0.15	0.44	+	5.4	-	<	4.8
Post-Fire	Rendija Cyn	Fire-impacted sediment	-	<	+	11	0.13	+	-	0.072	0.79	-	<	+
Pueblo Canyon	P-1E		0.000184	0.074	<	<	0.2	<	-	1.2	<	-	1.6	<
Pueblo Canyon	P-1FW		-	+	<	<	+	<	-	0.16	<	-	0.2	<
Pueblo Canyon	P-1W		0.000226	+	<	<	0.14	<	-	0.8	<	-	1.1	<
Pueblo Canyon	P-2W		-	-	-	-	-	-	-	-	-	-	-	-

Table E-1.0-1 (continued)

Subwatershed	Reach	Status	Methylmercury(+) Ion	2-Methylnaphthalene	2-Methylphenol	4-Methylphenol	Naphthalene	Nitrobenzene	2-Nitrotoluene	Phenanthrene	Phenol	1-Propylbenzene	Pyrene	Pyridine
Pueblo Canyon	P-3W		-	-	-	-	-	-	-	-	-	-	-	-
Pueblo Canyon	P-4E		-	+	<	<	+	<	-	+	<	-	0.053	-
Pueblo Canyon	P-4W		-	0.167	<	<	0.374	<	-	1.505	<	-	1.055	-
Pueblo Canyon	WC		-	+	<	<	+	<	-	+	<	-	+	<
Upper Los Alamos Canyon	LA-0		-	<	<	<	+	<	-	0.12	<	-	+	<
Upper Los Alamos Canyon	LA-1C		-	<	<	<	+	<	-	0.57	<	-	0.47	-
Upper Los Alamos Canyon	LA-1E		-	<	<	<	0.19	<	-	1.2	<	-	0.69	-
Upper Los Alamos Canyon	LA-1FW		-	<	<	<	+	<	-	0.62	<	-	0.75	<
Upper Los Alamos Canyon	LA-1W		-	<	<	<	0.085	<	-	0.2	<	-	+	-
Upper Los Alamos Canyon	LA-1W+		-	<	<	<	+	<	-	0.27	<	-	0.4	-
Upper Los Alamos Canyon	LA-2E		-	<	<	<	0.11	<	-	0.33	<	-	0.589	-
Upper Los Alamos Canyon	LA-2E	Removed	-	<	<	<	+	<	-	0.18	<	-	0.27	-
Upper Los Alamos Canyon	LA-2FE		-	<	<	<	+	<	-	0.59	<	-	0.65	-
Upper Los Alamos Canyon	LA-2W		-	<	<	<	0.2	<	-	0.44	<	-	0.58	-
Upper Los Alamos Canyon	LA-3E		-	<	<	<	+	<	-	0.21	<	-	0.37	-
Upper Los Alamos Canyon	LA-3FE	Fire-impacted sediment	-	<	<	<	0.25	<	-	0.46	<	-	0.58	<
Upper Los Alamos Canyon	LA-3W		-	<	<	<	+	<	-	0.18	<	-	0.44	-

Table E-1.0-1 (continued)

Subwatershed	Reach	Status	Total Petroleum Hydrocarbons, Diesel Range Organics	Total Petroleum Hydrocarbons, Gasoline Range Organics	Tetral	Toluene	Trichloroethene	Trichlorofluoromethane	1,2,4-Trimethylbenzene	Total Xylene	1,2-Xylene	1,3-Xylene+1,4-Xylene
Acid Canyon	AC-1		-	-	-	-	-	-	-	-	-	-
Acid Canyon	AC-2		-	-	-	-	-	-	-	-	-	-
Acid Canyon	AC-3		-	-	-	-	-	-	-	-	-	-
Acid Canyon	ACS		-	-	-	0.0233	0.0054	0.0019	0.00033	0.0049	0.00051	0.0013
Acid Canyon	ACS	ACS removed	-	-	-	-	-	-	-	-	-	-
Acid Canyon	ACS	ACS WC	-	-	-	0.00077	+	+	+	-	+	-
DP Canyon	DP-1C		18000	2000	-	0.0047	<	<	1.1	<	<	-
DP Canyon	DP-1E		330	-	-	+	<	<	+	<	-	-
DP Canyon	DP-1W		680	+	-	+	-	-	+	<	<	-
DP Canyon	DP-2		260	-	-	0.002	<	<	+	<	-	-
DP Canyon	DP-3		87	-	-	+	<	<	+	<	-	-
DP Canyon	DP-4		82	-	-	-	-	-	-	-	-	-
DP Canyon	DPTF		190	0.027	-	+	-	-	+	<	<	-
Lower Los Alamos Canyon	LA-4E		-	-	-	-	-	-	-	-	-	-
Lower Los Alamos Canyon	LA-4FE	Fire-impacted sediment	-	-	-	-	-	-	-	-	-	-
Lower Los Alamos Canyon	LA-4W		-	-	-	-	-	-	-	-	-	-
Lower Los Alamos Canyon	LA-5		-	-	-	-	-	-	-	-	-	-
Post-Fire	Baseline	Fire-impacted sediment	-	-	0.76	-	-	-	-	-	-	-
Post-Fire	Rendija Cyn	Fire-impacted sediment	-	-	-	-	-	-	-	-	-	-
Pueblo Canyon	P-1E		-	-	-	-	-	-	-	-	-	-
Pueblo Canyon	P-1FW		-	-	-	-	-	-	-	-	-	-
Pueblo Canyon	P-1W		-	-	-	-	-	-	-	-	-	-
Pueblo Canyon	P-2W		-	-	-	-	-	-	-	-	-	-

Table E-1.0-1 (continued)

Subwatershed	Reach	Status	Total Petroleum Hydrocarbons, Diesel Range Organics	Total Petroleum Hydrocarbons, Gasoline Range Organics	Tetryl	Toluene	Trichloroethene	Trichlorofluoromethane	1,2,4-Trimethylbenzene	Total Xylene	1,2-Xylene	1,3-Xylene+1,4-Xylene
Pueblo Canyon	P-3W		-	-	-	-	-	-	-	-	-	-
Pueblo Canyon	P-4E		-	-	-	-	-	-	-	-	-	-
Pueblo Canyon	P-4W		-	-	-	-	-	-	-	-	-	-
Pueblo Canyon	WC		-	-	-	-	-	-	-	-	-	-
Upper Los Alamos Canyon	LA-0		-	-	-	-	-	-	-	-	-	-
Upper Los Alamos Canyon	LA-1C		-	-	-	-	-	-	-	-	-	-
Upper Los Alamos Canyon	LA-1E		-	-	-	-	-	-	-	-	-	-
Upper Los Alamos Canyon	LA-1FW		-	-	-	-	-	-	-	-	-	-
Upper Los Alamos Canyon	LA-1W		-	-	-	-	-	-	-	-	-	-
Upper Los Alamos Canyon	LA-1W+		-	-	-	-	-	-	-	-	-	-
Upper Los Alamos Canyon	LA-2E		-	-	-	-	-	-	-	-	-	-
Upper Los Alamos Canyon	LA-2E	Removed	-	-	-	-	-	-	-	-	-	-
Upper Los Alamos Canyon	LA-2FE		-	-	-	-	-	-	-	-	-	-
Upper Los Alamos Canyon	LA-2W		-	-	-	-	-	-	-	-	-	-
Upper Los Alamos Canyon	LA-3E		-	-	-	-	-	-	-	-	-	-
Upper Los Alamos Canyon	LA-3FE	Fire-impacted sediment	-	-	-	-	-	-	-	-	-	-
Upper Los Alamos Canyon	LA-3W		-	-	-	-	-	-	-	-	-	-

Notes: 1. Units are mg/kg.

2. # = At least 1 detected result in Reach/Status. # = Maximum detected value.

3. + = Frequency of detection = 0% in Reach/Status.

4. - = No data.

5. < = Frequency of detection in associated SubWatershed < 5%.

Table E-1.0-2
Sediment: Radionuclide COPCs

Reach	Americium-241	Cesium-134	Cesium-137	Cobalt-60	Europium-152	Plutonium-238	Plutonium-239	Strontium-90	Tritium	Uranium-234	Uranium-235	Uranium-238	Thorium-228	Thorium-230	Thorium-232
BV	0.04	na	0.9	na	na	0.006	0.068	1.04	0.093	2.59	0.2	2.29	2.28	2.29	2.33
AC-1	+	+	1.07	+	+	+	0.123	+	+	<	0.3	<	-	-	-
AC-2	1.63	+	<	+	+	+	1.25	+	<	<	<	<	-	-	-
AC-3	88	+	32.5	+	+	3.7	477	30.5	1.117	2.63	<	<	<	<	<
ACS	101	+	148	+	+	37.3	7780	80	1.860	21.5	0.632	16.6	-	-	-
Baseline	0.13	+	8.26	+	+	0.0486	0.343	2	0.363	<	<	2.33	<	<	<
DP-1C	0.053	+	<	+	+	+	<	+	+	<	<	<	-	-	-
DP-1E	+	+	<	+	+	+	0.075	+	<	<	<	<	-	-	-
DP-1W	0.34	+	<	+	+	+	<	+	0.130	<	<	<	-	-	-
DP-2	29.8	+	442	+	+	1.286	11.11	32.8	0.480	<	<	<	-	-	-
DP-3	71	+	192	+	+	2.79	11.2	17.1	0.130	<	<	<	-	-	-
DP-4	32.7	+	149	+	+	1.34	48.3	31.1	0.143	2.8	<	2.3	<	<	<
Garcia Cyn	+	+	4.36	+	+	+	0.186	1.47	+	<	+	<	-	-	-
Guaje Cyn	+	+	6.22	+	+	+	0.245	1.25	-	-	-	-	-	-	-
LA-1C	0.071	+	<	+	+	0.041	8.78	+	-	<	<	<	-	-	-
LA-1E	0.206	+	2.9	+	+	0.078	19.3	-	-	<	<	2.31	-	-	-
LA-1FW	<	+	+	+	+	+	<	-	-	<	<	<	-	-	-
LA-1W	0.571	+	<	+	+	0.083	19.1	-	-	<	<	<	-	-	-
LA-1W+	-	-	-	-	-	+	0.623	-	-	<	<	<	-	-	-
LA-2E	28	0.18	192.31	0.116	0.474	2.01	6.39	39.56	0.137	<	<	2.4	<	2.442	<
LA-2FE	18.3	0.12	114	+	+	0.89	15.5	20.6	<	<	<	<	<	<	<
LA-2W	0.104	+	1.6	+	+	0.069	10.62	3.7	<	2.6	<	2.52	<	<	<

Table E-1.0-2 (continued)

Reach	Americium-241	Cesium-134	Cesium-137	Cobalt-60	Europium-152	Plutonium-238	Plutonium-239	Strontium-90	Tritium	Uranium-234	Uranium-235	Uranium-238	Thorium-228	Thorium-230	Thorium-232
BV	0.04	na	0.9	na	na	0.006	0.068	1.04	0.093	2.59	0.2	2.29	2.28	2.29	2.33
LA-3E	11.8	+	13.8	0.206	0.492	0.769	3.18	7.03	+	<	<	<	2.9	2.61	2.64
LA-3FE	0.926	0.18	4.77	+	+	0.0538	1.28	1.24	+	<	+	<	-	-	-
LA-3W	4.73	+	42.7	+	+	0.334	2.73	9.5	0.132	<	<	<	<	<	<
LA-4E	0.602	+	1.81	+	0.248	0.051	6.02	+	-	-	-	-	-	-	-
LA-4FE	0.22	0.11	2.27	+	+	0.037	1.51	<	-	-	-	-	-	-	-
LA-4W	4.64	+	4.65	+	0.349	0.227	13.8	+	-	-	-	-	-	-	-
LA-5	0.065	0.24	1.073	+	+	+	2.524	+	+	<	+	<	<	<	<
LA-5E	+	0.127	6.27	+	+	+	1.59	1.4	+	<	<	<	-	-	-
P-1E	10.671	0.55	1.88	+	0.267	2.078	502.01	1.4	1.208	<	+	<	<	<	<
P-1W	+	+	5.66	+	+	+	0.421	1.16	+	<	+	<	<	<	<
P-2E	-	-	-	-	-	0.072	8.07	-	-	-	-	-	-	-	-
P-2W	1.199	0.0961	2.33	+	+	0.231	73.4	1.16	-	-	-	-	-	-	-
P-3E	+	+	1.85	+	+	0.075	7.93	<	-	-	-	-	-	-	-
P-3W	0.138	0.103	1.98	+	+	0.136	44.9	<	-	-	-	-	-	-	-
P-4E	+	+	2.88	+	+	+	18.65	1.12	<	<	+	<	<	<	<
P-4W	2.077	+	<	+	+	0.62	170.5	+	0.117	<	+	<	<	<	<
Rendija Cyn	+	+	4.69	+	+	+	0.34	1.08	-	-	-	-	-	-	-

Notes: 1. Units are pCi/g.

2. # = Analyte with BV, at least 1 detected result>BV. # = Maximum detected value. Analyte without BV, at least 1 detected result. # = Maximum detected value.

3. + = Analyte with or without BV, no detected results.

4. - = No data.

5. < = Analyte with BV, at least 1 detected result. No detected result>BV.

6. na = No BV.

Table E-1.0-3
Sediment: Inorganic COPCs

Reach	Aluminum	Antimony	Arsenic	Barium	Beryllium	Cadmium	Calcium	Chromium	Cobalt	Copper	Iron	Lead	Magnesium	Manganese	Mercury	Nickel
BV	15400	0.83	3.98	127	1.31	0.4	4420	10.5	4.73	11.2	13800	19.7	2370	543	0.1	9.38
AC-1	<	0.94	4.1	129	<	<	4590	19	6.2	14.9	<	130	<	<	<	<
AC-2	<	0.84	5.1	<	<	<	<	15	8.6	16	<	170	<	620	<	<
AC-3	<	<	<	<	<	7.1	23000	15	6.2	40	<	200	<	560	2.6	17
ACS	<	1.7	7.1	240	2	11	24000	56	<	190	<	2300	<	<	7.2	17
Baseline	33640	<	4.7	550	1.45	0.705	25000	18.9	7.84	24.6	15640	48	3760	2200	<	15.7
DP-1C	<	[1]	<	<	1.6	0.67	8400	16.6	7.2	14.8	<	205	<	1100	0.25	<
DP-1E	<	[0.98]	<	<	<	<	5380	20.4	<	13.6	<	189	<	<	<	<
DP-1W	<	[1.2]	<	135	<	<	12000	14.8	<	15	<	207	<	<	0.12	<
DP-2	<	[7.9]	<	<	<	[0.69]	5200	<	<	14.4	<	76.5	<	738	<	<
DP-3	<	[1.1]	<	<	<	0.402	<	18.3	4.8	<	<	80.1	<	<	<	<
DP-4	<	[4.9]	<	<	<	<	<	<	<	15.1	<	57.7	<	<	<	<
DPTF	<	<	<	<	<	<	<	<	<	<	<	23	<	<	<	<
Garcia Cyn	<	-	5.4	290	1.6	<	13000	<	8.2	17	<	34	2900	950	<	11
Guaje Cyn	<	0.92	4.2	360	<	0.46	18000	<	6.6	18	<	38	2500	1800	<	9.8
LA-1C	<	[8.1]	<	128	<	[0.7]	<	<	<	16.8	<	38.8	<	<	0.11	<
LA-1E	<	[8.6]	<	<	<	[0.74]	<	10.6	<	23.8	<	30	<	<	<	<
LA-1FW	<	<	<	<	<	<	<	<	<	13.5	<	39.3	<	<	<	<
LA-1W	<	[9.2]	<	<	1.4	[0.8]	<	<	<	13.1	<	43.7	<	<	0.16	<
LA-1W+	<	<	<	<	<	<	<	<	<	<	<	41.2	<	<	<	<
LA-2E	<	[14]	4.7	132	<	0.89	5740	38.4	<	13.9	<	61.9	<	<	0.14	<
LA-2FE	<	<	<	<	<	<	<	15	<	12	<	49	<	<	0.15	<
LA-2W	<	[12]	<	<	<	[0.6]	<	19.5	<	12.5	<	46.9	<	<	0.31	<
LA-3E	<	[6.5]	<	<	<	[0.54]	<	10.6	<	15.4	<	36.9	<	<	0.14	<
LA-3FE	<	<	5	370	1.7	0.59	15000	11	8.1	26	16000	53	2930	2100	<	14
LA-3W	<	<	<	<	<	<	<	11	<	<	<	33	<	<	<	<
LA-4E	<	[4.9]	<	<	<	[0.49]	6980	<	<	<	<	<	<	<	<	<
LA-4FE	<	<	<	230	<	<	14000	<	6.3	16	<	31	3100	1000	<	11
LA-4W	<	[5.3]	<	<	<	[0.53]	7410	<	<	<	<	31.6	<	<	<	<
LA-5	<	-	<	<	<	<	4910	<	<	<	<	26.2	<	<	<	<
LA-5E	<	<	<	290	<	0.57	14000	<	5.6	15	<	30	<	1100	<	<
P-1E	<	[0.91]	<	130	<	0.92	5700	12.9	4.9	15.1	<	77.3	<	820	0.65	<
P-1FW	<	<	<	<	<	<	<	<	<	<	<	68	<	700	<	<
P-1W	<	<	4.3	280	<	0.54	12000	<	5.9	21	<	66	<	1500	0.49	<
P-2W	<	[1.3]	<	248	<	[0.6]	11400	<	6.4	31.5	<	33.9	<	1140	0.15	10.4
P-3E	<	<	4.3	220	<	<	8500	<	5.9	13	<	27	<	1000	<	9.4
P-3W	<	[1.3]	<	150	<	[0.69]	5970	<	5.8	20.5	<	24.7	<	681	[0.14]	9.5
P-4E	<	1.2	5.4	270	1.6	0.41	8700	<	7.7	17	36600	36	<	1300	<	14
P-4W	18400	[4.4]	5.1	163	1.7	0.52	4610	14.5	5.6	12.8	15400	30.5	3050	<	0.11	11
Rendija Cyn	<	1.2	6	210	2	<	9100	<	7	15	<	110	<	1200	<	10
WC	<	<	<	<	<	<	<	<	<	<	<	24	<	<	<	<

Table E-1.0-3 (continued)

Reach	Potassium	Selenium	Silver	Sodium	Thallium	Uranium	Vanadium	Zinc	Boron	Total Cyanide	Titanium	Bromide	Chloride	Sulfate
BV	2690	0.3	1	1470	0.73	6.99	19.7	60.2	na	0.82	439	na	17.1	58.2
AC-1	<	0.91	<	<	<	<	21	190	-	-	-	-	-	-
AC-2	<	0.87	<	<	<	<	24	170	-	-	-	-	-	-
AC-3	<	1.1	5.8	<	<	<	<	180	+	<	<	-	-	-
ACS	<	0.953	29	<	<	49.34	<	110	-	-	-	-	-	-
Baseline	3670	[0.92]	<	<	[1.2]	<	32.2	104	-	2.5	-	1.2	32	380
DP-1C	<	0.75	[2.6]	<	[0.81]	<	<	106	-	-	-	-	-	-
DP-1E	<	[0.65]	<	<	[0.77]	<	<	106	-	-	-	-	-	-
DP-1W	<	1.1	<	<	[0.76]	<	<	166	-	-	-	-	-	-
DP-2	<	1.3	<	<	[0.88]	<	<	71.6	-	-	-	-	-	-
DP-3	<	0.71	<	<	[0.78]	<	<	<	-	-	-	-	-	-
DP-4	<	[0.64]	<	<	<	<	<	<	+	<	<	-	-	-
DPTF	<	0.43	<	<	<	-	<	<	-	-	-	-	-	-
Garcia Cyn	<	1.28	1.5	<	<	<	<	<	-	1.6	-	-	-	-
Guaje Cyn	<	1.6	<	<	<	-	<	84	-	2	-	-	-	-
LA-1C	<	[0.89]	<	<	<	<	<	<	-	-	-	-	-	-
LA-1E	<	[1.1]	1.4	<	<	<	<	<	-	-	-	-	-	-
LA-1FW	<	[0.76]	<	<	<	<	<	<	-	-	-	-	-	-
LA-1W	<	[0.89]	1.7	<	<	<	<	<	-	-	-	-	-	-
LA-1W+	<	[1]	<	<	<	<	<	<	-	-	-	-	-	-
LA-2E	<	[1.4]	[2.7]	<	<	7.133	21.9	90.5	+	<	<	-	-	-
LA-2FE	<	0.5	<	<	<	<	<	<	-	-	-	-	-	-
LA-2W	<	[1.2]	15.8	<	<	7.538	<	81.7	+	<	<	-	-	-
LA-3E	<	<	[1.9]	<	<	<	<	<	-	<	-	-	-	-
LA-3FE	<	1.7	<	<	[1.4]	<	22	140	-	2.5	-	-	-	-
LA-3W	<	0.42	<	<	<	<	<	<	-	-	-	-	-	-
LA-4E	<	[0.83]	<	<	[0.88]	-	<	<	-	-	-	-	-	-
LA-4FE	<	0.53	<	<	<	-	20	87	-	-	-	-	-	-
LA-4W	<	[0.63]	<	<	<	-	<	<	-	-	-	-	-	-
LA-5	2880	[0.74]	<	1530	<	<	20.6	<	6.8	<	<	-	-	-
LA-5E	<	1.3	<	<	<	<	<	<	-	2	-	-	-	-
P-1E	<	[1.1]	1.5	<	<	<	<	113	6.2	<	<	-	-	-
P-1FW	<	0.65	<	<	1	-	<	71	-	-	-	-	-	-
P-1W	<	1.4	1.7	<	<	<	<	110	1.4	<	<	-	-	-
P-2W	<	0.98	[1.7]	<	[1.2]	-	<	<	-	-	-	-	-	-
P-3E	<	1.2	<	<	<	-	<	<	-	-	-	-	-	-
P-3W	<	0.84	[1.7]	<	[1.4]	-	<	<	-	-	-	-	-	-
P-4E	<	1.5	<	<	6.7	-	23.8	222	+	<	1840	-	-	-
P-4W	3740	[0.5]	<	<	[2.2]	-	20.3	66.9	+	1	454	-	-	-

Table E-1.0-3 (continued)

Reach	Potassium	Selenium	Silver	Sodium	Thallium	Uranium	Vanadium	Zinc	Boron	Total Cyanide	Titanium	Bromide	Chloride	Sulfate
BV	2690	0.3	1	1470	0.73	6.99	19.7	60.2	na	0.82	439	na	17.1	58.2
Rendija Cyn	<	1.3	<	<	<	-	<	69	-	1.1	-	-	-	-
WC	<	0.36	<	<	1.2	-	<	<	-	-	-	-	-	-

Notes: 1. Units are mg/kg.

2. # = Analyte with BV, at least 1 result > BV. # = Maximum value, maximum is detect. Analyte without BV, at least 1 detected result. # = Maximum detected value.
3. [#] = Analyte with BV, at least 1 result > BV. # = Maximum value, maximum is nondetect.
4. + = Analyte without BV. No detected results.
5. - = No data.
6. < = Analyte with BV, no result (detect or nondetect) > BV.
7. na = No BV.

Table E-1.0-4
Soil ESLs

Analyte Name	Soil ESL	Units
Acenaphthene	0.25	mg/kg
Aluminum	5	mg/kg
Americium-241	44	pCi/g
Antimony	0.05	mg/kg
Aroclor-1248	0.0072	mg/kg
Aroclor-1254	0.022	mg/kg
Aroclor-1260	0.44	mg/kg
Arsenic	0.83	mg/kg
Barium	2.5	mg/kg
Benz(a)anthracene	3	mg/kg
Benzo(a)pyrene	9.6	mg/kg
Benzo(b)fluoranthene	18	mg/kg
Benzo(g,h,i)perylene	12	mg/kg
Benzoic Acid	7.3	mg/kg
Beryllium	2.5	mg/kg
Bis(2-ethylhexyl)phthalate	1	mg/kg
Boron	10	mg/kg
Cadmium	0.0047	mg/kg
Cesium-137	680	pCi/g
Chromium	1.4	mg/kg
Chrysene	2.4	mg/kg

Table E-1.0-4 (continued)

Analyte Name	Soil ESL	Units
Cobalt	0.051	mg/kg
Copper	10	mg/kg
Cyanide (Total)	0.1	mg/kg
DDE[4,4'-]	0.0026	mg/kg
DDT[4,4'-]	0.0026	mg/kg
Dieldrin	0.04	mg/kg
Endrin	0.0034	mg/kg
Endrin Aldehyde*	0.0034	mg/kg
Fluoranthene	26	mg/kg
Fluorene	1.7	mg/kg
Lead	100	mg/kg
Manganese	50	mg/kg
Mercury	0.05	mg/kg
Methylmercury(+1) Ion	0.00035	mg/kg
Naphthalene	0.02	mg/kg
Nickel	1.5	mg/kg
Phenanthrene	11	mg/kg
Phenol	0.79	mg/kg
Plutonium-238	44	pCi/g
Plutonium-239	47	pCi/g
Pyrene	15	mg/kg
Selenium	0.1	mg/kg
Silver	0.05	mg/kg
Tetryl	2	mg/kg
Thallium	0.032	mg/kg
Thorium-232	6.2	pCi/g
Titanium	72	mg/kg
Uranium	25	mg/kg
Uranium-234	51	pCi/g
Uranium-238	55	pCi/g
Vanadium	0.025	mg/kg
Zinc	10	mg/kg

*Endrin used as surrogate (LANL 2002, 72639).

Table E-1.0-5
Sediment (Terrestrial): Ecological Screening Summary

Canyon	Reach	Distance to Rio Grande (km)	Status	Aluminum	Antimony	Arsenic	Barium	Beryllium	Boron	Cadmium	Chromium	Cobalt	Copper	Lead
BVs				15400	0.83	3.98	127	1.31		0.4	10.5	4.73	11.2	19.7
ESLs				5	0.05	0.83	2.5	2.5	10	0.005	1.4	0.051	10	100
Max HQ				6728	34	8.554	220	0.8	0.68	2340.426	40	168.627	19	23
Baseline	Baseline		Fire-impacted sediment	>6728.000<	NR>BV	>5.663<	>220.000<	<0.580>	-	>150.000<	>13.500<	>153.725<	<2.460>	<0.480>
Baseline	Garcia Cyn		Fire-impacted sediment	NR>BV	-	>6.506<	>116.000<	<0.640>	-	NR>BV	NR>BV	>160.784<	<1.700>	<0.340>
Baseline	Guaje Cyn		Fire-impacted sediment	NR>BV	>18.400<	>5.060<	>144.000<	NR>BV	-	>97.872<	NR>BV	>129.412<	<1.800>	<0.380>
Baseline	Rendija Cyn		Fire-impacted sediment	NR>BV	>24.000<	>7.229<	>84.000<	<0.800>	-	NR>BV	NR>BV	>137.255<	<1.500>	<1.100>
DPC	DP-1C	16.29		NR>BV	>16.600<	NR>BV	NR>BV	<0.640>	-	>142.553<	>11.857<	>141.176<	<1.480>	<2.050>
DPC	DP-1E	15.47		NR>BV	AIIND	NR>BV	NR>BV	NR>BV	-	NR>BV	>14.571<	NR>BV	<1.360>	<1.890>
DPC	DP-1W	16.39		NR>BV	AIIND	NR>BV	>54.000<	NR>BV	-	NR>BV	>10.571<	NR>BV	<1.500>	<2.070>
DPC	DP-2	14.69		NR>BV	AIIND	NR>BV	NR>BV	NR>BV	-	>96.383<	NR>BV	NR>BV	<1.440>	<0.765>
DPC	DP-2	14.69	Removed	-	-	-	-	-	-	-	-	-	-	-
DPC	DP-3	13.85		NR>BV	AIIND	NR>BV	NR>BV	NR>BV	-	>85.532<	>13.071<	>94.118<	NR>BV	<0.801>
DPC	DP-4	13.12		NR>BV	AIIND	NR>BV	NR>BV	NR>BV	NBV-NDR AIIND	NR>BV AIIND	NR>BV	NR>BV	<1.510>	<0.577>
DPC	DPTF	16.29		NR>BV	NR>BV AIIND	NR>BV	NR>BV	NR>BV	-	NR>BV	NR>BV	NR>BV	NR>BV	0.23
LAC	LA-0	19.5		-	-	-	-	-	-	-	-	-	-	-
LAC	LA-1C	15.66		NR>BV	AIIND	NR>BV	>51.200<	NR>BV	-	AIIND	NR>BV	NR>BV	<1.680>	<0.388>
LAC	LA-1E	14.81		NR>BV	AIIND	NR>BV	NR>BV	NR>BV	-	>8.511<	>7.571<	NR>BV	<2.380>	0.3
LAC	LA-1FW	18.36		NR>BV	NR>BV AIIND	NR>BV	NR>BV	NR>BV	-	NR>BV AIIND	NR>BV	NR>BV	<1.350>	<0.393>
LAC	LA-1W	17.18		NR>BV	AIIND	NR>BV	NR>BV	<0.560>	-	AIIND	NR>BV	NR>BV	<1.310>	<0.437>
LAC	LA-1W+	17.47		NR>BV	NR>BV AIIND	NR>BV	NR>BV	NR>BV	-	NR>BV AIIND	NR>BV	NR>BV	NR>BV	<0.412>

Table E-1.0-5 (continued)

Canyon	Reach	Distance to Rio Grande (km)	Status	Aluminum	Antimony	Arsenic	Barium	Beryllium	Boron	Cadmium	Chromium	Cobalt	Copper	Lead
BVs				15400	0.83	3.98	127	1.31		0.4	10.5	4.73	11.2	19.7
ESLs				5	0.05	0.83	2.5	2.5	10	0.005	1.4	0.051	10	100
Max HQ				6728	34	8.554	220	0.8	0.68	2340.426	40	168.627	19	23
LAC	LA-2E	12.55		NR>BV	AIIND	>3.253<	>29.200<	NR>BV	NBV-NDR AIIND	>189.362<	>13.500<	NR>BV	<0.930>	<0.510>
LAC	LA-2E	12.55	Removed	NR>BV	AIIND	>5.663<	>52.800<	NR>BV	NBV-NDR AIIND	AIIND	>27.429<	NR>BV	<1.390>	<0.619>
LAC	LA-2FE	11.22		NR>BV	NR>BV	NR>BV	NR>BV	NR>BV	-	NR>BV	>10.714<	NR>BV	<1.200>	<0.490>
LAC	LA-2W	13		NR>BV	AIIND	NR>BV	NR>BV	NR>BV	NBV-NDR AIIND	>12.766<	>13.929<	NR>BV	<1.250>	<0.469>
LAC	LA-3E	8.75		NR>BV	AIIND	NR>BV	NR>BV	NR>BV	-	AIIND	>7.571<	NR>BV	<1.540>	<0.369>
LAC	LA-3FE	8.85	Fire-impacted sediment	NR>BV	NR>BV	>6.024<	>148.000<	<0.680>	-	>125.532<	>7.857<	>158.824<	<2.600>	<0.530>
LAC	LA-3W	10.48		NR>BV	NR>BV	NR>BV	NR>BV	NR>BV	-	NR>BV	>7.857<	NR>BV	NR>BV	<0.330>
LAC	LA-4E	5.03		NR>BV	AIIND	NR>BV	NR>BV	NR>BV	-	AIIND	NR>BV	NR>BV	NR>BV	NR>BV
LAC	LA-4FE	4.29	Fire-impacted sediment	NR>BV	NR>BV	NR>BV	>92.000<	NR>BV	-	NR>BV	NR>BV	>123.529<	<1.600>	<0.310>
LAC	LA-4W	6.04		NR>BV	AIIND	NR>BV	NR>BV	NR>BV	-	>14.894<	NR>BV	NR>BV	NR>BV	<0.316>
LAC	LA-5	0.88		NR>BV	-	NR>BV AIIND	NR>BV	NR>BV	<0.680>	NR>BV AIIND	NR>BV	NR>BV	NR>BV	0.262
LAC	LA-5E	0.09	Fire-impacted sediment	NR>BV	NR>BV	NR>BV	>116.000<	NR>BV	-	>121.277<	NR>BV	>109.804<	<1.500>	0.3
PC	AC-1	19.08		NR>BV	>18.800<	>4.940<	>51.600<	NR>BV	-	NR>BV	>13.571<	>121.569<	<1.490>	<1.300>
PC	AC-2	18.77		NR>BV	>16.800<	>6.145<	NR>BV	NR>BV	-	NR>BV	>10.714<	>168.627<	<1.600>	<1.700>
PC	AC-3	18.27		NR>BV	NR>BV	NR>BV	NR>BV	NR>BV	NBV-NDR AIIND	>1510.638<	>10.714<	>121.569<	>4.000<	<2.000>
PC	ACS	18.62		NR>BV	>8.600<	>3.373<	>34.640<	0.242	-	>468.085<	>15.857<	NR>BV	>3.580<	<1.560>
PC	ACS	18.62	ACS removed	NR>BV	>34.000<	>8.554<	>96.000<	<0.800>	-	>2340.426<	>40.000<	NR>BV	>19.000<	>23.000<
PC	P-1E	17.81		NR>BV	AIIND	NR>BV	>37.760<	NR>BV	<0.620>	>195.745<	>9.214<	>96.078<	<1.510>	<0.773>

Table E-1.0-5 (continued)

Canyon	Reach	Distance to Rio Grande (km)	Status	Aluminum	Antimony	Arsenic	Barium	Beryllium	Boron	Cadmium	Chromium	Cobalt	Copper	Lead
BVs				15400	0.83	3.98	127	1.31		0.4	10.5	4.73	11.2	19.7
ESLs				5	0.05	0.83	2.5	2.5	10	0.005	1.4	0.051	10	100
Max HQ				6728	34	8.554	220	0.8	0.68	2340.426	40	168.627	19	23
PC	P-1E	17.81	Fire-impacted sediment	NR>BV	>14.200<	NR>BV	>52.000<	NR>BV	-	>31.915<	>4.071<	>88.235<	<0.910>	0.25
PC	P-1FW	18.51		NR>BV	NR>BV	NR>BV	NR>BV	NR>BV	-	NR>BV AIIND	NR>BV	NR>BV	NR>BV	<0.680>
PC	P-1W	18.26		NR>BV	NR>BV	>4.217<	>37.600<	NR>BV	0.14	>114.894<	NR>BV	>66.667<	<2.100>	<0.660>
PC	P-1W	18.26	Fire-impacted sediment	NR>BV	NR>BV	>5.181<	>112.000<	NR>BV	-	>85.106<	NR>BV	>115.686<	<1.500>	<0.450>
PC	P-2E	13.34		-	-	-	-	-	-	-	-	-	-	-
PC	P-2W	14.61		NR>BV	AIIND	NR>BV	>35.640<	NR>BV	-	AIIND	NR>BV	>64.706<	>3.150<	0.277
PC	P-2W	14.61	Fire-impacted sediment	NR>BV	AIIND	NR>BV	>99.200<	NR>BV	-	>93.617<	NR>BV	>125.490<	<1.420>	<0.339>
PC	P-3E	10.42		-	-	-	-	-	-	-	-	-	-	-
PC	P-3E	10.42	Fire-impacted sediment	NR>BV	NR>BV	>5.181<	>88.000<	NR>BV	-	NR>BV	NR>BV	>115.686<	<1.300>	0.27
PC	P-3W	11.4		NR>BV	AIIND	NR>BV	>21.120<	NR>BV	-	AIIND	NR>BV	>49.020<	<2.050>	0.142
PC	P-3W	11.4	Fire-impacted sediment	NR>BV	>11.000<	NR>BV	>60.000<	NR>BV	-	>53.191<	NR>BV	>113.725<	<1.110>	0.247
PC	P-4E	8.6		NR>BV	-	AIIND	>31.920<	<0.376>	NBV-NDR AIIND	>87.234<	NR>BV	>54.902<	<0.650>	0.194
PC	P-4E	8.6	Fire-impacted sediment	NR>BV	>24.000<	>6.506<	>108.000<	<0.640>	-	>51.064<	NR>BV	>150.980<	<1.700>	<0.360>
PC	P-4W	9.49		>3680.000<	AIIND	>6.145<	>65.200<	<0.680>	NBV-NDR AIIND	>110.638<	>10.357<	>109.804<	<1.280>	<0.305>
PC	WC	17.77		NR>BV	NR>BV	NR>BV	NR>BV	NR>BV	-	NR>BV AIIND	NR>BV	NR>BV	NR>BV	0.24

Table E-1.0-5 (continued)

Canyon	Reach	Distance to Rio Grande (km)	Status	Manganese	Mercury	Methylmercury (+1) Ion	Nickel	Selenium	Silver	Thallium	Titanium	Uranium	Vanadium	Zinc
BVs				543	0.1		9.38	0.3	1	0.73		6.99	19.7	60.2
ESLs				50	0.05	0	1.5	0.1	0.05	0.032	72	25	0.025	10
Max HQ				44	144	5.714	11.333	17	580	209.375	25.556	1.974	1288	22.2
Baseline	Baseline		Fire-impacted sediment	>44.000<	NR>BV	-	>10.467<	>7.800<	NR>BV	>21.938<	-	NR>BV	>1288.000<	>10.400<
Baseline	Garcia Cyn		Fire-impacted sediment	>19.000<	NR>BV	-	>7.333<	>12.800<	>30.000<	NR>BV	-	NR>BV	NR>BV	NR>BV
Baseline	Guaje Cyn		Fire-impacted sediment	>36.000<	NR>BV	-	>6.533<	>16.000<	NR>BV AIIND	NR>BV AIIND	-	-	NR>BV	>8.400<
Baseline	Rendija Cyn		Fire-impacted sediment	>24.000<	NR>BV	-	>6.667<	>13.000<	NR>BV AIIND	NR>BV AIIND	-	-	NR>BV	>6.900<
DPC	DP-1C	16.29		>22.000<	>5.000<	-	NR>BV	>7.500<	>40.000<	>17.813<	-	NR>BV	NR>BV	>10.600<
DPC	DP-1E	15.47		NR>BV	NR>BV	-	NR>BV	AIIND	NR>BV	AIIND	-	NR>BV	NR>BV	>10.600<
DPC	DP-1W	16.39		NR>BV	<2.400>	-	NR>BV	>11.000<	NR>BV AIIND	AIIND	-	NR>BV	NR>BV	>16.600<
DPC	DP-2	14.69		>14.760<	NR>BV	-	NR>BV	>13.000<	NR>BV	>4.000<	-	NR>BV	NR>BV	>7.160<
DPC	DP-2	14.69	Removed	-	-	-	-	-	-	-	-	-	-	-
DPC	DP-3	13.85		NR>BV	NR>BV	-	NR>BV	>7.100<	NR>BV	AIIND	-	NR>BV	NR>BV	NR>BV
DPC	DP-4	13.12		NR>BV	NR>BV	-	NR>BV	AIIND	NR>BV AIIND	NR>BV AIIND	NR>BV	NR>BV	NR>BV	NR>BV
DPC	DPTF	16.29		NR>BV	NR>BV AIIND	-	NR>BV	>4.300<	NR>BV AIIND	NR>BV AIIND	-	-	NR>BV	NR>BV
LAC	LA-0	19.5		-	-	-	-	-	-	-	-	-	-	-
LAC	LA-1C	15.66		NR>BV	<2.200>	-	NR>BV	AIIND	NR>BV	NR>BV AIIND	-	NR>BV	NR>BV	NR>BV
LAC	LA-1E	14.81		NR>BV	NR>BV	-	NR>BV	AIIND	>28.000<	NR>BV AIIND	-	NR>BV	NR>BV	NR>BV
LAC	LA-1FW	18.36		NR>BV	NR>BV	-	NR>BV	AIIND	NR>BV AIIND	NR>BV AIIND	-	NR>BV	NR>BV	NR>BV
LAC	LA-1W	17.18		NR>BV	>3.200<	-	NR>BV	AIIND	>34.000<	NR>BV AIIND	-	NR>BV	NR>BV	NR>BV

Table E-1.0-5 (continued)

Canyon	Reach	Distance to Rio Grande (km)	Status	Manganese	Mercury	Methylmercury (+1) Ion	Nickel	Selenium	Silver	Thallium	Titanium	Uranium	Vanadium	Zinc
BVs				543	0.1		9.38	0.3	1	0.73		6.99	19.7	60.2
ESLs				50	0.05	0	1.5	0.1	0.05	0.032	72	25	0.025	10
Max HQ				44	144	5.714	11.333	17	580	209.375	25.556	1.974	1288	22.2
LAC	LA-1W+	17.47		NR>BV	NR>BV	-	NR>BV	AIIND	NR>BV AIIND	NR>BV AIIND	-	NR>BV	NR>BV	NR>BV
LAC	LA-2E	12.55		NR>BV	<1.200>	-	NR>BV	>3.700<	AIIND	NR>BV AIIND	NR>BV	0.25	>476.000<	>7.280<
LAC	LA-2E	12.55	Removed	NR>BV	<2.800>	-	NR>BV	>6.500<	AIIND	NR>BV AIIND	NR>BV	0.285	>876.000<	>9.050<
LAC	LA-2FE	11.22		NR>BV	<3.000>	-	NR>BV	>5.000<	NR>BV	NR>BV AIIND	-	NR>BV	NR>BV	NR>BV
LAC	LA-2W	13		NR>BV	>6.200<	-	NR>BV	<2.300>	>316.000<	NR>BV	NR>BV	<0.302>	NR>BV	>8.170<
LAC	LA-3E	8.75		NR>BV	<2.800>	-	NR>BV	NR>BV AIIND	AIIND	NR>BV AIIND	-	NR>BV	NR>BV	NR>BV
LAC	LA-3FE	8.85	Fire-impacted sediment	>42.000<	NR>BV	-	>9.333<	>17.000<	NR>BV	>10.938<	-	NR>BV	>880.000<	>14.000<
LAC	LA-3W	10.48		NR>BV	NR>BV	-	NR>BV	>4.200<	NR>BV AIIND	NR>BV AIIND	-	NR>BV	NR>BV	NR>BV
LAC	LA-4E	5.03		NR>BV	NR>BV	-	NR>BV	AIIND	NR>BV AIIND	AIIND	-	-	NR>BV	NR>BV
LAC	LA-4FE	4.29	Fire-impacted sediment	>20.000<	NR>BV	-	>7.333<	>5.300<	NR>BV	NR>BV AIIND	-	-	>800.000<	>8.700<
LAC	LA-4W	6.04		NR>BV	NR>BV	-	NR>BV	AIIND	NR>BV	NR>BV AIIND	-	-	NR>BV	NR>BV
LAC	LA-5	0.88		NR>BV	NR>BV AIIND	-	NR>BV	>4.000<	NR>BV AIIND	NR>BV AIIND	NR>BV	NR>BV	>824.000<	NR>BV
LAC	LA-5E	0.09	Fire-impacted sediment	>22.000<	NR>BV	-	NR>BV	>13.000<	NR>BV	NR>BV AIIND	-	NR>BV	NR>BV	NR>BV
PC	AC-1	19.08		NR>BV	NR>BV	-	NR>BV	>9.100<	NR>BV AIIND	NR>BV	-	NR>BV	>840.000<	>19.000<
PC	AC-2	18.77		>12.400<	NR>BV	-	NR>BV	>8.700<	NR>BV AIIND	NR>BV	-	NR>BV	>960.000<	>17.000<
PC	AC-3	18.27		>11.200<	>52.000<	-	>11.333<	>11.000<	>116.000<	NR>BV	NR>BV	NR>BV	NR>BV	>18.000<

Table E-1.0-5 (continued)

Canyon	Reach	Distance to Rio Grande (km)	Status	Manganese	Mercury	Methylmercury (+1) Ion	Nickel	Selenium	Silver	Thallium	Titanium	Uranium	Vanadium	Zinc
BVs				543	0.1		9.38	0.3	1	0.73		6.99	19.7	60.2
ESLs				50	0.05	0	1.5	0.1	0.05	0.032	72	25	0.025	10
Max HQ				44	144	5.714	11.333	17	580	209.375	25.556	1.974	1288	22.2
PC	ACS	18.62		NR>BV	>55.600<	>5.714<	>7.400<	>9.530<	>102.800<	NR>BV	-	<0.453>	NR>BV	>9.210<
PC	ACS	18.62	ACS removed	NR>BV	>144.000<	<1.629>	>11.333<	>7.500<	>580.000<	NR>BV	-	<1.974>	NR>BV	>11.000<
PC	P-1E	17.81		>10.580<	>13.000<	<0.526>	NR>BV	>6.200<	>30.000<	NR>BV AIIND	NR>BV	NR>BV	NR>BV	>11.300<
PC	P-1E	17.81	Fire-impacted sediment	>16.400<	<0.700>	-	NR>BV	>8.400<	AIIND	NR>BV AIIND	-	-	NR>BV	>4.800<
PC	P-1FW	18.51		>14.000<	NR>BV	-	NR>BV	>6.500<	NR>BV AIIND	>31.250<	-	-	NR>BV	>7.100<
PC	P-1W	18.26		>10.200<	>9.800<	<0.646>	NR>BV	>6.500<	>34.000<	NR>BV	NR>BV	NR>BV	NR>BV	>11.000<
PC	P-1W	18.26	Fire-impacted sediment	>30.000<	<0.700>	-	NR>BV	>14.000<	AIIND	NR>BV AIIND	-	-	NR>BV	>6.000<
PC	P-2E	13.34		-	-	-	-	-	-	-	-	-	-	-
PC	P-2W	14.61		>6.880<	<3.000>	-	>3.333<	>9.800<	AIIND	AIIND	-	-	NR>BV	NR>BV
PC	P-2W	14.61	Fire-impacted sediment	>22.800<	<1.560>	-	>6.933<	>6.900<	>14.400<	>8.438<	-	-	NR>BV	NR>BV
PC	P-3E	10.42		-	-	-	-	-	-	-	-	-	-	-
PC	P-3E	10.42	Fire-impacted sediment	>20.000<	NR>BV	-	>6.267<	>12.000<	NR>BV AIIND	NR>BV AIIND	-	-	NR>BV	NR>BV
PC	P-3W	11.4		>4.940<	AIIND	-	<2.667>	>6.900<	AIIND	AIIND	-	-	NR>BV	NR>BV
PC	P-3W	11.4	Fire-impacted sediment	>13.620<	<1.200>	-	>6.333<	>8.400<	>14.600<	>40.625<	-	-	NR>BV	NR>BV
PC	P-4E	8.6		>20.600<	NR>BV	-	>4.000<	AIIND	NR>BV	>209.375<	>25.556<	-	>952.000<	>22.200<
PC	P-4E	8.6	Fire-impacted sediment	>26.000<	NR>BV	-	>9.333<	>15.000<	NR>BV AIIND	AIIND	-	-	>840.000<	>6.600<
PC	P-4W	9.49		NR>BV	<2.200>	-	>7.333<	AIIND	NR>BV	AIIND	>6.306<	-	>812.000<	>6.690<
PC	WC	17.77		NR>BV	NR>BV	-	NR>BV	>3.600<	NR>BV AIIND	>37.500<	-	-	NR>BV	NR>BV

Table E-1.0-5 (continued)

Canyon	Reach	Distance to Rio Grande (km)	Status	Cyanide (Total)	Acenaphthene	Benz(a)anthracene	Benzo(a)pyrene	Benzo(b)fluoranthene	Benzo(g,h,i)perylene	Benzoic Acid	Bis(2-ethylhexyl) phthalate	Chrysene	4,4'-DDE	4,4'-DDT
BVs				0.82										
ESLs				0.1	0.25	3	9.6	18	12	7.3	1	2.4	0.003	0.003
Max HQ				25	6.4	1.867	0.615	0.372	0.417	0.479	2	2.208	76.923	107.692
Baseline	Baseline		Fire-impacted sediment	>25.000<	SW%D<5A IIIND	SW%D<5 AIIND	SW%D<5 AIIND	SW%D<5 AIIND	SW%D<5 AIIND	<0.479>	SW%D<5 AIIND	SW%D<5 AIIND	>3.038<	>3.538<
Baseline	Garcia Cyn		Fire-impacted sediment	>16.000<	-	-	-	-	-	-	-	-	-	-
Baseline	Guaje Cyn		Fire-impacted sediment	>20.000<	-	-	-	-	-	-	-	-	-	-
Baseline	Rendija Cyn		Fire-impacted sediment	>11.000<	SW%D<5 AIIND	SW%D<5 AIIND	SW%D<5 AIIND	SW%D<5 AIIND	SW%D<5 AIIND	<0.466>	SW%D<5 AIIND	SW%D<5 AIIND	-	-
DPC	DP-1C	16.29		-	<0.960>	<0.400>	0.078	0.094	AIIND	SW%D<5	<1.100>	<0.413>	-	-
DPC	DP-1E	15.47		-	<0.348>	<0.320>	0.086	0.067	0.023	SW%D<5 AIIND	<0.460>	<0.375>	-	>7.962<
DPC	DP-1W	16.39		-	AIIND	<1.000>	<0.333>	0.211	<0.417>	SW%D<5 AIIND	<1.700>	<1.375>	AIIND	>46.154<
DPC	DP-2	14.69		-	AIIND	0.257	0.075	0.056	0.058	SW%D<5 AIIND	<0.840>	<0.346>	AIIND	>45.769<
DPC	DP-2	14.69	Removed	-	-	-	-	-	-	-	-	-	-	-
DPC	DP-3	13.85		-	AIIND	0.22	0.075	0.072	AIIND	SW%D<5	<0.950>	0.275	AIIND	>21.538<
DPC	DP-4	13.12		NR>BV	0.268	0.097	0.036	0.034	0.028	SW%D<5 AIIND	0.073	0.154	<1.615>	>17.308<
DPC	DPTF	16.29		-	AIIND	AIIND	AIIND	AIIND	AIIND	SW%D<5 AIIND	AIIND	AIIND	-	-
LAC	LA-0	19.5		-	AIIND	0.037	0.013	0.005	AIIND	0.025	0.22	0.054	>8.846<	>23.462<
LAC	LA-1C	15.66		-	<0.316>	0.087	0.023	0.012	AIIND	0.022	<1.300>	0.108	>3.269<	>53.846<
LAC	LA-1E	14.81		-	AIIND	0.107	0.025	0.012	AIIND	AIIND	<0.530>	0.117	>3.846<	>6.538<
LAC	LA-1FW	18.36		-	AIIND	0.107	0.033	0.013	AIIND	0.026	0.16	<0.958>	<2.808>	>8.462<
LAC	LA-1W	17.18		-	AIIND	0.031	0.009	AIIND	AIIND	AIIND	0.1	0.05	AIIND	>6.538<

Table E-1.0-5 (continued)

Canyon	Reach	Distance to Rio Grande (km)	Status	Cyanide (Total)	Acenaphthene	Benz(a)anthracene	Benzo(a)pyrene	Benzo(b)fluoranthene	Benzo(g,h,i)perylene	Benzoic Acid	Bis(2-ethylhexyl) phthalate	Chrysene	4,4'-DDE	4,4'-DDT
BVs				0.82										
ESLs				0.1	0.25	3	9.6	18	12	7.3	1	2.4	0.003	0.003
Max HQ				25	6.4	1.867	0.615	0.372	0.417	0.479	2	2.208	76.923	107.692
LAC	LA-1W+	17.47		-	AIIND	0.07	0.025	0.014	AIIND	0.026	<1.200>	0.121	<2.115>	>10.000<
LAC	LA-2E	12.55		NR>BV	<1.040>	0.123	0.068	0.037	0.025	AIIND	AIIND	0.171	AIIND	AIIND
LAC	LA-2E	12.55	Removed	NR>BV	AIIND	0.045	0.016	0.014	AIIND	AIIND	AIIND	0.068	>12.692<	AIIND
LAC	LA-2FE	11.22		-	<0.348>	0.097	0.029	0.013	AIIND	AIIND	0.11	0.133	>10.385<	>33.462<
LAC	LA-2W	13		NR>BV	<0.920>	0.09	0.025	0.014	AIIND	0.019	<0.400>	0.121	>5.000<	>11.923<
LAC	LA-3E	8.75		NR>BV AIIND	AIIND	0.073	0.029	0.018	0.018	AIIND	<0.340>	0.113	AIIND	AIIND
LAC	LA-3FE	8.85	Fire-impacted sediment	>25.000<	AIIND	0.083	0.027	0.018	0.013	AIIND	AIIND	0.113	-	-
LAC	LA-3W	10.48		-	AIIND	0.067	0.02	0.014	AIIND	AIIND	0.27	0.121	AIIND	>28.846<
LAC	LA-4E	5.03		-	-	-	-	-	-	-	-	-	SW%D<5 AIIND	AIIND
LAC	LA-4FE	4.29	Fire-impacted sediment	-	SW%D<5 AIIND	0.015	SW%D<5 AIIND	SW%D<5 AIIND	SW%D<5 AIIND	SW%D<5 AIIND	0.14	0.019	-	-
LAC	LA-4W	6.04		-	-	-	-	-	-	-	-	-	SW%D<5 AIIND	<1.962>
LAC	LA-5	0.88		NR>BV	SW%D<5 AIIND	AIIND	SW%D<5 AIIND	SW%D<5 AIIND	SW%D<5 AIIND	SW%D<5 AIIND	AIIND	AIIND	SW%D<5 AIIND	AIIND
LAC	LA-5E	0.09	Fire-impacted sediment	>20.000<	-	-	-	-	-	-	-	-	-	-
PC	AC-1	19.08		-	>6.400<	<1.867>	<0.615>	<0.372>	0.117	AIIND	<2.000>	<2.208>	>11.538<	>30.769<
PC	AC-2	18.77		-	<2.320>	<0.867>	<0.313>	0.294	0.062	0.104	<1.700>	<1.292>	>3.577<	>15.000<
PC	AC-3	18.27		NR>BV AIIND	<2.120>	<0.600>	0.156	0.161	AIIND	0.247	0.18	<0.667>	>5.385<	>38.462<
PC	ACS	18.62		-	0.152	0.05	0.018	0.007	AIIND	0.059	0.24	0.075	>10.769<	>107.692<
PC	ACS	18.62	ACS removed	-	AIIND	0.117	0.032	0.037	0.016	AIIND	AIIND	0.125	>76.923<	>88.462<

Table E-1.0-5 (continued)

Canyon	Reach	Distance to Rio Grande (km)	Status	Cyanide (Total)	Acenaphthene	Benz(a)anthracene	Benzo(a)pyrene	Benzo(b)fluoranthene	Benzo(g,h,i)perylene	Benzoic Acid	Bis(2-ethylhexyl) phthalate	Chrysene	4,4'-DDE	4,4'-DDT
BVs				0.82										
ESLs				0.1	0.25	3	9.6	18	12	7.3	1	2.4	0.003	0.003
Max HQ				25	6.4	1.867	0.615	0.372	0.417	0.479	2	2.208	76.923	107.692
PC	P-1E	17.81		NR>BV	<0.680>	<0.333>	0.188	0.139	0.058	0.033	AIIND	<0.500>	<0.731>	>4.615<
PC	P-1E	17.81	Fire-impacted sediment	-	-	-	-	-	-	-	-	-	-	-
PC	P-1FW	18.51		-	AIIND	AIIND	AIIND	AIIND	0.012	0.027	<0.340>	AIIND	<1.500>	>10.000<
PC	P-1W	18.26		NR>BV AIIND	0.22	0.14	0.045	0.033	0.006	0.036	<0.350>	0.163	<1.423>	>6.154<
PC	P-1W	18.26	Fire-impacted sediment	-	-	-	-	-	-	-	-	-	-	-
PC	P-2E	13.34		-	-	-	-	-	-	-	-	-	-	-
PC	P-2W	14.61		-	-	-	-	-	-	-	-	-	AIIND	AIIND
PC	P-2W	14.61	Fire-impacted sediment	-	-	-	-	-	-	-	-	-	-	-
PC	P-3E	10.42		-	-	-	-	-	-	-	-	-	-	-
PC	P-3E	10.42	Fire-impacted sediment	-	-	-	-	-	-	-	-	-	-	-
PC	P-3W	11.4		-	-	-	-	-	-	-	-	-	AIIND	AIIND
PC	P-3W	11.4	Fire-impacted sediment	-	-	-	-	-	-	-	-	-	-	-
PC	P-4E	8.6		NR>BV	AIIND	0.012	AIIND	AIIND	AIIND	AIIND	AIIND	0.014	AIIND	AIIND
PC	P-4E	8.6	Fire-impacted sediment	-	-	-	-	-	-	-	-	-	-	-
PC	P-4W	9.49		>10.000<	<0.876>	0.203	0.07	0.051	0.039	AIIND	AIIND	0.25	AIIND	AIIND
PC	WC	17.77		-	AIIND	AIIND	AIIND	AIIND	AIIND	AIIND	AIIND	AIIND	<1.000>	<1.846>

Table E-1.0-5 (continued)

Canyon	Reach	Distance to Rio Grande (km)	Status	Dieldrin	Endrin	Endrin Aldehyde	Fluoranthene	Fluorene	Naphthalene	Phenanthrene	Phenol	Pyrene	Tetral
BVs													
ESLs				0.04	0.003	0.003	26	1.7	0.02	11	0.79	15	2
Max HQ				1.263	0.971	16.765	0.462	1.059	120	1	6.835	0.8	0.38
Baseline	Baseline		Fire-impacted sediment	SW%D<5 AIIND	SW%D<5 AIIND	SW%D<5 AIIND	SW%D<5 AIIND	SW%D<5 AIIND	>38.000<	AIIND	>6.835<	SW%D<5 AIIND	<0.380>
Baseline	Garcia Cyn		Fire-impacted sediment	-	-	-	-	-	-	-	-	-	-
Baseline	Guaje Cyn		Fire-impacted sediment	-	-	-	-	-	-	-	-	-	-
Baseline	Rendija Cyn		Fire-impacted sediment	-	-	-	SW%D<5 AIIND	SW%D<5 AIIND	>6.500<	0.007	<1.000>	SW%D<5 AIIND	-
DPC	DP-1C	16.29		-	-	-	0.108	0.044	>35.500<	0.245	SW%D<5 AIIND	0.24	-
DPC	DP-1E	15.47		-	-	-	0.065	0.053	>4.150<	0.075	SW%D<5 AIIND	0.193	-
DPC	DP-1W	16.39		SW%D<5 AIIND	SW%D<5 AIIND	SW%D<5 AIIND	0.169	AIIND	>31.000<	0.291	SW%D<5 AIIND	<0.800>	-
DPC	DP-2	14.69		SW%D<5 AIIND	SW%D<5 AIIND	SW%D<5 AIIND	0.054	0.039	>3.550<	0.072	SW%D<5 AIIND	0.167	-
DPC	DP-2	14.69	Removed	-	-	-	-	-	-	-	-	-	-
DPC	DP-3	13.85		SW%D<5 AIIND	SW%D<5 AIIND	SW%D<5 AIIND	0.058	AIIND	AIIND	0.073	SW%D<5 AIIND	0.107	-
DPC	DP-4	13.12		SW%D<5 AIIND	SW%D<5 AIIND	SW%D<5 AIIND	0.02	0.039	>4.150<	0.039	SW%D<5 AIIND	0.073	-
DPC	DPTF	16.29		-	-	-	AIIND	AIIND	AIIND	AIIND	SW%D<5 AIIND	AIIND	-
LAC	LA-0	19.5		AIIND	SW%D<5 AIIND	AIIND	0.008	AIIND	AIIND	0.011	SW%D<5 AIIND	AIIND	-

Table E-1.0-5 (continued)

Canyon	Reach	Distance to Rio Grande (km)	Status	Dieldrin	Endrin	Endrin Aldehyde	Fluoranthene	Fluorene	Naphthalene	Phenanthrene	Phenol	Pyrene	Tetryl
BVs													
ESLs				0.04	0.003	0.003	26	1.7	0.02	11	0.79	15	2
Max HQ				1.263	0.971	16.765	0.462	1.059	120	1	6.835	0.8	0.38
LAC	LA-1C	15.66		<0.750>	SW%D<5	>16.765<	0.027	0.049	AIIND	0.052	SW%D<5 AIIND	0.031	-
LAC	LA-1E	14.81		<0.350>	SW%D<5	<2.941>	0.073	0.135	>9.500<	0.109	SW%D<5 AIIND	0.046	-
LAC	LA-1FW	18.36		0.045	SW%D<5 AIIND	AIIND	0.035	AIIND	AIIND	0.056	SW%D<5 AIIND	0.05	-
LAC	LA-1W	17.18		AIIND	SW%D<5 AIIND	AIIND	0.01	AIIND	>4.250<	0.018	SW%D<5 AIIND	AIIND	-
LAC	LA-1W+	17.47		AIIND	SW%D<5 AIIND	AIIND	0.021	AIIND	AIIND	0.025	SW%D<5 AIIND	0.027	-
LAC	LA-2E	12.55		AIIND	SW%D<5 AIIND	AIIND	0.028	0.006	>5.500<	0.03	SW%D<5 AIIND	0.039	-
LAC	LA-2E	12.55	Removed	AIIND	SW%D<5 AIIND	AIIND	0.011	AIIND	AIIND	0.016	SW%D<5 AIIND	0.018	-
LAC	LA-2FE	11.22		<0.575>	SW%D<5 AIIND	AIIND	0.03	0.046	AIIND	0.054	SW%D<5 AIIND	0.043	-
LAC	LA-2W	13		AIIND	SW%D<5 AIIND	>3.824<	0.028	0.006	>10.000<	0.04	SW%D<5 AIIND	0.039	-
LAC	LA-3E	8.75		AIIND	SW%D<5 AIIND	AIIND	0.016	AIIND	AIIND	0.019	SW%D<5 AIIND	0.025	-
LAC	LA-3FE	8.85	Fire-impacted sediment	-	-	-	0.02	AIIND	>12.500<	0.042	SW%D<5 AIIND	0.039	-
LAC	LA-3W	10.48		<0.350>	SW%D<5 AIIND	AIIND	0.016	AIIND	AIIND	0.016	SW%D<5 AIIND	0.029	-
LAC	LA-4E	5.03		SW%D<5 AIIND	SW%D<5 AIIND	SW%D<5 AIIND	-	-	-	-	-	-	-
LAC	LA-4FE	4.29	Fire-impacted sediment	-	-	-	0.003	0.004	SW%D<5 AIIND	0.005	SW%D<5 AIIND	0.006	-

Table E-1.0-5 (continued)

Canyon	Reach	Distance to Rio Grande (km)	Status	Dieldrin	Endrin	Endrin Aldehyde	Fluoranthene	Fluorene	Naphthalene	Phenanthrene	Phenol	Pyrene	Tetryl
BVs													
ESLs				0.04	0.003	0.003	26	1.7	0.02	11	0.79	15	2
Max HQ				1.263	0.971	16.765	0.462	1.059	120	1	6.835	0.8	0.38
LAC	LA-4W	6.04		SW%D<5 AIIND	SW%D<5 AIIND	SW%D<5 AIIND	-	-	-	-	-	-	-
LAC	LA-5	0.88		SW%D<5 AIIND	SW%D<5 AIIND	SW%D<5 AIIND	AIIND	AIIND	SW%D<5 AIIND	AIIND	SW%D<5 AIIND	AIIND	-
LAC	LA-5E	0.09	Fire-impacted sediment	-	-	-	-	-	-	-	-	-	-
PC	AC-1	19.08		<0.625>	AIIND	AIIND	<0.462>	<1.059>	>120.000<	<1.000>	SW%D<5 AIIND	<0.733>	-
PC	AC-2	18.77		AIIND	AIIND	AIIND	0.242	<0.329>	>40.500<	<0.464>	SW%D<5 AIIND	<0.393>	-
PC	AC-3	18.27		AIIND	AIIND	AIIND	0.142	0.288	>40.500<	<0.318>	SW%D<5 AIIND	0.213	-
PC	ACS	18.62		<1.263>	<0.971>	<1.088>	0.011	0.039	<1.530>	0.028	SW%D<5 AIIND	0.024	-
PC	ACS	18.62	ACS removed	AIIND	AIIND	AIIND	0.025	AIIND	>16.000<	0.05	SW%D<5 AIIND	0.048	-
PC	P-1E	17.81		AIIND	SW%D<5 AIIND	SW%D<5 AIIND	0.069	0.106	>10.000<	0.109	SW%D<5 AIIND	0.107	-
PC	P-1E	17.81	Fire-impacted sediment	-	-	-	-	-	-	-	-	-	-
PC	P-1FW	18.51		0.065	SW%D<5 AIIND	SW%D<5 AIIND	0.008	AIIND	AIIND	0.015	SW%D<5 AIIND	0.013	-
PC	P-1W	18.26		AIIND	SW%D<5 AIIND	SW%D<5 AIIND	0.033	0.027	>7.000<	0.073	SW%D<5 AIIND	0.073	-
PC	P-1W	18.26	Fire-impacted sediment	-	-	-	-	-	-	-	-	-	-
PC	P-2E	13.34		-	-	-	-	-	-	-	-	-	-

Table E-1.0-5 (continued)

Canyon	Reach	Distance to Rio Grande (km)	Status	Dieldrin	Endrin	Endrin Aldehyde	Fluoranthene	Fluorene	Naphthalene	Phenanthrene	Phenol	Pyrene	Tetryl
BVs													
ESLs				0.04	0.003	0.003	26	1.7	0.02	11	0.79	15	2
Max HQ				1.263	0.971	16.765	0.462	1.059	120	1	6.835	0.8	0.38
PC	P-2W	14.61		AIIND	SW%D<5 AIIND	SW%D<5 AIIND	-	-	-	-	-	-	-
PC	P-2W	14.61	Fire-impacted sediment	-	-	-	-	-	-	-	-	-	-
PC	P-3E	10.42		-	-	-	-	-	-	-	-	-	-
PC	P-3E	10.42	Fire-impacted sediment	-	-	-	-	-	-	-	-	-	-
PC	P-3W	11.4		AIIND	SW%D<5 AIIND	SW%D<5 AIIND	-	-	-	-	-	-	-
PC	P-3W	11.4	Fire-impacted sediment	-	-	-	-	-	-	-	-	-	-
PC	P-4E	8.6		AIIND	SW%D<5 AIIND	SW%D<5 AIIND	0.002	AIIND	AIIND	AIIND	SW%D<5 AIIND	0.004	-
PC	P-4E	8.6	Fire-impacted sediment	-	-	-	-	-	-	-	-	-	-
PC	P-4W	9.49		AIIND	SW%D<5 AIIND	SW%D<5 AIIND	0.049	0.173	>18.700<	0.137	SW%D<5 AIIND	0.07	-
PC	WC	17.77		AIIND	SW%D<5 AIIND	SW%D<5 AIIND	AIIND	AIIND	AIIND	AIIND	SW%D<5 AIIND	AIIND	-

Table E-1.0-5 (continued)

Canyon	Reach	Distance to Rio Grande (km)	Status	Aroclor-1248	Aroclor-1254	Aroclor-1260	Americium-241	Cesium-137	Plutonium-238	Plutonium-239	Thorium-232	Uranium-234	Uranium-238
BVs							0.04	0.9	0.006	0.068	2.33	2.59	2.29
ESLs				0.007	0.022	0.44	44	680	44	47	6.2	51	55
Max HQ				708.333	281.818	7.5	2.295	0.65	0.848	165.532	0.426	0.422	0.302
Baseline	Baseline		Fire-impacted sediment	SW%D<5 AIIND	SW%D<5 AIIND	SW%D<5 AIIND	0.003	0.012	0.001	0.007	NDR>BV	NDR>BV	0.042
Baseline	Garcia Cyn		Fire-impacted sediment	-	-	-	NDR>BV AIIND	0.006	NDR>BV AIIND	0.004	-	NDR>BV	NDR>BV
Baseline	Guaje Cyn		Fire-impacted sediment	-	-	-	NDR>BV AIIND	0.009	NDR>BV AIIND	0.005	-	-	-
Baseline	Rendija Cyn		Fire-impacted sediment	-	-	-	NDR>BV AIIND	0.007	NDR>BV AIIND	0.007	-	-	-
DPC	DP-1C	16.29		SW%D<5 AIIND	SW%D<5 AIIND	<2.273>	0.001	NDR>BV	NDR>BV AIIND	NDR>BV	-	NDR>BV	NDR>BV
DPC	DP-1E	15.47		SW%D<5 AIIND	SW%D<5 AIIND	0.175	NDR>BV AIIND	NDR>BV	NDR>BV AIIND	0.002	-	NDR>BV	NDR>BV
DPC	DP-1W	16.39		SW%D<5 AIIND	SW%D<5 AIIND	AIIND	0.008	NDR>BV	NDR>BV AIIND	NDR>BV	-	NDR>BV	NDR>BV
DPC	DP-2	14.69		SW%D<5 AIIND	SW%D<5 AIIND	<0.398>	<0.418>	0.268	0.029	0.236	-	NDR>BV	NDR>BV
DPC	DP-2	14.69	Removed	-	-	-	<0.677>	<0.650>	0.022	0.088	-	-	-
DPC	DP-3	13.85		SW%D<5 AIIND	SW%D<5 AIIND	0.207	<1.614>	0.282	0.063	0.238	-	NDR>BV	NDR>BV
DPC	DP-4	13.12		SW%D<5 AIIND	SW%D<5 AIIND	0.093	<0.743>	0.219	0.03	<1.028>	NDR>BV	0.055	0.042
DPC	DPTF	16.29		-	-	-	-	-	-	-	-	-	-
LAC	LA-0	19.5		SW%D<5 AIIND	AIIND	0.198	-	-	-	-	-	-	-
LAC	LA-1C	15.66		SW%D<5 AIIND	>21.364<	<1.955>	0.002	NDR>BV	0.001	0.187	-	NDR>BV	NDR>BV
LAC	LA-1E	14.81		SW%D<5 AIIND	AIIND	<0.909>	0.005	0.004	0.002	<0.411>	-	NDR>BV	0.042

Table E-1.0-5 (continued)

Canyon	Reach	Distance to Rio Grande (km)	Status	Aroclor-1248	Aroclor-1254	Aroclor-1260	Americium-241	Cesium-137	Plutonium-238	Plutonium-239	Thorium-232	Uranium-234	Uranium-238
BV's							0.04	0.9	0.006	0.068	2.33	2.59	2.29
ESL's				0.007	0.022	0.44	44	680	44	47	6.2	51	55
Max HQ				708.333	281.818	7.5	2.295	0.65	0.848	165.532	0.426	0.422	0.302
LAC	LA-1FW	18.36		SW%D<5 AIIND	AIIND	<0.318>	NDR>BV	NDR>BV AIIND	NDR>BV AIIND	NDR>BV	-	NDR>BV	NDR>BV
LAC	LA-1W	17.18		SW%D<5 AIIND	>24.545<	0.15	0.013	NDR>BV	0.002	<0.406>	-	NDR>BV	NDR>BV
LAC	LA-1W+	17.47		SW%D<5 AIIND	>29.545<	<0.341>	-	-	NDR>BV AIIND	0.013	-	NDR>BV	NDR>BV
LAC	LA-2E	12.55		SW%D<5 AIIND	AIIND	<0.523>	<0.636>	0.056	0.046	0.136	NDR>BV	NDR>BV	0.038
LAC	LA-2E	12.55	Removed	SW%D<5 AIIND	AIIND	<0.955>	0.052	0.283	0.003	0.115	NDR>BV	NDR>BV	0.044
LAC	LA-2FE	11.22		SW%D<5 AIIND	AIIND	<1.318>	<0.416>	0.168	0.02	<0.330>	NDR>BV	NDR>BV	NDR>BV
LAC	LA-2W	13		SW%D<5 AIIND	AIIND	<0.773>	0.002	0.002	0.002	0.226	NDR>BV	0.051	0.046
LAC	LA-3E	8.75		SW%D<5 AIIND	AIIND	0.25	0.268	0.02	0.017	0.068	<0.426>	NDR>BV	NDR>BV
LAC	LA-3FE	8.85	Fire-impacted sediment	-	-	-	0.021	0.007	0.001	0.027	-	NDR>BV	NDR>BV
LAC	LA-3W	10.48		SW%D<5 AIIND	AIIND	<0.773>	0.108	0.063	0.008	0.058	NDR>BV	NDR>BV	NDR>BV
LAC	LA-4E	5.03		SW%D<5 AIIND	SW%D<5 AIIND	SW%D<5 AIIND	0.014	0.003	0.001	0.128	-	-	-
LAC	LA-4FE	4.29	Fire-impacted sediment	-	-	-	0.005	0.003	0.001	0.032	-	-	-
LAC	LA-4W	6.04		SW%D<5 AIIND	SW%D<5 AIIND	SW%D<5 AIIND	0.105	0.007	0.005	0.294	-	-	-
LAC	LA-5	0.88		SW%D<5 AIIND	SW%D<5 AIIND	SW%D<5 AIIND	0.001	0.002	NDR>BV AIIND	0.054	NDR>BV	NDR>BV	NDR>BV
LAC	LA-5E	0.09	Fire-impacted sediment	-	-	-	NDR>BV AIIND	0.009	NDR>BV AIIND	0.034	-	NDR>BV	NDR>BV

Table E-1.0-5 (continued)

Canyon	Reach	Distance to Rio Grande (km)	Status	Aroclor-1248	Aroclor-1254	Aroclor-1260	Americium-241	Cesium-137	Plutonium-238	Plutonium-239	Thorium-232	Uranium-234	Uranium-238
BVs							0.04	0.9	0.006	0.068	2.33	2.59	2.29
ESLs				0.007	0.022	0.44	44	680	44	47	6.2	51	55
Max HQ				708.333	281.818	7.5	2.295	0.65	0.848	165.532	0.426	0.422	0.302
PC	AC-1	19.08		AIIND	AIIND	0.295	NDR>BV AIIND	0.002	NDR>BV AIIND	0.003	-	NDR>BV	NDR>BV
PC	AC-2	18.77		AIIND	AIIND	0.157	0.037	NDR>BV	NDR>BV AIIND	0.027	-	NDR>BV	NDR>BV
PC	AC-3	18.27		AIIND	>281.818<	0.216	<2.000>	0.048	0.084	>10.149<	NDR>BV	0.052	NDR>BV
PC	ACS	18.62		AIIND	>33.000<	<0.345>	0.227	0.009	0.057	>7.404<	-	0.182	0.067
PC	ACS	18.62	ACS removed	>708.333<	>254.545<	>7.500<	<2.295>	0.218	<0.848>	>165.532<	-	<0.422>	<0.302>
PC	P-1E	17.81		SW%D<5 AIIND	>10.818<	0.266	0.243	0.002	0.047	>10.681<	NDR>BV	NDR>BV	NDR>BV
PC	P-1E	17.81	Fire-impacted sediment	-	-	-	AIIND	0.003	0.001	0.028	-	-	-
PC	P-1FW	18.51		SW%D<5 AIIND	<0.682>	0.173	-	-	-	-	-	-	-
PC	P-1W	18.26		SW%D<5 AIIND	AIIND	0.25	NDR>BV AIIND	0.001	NDR>BV AIIND	0.002	NDR>BV	NDR>BV	NDR>BV
PC	P-1W	18.26	Fire-impacted sediment	-	-	-	NDR>BV AIIND	0.008	NDR>BV AIIND	0.009	-	-	-
PC	P-2E	13.34		-	-	-	-	-	0.002	0.172	-	-	-
PC	P-2W	14.61		SW%D<5 AIIND	AIIND	0.125	0.027	0.001	0.005	<1.562>	-	-	-
PC	P-2W	14.61	Fire-impacted sediment	-	-	-	0.002	0.003	AIIND	0.016	-	-	-
PC	P-3E	10.42		-	-	-	-	-	0.002	0.169	-	-	-
PC	P-3E	10.42	Fire-impacted sediment	-	-	-	NDR>BV AIIND	0.003	AIIND	0.02	-	-	-
PC	P-3W	11.4		SW%D<5 AIIND	AIIND	AIIND	AIIND	0.001	0.003	<0.955>	-	-	-

Table E-1.0-5 (continued)

Canyon	Reach	Distance to Rio Grande (km)	Status	Aroclor-1248	Aroclor-1254	Aroclor-1260	Amercium-241	Cesium-137	Plutonium-238	Plutonium-239	Thorium-232	Uranium-234	Uranium-238
BVs							0.04	0.9	0.006	0.068	2.33	2.59	2.29
ESLs				0.007	0.022	0.44	44	680	44	47	6.2	51	55
Max HQ				708.333	281.818	7.5	2.295	0.65	0.848	165.532	0.426	0.422	0.302
PC	P-3W	11.4	Fire-impacted sediment	-	-	-	0.003	0.003	AIIND	0.018	-	-	-
PC	P-4E	8.6		SW%D<5 AIIND	AIIND	AIIND	NDR>BV AIIND	0.001	NDR>BV AIIND	<0.397>	NDR>BV	NDR>BV	NDR>BV
PC	P-4E	8.6	Fire-impacted sediment	-	-	-	NDR>BV AIIND	0.004	NDR>BV AIIND	0.023	-	-	-
PC	P-4W	9.49		SW%D<5 AIIND	AIIND	AIIND	0.047	NDR>BV	0.014	>3.628<	NDR>BV	NDR>BV	NDR>BV
PC	WC	17.77		SW%D<5 AIIND	AIIND	AIIND	-	-	-	-	-	-	-

- Notes:
1. Units are mg/kg for organic and inorganic chemicals and pCi/g for radionuclides.
 2. <#> = HQ > 0.3.
 3. >#< = HQ > 3.
 4. - = No data.
 5. AIIND = Analyte never detected.
 6. NBV-NDR = No BV, no detected result (inorganic chemicals and radionuclides). Not a COPC.
 7. NDR>BV = No detected result > BV (radionuclides). Not a COPC.
 8. NR>BV = No result > BV (inorganic chemicals). Not a COPC.
 9. SW%D<5 = % detection in the subwatershed < 5%. Not a COPC.

Table E-1.0-6
Sediment (Terrestrial): COPECs

Canyon	Reach	Distance to Rio Grande (km)	Status	Aluminum	Antimony	Arsenic	Barium	Beryllium	Boron	Cadmium	Chromium	Cobalt	Copper	Lead
BVs				15400	0.83	3.98	127	1.31		0.4	10.5	4.73	11.2	19.7
ESLs				5	0.05	0.83	2.5	2.5	10	0.005	1.4	0.051	10	100
Max HQ				6728	34	8.554	220	0.8	0.68	2340.426	40	168.627	19	23
Baseline	Baseline		Fire-impacted sediment	>6728.000<	NR>BV	>5.663<	>220.000<	<0.580>	-	>150.000<	>13.500<	>153.725<	<2.460>	<0.480>
Baseline	Garcia Cyn		Fire-impacted sediment	NR>BV	-	>6.506<	>116.000<	<0.640>	-	NR>BV	NR>BV	>160.784<	<1.700>	<0.340>
Baseline	Guaje Cyn		Fire-impacted sediment	NR>BV	>18.400<	>5.060<	>144.000<	NR>BV	-	>97.872<	NR>BV	>129.412<	<1.800>	<0.380>
Baseline	Rendija Cyn		Fire-impacted sediment	NR>BV	>24.000<	>7.229<	>84.000<	<0.800>	-	NR>BV	NR>BV	>137.255<	<1.500>	<1.100>
DPC	DP-1C	16.29		NR>BV	>16.600<	NR>BV	NR>BV	<0.640>	-	>142.553<	>11.857<	>141.176<	<1.480>	<2.050>
DPC	DP-1E	15.47		NR>BV	AIIND	NR>BV	NR>BV	NR>BV	-	NR>BV	>14.571<	NR>BV	<1.360>	<1.890>
DPC	DP-1W	16.39		NR>BV	AIIND	NR>BV	NR>BV	NR>BV	-	NR>BV	>10.571<	NR>BV	<1.500>	<2.070>
DPC	DP-2	14.69		NR>BV	AIIND	NR>BV	NR>BV	NR>BV	-	>96.383<	NR>BV	NR>BV	<1.440>	<0.765>
DPC	DP-2	14.69	Removed	-	-	-	-	-	-	-	-	-	-	-
DPC	DP-3	13.85		NR>BV	AIIND	NR>BV	NR>BV	NR>BV	-	>85.532<	>13.071<	>94.118<	NR>BV	<0.801>
DPC	DP-4	13.12		NR>BV	AIIND	NR>BV	NR>BV	NR>BV	NBV-NDR AIIND	NR>BV AIIND	NR>BV	NR>BV	<1.510>	<0.577>
DPC	DPTF	16.29		NR>BV	NR>BV AIIND	NR>BV	NR>BV	NR>BV	-	NR>BV	NR>BV	NR>BV	NR>BV	N
LAC	LA-0	19.5		-	-	-	-	-	-	-	-	-	-	-
LAC	LA-1C	15.66		NR>BV	AIIND	NR>BV	>51.200<	NR>BV	-	AIIND	NR>BV	NR>BV	<1.680>	<0.388>
LAC	LA-1E	14.81		NR>BV	AIIND	NR>BV	NR>BV	NR>BV	-			NR>BV	<2.380>	N
LAC	LA-1FW	18.36		NR>BV	NR>BV AIIND	NR>BV	NR>BV	NR>BV	-	NR>BV AIIND	NR>BV	NR>BV	<1.350>	<0.393>
LAC	LA-1W	17.18		NR>BV	AIIND	NR>BV	NR>BV	<0.560>	-	AIIND	NR>BV	NR>BV	<1.310>	<0.437>
LAC	LA-1W+	17.47		NR>BV	NR>BV AIIND	NR>BV	NR>BV	NR>BV	-	NR>BV AIIND	NR>BV	NR>BV	NR>BV	<0.412>

Table E-1.0-6 (continued)

Canyon	Reach	Distance to Rio Grande (km)	Status	Aluminum	Antimony	Arsenic	Barium	Beryllium	Boron	Cadmium	Chromium	Cobalt	Copper	Lead
BVs				15400	0.83	3.98	127	1.31		0.4	10.5	4.73	11.2	19.7
ESLs				5	0.05	0.83	2.5	2.5	10	0.005	1.4	0.051	10	100
Max HQ				6728	34	8.554	220	0.8	0.68	2340.426	40	168.627	19	23
LAC	LA-2E	12.55		NR>BV	AIIND	>3.253<	>29,200<	NR>BV	NBV-NDR AIIND	>189.362<	>13.500<	NR>BV	<0.930>	<0.510>
LAC	LA-2E	12.55	Removed	NR>BV	AIIND	>5.663<	>52.800<	NR>BV	NBV-NDR AIIND	AIIND	>27.429<	NR>BV	<1.390>	<0.619>
LAC	LA-2FE	11.22		NR>BV	NR>BV	NR>BV	NR>BV	NR>BV	-	NR>BV	>10.714<	NR>BV	<1.200>	<0.490>
LAC	LA-2W	13		NR>BV	AIIND	NR>BV	NR>BV	NR>BV	NBV-NDR AIIND	>12.766<	>13.929<	NR>BV	<1.250>	<0.469>
LAC	LA-3E	8.75		NR>BV	AIIND	NR>BV	NR>BV	NR>BV	-	AIIND	>7.571<	NR>BV	<1.540>	<0.369>
LAC	LA-3FE	8.85	Fire-impacted sediment	NR>BV	NR>BV	>6.024<	>148.000<	<0.680>	-	>125.532<	>7.857<	>158.824<	<2.600>	<0.530>
LAC	LA-3W	10.48		NR>BV	NR>BV	NR>BV	NR>BV	NR>BV	-	NR>BV		NR>BV	NR>BV	
LAC	LA-4E	5.03		NR>BV	AIIND	NR>BV	NR>BV	NR>BV	-	AIIND	NR>BV	NR>BV	NR>BV	NR>BV
LAC	LA-4FE	4.29	Fire-impacted sediment	NR>BV	NR>BV	NR>BV	>92.000<	NR>BV	-	NR>BV	NR>BV	>123.529<	<1.600>	<0.310>
LAC	LA-4W	6.04		NR>BV	AIIND	NR>BV	NR>BV	NR>BV	-	>14.894<	NR>BV	NR>BV	NR>BV	<0.316>
LAC	LA-5	0.88		NR>BV	-	NR>BV AIIND	NR>BV	NR>BV	<0.680>	NR>BV AIIND	NR>BV	NR>BV	NR>BV	N
LAC	LA-5E	0.09	Fire-impacted sediment	NR>BV	NR>BV	NR>BV	>116.000<	NR>BV	-	>121.277<	NR>BV	>109.804<	<1.500>	N
PC	AC-1	19.08		NR>BV	>18.800<	>4.940<	>51.600<	NR>BV	-	NR>BV	>13.571<	>121.569<	<1.490>	<1.300>
PC	AC-2	18.77		NR>BV	>16.800<	>6.145<	NR>BV	NR>BV	-	NR>BV	>10.714<	>168.627<	<1.600>	<1.700>
PC	AC-3	18.27		NR>BV	NR>BV	NR>BV	NR>BV	NR>BV	NBV-NDR AIIND	>1510.638<	>10.714<	>121.569<	>4.000<	<2.000>
PC	ACS	18.62		NR>BV	>8.600<	>3.373<	>34.640<	N	-	>468.085<	>15.857<	NR>BV	>3.580<	<1.560>
PC	ACS	18.62	ACS removed	NR>BV	>34.000<	>8.554<	>96.000<	<0.800>	-	>2340.426<	>40.000<	NR>BV	>19.000<	>23.000<
PC	P-1E	17.81		NR>BV	AIIND	NR>BV	>37.760<	NR>BV	<0.620>	>195.745<	>9.214<	>96.078<	<1.510>	<0.773>
PC	P-1E	17.81	Fire-impacted sediment	NR>BV	>14.200<	NR>BV	>52.000<	NR>BV	-	>31.915<	>4.071<	>88.235<	<0.910>	N

Table E-1.0-6 (continued)

Canyon	Reach	Distance to Rio Grande (km)	Status	Aluminum	Antimony	Arsenic	Barium	Beryllium	Boron	Cadmium	Chromium	Cobalt	Copper	Lead
BVs				15400	0.83	3.98	127	1.31		0.4	10.5	4.73	11.2	19.7
ESLs				5	0.05	0.83	2.5	2.5	10	0.005	1.4	0.051	10	100
Max HQ				6728	34	8.554	220	0.8	0.68	2340.426	40	168.627	19	23
PC	P-1FW	18.51		NR>BV	NR>BV	NR>BV	NR>BV	NR>BV	-	NR>BV AIIND	NR>BV	NR>BV	NR>BV	<0.680>
PC	P-1W	18.26		NR>BV	NR>BV	>4.217<	>37.600<	NR>BV	N	>114.894<	NR>BV	>66.667<	<2.100>	<0.660>
PC	P-1W	18.26	Fire-impacted sediment	NR>BV	NR>BV	>5.181<	>112.000<	NR>BV	-	>85.106<	NR>BV	>115.686<	<1.500>	<0.450>
PC	P-2E	13.34		-	-	-	-	-	-	-	-	-	-	-
PC	P-2W	14.61		NR>BV	AIIND	NR>BV	>35.640<	NR>BV	-	AIIND	NR>BV	>64.706<	>3.150<	N
PC	P-2W	14.61	Fire-impacted sediment	NR>BV	AIIND	NR>BV	>99.200<	NR>BV	-	>93.617<	NR>BV	>125.490<	<1.420>	<0.339>
PC	P-3E	10.42		-	-	-	-	-	-	-	-	-	-	-
PC	P-3E	10.42	Fire-impacted sediment	NR>BV	NR>BV	>5.181<	>88.000<	NR>BV	-	NR>BV	NR>BV	>115.686<	<1.300>	N
PC	P-3W	11.4		NR>BV	AIIND	NR>BV	>21.120<	NR>BV	-	AIIND	NR>BV	>49.020<	<2.050>	N
PC	P-3W	11.4	Fire-impacted sediment	NR>BV		NR>BV	>60.000<	NR>BV	-	>53.191<	NR>BV	>113.725<	<1.110>	N
PC	P-4E	8.6		NR>BV	-	AIIND	>31.920<	<0.376>	NBV-NDR AIIND	>87.234<	NR>BV	>54.902<	<0.650>	N
PC	P-4E	8.6	Fire-impacted sediment	NR>BV	>24.000<	>6.506<	>108.000<	<0.640>	-	>51.064<	NR>BV	>150.980<	<1.700>	<0.360>
PC	P-4W	9.49		>3680.000<	AIIND	>6.145<	>65.200<	<0.680>	NBV-NDR AIIND	>110.638<	>10.357<	>109.804<	<1.280>	<0.305>
PC	WC	17.77		NR>BV	NR>BV	NR>BV	NR>BV	NR>BV	-	NR>BV AIIND	NR>BV	NR>BV	NR>BV	N

Table E-1.0-6 (continued)

Canyon	Reach	Distance to Rio Grande (km)	Status	Manganese	Mercury	Methylmercury (+1) Ion	Nickel	Selenium	Silver	Thallium	Titanium	Uranium	Vanadium	Zinc
BVs				543	0.1		9.38	0.3	1	0.73		6.99	19.7	60.2
ESLs				50	0.05	0	1.5	0.1	0.05	0.032	72	25	0.025	10
Max HQ				44	144	5.714	11.333	17	580	209.375	25.556	1.974	1288	22.2
Baseline	Baseline		Fire-impacted sediment	>44.000<	NR>BV	-	>10.467<	>7.800<	NR>BV	>21.938<	-	NR>BV	>1288.000<	>10.400<
Baseline	Garcia Cyn		Fire-impacted sediment	>19.000<	NR>BV	-	>7.333<	>12.800<	>30.000<	NR>BV	-	NR>BV	NR>BV	NR>BV
Baseline	Guaje Cyn		Fire-impacted sediment	>36.000<	NR>BV	-	>6.533<	>16.000<	NR>BV AIIND	NR>BV AIIND	-	-	NR>BV	>8.400<
Baseline	Rendija Cyn		Fire-impacted sediment	>24.000<	NR>BV	-	>6.667<	>13.000<	NR>BV AIIND	NR>BV AIIND	-	-	NR>BV	>6.900<
DPC	DP-1C	16.29		>22.000<	>5.000<	-	NR>BV	>7.500<	>40.000<	>17.813<	-	NR>BV	NR>BV	>10.600<
DPC	DP-1E	15.47		NR>BV	NR>BV	-	NR>BV	AIIND	NR>BV	AIIND	-	NR>BV	NR>BV	>10.600<
DPC	DP-1W	16.39		NR>BV	<2.400>	-	NR>BV	>11.000<	NR>BV AIIND	AIIND	-	NR>BV	NR>BV	>16.600<
DPC	DP-2	14.69		>14.760<	NR>BV	-	NR>BV	>13.000<	NR>BV	>4.000<	-	NR>BV	NR>BV	>7.160<
DPC	DP-2	14.69	Removed	-	-	-	-	-	-	-	-	-	-	-
DPC	DP-3	13.85		NR>BV	NR>BV	-	NR>BV		NR>BV	AIIND	-	NR>BV	NR>BV	NR>BV
DPC	DP-4	13.12		NR>BV	NR>BV	-	NR>BV	AIIND	NR>BV AIIND	NR>BV AIIND	NR>BV	NR>BV	NR>BV	NR>BV
DPC	DPTF	16.29		NR>BV	NR>BV AIIND	-	NR>BV	>4.300<	NR>BV AIIND	NR>BV AIIND	-	-	NR>BV	NR>BV
LAC	LA-0	19.5		-	-	-	-	-	-	-	-	-	-	-
LAC	LA-1C	15.66		NR>BV	<2.200>	-	NR>BV	AIIND	NR>BV	NR>BV AIIND	-	NR>BV	NR>BV	NR>BV
LAC	LA-1E	14.81		NR>BV	NR>BV	-	NR>BV	AIIND	>28.000<	NR>BV AIIND	-	NR>BV	NR>BV	NR>BV
LAC	LA-1FW	18.36		NR>BV	NR>BV	-	NR>BV	AIIND	NR>BV AIIND	NR>BV AIIND	-	NR>BV	NR>BV	NR>BV
LAC	LA-1W	17.18		NR>BV	>3.200<	-	NR>BV	AIIND	>34.000<	NR>BV AIIND	-	NR>BV	NR>BV	NR>BV

Table E-1.0-6 (continued)

Canyon	Reach	Distance to Rio Grande (km)	Status	Manganese	Mercury	Methylmercury (+1) Ion	Nickel	Selenium	Silver	Thallium	Titanium	Uranium	Vanadium	Zinc
BVs				543	0.1		9.38	0.3	1	0.73		6.99	19.7	60.2
ESLs				50	0.05	0	1.5	0.1	0.05	0.032	72	25	0.025	10
Max HQ				44	144	5.714	11.333	17	580	209.375	25.556	1.974	1288	22.2
LAC	LA-1W+	17.47		NR>BV	NR>BV	-	NR>BV	AIIND	NR>BV AIIND	NR>BV AIIND	-	NR>BV	NR>BV	NR>BV
LAC	LA-2E	12.55		NR>BV	<1.200>	-	NR>BV	>3.700<	AIIND	NR>BV AIIND	NR>BV	N	>476.000<	>7.280<
LAC	LA-2E	12.55	Removed	NR>BV	<2.800>	-	NR>BV	>6.500<	AIIND	NR>BV AIIND	NR>BV	N	>876.000<	>9.050<
LAC	LA-2FE	11.22		NR>BV	<3.000>	-	NR>BV	>5.000<	NR>BV	NR>BV AIIND	-	NR>BV	NR>BV	NR>BV
LAC	LA-2W	13		NR>BV	>6.200<	-	NR>BV	<2.300>	>316.000<	NR>BV	NR>BV	<0.302>	NR>BV	>8.170<
LAC	LA-3E	8.75		NR>BV	<2.800>	-	NR>BV	NR>BV AIIND	AIIND	NR>BV AIIND	-	NR>BV	NR>BV	NR>BV
LAC	LA-3FE	8.85	Fire-impacted sediment	>42.000<	NR>BV	-	>9.333<	>17.000<	NR>BV	>10.938<	-	NR>BV	>880.000<	>14.000<
LAC	LA-3W	10.48		NR>BV	NR>BV	-	NR>BV	>4.200<	NR>BV AIIND	NR>BV AIIND	-	NR>BV	NR>BV	NR>BV
LAC	LA-4E	5.03		NR>BV	NR>BV	-	NR>BV	AIIND	NR>BV AIIND	AIIND	-	-	NR>BV	NR>BV
LAC	LA-4FE	4.29	Fire-impacted sediment	>20.000<	NR>BV	-	>7.333<	>5.300<	NR>BV	NR>BV AIIND	-	-	>800.000<	>8.700<
LAC	LA-4W	6.04		NR>BV	NR>BV	-	NR>BV	AIIND	NR>BV	NR>BV AIIND	-	-	NR>BV	NR>BV
LAC	LA-5	0.88		NR>BV	NR>BV AIIND	-	NR>BV	>4.000<	NR>BV AIIND	NR>BV AIIND	NR>BV	NR>BV	>824.000<	NR>BV
LAC	LA-5E	0.09	Fire-impacted sediment	>22.000<	NR>BV	-	NR>BV	>13.000<	NR>BV	NR>BV AIIND	-	NR>BV	NR>BV	NR>BV
PC	AC-1	19.08		NR>BV	NR>BV	-	NR>BV	>9.100<	NR>BV AIIND	NR>BV	-	NR>BV	>840.000<	>19.000<
PC	AC-2	18.77		>12.400<	NR>BV	-	NR>BV	>8.700<	NR>BV AIIND	NR>BV	-	NR>BV	>960.000<	>17.000<
PC	AC-3	18.27		>11.200<	>52.000<	-	>11.333<	>11.000<	>116.000<	NR>BV	NR>BV	NR>BV	NR>BV	

Table E-1.0-6 (continued)

Canyon	Reach	Distance to Rio Grande (km)	Status	Manganese	Mercury	Methylmercury (+1) Ion	Nickel	Selenium	Silver	Thallium	Titanium	Uranium	Vanadium	Zinc
BVs				543	0.1		9.38	0.3	1	0.73		6.99	19.7	60.2
ESLs				50	0.05	0	1.5	0.1	0.05	0.032	72	25	0.025	10
Max HQ				44	144	5.714	11.333	17	580	209.375	25.556	1.974	1288	22.2
PC	ACS	18.62		NR>BV	>55.600<	>5.714<	>7.400<	>9.530<	>102.800<	NR>BV	-	<0.453>	NR>BV	>9.210<
PC	ACS	18.62	ACS removed	NR>BV	>144.000<	<1.629>	>11.333<	>7.500<	>580.000<	NR>BV	-	<1.974>	NR>BV	>11.000<
PC	P-1E	17.81		>10.580<	>13.000<	<0.526>	NR>BV	>6.200<	>30.000<	NR>BV AIIND	NR>BV	NR>BV	NR>BV	>11.300<
PC	P-1E	17.81	Fire-impacted sediment	>16.400<	<0.700>	-	NR>BV	>8.400<	AIIND	NR>BV AIIND	-	-	NR>BV	>4.800<
PC	P-1FW	18.51		>14.000<	NR>BV	-	NR>BV	>6.500<	NR>BV AIIND	>31.250<	-	-	NR>BV	>7.100<
PC	P-1W	18.26		>10.200<	>9.800<	<0.646>	NR>BV	>6.500<		NR>BV	NR>BV	NR>BV	NR>BV	>11.000<
PC	P-1W	18.26	Fire-impacted sediment	>30.000<	<0.700>	-	NR>BV	>14.000<	AIIND	NR>BV AIIND	-	-	NR>BV	>6.000<
PC	P-2E	13.34		-	-	-	-	-	-	-	-	-	-	-
PC	P-2W	14.61		>6.880<	<3.000>	-	>3.333<	>9.800<	AIIND	AIIND	-	-	NR>BV	NR>BV
PC	P-2W	14.61	Fire-impacted sediment	>22.800<	<1.560>	-	>6.933<	>6.900<	>14.400<	>8.438<	-	-	NR>BV	NR>BV
PC	P-3E	10.42		-	-	-	-	-	-	-	-	-	-	-
PC	P-3E	10.42	Fire-impacted sediment	>20.000<	NR>BV	-	>6.267<	>12.000<	NR>BV AIIND	NR>BV AIIND	-	-	NR>BV	NR>BV
PC	P-3W	11.4		>4.940<	AIIND	-	<2.667>	>6.900<	AIIND	AIIND	-	-	NR>BV	NR>BV
PC	P-3W	11.4	Fire-impacted sediment	>13.620<	<1.200>	-	>6.333<	>8.400<	>14.600<	>40.625<	-	-	NR>BV	NR>BV
PC	P-4E	8.6		>20.600<	NR>BV	-	>4.000<	AIIND	NR>BV	>209.375<	>25.556<	-	>952.000<	>22.200<
PC	P-4E	8.6	Fire-impacted sediment	>26.000<	NR>BV	-	>9.333<	>15.000<	NR>BV AIIND	AIIND	-	-	>840.000<	>6.600<
PC	P-4W	9.49		NR>BV	<2.200>	-	>7.333<	AIIND	NR>BV	AIIND	>6.306<	-	>812.000<	>6.690<
PC	WC	17.77		NR>BV	NR>BV	-	NR>BV	>3.600<	NR>BV AIIND	>37.500<	-	-	NR>BV	NR>BV

Table E-1.0-6 (continued)

Canyon	Reach	Distance to Rio Grande (km)	Status	Cyanide (Total)	Acenaphthene	Benz(a)anthracene	Benzo(a)pyrene	Benzo(b)fluoranthene	Benzo(g,h,i)perylene	Benzoic Acid	Bis(2-ethylhexyl) phthalate	Chrysene	4,4'-DDE	4,4'-DDT
BVs				0.82										
ESLs				0.1	0.25	3	9.6	18	12	7.3	1	2.4	0.003	0.003
Max HQ				25	6.4	1.867	0.615	0.372	0.417	0.479	2	2.208	76.923	107.692
Baseline	Baseline		Fire-impacted sediment	>25.000<	SW%D<5 AIIND	SW%D<5 AIIND	SW%D<5 AIIND	SW%D<5 AIIND	SW%D<5 AIIND	<0.479>	SW%D<5 AIIND	SW%D<5 AIIND	>3.038<	>3.538<
Baseline	Garcia Cyn		Fire-impacted sediment	>16.000<	-	-	-	-	-	-	-	-	-	-
Baseline	Guaje Cyn		Fire-impacted sediment	>20.000<	-	-	-	-	-	-	-	-	-	-
Baseline	Rendija Cyn		Fire-impacted sediment	>11.000<	SW%D<5 AIIND	SW%D<5 AIIND	SW%D<5 AIIND	SW%D<5 AIIND	SW%D<5 AIIND	<0.466>	SW%D<5 AIIND	SW%D<5 AIIND	-	-
DPC	DP-1C	16.29		-	<0.960>	<0.400>	N	N	AIIND	SW%D<5	<1.100>	<0.413>	-	-
DPC	DP-1E	15.47		-	<0.348>	<0.320>	N	N	N	SW%D<5 AIIND	<0.460>	<0.375>	-	>7.962<
DPC	DP-1W	16.39		-	AIIND	<1.000>	<0.333>	N		SW%D<5 AIIND	<1.700>	<1.375>	AIIND	>46.154<
DPC	DP-2	14.69		-	AIIND	N	N	N	N	SW%D<5 AIIND	<0.840>	<0.346>	AIIND	>45.769<
DPC	DP-2	14.69	Removed	-	-	-	-	-	-	-	-	-	-	-
DPC	DP-3	13.85		-	AIIND	N	N	N	AIIND	SW%D<5	<0.950>	N	AIIND	>21.538<
DPC	DP-4	13.12		NR>BV	N	N	N	N	N	SW%D<5 AIIND	N	N	<1.615>	>17.308<
DPC	DPTF	16.29		-	AIIND	AIIND	AIIND	AIIND	AIIND	SW%D<5 AIIND	AIIND	AIIND	-	-
LAC	LA-0	19.5		-	AIIND	N	N	N	AIIND	N	N	N	>8.846<	>23.462<
LAC	LA-1C	15.66		-	<0.316>	N	N	N	AIIND	N	<1.300>	N	>3.269<	>53.846<
LAC	LA-1E	14.81		-	AIIND	N	N	N	AIIND	AIIND	<0.530>	N	>3.846<	>6.538<
LAC	LA-1FW	18.36		-	AIIND	N	N	N	AIIND	N	N	<0.958>	<2.808>	>8.462<
LAC	LA-1W	17.18		-	AIIND	N	N	AIIND	AIIND	AIIND	N	N	AIIND	>6.538<

Table E-1.0-6 (continued)

Canyon	Reach	Distance to Rio Grande (km)	Status	Cyanide (Total)	Acenaphthene	Benz(a)anthracene	Benzo(a)pyrene	Benzo(b)fluoranthene	Benzo(g,h,i)perylene	Benzoic Acid	Bis(2-ethylhexyl) phthalate	Chrysene	4,4'-DDE	4,4'-DDT
BVs				0.82										
ESLs				0.1	0.25	3	9.6	18	12	7.3	1	2.4	0.003	0.003
Max HQ				25	6.4	1.867	0.615	0.372	0.417	0.479	2	2.208	76.923	107.692
LAC	LA-1W+	17.47		-	AIIND	N	N	N	AIIND	N	<1.200>	N	<2.115>	>10.000<
LAC	LA-2E	12.55		NR>BV	<1.040>	N	N	N	N	AIIND	AIIND	N	AIIND	AIIND
LAC	LA-2E	12.55	Removed	NR>BV	AIIND	N	N	N	AIIND	AIIND	AIIND	N	>12.692<	AIIND
LAC	LA-2FE	11.22		-	<0.348>	N	N	N	AIIND	AIIND	N	N	>10.385<	>33.462<
LAC	LA-2W	13		NR>BV	<0.920>	N	N	N	AIIND	N	<0.400>	N	>5.000<	>11.923<
LAC	LA-3E	8.75		NR>BV AIIND	AIIND	N	N	N	N	AIIND	<0.340>	N	AIIND	AIIND
LAC	LA-3FE	8.85	Fire-impacted sediment	>25.000<	AIIND	N	N	N	N	AIIND	AIIND	N	-	-
LAC	LA-3W	10.48		-	AIIND	N	N	N	AIIND	AIIND	N	N	AIIND	>28.846<
LAC	LA-4E	5.03		-	-	-	-	-	-	-	-	-	SW%D<5 AIIND	AIIND
LAC	LA-4FE	4.29	Fire-impacted sediment	-	SW%D<5 AIIND	N	SW%D<5 AIIND	SW%D<5 AIIND	SW%D<5 AIIND	SW%D<5 AIIND	N	N	-	-
LAC	LA-4W	6.04		-	-	-	-	-	-	-	-	-	SW%D<5 AIIND	<1.962>
LAC	LA-5	0.88		NR>BV	SW%D<5 AIIND	AIIND	SW%D<5 AIIND	SW%D<5 AIIND	SW%D<5 AIIND	SW%D<5 AIIND	AIIND	AIIND	SW%D<5 AIIND	AIIND
LAC	LA-5E	0.09	Fire-impacted sediment	>20.000<	-	-	-	-	-	-	-	-	-	-
PC	AC-1	19.08		-	>6.400<	<1.867>	<0.615>	<0.372>	N	AIIND	<2.000>	<2.208>	>11.538<	>30.769<
PC	AC-2	18.77		-	<2.320>	<0.867>	<0.313>	N	N	N	<1.700>	<1.292>	>3.577<	>15.000<
PC	AC-3	18.27		NR>BV AIIND	<2.120>	<0.600>	N	N	AIIND	N	N	<0.667>	>5.385<	>38.462<
PC	ACS	18.62		-	N	N	N	N	AIIND	N	N	N	>10.769<	>107.692<
PC	ACS	18.62	ACS removed	-	AIIND	N	N	N	N	AIIND	AIIND	N	>76.923<	>88.462<

Table E-1.0-6 (continued)

Canyon	Reach	Distance to Rio Grande (km)	Status	Cyanide (Total)	Acenaphthene	Benz(a)anthracene	Benzo(a)pyrene	Benzo(b)fluoranthene	Benzo(g,h,i)perylene	Benzoic Acid	Bis(2-ethylhexyl) phthalate	Chrysene	4,4'-DDE	4,4'-DDT
BVs				0.82										
ESLs				0.1	0.25	3	9.6	18	12	7.3	1	2.4	0.003	0.003
Max HQ				25	6.4	1.867	0.615	0.372	0.417	0.479	2	2.208	76.923	107.692
PC	P-1E	17.81		NR>BV	<0.680>	<0.333>	N	N	N	N	AIIND	<0.500>	<0.731>	>4.615<
PC	P-1E	17.81	Fire-impacted sediment	-	-	-	-	-	-	-	-	-	-	-
PC	P-1FW	18.51		-	AIIND	AIIND	AIIND	AIIND	N	N	<0.340>	AIIND	<1.500>	>10.000<
PC	P-1W	18.26		NR>BV AIIND	N	N	N	N	N	N		N	<1.423>	>6.154<
PC	P-1W	18.26	Fire-impacted sediment	-	-	-	-	-	-	-	-	-	-	-
PC	P-2E	13.34		-	-	-	-	-	-	-	-	-	-	-
PC	P-2W	14.61		-	-	-	-	-	-	-	-	-	AIIND	AIIND
PC	P-2W	14.61	Fire-impacted sediment	-	-	-	-	-	-	-	-	-	-	-
PC	P-3E	10.42		-	-	-	-	-	-	-	-	-	-	-
PC	P-3E	10.42	Fire-impacted sediment	-	-	-	-	-	-	-	-	-	-	-
PC	P-3W	11.4		-	-	-	-	-	-	-	-	-	AIIND	AIIND
PC	P-3W	11.4	Fire-impacted sediment	-	-	-	-	-	-	-	-	-	-	-
PC	P-4E	8.6		NR>BV	AIIND	N	AIIND	AIIND	AIIND	AIIND	AIIND	N	AIIND	AIIND
PC	P-4E	8.6	Fire-impacted sediment	-	-	-	-	-	-	-	-	-	-	-
PC	P-4W	9.49		>10.000<	<0.876>	N	N	N	N	AIIND	AIIND	N	AIIND	AIIND
PC	WC	17.77		-	AIIND	AIIND	AIIND	AIIND	AIIND	AIIND	AIIND	AIIND	<1.000>	<1.846>

Table E-1.0-6 (continued)

Canyon	Reach	Distance to Rio Grande (km)	Status	Dieldrin	Endrin	Endrin Aldehyde	Fluoranthene	Fluorene	Naphthalene	Phenanthrene	Phenol	Pyrene	Tetryl
BVs													
ESLs				0.04	0.003	0.003	26	1.7	0.02	11	0.79	15	2
Max HQ				1.263	0.971	16.765	0.462	1.059	120	1	6.835	0.8	0.38
Baseline	Baseline		Fire-impacted sediment	SW%D<5 AIIND	SW%D<5 AIIND	SW%D<5 AIIND	SW%D<5 AIIND	SW%D<5 AIIND	>38.000<	AIIND	>6.835<	SW%D<5 AIIND	<0.380>
Baseline	Garcia Cyn		Fire-impacted sediment	-	-	-	-	-	-	-	-	-	-
Baseline	Guaje Cyn		Fire-impacted sediment	-	-	-	-	-	-	-	-	-	-
Baseline	Rendija Cyn		Fire-impacted sediment	-	-	-	SW%D<5 AIIND	SW%D<5 AIIND	>6.500<	N	<1.000>	SW%D<5 AIIND	-
DPC	DP-1C	16.29		-	-	-	N	N	>35.500<	N	SW%D<5 AIIND	N	-
DPC	DP-1E	15.47		-	-	-	N	N	>4.150<	N	SW%D<5 AIIND	N	-
DPC	DP-1W	16.39		SW%D<5 AIIND	SW%D<5 AIIND	SW%D<5 AIIND	N	AIIND	>31.000<	N	SW%D<5 AIIND	<0.800>	-
DPC	DP-2	14.69		SW%D<5 AIIND	SW%D<5 AIIND	SW%D<5 AIIND	N	N	>3.550<	N	SW%D<5 AIIND	N	-
DPC	DP-2	14.69	Removed	-	-	-	-	-	-	-	-	-	-
DPC	DP-3	13.85		SW%D<5 AIIND	SW%D<5 AIIND	SW%D<5 AIIND	N	AIIND	AIIND	N	SW%D<5 AIIND	N	-
DPC	DP-4	13.12		SW%D<5 AIIND	SW%D<5 AIIND	SW%D<5 AIIND	N	N	>4.150<	N	SW%D<5 AIIND	N	-
DPC	DPTF	16.29		-	-	-	AIIND	AIIND	AIIND	AIIND	SW%D<5 AIIND	AIIND	-
LAC	LA-0	19.5		AIIND	SW%D<5 AIIND	AIIND	N	AIIND	AIIND	N	SW%D<5 AIIND	AIIND	-
LAC	LA-1C	15.66		<0.750>	SW%D<5	>16.765<	N	N	AIIND	N	SW%D<5 AIIND	N	-

Table E-1.0-6 (continued)

Canyon	Reach	Distance to Rio Grande (km)	Status	Dieldrin	Endrin	Endrin Aldehyde	Fluoranthene	Fluorene	Naphthalene	Phenanthrene	Phenol	Pyrene	Tetryl
BVs													
ESLs				0.04	0.003	0.003	26	1.7	0.02	11	0.79	15	2
Max HQ				1.263	0.971	16.765	0.462	1.059	120	1	6.835	0.8	0.38
LAC	LA-1E	14.81		<0.350>	SW%D<5	<2.941>	N	N	>9.500<	N	SW%D<5 AIIND	N	-
LAC	LA-1FW	18.36		N	SW%D<5 AIIND	AIIND	N	AIIND	AIIND	N	SW%D<5 AIIND	N	-
LAC	LA-1W	17.18		AIIND	SW%D<5 AIIND	AIIND	N	AIIND	>4.250<	N	SW%D<5 AIIND	AIIND	-
LAC	LA-1W+	17.47		AIIND	SW%D<5 AIIND	AIIND	N	AIIND	AIIND	N	SW%D<5 AIIND	N	-
LAC	LA-2E	12.55		AIIND	SW%D<5 AIIND	AIIND	N	N	>5.500<	N	SW%D<5 AIIND	N	-
LAC	LA-2E	12.55	Removed	AIIND	SW%D<5 AIIND	AIIND	N	AIIND	AIIND	N	SW%D<5 AIIND	N	-
LAC	LA-2FE	11.22		<0.575>	SW%D<5 AIIND	AIIND	N	N	AIIND	N	SW%D<5 AIIND	N	-
LAC	LA-2W	13		AIIND	SW%D<5 AIIND	>3.824<	N	N	>10.000<	N	SW%D<5 AIIND	N	-
LAC	LA-3E	8.75		AIIND	SW%D<5 AIIND	AIIND	N	AIIND	AIIND	N	SW%D<5 AIIND	N	-
LAC	LA-3FE	8.85	Fire-impacted sediment	-	-	-	N	AIIND	>12.500<	N	SW%D<5 AIIND	N	-
LAC	LA-3W	10.48		<0.350>	SW%D<5 AIIND	AIIND	N	AIIND	AIIND	N	SW%D<5 AIIND	N	-
LAC	LA-4E	5.03		SW%D<5 AIIND	SW%D<5 AIIND	SW%D<5 AIIND	-	-	-	-	-	-	-
LAC	LA-4FE	4.29	Fire-impacted sediment	-	-	-	N	N	SW%D<5 AIIND	N	SW%D<5 AIIND	N	-
LAC	LA-4W	6.04		SW%D<5 AIIND	SW%D<5 AIIND	SW%D<5 AIIND	-	-	-	-	-	-	-
LAC	LA-5	0.88		SW%D<5 AIIND	SW%D<5 AIIND	SW%D<5 AIIND	AIIND	AIIND	SW%D<5 AIIND	AIIND	SW%D<5 AIIND	AIIND	-

Table E-1.0-6 (continued)

Canyon	Reach	Distance to Rio Grande (km)	Status	Dieldrin	Endrin	Endrin Aldehyde	Fluoranthene	Fluorene	Naphthalene	Phenanthrene	Phenol	Pyrene	Tetryl
BVs													
ESLs				0.04	0.003	0.003	26	1.7	0.02	11	0.79	15	2
Max HQ				1.263	0.971	16.765	0.462	1.059	120	1	6.835	0.8	0.38
LAC	LA-5E	0.09	Fire-impacted sediment	-	-	-	-	-	-	-	-	-	-
PC	AC-1	19.08		<0.625>	AIIND	AIIND	<0.462>	<1.059>	>120.000<	<1.000>	SW%D<5 AIIND	<0.733>	-
PC	AC-2	18.77		AIIND	AIIND	AIIND	N	<0.329>	>40.500<	<0.464>	SW%D<5 AIIND	<0.393>	-
PC	AC-3	18.27		AIIND	AIIND	AIIND	N	N	>40.500<	<0.318>	SW%D<5 AIIND	N	-
PC	ACS	18.62		<1.263>	<0.971>	<1.088>	N	N	<1.530>	N	SW%D<5 AIIND	N	-
PC	ACS	18.62	ACS removed	AIIND	AIIND	AIIND	N	AIIND	>16.000<	N	SW%D<5 AIIND	N	-
PC	P-1E	17.81		AIIND	SW%D<5 AIIND	SW%D<5 AIIND	N	N	>10.000<	N	SW%D<5 AIIND	N	-
PC	P-1E	17.81	Fire-impacted sediment	-	-	-	-	-	-	-	-	-	-
PC	P-1FW	18.51		N	SW%D<5 AIIND	SW%D<5 AIIND	N	AIIND	AIIND	N	SW%D<5 AIIND	N	-
PC	P-1W	18.26		AIIND	SW%D<5 AIIND	SW%D<5 AIIND	N	N	>7.000<	N	SW%D<5 AIIND	N	-
PC	P-1W	18.26	Fire-impacted sediment	-	-	-	-	-	-	-	-	-	-
PC	P-2E	13.34		-	-	-	-	-	-	-	-	-	-
PC	P-2W	14.61		AIIND	SW%D<5 AIIND	SW%D<5 AIIND	-	-	-	-	-	-	-
PC	P-2W	14.61	Fire-impacted sediment	-	-	-	-	-	-	-	-	-	-
PC	P-3E	10.42		-	-	-	-	-	-	-	-	-	-

Table E-1.0-6 (continued)

Canyon	Reach	Distance to Rio Grande (km)	Status	Dieldrin	Endrin	Endrin Aldehyde	Fluoranthene	Fluorene	Naphthalene	Phenanthrene	Phenol	Pyrene	Tetryl
BVs													
ESLs				0.04	0.003	0.003	26	1.7	0.02	11	0.79	15	2
Max HQ				1.263	0.971	16.765	0.462	1.059	120	1	6.835	0.8	0.38
PC	P-3E	10.42	Fire-impacted sediment	-	-	-	-	-	-	-	-	-	-
PC	P-3W	11.4		AIIND	SW%D<5 AIIND	SW%D<5 AIIND	-	-	-	-	-	-	-
PC	P-3W	11.4	Fire-impacted sediment	-	-	-	-	-	-	-	-	-	-
PC	P-4E	8.6		AIIND	SW%D<5 AIIND	SW%D<5 AIIND	N	AIIND	AIIND	AIIND	SW%D<5 AIIND	N	-
PC	P-4E	8.6	Fire-impacted sediment	-	-	-	-	-	-	-	-	-	-
PC	P-4W	9.49		AIIND	SW%D<5 AIIND	SW%D<5 AIIND	N	N	>18.700<	N	SW%D<5 AIIND	N	-
PC	WC	17.77		AIIND	SW%D<5 AIIND	SW%D<5 AIIND	AIIND	AIIND	AIIND	AIIND	SW%D<5 AIIND	AIIND	-

Table E-1.0-6 (continued)

Canyon	Reach	Distance to Rio Grande (km)	Status	Aroclor-1248	Aroclor-1254	Aroclor-1260	Americium-241	Cesium-137	Plutonium-238	Plutonium-239	Thorium-232	Uranium-234	Uranium-238
BVs							0.04	0.9	0.006	0.068	2.33	2.59	2.29
ESLs				0.007	0.022	0.44	44	680	44	47	6.2	51	55
Max HQ				708.333	281.818	7.5	2.295	0.65	0.848	165.532	0.426	0.422	0.302
Baseline	Baseline		Fire-impacted sediment	SW%D<5 AIIND	SW%D<5 AIIND	SW%D<5 AIIND	N	N	N	N	NDR>BV	NDR>BV	N
Baseline	Garcia Cyn		Fire-impacted sediment	-	-	-	NDR>BV AIIND	N	NDR>BV AIIND	N	-	NDR>BV	NDR>BV
Baseline	Guaje Cyn		Fire-impacted sediment	-	-	-	NDR>BV AIIND	N	NDR>BV AIIND	N	-	-	-
Baseline	Rendija Cyn		Fire-impacted sediment	-	-	-	NDR>BV AIIND	N	NDR>BV AIIND	N	-	-	-
DPC	DP-1C	16.29		SW%D<5 AIIND	SW%D<5 AIIND	<2.273>	N	NDR>BV	NDR>BV AIIND	NDR>BV	-	NDR>BV	NDR>BV
DPC	DP-1E	15.47		SW%D<5 AIIND	SW%D<5 AIIND	N	NDR>BV AIIND	NDR>BV	NDR>BV AIIND	N	-	NDR>BV	NDR>BV
DPC	DP-1W	16.39		SW%D<5 AIIND	SW%D<5 AIIND	AIIND	N	NDR>BV	NDR>BV AIIND	NDR>BV	-	NDR>BV	NDR>BV
DPC	DP-2	14.69		SW%D<5 AIIND	SW%D<5 AIIND	<0.398>	<0.418>	N	N	N	-	NDR>BV	NDR>BV
DPC	DP-2	14.69	Removed	-	-	-	<0.677>		N	N	-	-	-
DPC	DP-3	13.85		SW%D<5 AIIND	SW%D<5 AIIND	N	<1.614>	N	N	N	-	NDR>BV	NDR>BV
DPC	DP-4	13.12		SW%D<5 AIIND	SW%D<5 AIIND	N	<0.743>	N	N		NDR>BV	N	N
DPC	DPTF	16.29		-	-	-	-	-	-	-	-	-	-
LAC	LA-0	19.5		SW%D<5 AIIND	AIIND	N	-	-	-	-	-	-	-
LAC	LA-1C	15.66		SW%D<5 AIIND	>21.364<	<1.955>	N	NDR>BV	N	N	-	NDR>BV	NDR>BV
LAC	LA-1E	14.81		SW%D<5 AIIND	AIIND	<0.909>	N	N	N	<0.411>	-	NDR>BV	N

Table E-1.0-6 (continued)

Canyon	Reach	Distance to Rio Grande (km)	Status	Aroclor-1248	Aroclor-1254	Aroclor-1260	Americium-241	Cesium-137	Plutonium-238	Plutonium-239	Thorium-232	Uranium-234	Uranium-238
BVs							0.04	0.9	0.006	0.068	2.33	2.59	2.29
ESLs				0.007	0.022	0.44	44	680	44	47	6.2	51	55
Max HQ				708.333	281.818	7.5	2.295	0.65	0.848	165.532	0.426	0.422	0.302
LAC	LA-1FW	18.36		SW%D<5 AIIND	AIIND		NDR>BV	NDR>BV AIIND	NDR>BV AIIND	NDR>BV	-	NDR>BV	NDR>BV
LAC	LA-1W	17.18		SW%D<5 AIIND	>24.545<	N	N	NDR>BV	N	<0.406>	-	NDR>BV	NDR>BV
LAC	LA-1W+	17.47		SW%D<5 AIIND	>29.545<	<0.341>	-	-	NDR>BV AIIND	N	-	NDR>BV	NDR>BV
LAC	LA-2E	12.55		SW%D<5 AIIND	AIIND	<0.523>		N	N	N	NDR>BV	NDR>BV	N
LAC	LA-2E	12.55	Removed	SW%D<5 AIIND	AIIND	<0.955>	N	N	N	N	NDR>BV	NDR>BV	N
LAC	LA-2FE	11.22		SW%D<5 AIIND	AIIND	<1.318>	<0.416>	N	N	<0.330>	NDR>BV	NDR>BV	NDR>BV
LAC	LA-2W	13		SW%D<5 AIIND	AIIND	<0.773>	N	N	N	N	NDR>BV	N	N
LAC	LA-3E	8.75		SW%D<5 AIIND	AIIND	N	N	N	N	N	<0.426>	NDR>BV	NDR>BV
LAC	LA-3FE	8.85	Fire-impacted sediment	-	-	-	N	N	N	N	-	NDR>BV	NDR>BV
LAC	LA-3W	10.48		SW%D<5 AIIND	AIIND	<0.773>	N	N	N	N	NDR>BV	NDR>BV	NDR>BV
LAC	LA-4E	5.03		SW%D<5 AIIND	SW%D<5 AIIND	SW%D<5 AIIND	N	N	N	N	-	-	-
LAC	LA-4FE	4.29	Fire-impacted sediment	-	-	-	N	N	N	N	-	-	-
LAC	LA-4W	6.04		SW%D<5 AIIND	SW%D<5 AIIND	SW%D<5 AIIND	N	N	N	N	-	-	-
LAC	LA-5	0.88		SW%D<5 AIIND	SW%D<5 AIIND	SW%D<5 AIIND	N	N	NDR>BV AIIND	N	NDR>BV	NDR>BV	NDR>BV
LAC	LA-5E	0.09	Fire-impacted sediment	-	-	-	NDR>BV AIIND	N	NDR>BV AIIND	N	-	NDR>BV	NDR>BV

Table E-1.0-6 (continued)

Canyon	Reach	Distance to Rio Grande (km)	Status	Aroclor-1248	Aroclor-1254	Aroclor-1260	Americium-241	Cesium-137	Plutonium-238	Plutonium-239	Thorium-232	Uranium-234	Uranium-238
BVs							0.04	0.9	0.006	0.068	2.33	2.59	2.29
ESLs				0.007	0.022	0.44	44	680	44	47	6.2	51	55
Max HQ				708.333	281.818	7.5	2.295	0.65	0.848	165.532	0.426	0.422	0.302
PC	AC-1	19.08		AIIND	AIIND	N	NDR>BV AIIND	N	NDR>BV AIIND	N	-	NDR>BV	NDR>BV
PC	AC-2	18.77		AIIND	AIIND	N	N	NDR>BV	NDR>BV AIIND	N	-	NDR>BV	NDR>BV
PC	AC-3	18.27		AIIND	>281.818<	N		N	N	>10.149<	NDR>BV	N	NDR>BV
PC	ACS	18.62		AIIND	>33.000<	<0.345>	N	N	N	>7.404<	-	N	N
PC	ACS	18.62	ACS removed	>708.333<	>254.545<	>7.500<	<2.295>	N	<0.848>	>165.532<	-	<0.422>	<0.302>
PC	P-1E	17.81		SW%D<5 AIIND	>10.818<	N	N	N	N	>10.681<	NDR>BV	NDR>BV	NDR>BV
PC	P-1E	17.81	Fire-impacted sediment	-	-	-	AIIND	N	N	N	-	-	-
PC	P-1FW	18.51		SW%D<5 AIIND	<0.682>	N	-	-	-	-	-	-	-
PC	P-1W	18.26		SW%D<5 AIIND	AIIND	N	NDR>BV AIIND	N	NDR>BV AIIND	N	NDR>BV	NDR>BV	NDR>BV
PC	P-1W	18.26	Fire-impacted sediment	-	-	-	NDR>BV AIIND	N	NDR>BV AIIND	N	-	-	-
PC	P-2E	13.34		-	-	-	-	-	N	N	-	-	-
PC	P-2W	14.61		SW%D<5 AIIND	AIIND	N	N	N	N	<1.562>	-	-	-
PC	P-2W	14.61	Fire-impacted sediment	-	-	-	N	N	AIIND	N	-	-	-
PC	P-3E	10.42		-	-	-	-	-	N	N	-	-	-
PC	P-3E	10.42	Fire-impacted sediment	-	-	-	NDR>BV AIIND	N	AIIND	N	-	-	-
PC	P-3W	11.4		SW%D<5 AIIND	AIIND	AIIND	AIIND	N	N	<0.955>	-	-	-

Table E-1.0-6 (continued)

Canyon	Reach	Distance to Rio Grande (km)	Status	Aroclor-1248	Aroclor-1254	Aroclor-1260	Americium-241	Cesium-137	Plutonium-238	Plutonium-239	Thorium-232	Uranium-234	Uranium-238
BVs							0.04	0.9	0.006	0.068	2.33	2.59	2.29
ESLs				0.007	0.022	0.44	44	680	44	47	6.2	51	55
Max HQ				708.333	281.818	7.5	2.295	0.65	0.848	165.532	0.426	0.422	0.302
PC	P-3W	11.4	Fire-impacted sediment	-	-	-	N	N	AIIND	N	-	-	-
PC	P-4E	8.6		SW%D<5 AIIND	AIIND	AIIND	NDR>BV AIIND	N	NDR>BV AIIND	<0.397>	NDR>BV	NDR>BV	NDR>BV
PC	P-4E	8.6	Fire-impacted sediment	-	-	-	NDR>BV AIIND	N	NDR>BV AIIND	N	-	-	-
PC	P-4W	9.49		SW%D<5 AIIND	AIIND	AIIND	N	NDR>BV	N	>3.628<	NDR>BV	NDR>BV	NDR>BV
PC	WC	17.77		SW%D<5 AIIND	AIIND	AIIND	-	-	-	-	-	-	-

- Notes: 1. Units are mg/kg for organic and inorganic chemicals and pCi/g for radionuclides.
2. <#> = Retained as COPC.
3. >#< = Retained as COPC.
4. - = No data.
5. AIIND = Analyte never detected.
6. N = Analyte eliminated as a COPEC.
7. NBV-NDR = No BV, no detected result (inorganic chemicals and radionuclides). Not a COPC.
8. NDR>BV = No detected result > BV (radionuclides). Not a COPC.
9. NR>BV = No result > BV (inorganic chemicals). Not a COPC.
10. SW%D<5 = % detection in the subwatershed < 5%. Not a COPC.

**Table E-1.0-7
Sediment ESLs**

Analyte Name	Sediment ESL	Units
Americium-241	0.0058	pCi/g
Anthracene	0.00039	mg/kg
Aroclor-1254	0.028	mg/kg
Aroclor-1260	0.031	mg/kg
Arsenic	1.1	mg/kg
Barium	3.4	mg/kg
Benz(a)anthracene	0.11	mg/kg
Benzo(a)pyrene	0.35	mg/kg
Benzo(b)fluoranthene	0.24	mg/kg
Benzo(g,h,i)perylene	0.29	mg/kg
Benzo(k)fluoranthene	0.24	mg/kg
Benzoic Acid	0.065	mg/kg
Beryllium	4.1	mg/kg
Bis(2-ethylhexyl)phthalate	1.3	mg/kg
Cadmium	0.006	mg/kg
Cesium-134	0.47	pCi/g
Cesium-137	1.1	pCi/g
Chlordane[alpha-]	0.0005	mg/kg
Chlordane[gamma-]	0.0005	mg/kg
Chromium	56	mg/kg
Chrysene	0.5	mg/kg
Cobalt	0.074	mg/kg
Copper	28	mg/kg
Cyanide (Total)	0.1	mg/kg
DDE[4,4'-]	0.0022	mg/kg
DDT[4,4'-]	0.0015	mg/kg
Europium-152	0.1	pCi/g
Fluoranthene	2.9	mg/kg
Indeno(1,2,3-cd)pyrene	0.078	mg/kg
Lead	34	mg/kg
Manganese	720	mg/kg
Naphthalene	0.027	mg/kg
Nickel	3.5	mg/kg
Phenanthrene	0.85	mg/kg
Plutonium-238	0.019	pCi/g
Plutonium-239	0.02	pCi/g
Pyrene	0.57	mg/kg
Selenium	1	mg/kg
Strontium-90	0.57	pCi/g
Thallium	0.044	mg/kg
Vanadium	4.1	mg/kg
Zinc	130	mg/kg

Table E-1.0-8
Active Channel Sediment (Aquatic): Ecological Screening Summary

Canyon	Reach	Distance to Rio Grande (km)	Status	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Copper	Lead	Manganese	Nickel	Selenium
BVs				3.98	127	1.31	0.4	10.5	4.73	11.2	19.7	543	9.38	0.3
ESLs				1.1	3.4	4.1	0.006	56	0.074	28	34	720	3.5	1
Max HQ				4.545	108.824	0.415	98.333	0.339	109.459	0.929	2.674	2.917	4	1.7
DPC	DP-1C	16.29		NR>BV	NR>BV	<0.390>	NR>BV	NR>BV	NR>BV	NR>BV	<1.412>	NR>BV	NR>BV	AIIND
DPC	DP-1E	15.47		NR>BV	NR>BV	NR>BV	NR>BV AIIND	NR>BV	NR>BV	NR>BV	NR>BV	NR>BV	NR>BV	AIIND
DPC	DP-1W	16.39		NR>BV	NR>BV	NR>BV	NR>BV	NR>BV	NR>BV	<0.407>	<0.638>	NR>BV	NR>BV	AIIND
DPC	DP-2	14.69		NR>BV	NR>BV	NR>BV	NR>BV AIIND	NR>BV	NR>BV	NR>BV	NR>BV	NR>BV	NR>BV	AIIND
DPC	DP-3	13.85		NR>BV	NR>BV	NR>BV	NR>BV AIIND	NR>BV	NR>BV	NR>BV	NR>BV	NR>BV	NR>BV	AIIND
DPC	DP-4	13.12		NR>BV AIIND	NR>BV	NR>BV	NR>BV AIIND	NR>BV	NR>BV	NR>BV	NR>BV	NR>BV	NR>BV	AIIND
DPC	DPTF	16.29		NR>BV	NR>BV	NR>BV	NR>BV	NR>BV	NR>BV	NR>BV	<0.676>	NR>BV	NR>BV	<0.430>
LAC	LA-1C	15.66		-	-	-	-	-	-	-	-	-	-	-
LAC	LA-1E	14.81		-	-	-	-	-	-	-	-	-	-	-
LAC	LA-1FW	18.36		NR>BV	NR>BV	NR>BV	NR>BV AIIND	NR>BV AIIND	NR>BV	NR>BV	NR>BV	NR>BV	NR>BV	AIIND
LAC	LA-1W	17.18		-	-	-	-	-	-	-	-	-	-	-
LAC	LA-1W+	17.47		NR>BV	NR>BV	NR>BV	NR>BV AIIND	NR>BV	NR>BV	NR>BV	NR>BV	NR>BV	NR>BV	AIIND
LAC	LA-2E	12.55		NR>BV	NR>BV	NR>BV	NR>BV AIIND	NR>BV	NR>BV	NR>BV	NR>BV	NR>BV	NR>BV AIIND	NR>BV AIIND
LAC	LA-2FE	11.22		-	-	-	-	-	-	-	-	-	-	-
LAC	LA-2W	13		NR>BV AIIND	NR>BV	NR>BV	NR>BV AIIND	NR>BV	NR>BV	NR>BV	NR>BV	NR>BV	NR>BV AIIND	NR>BV AIIND
LAC	LA-3E	8.75		NR>BV	NR>BV	NR>BV	AIIND	NR>BV	NR>BV	NR>BV	NR>BV	NR>BV	NR>BV	NR>BV AIIND
LAC	LA-3FE	8.85	Fire-impacted sediment	>4.545<	>108.824<	<0.415>	>98.333<	0.196	>109.459<	<0.929>	<1.559>	<2.917>	>4.000<	<1.700>

Table E-1.0-8 (continued)

Canyon	Reach	Distance to Rio Grande (km)	Status	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Copper	Lead	Manganese	Nickel	Selenium
BVs				3.98	127	1.31	0.4	10.5	4.73	11.2	19.7	543	9.38	0.3
ESLs				1.1	3.4	4.1	0.006	56	0.074	28	34	720	3.5	1
Max HQ				4.545	108.824	0.415	98.333	0.339	109.459	0.929	2.674	2.917	4	1.7
LAC	LA-4E	5.03		NR>BV	NR>BV	NR>BV	AIIND	NR>BV	NR>BV	NR>BV	NR>BV	NR>BV	NR>BV	AIIND
LAC	LA-4FE	4.29	Fire-impacted sediment	NR>BV	NR>BV	NR>BV	NR>BV	NR>BV	NR>BV	NR>BV	NR>BV	NR>BV	NR>BV	NR>BV AIIND
LAC	LA-4W	6.04		-	-	-	-	-	-	-	-	-	-	-
LAC	LA-5	0.88		NR>BV AIIND	NR>BV	NR>BV	NR>BV AIIND	NR>BV	NR>BV	NR>BV	NR>BV	NR>BV	NR>BV	AIIND
LAC	LA-5E	0.09	Fire-impacted sediment	NR>BV	NR>BV	NR>BV	NR>BV AIIND	NR>BV	NR>BV	NR>BV	NR>BV	NR>BV	NR>BV	NR>BV AIIND
PC	AC-1	19.08		NR>BV	NR>BV	NR>BV	NR>BV AIIND	<0.339>	NR>BV	NR>BV	<2.674>	NR>BV	NR>BV	<0.390>
PC	AC-2	18.77		NR>BV	NR>BV	NR>BV	NR>BV AIIND	NR>BV	NR>BV	NR>BV	NR>BV	NR>BV	NR>BV	NR>BV
PC	AC-3	18.27		NR>BV AIIND	NR>BV	NR>BV	NR>BV	NR>BV	NR>BV	NR>BV	<1.615>	NR>BV	NR>BV	<0.410>
PC	ACS	18.62		NR>BV	NR>BV	NR>BV	NR>BV	NR>BV	NR>BV	NR>BV	<1.735>	NR>BV	NR>BV	<0.510>
PC	ACS	18.62	ACS removed	NR>BV	NR>BV	NR>BV	NR>BV	NR>BV	NR>BV	NR>BV	<1.941>	NR>BV	NR>BV	AIIND
PC	P-1E	17.81		NR>BV AIIND	NR>BV	NR>BV	NR>BV	NR>BV	NR>BV	NR>BV	<0.871>	NR>BV	NR>BV	0.3
PC	P-1E	17.81	Fire-impacted sediment	NR>BV	NR>BV	NR>BV	NR>BV AIIND	NR>BV	NR>BV	NR>BV	0.182	NR>BV	NR>BV	<0.450>
PC	P-1FW	18.51		NR>BV	NR>BV	NR>BV	NR>BV AIIND	NR>BV	NR>BV	NR>BV	NR>BV	NR>BV	NR>BV	<0.350>
PC	P-1W	18.26		NR>BV	NR>BV	NR>BV	NR>BV AIIND	NR>BV	NR>BV	NR>BV	<0.765>	NR>BV	NR>BV	NR>BV AIIND
PC	P-2E	13.34		-	-	-	-	-	-	-	-	-	-	-
PC	P-2W	14.61		NR>BV AIIND	NR>BV	NR>BV AIIND	AIIND	NR>BV	NR>BV	NR>BV	NR>BV	NR>BV	NR>BV AIIND	<0.660>

Table E-1.0-8 (continued)

Canyon	Reach	Distance to Rio Grande (km)	Status	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Copper	Lead	Manganese	Nickel	Selenium
BVs				3.98	127	1.31	0.4	10.5	4.73	11.2	19.7	543	9.38	0.3
ESLs				1.1	3.4	4.1	0.006	56	0.074	28	34	720	3.5	1
Max HQ				4.545	108.824	0.415	98.333	0.339	109.459	0.929	2.674	2.917	4	1.7
PC	P-2W	14.61	Fire-impacted sediment	NR>BV AIIND	NR>BV	NR>BV	AIIND	NR>BV	NR>BV	NR>BV	NR>BV	NR>BV	NR>BV AIIND	AIIND
PC	P-3W	11.4		NR>BV AIIND	NR>BV	NR>BV AIIND	AIIND	NR>BV	NR>BV	NR>BV	NR>BV	NR>BV	NR>BV AIIND	<0.550>
PC	P-3W	11.4	Fire-impacted sediment	NR>BV	NR>BV	NR>BV	AIIND	NR>BV	NR>BV	NR>BV	NR>BV	NR>BV	NR>BV	AIIND
PC	P-4E	8.6		NR>BV AIIND	NR>BV	NR>BV	NR>BV AIIND	NR>BV	NR>BV	NR>BV	NR>BV	NR>BV	NR>BV	NR>BV AIIND
PC	P-4E	8.6	Fire-impacted sediment	NR>BV	NR>BV	NR>BV	NR>BV AIIND	NR>BV	NR>BV	NR>BV	NR>BV	NR>BV	NR>BV	NR>BV AIIND
PC	P-4W	9.49		-	-	-	-	-	-	-	-	-	-	-
PC	WC	17.77		NR>BV	NR>BV	NR>BV	NR>BV AIIND	NR>BV	NR>BV	NR>BV	NR>BV	NR>BV	NR>BV	<0.360>

Table E-1.0-8 (continued)

Canyon	Reach	Distance to Rio Grande (km)	Status	Thallium	Vanadium	Zinc	Cyanide (Total)	Anthracene	Benz(a)anthracene	Benzo(a)pyrene	Benzo(b)fluoranthene	Benzo(g,h,i)perylene	Benzo(k)fluoranthene	Benzoic Acid
BV _s				0.73	19.7	60.2	0.82							
ESL _s				0.044	4.1	130	0.1	0	0.11	0.35	0.24	0.29	0.24	0.065
Max HQ				7.955	5.366	1.077	25	4615.385	10.909	2.114	7.083	0.931	0.542	11.538
DPC	DP-1C	16.29		NR>BV	NR>BV	<0.585>	-	>4615.385<	>10.909<	AIIND	>7.083<	AIIND	AIIND	SW%D<5 AIIND
DPC	DP-1E	15.47		NR>BV AIIND	NR>BV	NR>BV	-	>176.923<	<2.636>	<0.743>	<1.167>	<0.931>	<0.346>	SW%D<5 AIIND
DPC	DP-1W	16.39		NR>BV AIIND	NR>BV	<0.531>	-	AIIND	>7.273<	<2.114>	>5.000<	AIIND	AIIND	SW%D<5 AIIND
DPC	DP-2	14.69		AIIND	NR>BV	NR>BV	-	AIIND	AIIND	AIIND	AIIND	AIIND	AIIND	SW%D<5 AIIND
DPC	DP-3	13.85		NR>BV AIIND	NR>BV	NR>BV	-	AIIND	0.236	AIIND	0.154	AIIND	AIIND	SW%D<5 AIIND
DPC	DP-4	13.12		NR>BV AIIND	NR>BV	NR>BV	-	AIIND	0.282	0.086	0.146	AIIND	AIIND	SW%D<5 AIIND
DPC	DPTF	16.29		NR>BV AIIND	NR>BV	NR>BV	-	AIIND	AIIND	AIIND	AIIND	AIIND	AIIND	SW%D<5 AIIND
LAC	LA-1C	15.66		-	-	-	-	-	-	-	-	-	-	-
LAC	LA-1E	14.81		-	-	-	-	-	-	-	-	-	-	-
LAC	LA-1FW	18.36		NR>BV AIIND	NR>BV	NR>BV	-	-	-	-	-	-	-	-
LAC	LA-1W	17.18		-	-	-	-	-	-	-	-	-	-	-
LAC	LA-1W+	17.47		NR>BV AIIND	NR>BV	NR>BV	-	-	-	-	-	-	-	-
LAC	LA-2E	12.55		NR>BV AIIND	NR>BV	<0.560>	NR>BV	>120.513<	<1.155>	<0.366>	<0.725>	AIIND	SW%D<5 AIIND	SW%D<5 AIIND
LAC	LA-2FE	11.22		-	-	-	-	-	-	-	-	-	-	-
LAC	LA-2W	13		NR>BV AIIND	NR>BV	NR>BV	NR>BV	-	-	-	-	-	-	-
LAC	LA-3E	8.75		NR>BV AIIND	NR>BV	NR>BV	NR>BV AIIND	AIIND	AIIND	AIIND	AIIND	AIIND	SW%D<5 AIIND	SW%D<5 AIIND

Table E-1.0-8 (continued)

Canyon	Reach	Distance to Rio Grande (km)	Status	Thallium	Vanadium	Zinc	Cyanide (Total)	Anthracene	Benz(a)anthracene	Benzo(a)pyrene	Benzo(b)fluoranthene	Benzo(g,h,i)perylene	Benzo(k)fluoranthene	Benzoic Acid
BVs				0.73	19.7	60.2	0.82							
ESLs				0.044	4.1	130	0.1	0	0.11	0.35	0.24	0.29	0.24	0.065
Max HQ				7.955	5.366	1.077	25	4615.385	10.909	2.114	7.083	0.931	0.542	11.538
LAC	LA-3FE	8.85	Fire-impacted sediment	>7.955<	>5.366<	<1.077>	>25.000<	AIIND	<2.273>	<0.743>	<1.375>	<0.552>	SW%D<5 AIIND	SW%D<5 AIIND
LAC	LA-4E	5.03		AIIND	NR>BV	NR>BV	-	-	-	-	-	-	-	-
LAC	LA-4FE	4.29	Fire-impacted sediment	NR>BV AIIND	NR>BV	NR>BV	-	SW%D<5 AIIND	SW%D<5 AIIND	SW%D<5 AIIND	SW%D<5 AIIND	SW%D<5 AIIND	SW%D<5 AIIND	SW%D<5 AIIND
LAC	LA-4W	6.04		-	-	-	-	-	-	-	-	-	-	-
LAC	LA-5	0.88		NR>BV AIIND	NR>BV	NR>BV	NR>BV AIIND	SW%D<5 AIIND	SW%D<5 AIIND	SW%D<5 AIIND	SW%D<5 AIIND	SW%D<5 AIIND	SW%D<5 AIIND	SW%D<5 AIIND
LAC	LA-5E	0.09	Fire-impacted sediment	NR>BV AIIND	NR>BV	NR>BV	NR>BV	-	-	-	-	-	-	-
PC	AC-1	19.08		NR>BV AIIND	NR>BV	<0.593>	-	AIIND	>4.182<	<1.286>	<2.958>	<0.448>	AIIND	AIIND
PC	AC-2	18.77		NR>BV AIIND	NR>BV	NR>BV	-	AIIND	<2.455>	<0.743>	<1.542>	AIIND	<0.542>	AIIND
PC	AC-3	18.27		NR>BV AIIND	NR>BV	<0.510>	NR>BV AIIND	>100.000<	<0.718>	<0.314>	<0.625>	AIIND	0.246	>11.538<
PC	ACS	18.62		NR>BV AIIND	NR>BV	0.285	-	>105.128<	<1.182>	<0.371>	<0.542>	AIIND	<0.542>	AIIND
PC	ACS	18.62	ACS removed	NR>BV	NR>BV	<0.554>	-	AIIND	AIIND	AIIND	AIIND	AIIND	AIIND	AIIND
PC	P-1E	17.81		NR>BV AIIND	NR>BV	NR>BV	NR>BV AIIND	SW%D<5 AIIND	SW%D<5 AIIND	0.149	0.292	AIIND	SW%D<5 AIIND	<1.354>
PC	P-1E	17.81	Fire-impacted sediment	NR>BV AIIND	NR>BV	NR>BV	-	-	-	-	-	-	-	-
PC	P-1FW	18.51		NR>BV AIIND	NR>BV	NR>BV	-	SW%D<5 AIIND	SW%D<5 AIIND	AIIND	AIIND	<0.483>	SW%D<5 AIIND	AIIND

Table E-1.0-8 (continued)

Canyon	Reach	Distance to Rio Grande (km)	Status	Thallium	Vanadium	Zinc	Cyanide (Total)	Anthracene	Benz(a)anthracene	Benzo(a)pyrene	Benzo(b)fluoranthene	Benzo(g,h,i)perylene	Benzo(k)fluoranthene	Benzoic Acid
BVs				0.73	19.7	60.2	0.82							
ESLs				0.044	4.1	130	0.1	0	0.11	0.35	0.24	0.29	0.24	0.065
Max HQ				7.955	5.366	1.077	25	4615.385	10.909	2.114	7.083	0.931	0.542	11.538
PC	P-1W	18.26		NR>BV AIIND	NR>BV	NR>BV	-	SW%D<5 AIIND	SW%D<5 AIIND	AIIND	AIIND	AIIND	SW%D<5 AIIND	AIIND
PC	P-2E	13.34		-	-	-	-	-	-	-	-	-	-	-
PC	P-2W	14.61		AIIND	NR>BV	NR>BV	-	-	-	-	-	-	-	-
PC	P-2W	14.61	Fire-impacted sediment	AIIND	NR>BV	NR>BV	-	-	-	-	-	-	-	-
PC	P-3W	11.4		AIIND	NR>BV	NR>BV	-	-	-	-	-	-	-	-
PC	P-3W	11.4	Fire-impacted sediment	AIIND	NR>BV	NR>BV	-	-	-	-	-	-	-	-
PC	P-4E	8.6		AIIND	NR>BV	NR>BV	NR>BV AIIND	SW%D<5 AIIND	SW%D<5 AIIND	AIIND	AIIND	AIIND	SW%D<5 AIIND	AIIND
PC	P-4E	8.6	Fire-impacted sediment	AIIND	NR>BV	NR>BV	-	-	-	-	-	-	-	-
PC	P-4W	9.49		-	-	-	-	-	-	-	-	-	-	-
PC	WC	17.77		NR>BV AIIND	NR>BV	NR>BV	-	SW%D<5 AIIND	SW%D<5 AIIND	AIIND	AIIND	AIIND	SW%D<5 AIIND	AIIND

Table E-1.0-8 (continued)

Canyon	Reach	Distance to Rio Grande (km)	Status	Bis(2-ethylhexyl) phthalate	alpha-Chlordane	gamma-Chlordane	Chrysene	4,4'-DDE	4,4'-DDT	Fluoranthene	Indeno(1,2,3-cd)pyrene	Naphthalene	Phenanthrene
BVs													
ESLs				1.3	0.001	0.001	0.5	0.002	0.002	2.9	0.078	0.027	0.85
Max HQ				0.615	3.6	6.2	1.98	0.818	10	0.966	7.051	9.259	3.176
DPC	DP-1C	16.29		<0.462>	-	-	<1.980>	-	-	<0.966>	AIIND	SW%D<5 AIIND	>3.176<
DPC	DP-1E	15.47		0.1	-	-	<0.580>	-	-	0.076	>3.077<	SW%D<5 AIIND	<0.365>
DPC	DP-1W	16.39		<0.615>	-	-	<1.820>	-	-	<0.414>	>7.051<	SW%D<5 AIIND	<1.082>
DPC	DP-2	14.69		0.058	SW%D<5 AIIND	SW%D<5 AIIND	AIIND	SW%D<5 AIIND	SW%D<5 AIIND	AIIND	AIIND	SW%D<5 AIIND	AIIND
DPC	DP-3	13.85		0.131	SW%D<5 AIIND	SW%D<5 AIIND	0.066	SW%D<5 AIIND	SW%D<5 AIIND	0.016	AIIND	SW%D<5 AIIND	0.032
DPC	DP-4	13.12		0.026	SW%D<5 AIIND	SW%D<5 AIIND	0.06	SW%D<5 AIIND	SW%D<5 AIIND	0.012	AIIND	SW%D<5 AIIND	AIIND
DPC	DPTF	16.29		AIIND	-	-	AIIND	-	-	AIIND	AIIND	SW%D<5 AIIND	AIIND
LAC	LA-1C	15.66		-	-	-	-	-	-	-	-	-	-
LAC	LA-1E	14.81		-	-	-	-	-	-	-	-	-	-
LAC	LA-1FW	18.36		-	SW%D<5 AIIND	SW%D<5 AIIND	-	SW%D<5 AIIND	SW%D<5 AIIND	-	-	-	-
LAC	LA-1W	17.18		-	-	-	-	-	-	-	-	-	-
LAC	LA-1W+	17.47		-	SW%D<5 AIIND	SW%D<5 AIIND	-	SW%D<5 AIIND	SW%D<5 AIIND	-	-	-	-
LAC	LA-2E	12.55		SW%D<5 AIIND	SW%D<5 AIIND	SW%D<5 AIIND	0.256	SW%D<5 AIIND	SW%D<5 AIIND	0.078	SW%D<5 AIIND	AIIND	0.184
LAC	LA-2FE	11.22		-	-	-	-	-	-	-	-	-	-
LAC	LA-2W	13		-	-	-	-	-	-	-	-	-	-
LAC	LA-3E	8.75		SW%D<5 AIIND	SW%D<5 AIIND	SW%D<5 AIIND	AIIND	SW%D<5 AIIND	SW%D<5 AIIND	AIIND	SW%D<5 AIIND	AIIND	AIIND
LAC	LA-3FE	8.85	Fire-impacted sediment	SW%D<5 AIIND	-	-	<0.540>	-	-	0.179	SW%D<5 AIIND	>9.259<	<0.541>

Table E-1.0-8 (continued)

Canyon	Reach	Distance to Rio Grande (km)	Status	Bis(2-ethylhexyl) phthalate	alpha-Chlordane	gamma-Chlordane	Chrysene	4,4'-DDE	4,4'-DDT	Fluoranthene	Indeno(1,2,3-cd)pyrene	Naphthalene	Phenanthrene
BVs													
ESLs				1.3	0.001	0.001	0.5	0.002	0.002	2.9	0.078	0.027	0.85
Max HQ				0.615	3.6	6.2	1.98	0.818	10	0.966	7.051	9.259	3.176
LAC	LA-4E	5.03		-	SW%D<5 AIIND	SW%D<5 AIIND	-	SW%D<5 AIIND	SW%D<5 AIIND	-	-	-	-
LAC	LA-4FE	4.29	Fire-impacted sediment	0.034	-	-	SW%D<5 AIIND	-	-	SW%D<5 AIIND	SW%D<5 AIIND	SW%D<5 AIIND	SW%D<5 AIIND
LAC	LA-4W	6.04		-	-	-	-	-	-	-	-	-	-
LAC	LA-5	0.88		AIIND	SW%D<5 AIIND	SW%D<5 AIIND	SW%D<5 AIIND	SW%D<5 AIIND	SW%D<5 AIIND	SW%D<5 AIIND	SW%D<5 AIIND	SW%D<5 AIIND	SW%D<5 AIIND
LAC	LA-5E	0.09	Fire-impacted sediment	-	-	-	-	-	-	-	-	-	-
PC	AC-1	19.08		AIIND	AIIND	AIIND	<0.940>	AIIND	AIIND	<0.307>	SW%D<5 AIIND	SW%D<5 AIIND	<0.800>
PC	AC-2	18.77		<0.354>	AIIND	AIIND	<0.600>	AIIND	AIIND	0.214	SW%D<5 AIIND	SW%D<5 AIIND	<0.482>
PC	AC-3	18.27		AIIND	<2.500>	>4.220<	0.196	AIIND	>3.993<	0.072	SW%D<5 AIIND	SW%D<5 AIIND	0.2
PC	ACS	18.62		0.185	AIIND	AIIND	0.3	AIIND	<1.867>	0.09	SW%D<5 AIIND	SW%D<5 AIIND	0.224
PC	ACS	18.62	ACS removed	AIIND	>3.000<	>3.800<	AIIND	<0.818>	>10.000<	AIIND	SW%D<5 AIIND	SW%D<5 AIIND	AIIND
PC	P-1E	17.81		SW%D<5 AIIND	AIIND	AIIND	0.112	SW%D<5 AIIND	>3.193<	0.032	SW%D<5 AIIND	SW%D<5 AIIND	0.075
PC	P-1E	17.81	Fire-impacted sediment	-	-	-	-	-	-	-	-	-	-
PC	P-1FW	18.51		SW%D<5 AIIND	AIIND	AIIND	AIIND	SW%D<5 AIIND	<1.467>	AIIND	SW%D<5 AIIND	SW%D<5 AIIND	AIIND
PC	P-1W	18.26		SW%D<5 AIIND	>3.600<	>6.200<	AIIND	SW%D<5 AIIND	<2.200>	AIIND	SW%D<5 AIIND	SW%D<5 AIIND	AIIND
PC	P-2E	13.34		-	-	-	-	-	-	-	-	-	-

Table E-1.0-8 (continued)

Canyon	Reach	Distance to Rio Grande (km)	Status	Bis(2-ethylhexyl) phthalate	alpha-Chlordane	gamma-Chlordane	Chrysene	4,4'-DDE	4,4'-DDT	Fluoranthene	Indeno(1,2,3-cd)pyrene	Naphthalene	Phenanthrene
BVs													
ESLs				1.3	0.001	0.001	0.5	0.002	0.002	2.9	0.078	0.027	0.85
Max HQ				0.615	3.6	6.2	1.98	0.818	10	0.966	7.051	9.259	3.176
PC	P-2W	14.61		-	AIIND	AIIND	-	SW%D<5 AIIND	AIIND	-	-	-	-
PC	P-2W	14.61	Fire-impacted sediment	-	-	-	-	-	-	-	-	-	-
PC	P-3W	11.4		-	AIIND	AIIND	-	SW%D<5 AIIND	AIIND	-	-	-	-
PC	P-3W	11.4	Fire-impacted sediment	-	-	-	-	-	-	-	-	-	-
PC	P-4E	8.6		SW%D<5 AIIND	AIIND	AIIND	AIIND	SW%D<5 AIIND	AIIND	AIIND	SW%D<5 AIIND	SW%D<5 AIIND	AIIND
PC	P-4E	8.6	Fire-impacted sediment	-	-	-	-	-	-	-	-	-	-
PC	P-4W	9.49		-	-	-	-	-	-	-	-	-	-
PC	WC	17.77		SW%D<5 AIIND	AIIND	AIIND	AIIND	SW%D<5 AIIND	<0.333>	AIIND	SW%D<5 AIIND	SW%D<5 AIIND	AIIND

Table E-1.0-8 (continued)

Canyon	Reach	Distance to Rio Grande (km)	Status	Pyrene	Aroclor-1254	Aroclor-1260	Americium-241	Cesium-134	Cesium-137	Europium-152	Plutonium-238	Plutonium-239	Strontium-90
BVs							0.04		0.9		0.006	0.068	1.04
ESLs				0.57	0.028	0.031	0.006	0.47	1.1	0.1	0.019	0.02	0.57
Max HQ				6.316	1.429	0.516	137.931	0.511	4.336	2.48	6.316	1300	2.175
DPC	DP-1C	16.29		>6.316<	SW%D<5 AIIND	SW%D<5 AIIND	>9.138<	NBV-NDR AIIND	NDR>BV	NBV-NDR AIIND	NDR>BV AIIND	NDR>BV AIIND	NDR>BV AIIND
DPC	DP-1E	15.47		<1.368>	-	-	-	-	-	-	-	-	-
DPC	DP-1W	16.39		>4.386<	SW%D<5 AIIND	SW%D<5 AIIND	NDR>BV AIIND	-	-	-	NDR>BV AIIND	NDR>BV AIIND	NDR>BV AIIND
DPC	DP-2	14.69		AIIND	SW%D<5 AIIND	SW%D<5 AIIND	NDR>BV AIIND	-	NDR>BV	-	NDR>BV AIIND	NDR>BV	NDR>BV AIIND
DPC	DP-3	13.85		0.17	SW%D<5 AIIND	SW%D<5 AIIND	NDR>BV AIIND	-	<0.936>	-	NDR>BV AIIND	>4.200<	NDR>BV AIIND
DPC	DP-4	13.12		0.132	SW%D<5 AIIND	SW%D<5 AIIND	NDR>BV AIIND	-	<1.009>	-	NDR>BV AIIND	NDR>BV	NDR>BV AIIND
DPC	DPTF	16.29		AIIND	-	-	-	-	-	-	-	-	-
LAC	LA-1C	15.66		-	-	-	-	-	-	-	NDR>BV AIIND	>3.800<	-
LAC	LA-1E	14.81		-	-	-	-	-	-	-	NDR>BV AIIND	>4.500<	-
LAC	LA-1FW	18.36		-	SW%D<5 AIIND	AIIND	NDR>BV	NBV-NDR AIIND	NDR>BV AIIND	NBV-NDR AIIND	NDR>BV AIIND	NDR>BV AIIND	-
LAC	LA-1W	17.18		-	-	-	-	-	-	-	NDR>BV AIIND	>8.200<	-
LAC	LA-1W+	17.47		-	SW%D<5 AIIND	AIIND	-	-	-	-	NDR>BV AIIND	NDR>BV AIIND	-
LAC	LA-2E	12.55		<0.361>	SW%D<5 AIIND	<0.516>	>47.931<	<0.383>	<2.618>	NBV-NDR AIIND	>3.211<	>11.050<	<2.140>
LAC	LA-2FE	11.22		-	-	-	>137.931<	NBV-NDR AIIND	<2.145>	NBV-NDR AIIND	>4.526<	>18.250<	NDR>BV AIIND
LAC	LA-2W	13		-	-	-	NDR>BV AIIND	NBV-NDR AIIND	NDR>BV AIIND	NBV-NDR AIIND	NDR>BV AIIND	>10.550<	NDR>BV AIIND
LAC	LA-3E	8.75		AIIND	SW%D<5 AIIND	AIIND	>54.655<	NBV-NDR AIIND	<1.509>	NBV-NDR AIIND	NDR>BV AIIND	>4.100<	NDR>BV AIIND
LAC	LA-3FE	8.85	Fire-impacted sediment	<1.018>	-	-	NDR>BV AIIND	0.281	>4.336<	NBV-NDR AIIND	NDR>BV AIIND	>64.000<	<2.175>

Table E-1.0-8 (continued)

Canyon	Reach	Distance to Rio Grande (km)	Status	Pyrene	Aroclor-1254	Aroclor-1260	Americium-241	Cesium-134	Cesium-137	Europium-152	Plutonium-238	Plutonium-239	Strontium-90
BVs							0.04		0.9		0.006	0.068	1.04
ESLs				0.57	0.028	0.031	0.006	0.47	1.1	0.1	0.019	0.02	0.57
Max HQ				6.316	1.429	0.516	137.931	0.511	4.336	2.48	6.316	1300	2.175
LAC	LA-4E	5.03		-	SW%D<5 AIIND	SW%D<5 AIIND	NDR>BV AIIND	-	NDR>BV	<2.480>	NDR>BV AIIND	>15.700<	NDR>BV AIIND
LAC	LA-4FE	4.29	Fire-impacted sediment	SW%D<5 AIIND	-	-	NDR>BV AIIND	NBV-NDR AIIND	NDR>BV	NBV-NDR AIIND	NDR>BV AIIND	>7.450<	NDR>BV AIIND
LAC	LA-4W	6.04		-	-	-	>31.724<	-	<0.890>	NBV-NDR AIIND	<2.316>	>43.000<	-
LAC	LA-5	0.88		SW%D<5 AIIND	SW%D<5 AIIND	SW%D<5 AIIND	NDR>BV AIIND	<0.511>	NDR>BV AIIND	NBV-NDR AIIND	NDR>BV AIIND	>8.050<	NDR>BV AIIND
LAC	LA-5E	0.09	Fire-impacted sediment	-	-	-	NDR>BV AIIND	NBV-NDR AIIND	NDR>BV AIIND	NBV-NDR AIIND	NDR>BV AIIND	>39.100<	NDR>BV AIIND
PC	AC-1	19.08		<2.632>	AIIND	SW%D<5 AIIND	NDR>BV AIIND	NBV-NDR AIIND	NDR>BV AIIND	NBV-NDR AIIND	NDR>BV AIIND	NDR>BV AIIND	NDR>BV AIIND
PC	AC-2	18.77		<0.772>	AIIND	SW%D<5 AIIND	NDR>BV AIIND	NBV-NDR AIIND	NDR>BV AIIND	NBV-NDR AIIND	NDR>BV AIIND	NDR>BV AIIND	NDR>BV AIIND
PC	AC-3	18.27		0.281	AIIND	SW%D<5 AIIND	>110.345<	NBV-NDR AIIND	NDR>BV AIIND	NBV-NDR AIIND	>3.105<	>629.650<	NDR>BV AIIND
PC	ACS	18.62		<0.579>	<0.643>	SW%D<5 AIIND	AIIND	NBV-NDR AIIND	NDR>BV	NBV-NDR AIIND	AIIND	>737.000<	NDR>BV AIIND
PC	ACS	18.62	ACS removed	0.281	<1.429>	SW%D<5 AIIND	>132.759<	NBV-NDR AIIND	NDR>BV AIIND	NBV-NDR AIIND	>6.316<	>1300.000<	NDR>BV AIIND
PC	P-1E	17.81		0.14	AIIND	SW%D<5 AIIND	>36.034<	NBV-NDR AIIND	NDR>BV AIIND	NBV-NDR AIIND	<1.526>	>314.850<	NDR>BV
PC	P-1E	17.81	Fire-impacted sediment	-	-	-	AIIND	NBV-NDR AIIND	NDR>BV	NBV-NDR AIIND	AIIND	>34.000<	NDR>BV AIIND
PC	P-1FW	18.51		AIIND	<0.536>	SW%D<5 AIIND	-	-	-	-	-	-	-
PC	P-1W	18.26		AIIND	AIIND	SW%D<5 AIIND	-	-	-	-	-	-	-
PC	P-2E	13.34		-	-	-	-	-	-	-	NDR>BV AIIND	>101.000<	-

Table E-1.0-8 (continued)

Canyon	Reach	Distance to Rio Grande (km)	Status	Pyrene	Aroclor-1254	Aroclor-1260	Americium-241	Cesium-134	Cesium-137	Europium-152	Plutonium-238	Plutonium-239	Strontium-90
BVs							0.04		0.9		0.006	0.068	1.04
ESLs				0.57	0.028	0.031	0.006	0.47	1.1	0.1	0.019	0.02	0.57
Max HQ				6.316	1.429	0.516	137.931	0.511	4.336	2.48	6.316	1300	2.175
PC	P-2W	14.61		-	AIIND	SW%D<5 AIIND	NDR>BV AIIND	NBV-NDR AIIND	NDR>BV AIIND	NBV-NDR AIIND	<1.158>	>192.000<	-
PC	P-2W	14.61	Fire-impacted sediment	-	-	-	NDR>BV AIIND	NBV-NDR AIIND	NDR>BV AIIND	NBV-NDR AIIND	AIIND	>14.250<	NDR>BV AIIND
PC	P-3W	11.4		-	AIIND	SW%D<5 AIIND	NDR>BV AIIND	NBV-NDR AIIND	NDR>BV AIIND	NBV-NDR AIIND	<1.632>	>45.450<	-
PC	P-3W	11.4	Fire-impacted sediment	-	-	-	NDR>BV AIIND	NBV-NDR AIIND	NDR>BV AIIND	NBV-NDR AIIND	AIIND	>12.450<	NDR>BV AIIND
PC	P-4E	8.6		AIIND	AIIND	SW%D<5 AIIND	NDR>BV AIIND	NBV-NDR AIIND	NDR>BV AIIND	NBV-NDR AIIND	NDR>BV AIIND	>159.000<	NDR>BV AIIND
PC	P-4E	8.6	Fire-impacted sediment	-	-	-	NDR>BV AIIND	NBV-NDR AIIND	NDR>BV AIIND	NBV-NDR AIIND	NDR>BV AIIND	>36.000<	NDR>BV AIIND
PC	P-4W	9.49		-	-	-	-	-	-	-	NDR>BV AIIND	NDR>BV AIIND	-
PC	WC	17.77		AIIND	AIIND	SW%D<5 AIIND	-	-	-	-	-	-	-

- Notes: 1. Units are mg/kg for organic and inorganic chemicals and pCi/g for radionuclides.
2. <#> = HQ > 0.3.
3. >#< = HQ > 3.
4. - = No data.
5. AIIND = Analyte never detected.
6. NBV-NDR = No BV, no detected result (inorganic chemicals and radionuclides). Not a COPC.
7. NDR>BV = No detected result > BV (radionuclides). Not a COPC.
8. NR>BV = No result > BV (inorganic chemicals). Not a COPC.
9. SW%D<5 = % detection in the subwatershed < 5%. Not a COPC.

Table E-1.0-9
Active Channel Sediment (Aquatic): COPECs

Canyon	Reach	Distance to Rio Grande (km)	Status	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Copper	Lead	Manganese	Nickel	Selenium
BVs				3.98	127	1.31	0.4	10.5	4.73	11.2	19.7	543	9.38	0.3
ESLs				1.1	3.4	4.1	0.006	56	0.074	28	34	720	3.5	1
Max HQ				4.545	108.824	0.415	98.333	0.339	109.459	0.929	2.674	2.917	4	1.7
DPC	DP-1C	16.29		NR>BV	NR>BV	<0.390>	NR>BV	NR>BV	NR>BV	NR>BV	<1.412>	NR>BV	NR>BV	AIIND
DPC	DP-1E	15.47		NR>BV	NR>BV	NR>BV	NR>BV AIIND	NR>BV	NR>BV	NR>BV	NR>BV	NR>BV	NR>BV	AIIND
DPC	DP-1W	16.39		NR>BV	NR>BV	NR>BV	NR>BV	NR>BV	NR>BV	<0.407>	<0.638>	NR>BV	NR>BV	AIIND
DPC	DP-2	14.69		NR>BV	NR>BV	NR>BV	NR>BV AIIND	NR>BV	NR>BV	NR>BV	NR>BV	NR>BV	NR>BV	AIIND
DPC	DP-3	13.85		NR>BV	NR>BV	NR>BV	NR>BV AIIND	NR>BV	NR>BV	NR>BV	NR>BV	NR>BV	NR>BV	AIIND
DPC	DP-4	13.12		NR>BV AIIND	NR>BV	NR>BV	NR>BV AIIND	NR>BV	NR>BV	NR>BV	NR>BV	NR>BV	NR>BV	AIIND
DPC	DPTF	16.29		NR>BV	NR>BV	NR>BV	NR>BV	NR>BV	NR>BV	NR>BV	<0.676>	NR>BV	NR>BV	<0.430>
LAC	LA-1C	15.66		-	-	-	-	-	-	-	-	-	-	-
LAC	LA-1E	14.81		-	-	-	-	-	-	-	-	-	-	-
LAC	LA-1FW	18.36		NR>BV	NR>BV	NR>BV	NR>BV AIIND	NR>BV AIIND	NR>BV	NR>BV	NR>BV	NR>BV	NR>BV	AIIND
LAC	LA-1W	17.18		-	-	-	-	-	-	-	-	-	-	-
LAC	LA-1W+	17.47		NR>BV	NR>BV	NR>BV	NR>BV AIIND	NR>BV	NR>BV	NR>BV	NR>BV	NR>BV	NR>BV	AIIND
LAC	LA-2E	12.55		NR>BV	NR>BV	NR>BV	NR>BV AIIND	NR>BV	NR>BV	NR>BV	NR>BV	NR>BV	NR>BV AIIND	NR>BV AIIND
LAC	LA-2FE	11.22		-	-	-	-	-	-	-	-	-	-	-
LAC	LA-2W	13		NR>BV AIIND	NR>BV	NR>BV	NR>BV AIIND	NR>BV	NR>BV	NR>BV	NR>BV	NR>BV	NR>BV AIIND	NR>BV AIIND
LAC	LA-3E	8.75		NR>BV	NR>BV	NR>BV	AIIND	NR>BV	NR>BV	NR>BV	NR>BV	NR>BV	NR>BV	NR>BV AIIND
LAC	LA-3FE	8.85	Fire-impacted sediment	>4.545<	>108.824<	<0.415>	>98.333<	N	>109.459<	<0.929>	<1.559>	<2.917>	>4.000<	<1.700>

Table E-1.0-9 (continued)

Canyon	Reach	Distance to Rio Grande (km)	Status	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Copper	Lead	Manganese	Nickel	Selenium
BVs				3.98	127	1.31	0.4	10.5	4.73	11.2	19.7	543	9.38	0.3
ESLs				1.1	3.4	4.1	0.006	56	0.074	28	34	720	3.5	1
Max HQ				4.545	108.824	0.415	98.333	0.339	109.459	0.929	2.674	2.917	4	1.7
LAC	LA-4E	5.03	Fire-impacted sediment	NR>BV	NR>BV	NR>BV	AIIND	NR>BV	NR>BV	NR>BV	NR>BV	NR>BV	NR>BV	AIIND
LAC	LA-4FE	4.29		NR>BV	NR>BV	NR>BV	NR>BV	NR>BV	NR>BV	NR>BV	NR>BV	NR>BV	NR>BV	NR>BV AIIND
LAC	LA-4W	6.04		-	-	-	-	-	-	-	-	-	-	-
LAC	LA-5	0.88	Fire-impacted sediment	NR>BV AIIND	NR>BV	NR>BV	NR>BV AIIND	NR>BV	NR>BV	NR>BV	NR>BV	NR>BV	NR>BV	AIIND
LAC	LA-5E	0.09		NR>BV	NR>BV	NR>BV	NR>BV AIIND	NR>BV	NR>BV	NR>BV	NR>BV	NR>BV	NR>BV	NR>BV AIIND
PC	AC-1	19.08		NR>BV	NR>BV	NR>BV	NR>BV AIIND	<0.339>	NR>BV	NR>BV	<2.674>	NR>BV	NR>BV	<0.390>
PC	AC-2	18.77		NR>BV	NR>BV	NR>BV	NR>BV AIIND	NR>BV	NR>BV	NR>BV	NR>BV	NR>BV	NR>BV	NR>BV
PC	AC-3	18.27		NR>BV AIIND	NR>BV	NR>BV	NR>BV	NR>BV	NR>BV	NR>BV	<1.615>	NR>BV	NR>BV	<0.410>
PC	ACS	18.62	ACS removed	NR>BV	NR>BV	NR>BV	NR>BV	NR>BV	NR>BV	NR>BV	<1.735>	NR>BV	NR>BV	<0.510>
PC	ACS	18.62		NR>BV	NR>BV	NR>BV	NR>BV	NR>BV	NR>BV	NR>BV	<1.941>	NR>BV	NR>BV	AIIND
PC	P-1E	17.81		NR>BV AIIND	NR>BV	NR>BV	NR>BV	NR>BV	NR>BV	NR>BV	<0.871>	NR>BV	NR>BV	N
PC	P-1E	17.81	Fire-impacted sediment	NR>BV	NR>BV	NR>BV	NR>BV AIIND	NR>BV	NR>BV	NR>BV	N	NR>BV	NR>BV	<0.450>
PC	P-1FW	18.51		NR>BV	NR>BV	NR>BV	NR>BV AIIND	NR>BV	NR>BV	NR>BV	NR>BV	NR>BV	NR>BV	<0.350>
PC	P-1W	18.26		NR>BV	NR>BV	NR>BV	NR>BV AIIND	NR>BV	NR>BV	NR>BV	<0.765>	NR>BV	NR>BV	NR>BV AIIND
PC	P-2E	13.34		-	-	-	-	-	-	-	-	-	-	-

Table E-1.0-9 (continued)

Canyon	Reach	Distance to Rio Grande (km)	Status	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Copper	Lead	Manganese	Nickel	Selenium
BVs				3.98	127	1.31	0.4	10.5	4.73	11.2	19.7	543	9.38	0.3
ESLs				1.1	3.4	4.1	0.006	56	0.074	28	34	720	3.5	1
Max HQ				4.545	108.824	0.415	98.333	0.339	109.459	0.929	2.674	2.917	4	1.7
PC	P-2W	14.61		NR>BV AIIND	NR>BV	NR>BV AIIND	AIIND	NR>BV	NR>BV	NR>BV	NR>BV	NR>BV	NR>BV AIIND	<0.660>
PC	P-2W	14.61	Fire-impacted sediment	NR>BV AIIND	NR>BV	NR>BV	AIIND	NR>BV	NR>BV	NR>BV	NR>BV	NR>BV	NR>BV AIIND	AIIND
PC	P-3W	11.4		NR>BV AIIND	NR>BV	NR>BV AIIND	AIIND	NR>BV	NR>BV	NR>BV	NR>BV	NR>BV	NR>BV AIIND	<0.550>
PC	P-3W	11.4	Fire-impacted sediment	NR>BV	NR>BV	NR>BV	AIIND	NR>BV	NR>BV	NR>BV	NR>BV	NR>BV	NR>BV	AIIND
PC	P-4E	8.6		NR>BV AIIND	NR>BV	NR>BV	NR>BV AIIND	NR>BV	NR>BV	NR>BV	NR>BV	NR>BV	NR>BV	NR>BV AIIND
PC	P-4E	8.6	Fire-impacted sediment	NR>BV	NR>BV	NR>BV	NR>BV AIIND	NR>BV	NR>BV	NR>BV	NR>BV	NR>BV	NR>BV	NR>BV AIIND
PC	P-4W	9.49		-	-	-	-	-	-	-	-	-	-	-
PC	WC	17.77		NR>BV	NR>BV	NR>BV	NR>BV AIIND	NR>BV	NR>BV	NR>BV	NR>BV	NR>BV	NR>BV	<0.360>

Table E-1.0-9 (continued)

Canyon	Reach	Distance to Rio Grande (km)	Status	Thallium	Vanadium	Zinc	Cyanide (Total)	Anthracene	Benz(a)anthracene	Benzo(a)pyrene	Benzo(b)fluoranthene	Benzo(g,h,i)perylene	Benzo(k)fluoranthene	Benzoic Acid
BVs				0.73	19.7	60.2	0.82							
ESLs				0.044	4.1	130	0.1	0	0.11	0.35	0.24	0.29	0.24	0.065
Max HQ				7.955	5.366	1.077	25	4615.385	10.909	2.114	7.083	0.931	0.542	11.538
DPC	DP-1C	16.29		NR>BV	NR>BV	<0.585>	-	>4615.385<	>10.909<	AIIND	>7.083<	AIIND	AIIND	SW%D<5 AIIND
DPC	DP-1E	15.47		NR>BV AIIND	NR>BV	NR>BV	-	>176.923<	<2.636>	<0.743>	<1.167>	<0.931>	<0.346>	SW%D<5 AIIND
DPC	DP-1W	16.39		NR>BV AIIND	NR>BV	<0.531>	-	AIIND	>7.273<	<2.114>	>5.000<	AIIND	AIIND	SW%D<5 AIIND
DPC	DP-2	14.69		AIIND	NR>BV	NR>BV	-	AIIND	AIIND	AIIND	AIIND	AIIND	AIIND	SW%D<5 AIIND
DPC	DP-3	13.85		NR>BV AIIND	NR>BV	NR>BV	-	AIIND	N	AIIND	N	AIIND	AIIND	SW%D<5 AIIND
DPC	DP-4	13.12		NR>BV AIIND	NR>BV	NR>BV	-	AIIND	N	N	N	AIIND	AIIND	SW%D<5 AIIND
DPC	DPTF	16.29		NR>BV AIIND	NR>BV	NR>BV	-	AIIND	AIIND	AIIND	AIIND	AIIND	AIIND	SW%D<5 AIIND
LAC	LA-1C	15.66		-	-	-	-	-	-	-	-	-	-	-
LAC	LA-1E	14.81		-	-	-	-	-	-	-	-	-	-	-
LAC	LA-1FW	18.36		NR>BV AIIND	NR>BV	NR>BV	-	-	-	-	-	-	-	-
LAC	LA-1W	17.18		-	-	-	-	-	-	-	-	-	-	-
LAC	LA-1W+	17.47		NR>BV AIIND	NR>BV	NR>BV	-	-	-	-	-	-	-	-
LAC	LA-2E	12.55		NR>BV AIIND	NR>BV	<0.560>	NR>BV	>120.513<	<1.155>	<0.366>	<0.725>	AIIND	SW%D<5 AIIND	SW%D<5 AIIND
LAC	LA-2FE	11.22		-	-	-	-	-	-	-	-	-	-	-
LAC	LA-2W	13		NR>BV AIIND	NR>BV	NR>BV	NR>BV	-	-	-	-	-	-	-

Table E-1.0-9 (continued)

Canyon	Reach	Distance to Rio Grande (km)	Status	Thallium	Vanadium	Zinc	Cyanide (Total)	Anthracene	Benz(a)anthracene	Benzo(a)pyrene	Benzo(b)fluoranthene	Benzo(g,h,i)perylene	Benzo(k)fluoranthene	Benzoic Acid
BVs				0.73	19.7	60.2	0.82							
ESLs				0.044	4.1	130	0.1	0	0.11	0.35	0.24	0.29	0.24	0.065
Max HQ				7.955	5.366	1.077	25	4615.385	10.909	2.114	7.083	0.931	0.542	11.538
LAC	LA-3E	8.75		NR>BV AIIND	NR>BV	NR>BV	NR>BV AIIND	AIIND	AIIND	AIIND	AIIND	AIIND	SW%D<5 AIIND	SW%D<5 AIIND
LAC	LA-3FE	8.85	Fire-impacted sediment	>7.955<	>5.366<	<1.077>	>25.000<	AIIND	<2.273>	<0.743>	<1.375>	<0.552>	SW%D<5 AIIND	SW%D<5 AIIND
LAC	LA-4E	5.03		AIIND	NR>BV	NR>BV	-	-	-	-	-	-	-	-
LAC	LA-4FE	4.29	Fire-impacted sediment	NR>BV AIIND	NR>BV	NR>BV	-	SW%D<5 AIIND	SW%D<5 AIIND	SW%D<5 AIIND	SW%D<5 AIIND	SW%D<5 AIIND	SW%D<5 AIIND	SW%D<5 AIIND
LAC	LA-4W	6.04		-	-	-	-	-	-	-	-	-	-	-
LAC	LA-5	0.88		NR>BV AIIND	NR>BV	NR>BV	NR>BV AIIND	SW%D<5 AIIND	SW%D<5 AIIND	SW%D<5 AIIND	SW%D<5 AIIND	SW%D<5 AIIND	SW%D<5 AIIND	SW%D<5 AIIND
LAC	LA-5E	0.09	Fire-impacted sediment	NR>BV AIIND	NR>BV	NR>BV	NR>BV	-	-	-	-	-	-	-
PC	AC-1	19.08		NR>BV AIIND	NR>BV	<0.593>	-	AIIND	>4.182<	<1.286>	<2.958>	<0.448>	AIIND	AIIND
PC	AC-2	18.77		NR>BV AIIND	NR>BV	NR>BV	-	AIIND	<2.455>	<0.743>	<1.542>	AIIND	<0.542>	AIIND
PC	AC-3	18.27		NR>BV AIIND	NR>BV	<0.510>	NR>BV AIIND	>100.000<	<0.718>	<0.314>	<0.625>	AIIND	N	>11.538<
PC	ACS	18.62		NR>BV AIIND	NR>BV	N	-	>105.128<	<1.182>	<0.371>	<0.542>	AIIND	<0.542>	AIIND
PC	ACS	18.62	ACS removed	NR>BV	NR>BV	<0.554>	-	AIIND	AIIND	AIIND	AIIND	AIIND	AIIND	AIIND
PC	P-1E	17.81		NR>BV AIIND	NR>BV	NR>BV	NR>BV AIIND	SW%D<5 AIIND	SW%D<5 AIIND	N	N	AIIND	SW%D<5 AIIND	<1.354>

Table E-1.0-9 (continued)

Canyon	Reach	Distance to Rio Grande (km)	Status	Thallium	Vanadium	Zinc	Cyanide (Total)	Anthracene	Benzo(a)anthracene	Benzo(a)pyrene	Benzo(b)fluoranthene	Benzo(g,h,i)perylene	Benzo(k)fluoranthene	Benzoic Acid
BV's				0.73	19.7	60.2	0.82							
ESL's				0.044	4.1	130	0.1	0	0.11	0.35	0.24	0.29	0.24	0.065
Max HQ				7.955	5.366	1.077	25	4615.385	10.909	2.114	7.083	0.931	0.542	11.538
PC	P-1E	17.81	Fire-impacted sediment	NR>BV AIIND	NR>BV	NR>BV	-	-	-	-	-	-	-	-
PC	P-1FW	18.51		NR>BV AIIND	NR>BV	NR>BV	-	SW%D<5 AIIND	SW%D<5 AIIND	AIIND	AIIND	<0.483>	SW%D<5 AIIND	AIIND
PC	P-1W	18.26		NR>BV AIIND	NR>BV	NR>BV	-	SW%D<5 AIIND	SW%D<5 AIIND	AIIND	AIIND	AIIND	SW%D<5 AIIND	AIIND
PC	P-2E	13.34		-	-	-	-	-	-	-	-	-	-	-
PC	P-2W	14.61		AIIND	NR>BV	NR>BV	-	-	-	-	-	-	-	-
PC	P-2W	14.61	Fire-impacted sediment	AIIND	NR>BV	NR>BV	-	-	-	-	-	-	-	-
PC	P-3W	11.4		AIIND	NR>BV	NR>BV	-	-	-	-	-	-	-	-
PC	P-3W	11.4	Fire-impacted sediment	AIIND	NR>BV	NR>BV	-	-	-	-	-	-	-	-
PC	P-4E	8.6		AIIND	NR>BV	NR>BV	NR>BV AIIND	SW%D<5 AIIND	SW%D<5 AIIND	AIIND	AIIND	AIIND	SW%D<5 AIIND	AIIND
PC	P-4E	8.6	Fire-impacted sediment	AIIND	NR>BV	NR>BV	-	-	-	-	-	-	-	-
PC	P-4W	9.49		-	-	-	-	-	-	-	-	-	-	-
PC	WC	17.77		NR>BV AIIND	NR>BV	NR>BV	-	SW%D<5 AIIND	SW%D<5 AIIND	AIIND	AIIND	AIIND	SW%D<5 AIIND	AIIND

Table E-1.0-9 (continued)

Canyon	Reach	Distance to Rio Grande (km)	Status	Bis(2-ethylhexyl)phthalate	alpha-Chlordane	gamma-Chlordane	Chrysene	4,4'-DDE	4,4'-DDT	Fluoranthene	Indeno(1,2,3-cd)pyrene	Naphthalene	Phenanthrene
BVs													
ESLs				1.3	0.001	0.001	0.5	0.002	0.002	2.9	0.078	0.027	0.85
Max HQ				0.615	3.6	6.2	1.98	0.818	10	0.966	7.051	9.259	3.176
DPC	DP-1C	16.29		<0.462>	-	-	<1.980>	-	-	<0.966>	AIIND	SW%D<5 AIIND	>3.176<
DPC	DP-1E	15.47		N	-	-	<0.580>	-	-	N	>3.077<	SW%D<5 AIIND	<0.365>
DPC	DP-1W	16.39		<0.615>	-	-	<1.820>	-	-	<0.414>	>7.051<	SW%D<5 AIIND	<1.082>
DPC	DP-2	14.69		N	SW%D<5 AIIND	SW%D<5 AIIND	AIIND	SW%D<5 AIIND	SW%D<5 AIIND	AIIND	AIIND	SW%D<5 AIIND	AIIND
DPC	DP-3	13.85		N	SW%D<5 AIIND	SW%D<5 AIIND	N	SW%D<5 AIIND	SW%D<5 AIIND	N	AIIND	SW%D<5 AIIND	N
DPC	DP-4	13.12		N	SW%D<5 AIIND	SW%D<5 AIIND	N	SW%D<5 AIIND	SW%D<5 AIIND	N	AIIND	SW%D<5 AIIND	AIIND
DPC	DPTF	16.29		AIIND	-	-	AIIND	-	-	AIIND	AIIND	SW%D<5 AIIND	AIIND
LAC	LA-1C	15.66		-	-	-	-	-	-	-	-	-	-
LAC	LA-1E	14.81		-	-	-	-	-	-	-	-	-	-
LAC	LA-1FW	18.36		-	SW%D<5 AIIND	SW%D<5 AIIND	-	SW%D<5 AIIND	SW%D<5 AIIND	-	-	-	-
LAC	LA-1W	17.18		-	-	-	-	-	-	-	-	-	-
LAC	LA-1W+	17.47		-	SW%D<5 AIIND	SW%D<5 AIIND	-	SW%D<5 AIIND	SW%D<5 AIIND	-	-	-	-
LAC	LA-2E	12.55		SW%D<5 AIIND	SW%D<5 AIIND	SW%D<5 AIIND	N	SW%D<5 AIIND	SW%D<5 AIIND	N	SW%D<5 AIIND	AIIND	N
LAC	LA-2FE	11.22		-	-	-	-	-	-	-	-	-	-
LAC	LA-2W	13		-	-	-	-	-	-	-	-	-	-
LAC	LA-3E	8.75		SW%D<5 AIIND	SW%D<5 AIIND	SW%D<5 AIIND	AIIND	SW%D<5 AIIND	SW%D<5 AIIND	AIIND	SW%D<5 AIIND	AIIND	AIIND

Table E-1.0-9 (continued)

Canyon	Reach	Distance to Rio Grande (km)	Status	Bis(2-ethylhexyl)phthalate	alpha-Chlordane	gamma-Chlordane	Chrysene	4,4'-DDE	4,4'-DDT	Fluoranthene	Indeno(1,2,3-cd)pyrene	Naphthalene	Phenanthrene
BVs													
ESLs				1.3	0.001	0.001	0.5	0.002	0.002	2.9	0.078	0.027	0.85
Max HQ				0.615	3.6	6.2	1.98	0.818	10	0.966	7.051	9.259	3.176
LAC	LA-3FE	8.85	Fire-impacted sediment	SW%D<5 AIIND	-	-	<0.540>	-	-	N	SW%D<5 AIIND	>9.259<	<0.541>
LAC	LA-4E	5.03		-	SW%D<5 AIIND	SW%D<5 AIIND	-	SW%D<5 AIIND	SW%D<5 AIIND	-	-	-	-
LAC	LA-4FE	4.29	Fire-impacted sediment	N	-	-	SW%D<5 AIIND	-	-	SW%D<5 AIIND	SW%D<5 AIIND	SW%D<5 AIIND	SW%D<5 AIIND
LAC	LA-4W	6.04		-	-	-	-	-	-	-	-	-	-
LAC	LA-5	0.88		AIIND	SW%D<5 AIIND	SW%D<5 AIIND	SW%D<5 AIIND	SW%D<5 AIIND	SW%D<5 AIIND	SW%D<5 AIIND	SW%D<5 AIIND	SW%D<5 AIIND	SW%D<5 AIIND
LAC	LA-5E	0.09	Fire-impacted sediment	-	-	-	-	-	-	-	-	-	-
PC	AC-1	19.08		AIIND	AIIND	AIIND	<0.940>	AIIND	AIIND	<0.307>	SW%D<5 AIIND	SW%D<5 AIIND	<0.800>
PC	AC-2	18.77		<0.354>	AIIND	AIIND	<0.600>	AIIND	AIIND	N	SW%D<5 AIIND	SW%D<5 AIIND	<0.482>
PC	AC-3	18.27		AIIND	<2.500>	>4.220<	N	AIIND	>3.993<	N	SW%D<5 AIIND	SW%D<5 AIIND	N
PC	ACS	18.62		N	AIIND	AIIND	N	AIIND	<1.867>	N	SW%D<5 AIIND	SW%D<5 AIIND	N
PC	ACS	18.62	ACS removed	AIIND	>3.000<	>3.800<	AIIND	<0.818>	>10.000<	AIIND	SW%D<5 AIIND	SW%D<5 AIIND	AIIND
PC	P-1E	17.81		SW%D<5 AIIND	AIIND	AIIND	N	SW%D<5 AIIND	>3.193<	N	SW%D<5 AIIND	SW%D<5 AIIND	N

Table E-1.0-9 (continued)

Canyon	Reach	Distance to Rio Grande (km)	Status	Bis(2-ethylhexyl)phthalate	alpha-Chlordane	gamma-Chlordane	Chrysene	4,4'-DDE	4,4'-DDT	Fluoranthene	Indeno(1,2,3-cd)pyrene	Naphthalene	Phenanthrene
BVs													
ESLs				1.3	0.001	0.001	0.5	0.002	0.002	2.9	0.078	0.027	0.85
Max HQ				0.615	3.6	6.2	1.98	0.818	10	0.966	7.051	9.259	3.176
PC	P-1E	17.81	Fire-impacted sediment	-	-	-	-	-	-	-	-	-	-
PC	P-1FW	18.51		SW%D<5 AIIND	AIIND	AIIND	AIIND	SW%D<5 AIIND	<1.467>	AIIND	SW%D<5 AIIND	SW%D<5 AIIND	AIIND
PC	P-1W	18.26		SW%D<5 AIIND	>3.600<	>6.200<	AIIND	SW%D<5 AIIND	<2.200>	AIIND	SW%D<5 AIIND	SW%D<5 AIIND	AIIND
PC	P-2E	13.34		-	-	-	-	-	-	-	-	-	-
PC	P-2W	14.61		-	AIIND	AIIND	-	SW%D<5 AIIND	AIIND	-	-	-	-
PC	P-2W	14.61	Fire-impacted sediment	-	-	-	-	-	-	-	-	-	-
PC	P-3W	11.4		-	AIIND	AIIND	-	SW%D<5 AIIND	AIIND	-	-	-	-
PC	P-3W	11.4	Fire-impacted sediment	-	-	-	-	-	-	-	-	-	-
PC	P-4E	8.6		SW%D<5 AIIND	AIIND	AIIND	AIIND	SW%D<5 AIIND	AIIND	AIIND	SW%D<5 AIIND	SW%D<5 AIIND	AIIND
PC	P-4E	8.6	Fire-impacted sediment	-	-	-	-	-	-	-	-	-	-
PC	P-4W	9.49		-	-	-	-	-	-	-	-	-	-
PC	WC	17.77		SW%D<5 AIIND	AIIND	AIIND	AIIND	SW%D<5 AIIND	<0.333>	AIIND	SW%D<5 AIIND	SW%D<5 AIIND	AIIND

Table E-1.0-9 (continued)

Canyon	Reach	Distance to Rio Grande (km)	Status	Pyrene	Aroclor-1254	Aroclor-1260	Americium-241	Cesium-134	Cesium-137	Europium-152	Plutonium-238	Plutonium-239	Strontium-90
BVs							0.04		0.9		0.006	0.068	1.04
ESLs				0.57	0.028	0.031	0.006	0.47	1.1	0.1	0.019	0.02	0.57
Max HQ				6.316	1.429	0.516	137.931	0.511	4.336	2.48	6.316	1300	2.175
DPC	DP-1C	16.29		>6.316<	SW%D<5 AIIND	SW%D<5 AIIND	>9.138<	NBV-NDR AIIND	NDR>BV	NBV-NDR AIIND	NDR>BV AIIND	NDR>BV AIIND	NDR>BV AIIND
DPC	DP-1E	15.47		<1.368>	-	-	-	-	-	-	-	-	-
DPC	DP-1W	16.39		>4.386<	SW%D<5 AIIND	SW%D<5 AIIND	NDR>BV AIIND	-	-	-	NDR>BV AIIND	NDR>BV AIIND	NDR>BV AIIND
DPC	DP-2	14.69		AIIND	SW%D<5 AIIND	SW%D<5 AIIND	NDR>BV AIIND	-	NDR>BV	-	NDR>BV AIIND	NDR>BV	NDR>BV AIIND
DPC	DP-3	13.85		N	SW%D<5 AIIND	SW%D<5 AIIND	NDR>BV AIIND	-	<0.936>	-	NDR>BV AIIND	>4.200<	NDR>BV AIIND
DPC	DP-4	13.12		N	SW%D<5 AIIND	SW%D<5 AIIND	NDR>BV AIIND	-	<1.009>	-	NDR>BV AIIND	NDR>BV	NDR>BV AIIND
DPC	DPTF	16.29		AIIND	-	-	-	-	-	-	-	-	-
LAC	LA-1C	15.66		-	-	-	-	-	-	-	NDR>BV AIIND	>3.800<	-
LAC	LA-1E	14.81		-	-	-	-	-	-	-	NDR>BV AIIND	>4.500<	-
LAC	LA-1FW	18.36		-	SW%D<5 AIIND	AIIND	NDR>BV	NBV-NDR AIIND	NDR>BV AIIND	NBV-NDR AIIND	NDR>BV AIIND	NDR>BV AIIND	-
LAC	LA-1W	17.18		-	-	-	-	-	-	-	NDR>BV AIIND	>8.200<	-
LAC	LA-1W+	17.47		-	SW%D<5 AIIND	AIIND	-	-	-	-	NDR>BV AIIND	NDR>BV AIIND	-
LAC	LA-2E	12.55		<0.361>	SW%D<5 AIIND	<0.516>	>47.931<	<0.383>	<2.618>	NBV-NDR AIIND	>3.211<	>11.050<	<2.140>
LAC	LA-2FE	11.22		-	-	-	>137.931<	NBV-NDR AIIND	<2.145>	NBV-NDR AIIND	>4.526<	>18.250<	NDR>BV AIIND
LAC	LA-2W	13		-	-	-	NDR>BV AIIND	NBV-NDR AIIND	NDR>BV AIIND	NBV-NDR AIIND	NDR>BV AIIND	>10.550<	NDR>BV AIIND

Table E-1.0-9 (continued)

Canyon	Reach	Distance to Rio Grande (km)	Status	Pyrene	Aroclor-1254	Aroclor-1260	Americium-241	Cesium-134	Cesium-137	Europium-152	Plutonium-238	Plutonium-239	Strontium-90
BVs							0.04		0.9		0.006	0.068	1.04
ESLs				0.57	0.028	0.031	0.006	0.47	1.1	0.1	0.019	0.02	0.57
Max HQ				6.316	1.429	0.516	137.931	0.511	4.336	2.48	6.316	1300	2.175
LAC	LA-3E	8.75		AIIND	SW%D<5 AIIND	AIIND	>54.655<	NBV-NDR AIIND	<1.509>	NBV-NDR AIIND	NDR>BV AIIND	>4.100<	NDR>BV AIIND
LAC	LA-3FE	8.85	Fire- impacted sediment	<1.018>	-	-	NDR>BV AIIND	N	>4.336<	NBV-NDR AIIND	NDR>BV AIIND	>64.000<	<2.175>
LAC	LA-4E	5.03		-	SW%D<5 AIIND	SW%D<5 AIIND	NDR>BV AIIND	-	NDR>BV	<2.480>	NDR>BV AIIND	>15.700<	NDR>BV AIIND
LAC	LA-4FE	4.29	Fire- impacted sediment	SW%D<5 AIIND	-	-	NDR>BV AIIND	NBV-NDR AIIND	NDR>BV	NBV-NDR AIIND	NDR>BV AIIND	>7.450<	NDR>BV AIIND
LAC	LA-4W	6.04		-	-	-	>31.724<	-	<0.890>	NBV-NDR AIIND	<2.316>	>43.000<	-
LAC	LA-5	0.88		SW%D<5 AIIND	SW%D<5 AIIND	SW%D<5 AIIND	NDR>BV AIIND	<0.511>	NDR>BV AIIND	NBV-NDR AIIND	NDR>BV AIIND	>8.050<	NDR>BV AIIND
LAC	LA-5E	0.09	Fire- impacted sediment	-	-	-	NDR>BV AIIND	NBV-NDR AIIND	NDR>BV AIIND	NBV-NDR AIIND	NDR>BV AIIND	>39.100<	NDR>BV AIIND
PC	AC-1	19.08		<2.632>	AIIND	SW%D<5 AIIND	NDR>BV AIIND	NBV-NDR AIIND	NDR>BV AIIND	NBV-NDR AIIND	NDR>BV AIIND	NDR>BV AIIND	NDR>BV AIIND
PC	AC-2	18.77		<0.772>	AIIND	SW%D<5 AIIND	NDR>BV AIIND	NBV-NDR AIIND	NDR>BV AIIND	NBV-NDR AIIND	NDR>BV AIIND	NDR>BV AIIND	NDR>BV AIIND
PC	AC-3	18.27		N	AIIND	SW%D<5 AIIND	>110.345<	NBV-NDR AIIND	NDR>BV AIIND	NBV-NDR AIIND	>3.105<	>629.650<	NDR>BV AIIND
PC	ACS	18.62		<0.579>	<0.643>	SW%D<5 AIIND	AIIND	NBV-NDR AIIND	NDR>BV	NBV-NDR AIIND	AIIND	>737.000<	NDR>BV AIIND
PC	ACS	18.62	ACS removed	N	<1.429>	SW%D<5 AIIND	>132.759<	NBV-NDR AIIND	NDR>BV AIIND	NBV-NDR AIIND	>6.316<	>1300.000<	NDR>BV AIIND
PC	P-1E	17.81		N	AIIND	SW%D<5 AIIND	>36.034<	NBV-NDR AIIND	NDR>BV AIIND	NBV-NDR AIIND	<1.526>	>314.850<	NDR>BV

Table E-1.0-9 (continued)

Canyon	Reach	Distance to Rio Grande (km)	Status	Pyrene	Aroclor-1254	Aroclor-1260	Americium-241	Cesium-134	Cesium-137	Europium-152	Plutonium-238	Plutonium-239	Strontium-90
BVs							0.04		0.9		0.006	0.068	1.04
ESLs				0.57	0.028	0.031	0.006	0.47	1.1	0.1	0.019	0.02	0.57
Max HQ				6.316	1.429	0.516	137.931	0.511	4.336	2.48	6.316	1300	2.175
PC	P-1E	17.81	Fire-impacted sediment	-	-	-	AIIND	NBV-NDR AIIND	NDR>BV	NBV-NDR AIIND	AIIND	>34.000<	NDR>BV AIIND
PC	P-1FW	18.51		AIIND	<0.536>	SW%D<5 AIIND	-	-	-	-	-	-	-
PC	P-1W	18.26		AIIND	AIIND	SW%D<5 AIIND	-	-	-	-	-	-	-
PC	P-2E	13.34		-	-	-	-	-	-	-	NDR>BV AIIND	>101.000<	-
PC	P-2W	14.61		-	AIIND	SW%D<5 AIIND	NDR>BV AIIND	NBV-NDR AIIND	NDR>BV AIIND	NBV-NDR AIIND	<1.158>	>192.000<	-
PC	P-2W	14.61	Fire-impacted sediment	-	-	-	NDR>BV AIIND	NBV-NDR AIIND	NDR>BV	NBV-NDR AIIND	AIIND	>14.250<	NDR>BV AIIND
PC	P-3W	11.4		-	AIIND	SW%D<5 AIIND	NDR>BV AIIND	NBV-NDR AIIND	NDR>BV AIIND	NBV-NDR AIIND	<1.632>	>45.450<	-
PC	P-3W	11.4	Fire-impacted sediment	-	-	-	NDR>BV AIIND	NBV-NDR AIIND	NDR>BV AIIND	NBV-NDR AIIND	AIIND	>12.450<	NDR>BV AIIND
PC	P-4E	8.6		AIIND	AIIND	SW%D<5 AIIND	NDR>BV AIIND	NBV-NDR AIIND	NDR>BV AIIND	NBV-NDR AIIND	NDR>BV AIIND	>159.000<	NDR>BV AIIND
PC	P-4E	8.6	Fire-impacted sediment	-	-	-	NDR>BV AIIND	NBV-NDR AIIND	NDR>BV AIIND	NBV-NDR AIIND	NDR>BV AIIND	>36.000<	NDR>BV AIIND

Table E-1.0-9 (continued)

Canyon	Reach	Distance to Rio Grande (km)	Status	Pyrene	Aroclor-1254	Aroclor-1260	Americium-241	Cesium-134	Cesium-137	Europium-152	Plutonium-238	Plutonium-239	Strontium-90
BVs							0.04		0.9		0.006	0.068	1.04
ESLs				0.57	0.028	0.031	0.006	0.47	1.1	0.1	0.019	0.02	0.57
Max HQ				6.316	1.429	0.516	137.931	0.511	4.336	2.48	6.316	1300	2.175
PC	P-4W	9.49		-	-	-	-	-	-	-	NDR>BV AIIND	NDR>BV AIIND	-
PC	WC	17.77		AIIND	AIIND	SW%D<5 AIIND	-	-	-	-	-	-	-

- Notes:
1. Units are mg/kg for organic and inorganic chemicals and pCi/g for radionuclides.
 2. <#> = Retained as COPC.
 3. >#< = Retained as COPC.
 4. - = No data.
 5. AIIND = Organic analyte never detected in reach. Not a COPC.
 6. N = Analyte eliminated as a COPEC.
 7. NBV-NDR = No BV, no detected result (inorganic chemicals and radionuclides). Not a COPC.
 8. NDR>BV = No detected result > BV (radionuclides). Not a COPC.
 9. NR>BV = No result > BV (inorganic chemicals). Not a COPC.
 10. SW%D<5 = % detection in the subwatershed < 5%. Not a COPC.

Table E-1.0-10
Sediment: Human Health SALs

Analyte Name	Risk Type	Source of SAL	SAL	Std Reporting Units	Surrogate	Source of Surrogate
Acenaphthene	Noncarcinogen	NMED 2000, 68554	2800	mg/kg		
Acetone	Noncarcinogen	EPA 2002, 73691	1600	mg/kg		
Aldrin	Carcinogen	NMED 2000, 68554	0.029	mg/kg		
Amino-2,6-dinitrotoluene[4-]	Noncarcinogen		61	mg/kg	Dinitrotoluene[2,6-]	LANL 2002, 72639
Amino-4,6-dinitrotoluene[2-]	Noncarcinogen		61	mg/kg	Dinitrotoluene[2,6-]	LANL 2002, 72639
Anthracene	Noncarcinogen	NMED 2000, 68554	16000	mg/kg		
Aroclor-1248	Carcinogen	NMED 2000, 68554	0.22	mg/kg		
Aroclor-1254	Carcinogen	NMED 2000, 68554	0.22	mg/kg		
Aroclor-1260	Carcinogen	NMED 2000, 68554	0.22	mg/kg		
Benzene	Carcinogen	NMED 2000, 68554	0.64	mg/kg		
Benz(a)anthracene	Carcinogen	NMED 2000, 68554	0.62	mg/kg		
Benzo(a)pyrene	Carcinogen	NMED 2000, 68554	0.062	mg/kg		
Benzo(b)fluoranthene	Carcinogen	NMED 2000, 68554	0.62	mg/kg		
Benzo(g,h,i)perylene	Noncarcinogen	NMED 2000, 68554	1800	mg/kg	Pyrene	LANL 2002, 72639
Benzo(k)fluoranthene	Carcinogen	NMED 2000, 68554	6.2	mg/kg		
Benzoic Acid	Max	EPA 2002, 73691	100000	mg/kg		
Benzyl Alcohol	Noncarcinogen	EPA 2002, 73691	18000	mg/kg		
Bis(2-ethylhexyl)phthalate	Carcinogen	NMED 2000, 68554	35	mg/kg		
Butanone[2-]	Noncarcinogen	NMED 2000, 68554	37000	mg/kg		
Butylbenzylphthalate	Sat	EPA 2002, 73691	240	mg/kg		
Carbazole	Carcinogen	EPA 2002, 73691	24	mg/kg		
Chlordane[alpha-]	Carcinogen	NMED 2000, 68554	1.6	mg/kg		
Chlordane[gamma-]	Carcinogen	NMED 2000, 68554	1.6	mg/kg		
Chlorobenzene	Noncarcinogen	NMED 2000, 68554	140	mg/kg		
Chloromethane	Carcinogen	NMED 2000, 68554	1.2	mg/kg		
Chrysene	Carcinogen	NMED 2000, 68554	61	mg/kg		
DDD[4,4'-]	Carcinogen	NMED 2000, 68554	2.4	mg/kg		
DDE[4,4'-]	Carcinogen	NMED 2000, 68554	1.7	mg/kg		

Table E-1.0-10 (continued)

Analyte Name	Risk Type	Source of SAL	SAL	Std Reporting Units	Surrogate	Source of Surrogate
DDT[4,4'-]	Carcinogen	NMED 2000, 68554	1.7	mg/kg		
Decachlorobiphenyl		No SAL		mg/kg		
Dibenz(a,h)anthracene	Carcinogen	NMED 2000, 68554	0.062	mg/kg		
Dibenzofuran	Noncarcinogen	EPA 2002, 73691	290	mg/kg		
Dichlorobenzene[1,2-]	Sat	NMED 2000, 68554	85	mg/kg		
Dichlorobenzene[1,4-]	Carcinogen	NMED 2000, 68554	3.2	mg/kg		
Dieldrin	Carcinogen	NMED 2000, 68554	0.03	mg/kg		
Dimethylphenol[2,4-]	Noncarcinogen	EPA 2002, 73691	1200	mg/kg		
Diphenylamine	Noncarcinogen	EPA 2002, 73691	1500	mg/kg		
Endrin	Noncarcinogen	NMED 2000, 68554	18	mg/kg		
Endrin Aldehyde	Noncarcinogen	NMED 2000, 68554	18	mg/kg		
Fluoranthene	Noncarcinogen	NMED 2000, 68554	2300	mg/kg		
Fluorene	Noncarcinogen	NMED 2000, 68554	2100	mg/kg		
Heptachlor Epoxide	Carcinogen	EPA 2002, 73691	0.053	mg/kg		
HMX	Noncarcinogen	NMED 2000, 68554	3100	mg/kg		
Indeno(1,2,3-cd)pyrene	Carcinogen	NMED 2000, 68554	0.62	mg/kg		
Iodomethane	Noncarcinogen		3.7	mg/kg	Bromomethane	Based on structural similarity
Isopropylbenzene	Noncarcinogen	EPA 2002, 73691	370	mg/kg		
Isopropyltoluene[4-]	Noncarcinogen	EPA 2002, 73691	370	mg/kg	Isopropylbenzene	LANL 2002, 72639
Methyl-2-pentanone[4-]	Noncarcinogen	EPA 2002, 73691	790	mg/kg		
Methylene Chloride	Carcinogen	NMED 2000, 68554	65	mg/kg		
Methylmercury(+1) Ion		No SAL		mg/kg		
Methylnaphthalene[2-]	Noncarcinogen	NMED 2000, 68554	53	mg/kg	Naphthalene	LANL 2002, 72639
Methylphenol[2-]	Noncarcinogen	EPA 2002, 73691	3100	mg/kg		
Methylphenol[4-]	Noncarcinogen	EPA 2002, 73691	310	mg/kg		
Naphthalene	Noncarcinogen	NMED 2000, 68554	53	mg/kg		
Nitrobenzene	Noncarcinogen	NMED 2000, 68554	17	mg/kg		
Nitrotoluene[2-]		No SAL		mg/kg		
Phenanthrene	Noncarcinogen	NMED 2000, 68554	1800	mg/kg		
Phenol	Noncarcinogen	NMED 2000, 68554	37000	mg/kg		
Propylbenzene[1-]	Noncarcinogen	EPA 2002, 73691	140	mg/kg		

Table E-1.0-10 (continued)

Analyte Name	Risk Type	Source of SAL	SAL	Std Reporting Units	Surrogate	Source of Surrogate
Pyrene	Noncarcinogen	NMED 2000, 68554	1800	mg/kg		
Pyridine	Noncarcinogen	EPA 2002, 73691	61	mg/kg		
Tetryl	Noncarcinogen	EPA 2002, 73691	610	mg/kg		
Toluene	Sat	NMED 2000, 68554	180	mg/kg		
Total Petroleum Hydrocarbons Diesel Range Organics		No SAL		mg/kg		
Total Petroleum Hydrocarbons Gasoline Range Org.		No SAL		mg/kg		
Trichloroethene	Carcinogen	NMED 2000, 68554	1.6	mg/kg		
Trichlorofluoromethane	Noncarcinogen	NMED 2000, 68554	390	mg/kg		
Trimethylbenzene[1,2,4-]	Noncarcinogen	EPA 2002, 73691	52	mg/kg		
Xylene (Total)	Sat	NMED 2000, 68554	63	mg/kg		
Xylene[1,2-]	Sat	EPA 2002, 73691	280	mg/kg		
Xylene[1,3-]+Xylene[1,4-]		No SAL		mg/kg		
Americium-241	Radionuclide	LANL 2002, 73705	39	pCi/g		
Cesium-134		No SAL		pCi/g		
Cesium-137	Radionuclide	LANL 2002, 73705	5.3	pCi/g		
Cobalt-60	Radionuclide	LANL 2002, 73705	1.2	pCi/g		
Europium-152	Radionuclide	LANL 2002, 73705	2.7	pCi/g		
Plutonium-238	Radionuclide	LANL 2002, 73705	49	pCi/g		
Plutonium-239,240	Radionuclide	LANL 2002, 73705	44	pCi/g		
Ruthenium-106	Radionuclide	LANL 2002, 73705	19	pCi/g		
Sodium-22	Radionuclide	LANL 2002, 73705	1.5	pCi/g		
Strontium-90	Radionuclide	LANL 2002, 73705	5.7	pCi/g		
Thorium-228	Radionuclide	LANL 2002, 73705	2	pCi/g		
Thorium-230	Radionuclide	LANL 2002, 73705	5	pCi/g		
Thorium-232	Radionuclide	LANL 2002, 73705	5	pCi/g		
Tritium	Radionuclide	LANL 2002, 73705	890	pCi/g		
Uranium-234	Radionuclide	LANL 2002, 73705	63	pCi/g		
Uranium-235	Radionuclide	LANL 2002, 73705	17	pCi/g		
Uranium-238	Radionuclide	LANL 2002, 73705	86	pCi/g		
Aluminum	Noncarcinogen	NMED 2000, 68554	74000	mg/kg		

Table E-1.0-10 (continued)

Analyte Name	Risk Type	Source of SAL	SAL	Std Reporting Units	Surrogate	Source of Surrogate
Antimony	Noncarcinogen	NMED 2000, 68554	30	mg/kg		
Arsenic	Carcinogen	NMED 2000, 68554	0.39	mg/kg		
Barium	Noncarcinogen	NMED 2000, 68554	5200	mg/kg		
Beryllium	Noncarcinogen	NMED 2000, 68554	150	mg/kg		
Boron	Noncarcinogen	NMED 2000, 68554	5500	mg/kg		
Bromide		No SAL		mg/kg		
Cadmium	Noncarcinogen	NMED 2000, 68554	70	mg/kg		
Calcium		No SAL		mg/kg		
Chloride	Noncarcinogen	EPA 2002, 73691	7800	mg/kg		
Chromium	Carcinogen	EPA 2002, 73691	210	mg/kg		
Cobalt	Noncarcinogen	NMED 2000, 68554	4500	mg/kg		
Copper	Noncarcinogen	NMED 2000, 68554	2800	mg/kg		
Cyanide (Total)		No SAL		mg/kg		
Iron	Noncarcinogen	NMED 2000, 68554	23000	mg/kg		
Lead	Noncarcinogen	NMED 2000, 68554	400	mg/kg		
Magnesium		No SAL		mg/kg		
Manganese	Noncarcinogen	NMED 2000, 68554	7800	mg/kg		
Mercury	Noncarcinogen	NMED 2000, 68554	23	mg/kg		
Nickel	Noncarcinogen	NMED 2000, 68554	1500	mg/kg		
Potassium		No SAL		mg/kg		
Selenium	Noncarcinogen	NMED 2000, 68554	380	mg/kg		
Silver	Noncarcinogen	NMED 2000, 68554	380	mg/kg		
Sodium		No SAL		mg/kg		
Sulfate		No SAL		mg/kg		
Thallium	Noncarcinogen	NMED 2000, 68554	6.1	mg/kg		
Titanium		No SAL		mg/kg		
Uranium	Noncarcinogen	EPA Region 9 2002, 76866	16	mg/kg		
Vanadium	Noncarcinogen	NMED 2000, 68554	530	mg/kg		
Zinc	Noncarcinogen	NMED 2000, 68554	23000	mg/kg		

Notes: 1. Sat = Saturation value.

2. Max = Ceiling limit of the concentration (EPA 2002, 73691).

Table E-1.0-11
Sediment: Tier 1 Human Health Screening Summary

Canyon	Reach	Distance to Rio Grande (km)	Status	Aluminum	Barium	Cadmium	Iron	Lead	Manganese	Mercury	Thallium	Uranium	Total Non Cancer HI	Americium-241
BVs				15400	127	0.4	13800	19.7	543	0.1	0.73	6.99		0.04
Max HQ				0.455	0.106	0.157	1.591	5.75	0.282	0.313	1.098	3.084		2.59
SALs				74000	5200	70	23000	400	7800	23	6.1	16		39
Baseline	Baseline		Fire-impacted sediment	<0.455>	<0.106>	0.01	<0.680>	<0.120>	<0.282>	NR>BV	<0.115>	NR>BV	>2.002<	0.003
Baseline	Garcia Cyn		Fire-impacted sediment	NR>BV	0.056	NR>BV	NR>BV	0.085	<0.122>	NR>BV	NR>BV	NR>BV	<0.296>	NDR>BV AIIND
Baseline	Guaje Cyn		Fire-impacted sediment	NR>BV	0.069	0.007	NR>BV	0.095	<0.231>	NR>BV	NR>BV AIIND	-	<0.455>	NDR>BV AIIND
Baseline	Rendija Cyn		Fire-impacted sediment	NR>BV	0.04	NR>BV	NR>BV	<0.275>	<0.154>	NR>BV	NR>BV AIIND	-	<0.581>	NDR>BV AIIND
DPC	DP-1C	16.29		NR>BV	NR>BV	0.01	NR>BV	<0.513>	<0.141>	0.011	0.093	NR>BV	<0.864>	0.001
DPC	DP-1E	15.47		NR>BV	NR>BV	NR>BV	NR>BV	<0.473>	NR>BV	NR>BV	AIIND	NR>BV	<0.487>	NDR>BV AIIND
DPC	DP-1W	16.39		NR>BV	0.026	NR>BV	NR>BV	<0.518>	NR>BV	0.005	AIIND	NR>BV	<0.589>	0.009
DPC	DP-2	14.69		NR>BV	NR>BV	0.006	NR>BV	<0.191>	0.095	NR>BV	0.021	NR>BV	<0.329>	<0.472>
DPC	DP-2	14.69	Removed	-	-	-	-	-	-	-	-	-	-	<0.764>
DPC	DP-3	13.85		NR>BV	NR>BV	0.006	NR>BV	<0.200>	NR>BV	NR>BV	AIIND	NR>BV	<0.211>	>1.821<
DPC	DP-4	13.12		NR>BV	NR>BV	NR>BV AIIND	NR>BV	<0.144>	NR>BV	NR>BV	NR>BV AIIND	NR>BV	<0.153>	<0.838>
DPC	DPTF	16.29		NR>BV	NR>BV	NR>BV	NR>BV	0.058	NR>BV	NR>BV AIIND	NR>BV AIIND	-	0.059	-
LAC	LA-0	19.5		-	-	-	-	-	-	-	-	-	0	-
LAC	LA-1C	15.66		NR>BV	0.025	AIIND	NR>BV	0.097	NR>BV	0.005	NR>BV AIIND	NR>BV	<0.137>	0.002
LAC	LA-1E	14.81		NR>BV	NR>BV	0.001	NR>BV	0.075	NR>BV	NR>BV	NR>BV AIIND	NR>BV	0.094	0.005
LAC	LA-1FW	18.36		NR>BV	NR>BV	NR>BV AIIND	NR>BV	0.098	NR>BV	NR>BV	NR>BV AIIND	NR>BV	<0.104>	NDR>BV
LAC	LA-1W	17.18		NR>BV	NR>BV	AIIND	NR>BV	<0.109>	NR>BV	0.007	NR>BV AIIND	NR>BV	<0.137>	0.015

Table E-1.0-11 (continued)

Canyon	Reach	Distance to Rio Grande (km)	Status	Aluminum	Barium	Cadmium	Iron	Lead	Manganese	Mercury	Thallium	Uranium	Total Non Cancer HI	Americium-241
BVs				15400	127	0.4	13800	19.7	543	0.1	0.73	6.99		0.04
Max HQ				0.455	0.106	0.157	1.591	5.75	0.282	0.313	1.098	3.084		2.59
SALs				74000	5200	70	23000	400	7800	23	6.1	16		39
LAC	LA-1W+	17.47		NR>BV	NR>BV	NR>BV AIIND	NR>BV	<0.103>	NR>BV	NR>BV	NR>BV AIIND	NR>BV	<0.104>	-
LAC	LA-2E	12.55		NR>BV	0.014	0.013	NR>BV	<0.128>	NR>BV	0.003	NR>BV AIIND	<0.390>	<0.580>	<0.718>
LAC	LA-2E	12.55	Removed	NR>BV	0.025	AIIND	NR>BV	<0.155>	NR>BV	0.006	NR>BV AIIND	<0.446>	<0.684>	0.058
LAC	LA-2FE	11.22		NR>BV	NR>BV	NR>BV	NR>BV	<0.123>	NR>BV	0.007	NR>BV AIIND	NR>BV	<0.136>	<0.469>
LAC	LA-2W	13		NR>BV	NR>BV	0.001	NR>BV	<0.117>	NR>BV	0.013	NR>BV	<0.471>	<0.658>	0.003
LAC	LA-3E	8.75		NR>BV	NR>BV	AIIND	NR>BV	0.092	NR>BV	0.006	NR>BV AIIND	NR>BV	<0.104>	<0.303>
LAC	LA-3FE	8.85	Fire-impacted sediment	NR>BV	0.071	0.008	<0.696>	<0.133>	<0.269>	NR>BV	0.057	NR>BV	>1.324<	0.024
LAC	LA-3W	10.48		NR>BV	NR>BV	NR>BV	NR>BV	0.083	NR>BV	NR>BV	NR>BV AIIND	NR>BV	0.084	<0.121>
LAC	LA-4E	5.03		NR>BV	NR>BV	AIIND	NR>BV	NR>BV	NR>BV	NR>BV	AIIND	-	-	0.015
LAC	LA-4FE	4.29	Fire-impacted sediment	NR>BV	0.044	NR>BV	NR>BV	0.078	<0.128>	NR>BV	NR>BV AIIND	-	<0.308>	0.006
LAC	LA-4W	6.04		NR>BV	NR>BV	0.001	NR>BV	0.079	NR>BV	NR>BV	NR>BV AIIND	-	0.08	<0.119>
LAC	LA-5	0.88		NR>BV	NR>BV	NR>BV AIIND	NR>BV	0.066	NR>BV	NR>BV AIIND	NR>BV AIIND	NR>BV	<0.107>	0.002
LAC	LA-5E	0.09	Fire-impacted sediment	NR>BV	0.056	0.008	NR>BV	0.075	<0.141>	NR>BV	NR>BV AIIND	NR>BV	<0.290>	NDR>BV AIIND
PC	AC-1	19.08		NR>BV	0.025	NR>BV	NR>BV	<0.325>	NR>BV	NR>BV	NR>BV	NR>BV	<0.521>	NDR>BV AIIND
PC	AC-2	18.77		NR>BV	NR>BV	NR>BV	NR>BV	<0.425>	0.079	NR>BV	NR>BV	NR>BV	<0.620>	0.042
PC	AC-3	18.27		NR>BV	NR>BV	<0.101>	NR>BV	<0.500>	0.072	<0.113>	NR>BV	NR>BV	<0.860>	>2.256<
PC	ACS	18.62		NR>BV	0.017	0.031	NR>BV	<0.390>	NR>BV	<0.121>	NR>BV	<0.707>	>1.330<	<0.256>
PC	ACS	18.62	ACS removed	NR>BV	0.046	<0.157>	NR>BV	>5.750<	NR>BV	<0.313>	NR>BV	>3.084<	>9.589<	>2.590<

Table E-1.0-11 (continued)

Canyon	Reach	Distance to Rio Grande (km)	Status	Aluminum	Barium	Cadmium	Iron	Lead	Manganese	Mercury	Thallium	Uranium	Total Non Cancer HI	Americium-241
BVs				15400	127	0.4	13800	19.7	543	0.1	0.73	6.99		0.04
Max HQ				0.455	0.106	0.157	1.591	5.75	0.282	0.313	1.098	3.084		2.59
SALs				74000	5200	70	23000	400	7800	23	6.1	16		39
PC	ACS	18.62	ACS WC	-	-	-	-	-	-	-	-	-	0	-
PC	P-1E	17.81		NR>BV	0.018	0.013	NR>BV	<0.193>	0.068	0.028	NR>BV AIIND	NR>BV	<0.347>	<0.274>
PC	P-1E	17.81	Fire-impacted sediment	NR>BV	0.025	0.002	NR>BV	0.063	<0.105>	0.002	NR>BV AIIND	-	<0.229>	AIIND
PC	P-1FW	18.51		NR>BV	NR>BV	NR>BV AIIND	NR>BV	<0.170>	0.09	NR>BV	<0.164>	-	<0.429>	-
PC	P-1W	18.26		NR>BV	0.018	0.008	NR>BV	<0.165>	0.065	0.021	NR>BV	NR>BV	<0.301>	NDR>BV AIIND
PC	P-1W	18.26	Fire-impacted sediment	NR>BV	0.054	0.006	NR>BV	<0.113>	<0.192>	0.002	NR>BV AIIND	-	<0.379>	NDR>BV AIIND
PC	P-2E	13.34		-	-	-	-	-	-	-	-	-	-	-
PC	P-2W	14.61		NR>BV	0.017	AIIND	NR>BV	0.069	0.044	0.007	AIIND	-	<0.155>	0.031
PC	P-2W	14.61	Fire-impacted sediment	NR>BV	0.048	0.006	NR>BV	0.085	<0.146>	0.003	0.044	-	<0.350>	0.002
PC	P-3E	10.42		-	-	-	-	-	-	-	-	-	-	-
PC	P-3E	10.42	Fire-impacted sediment	NR>BV	0.042	NR>BV	NR>BV	0.068	<0.128>	NR>BV	NR>BV AIIND	-	<0.253>	NDR>BV AIIND
PC	P-3W	11.4		NR>BV	0.01	AIIND	NR>BV	0.036	0.032	AIIND	AIIND	-	0.09	AIIND
PC	P-3W	11.4	Fire-impacted sediment	NR>BV	0.029	0.004	NR>BV	0.062	0.087	0.003	<0.213>	-	<0.431>	0.004
PC	P-4E	8.6		NR>BV	0.015	0.006	>1.591<	0.049	<0.132>	NR>BV	>1.098<	-	>2.959<	NDR>BV AIIND
PC	P-4E	8.6	Fire-impacted sediment	NR>BV	0.052	0.003	<0.696>	0.09	<0.167>	NR>BV	AIIND	-	>1.122<	NDR>BV AIIND
PC	P-4W	9.49		<0.249>	0.031	0.007	<0.670>	0.076	NR>BV	0.005	AIIND	-	>1.117<	0.053
PC	WC	17.77		NR>BV	NR>BV	NR>BV AIIND	NR>BV	0.06	NR>BV	NR>BV	<0.197>	-	<0.258>	-

Table E-1.0-11 (continued)

Canyon	Reach	Distance to Rio Grande (km)	Status	Cesium-137	Cobalt-60	Europium-152	Plutonium-238	Plutonium-239	Strontium-90	Thorium-228	Thorium-230	Thorium-232	Uranium-234	Uranium-238
BVs				0.9			0.006	0.068	1.04	2.28	2.29	2.33	2.59	2.29
Max HQ				83.396	0.172	0.182	0.761	176.818	14.035	1.45	0.522	0.528	0.341	0.193
SALs				5.3	1.2	2.7	49	44	5.7	2	5	5	63	86
Baseline	Baseline		Fire-impacted sediment	>1.558<	NBV-NDR AIIND	NBV-NDR AIIND	0.001	0.008	<0.351>	NDR>BV	NDR>BV	NDR>BV	NDR>BV	0.027
Baseline	Garcia Cyn		Fire-impacted sediment	<0.823>	NBV-NDR AIIND	NBV-NDR AIIND	NDR>BV AIIND	0.004	<0.258>	-	-	-	NDR>BV	NDR>BV
Baseline	Guaje Cyn		Fire-impacted sediment	>1.174<	NBV-NDR AIIND	NBV-NDR AIIND	NDR>BV AIIND	0.006	<0.219>	-	-	-	-	-
Baseline	Rendija Cyn		Fire-impacted sediment	<0.885>	NBV-NDR AIIND	NBV-NDR AIIND	NDR>BV AIIND	0.008	<0.189>	-	-	-	-	-
DPC	DP-1C	16.29		NDR>BV	NBV-NDR AIIND	NBV-NDR AIIND	NDR>BV AIIND	NDR>BV	NDR>BV AIIND	-	-	-	NDR>BV	NDR>BV
DPC	DP-1E	15.47		NDR>BV	NBV-NDR AIIND	NBV-NDR AIIND	NDR>BV AIIND	0.002	NDR>BV AIIND	-	-	-	NDR>BV	NDR>BV
DPC	DP-1W	16.39		NDR>BV	NBV-NDR AIIND	NBV-NDR AIIND	NDR>BV AIIND	NDR>BV	NDR>BV AIIND	-	-	-	NDR>BV	NDR>BV
DPC	DP-2	14.69		>34.340<	NBV-NDR AIIND	NBV-NDR AIIND	0.026	<0.253>	>5.754<	-	-	-	NDR>BV	NDR>BV
DPC	DP-2	14.69	Removed	>83.396<	-	-	0.02	0.094	>1.298<	-	-	-	-	-
DPC	DP-3	13.85		>36.226<	NBV-NDR AIIND	NBV-NDR AIIND	0.057	<0.255>	>3.000<	-	-	-	NDR>BV	NDR>BV
DPC	DP-4	13.12		>28.113<	NBV-NDR AIIND	NBV-NDR AIIND	0.027	>1.098<	>5.456<	NDR>BV	NDR>BV	NDR>BV	0.044	0.027
DPC	DPTF	16.29		-	-	-	-	-	-	-	-	-	-	-
LAC	LA-0	19.5		-	-	-	-	-	-	-	-	-	-	-
LAC	LA-1C	15.66		NDR>BV	NBV-NDR AIIND	NBV-NDR AIIND	0.001	<0.200>	NDR>BV AIIND	-	-	-	NDR>BV	NDR>BV
LAC	LA-1E	14.81		<0.547>	NBV-NDR AIIND	NBV-NDR AIIND	0.002	<0.439>	-	-	-	-	NDR>BV	0.027

Table E-1.0-11 (continued)

Canyon	Reach	Distance to Rio Grande (km)	Status	Cesium-137	Cobalt-60	Europium-152	Plutonium-238	Plutonium-239	Strontium-90	Thorium-228	Thorium-230	Thorium-232	Uranium-234	Uranium-238
BVs				0.9			0.006	0.068	1.04	2.28	2.29	2.33	2.59	2.29
Max HQ				83.396	0.172	0.182	0.761	176.818	14.035	1.45	0.522	0.528	0.341	0.193
SALs				5.3	1.2	2.7	49	44	5.7	2	5	5	63	86
LAC	LA-1FW	18.36		NDR>BV AIIND	NBV-NDR AIIND	NBV-NDR AIIND	NDR>BV AIIND	NDR>BV	-	-	-	-	NDR>BV	NDR>BV
LAC	LA-1W	17.18		NDR>BV	NBV-NDR AIIND	NBV-NDR AIIND	0.002	<0.434>	-	-	-	-	NDR>BV	NDR>BV
LAC	LA-1W+	17.47		-	-	-	NDR>BV AIIND	0.014	-	-	-	-	NDR>BV	NDR>BV
LAC	LA-2E	12.55		>7.170<	0.097	<0.176>	0.041	<0.145>	>1.211<	NDR>BV	<0.488>	NDR>BV	NDR>BV	0.024
LAC	LA-2E	12.55	Removed	>36.285<	AIIND	AIIND	0.003	<0.123>	>6.940<	NDR>BV	<0.390>	NDR>BV	NDR>BV	0.028
LAC	LA-2FE	11.22		>21.509<	NBV-NDR AIIND	NBV-NDR AIIND	0.018	<0.352>	>3.614<	NDR>BV	NDR>BV	NDR>BV	NDR>BV	NDR>BV
LAC	LA-2W	13		<0.302>	NBV-NDR AIIND	NBV-NDR AIIND	0.001	<0.241>	<0.649>	NDR>BV	NDR>BV	NDR>BV	0.041	0.029
LAC	LA-3E	8.75		>2.604<	<0.172>	<0.182>	0.016	0.072	>1.233<	>1.450<	<0.522>	<0.528>	NDR>BV	NDR>BV
LAC	LA-3FE	8.85	Fire-impacted sediment	<0.900>	NBV-NDR AIIND	NBV-NDR AIIND	0.001	0.029	<0.218>	-	-	-	NDR>BV	NDR>BV
LAC	LA-3W	10.48		>8.057<	NBV-NDR AIIND	NBV-NDR AIIND	0.007	0.062	>1.667<	NDR>BV	NDR>BV	NDR>BV	NDR>BV	NDR>BV
LAC	LA-4E	5.03		<0.342>	NBV-NDR AIIND	0.092	0.001	<0.137>	NDR>BV AIIND	-	-	-	-	-
LAC	LA-4FE	4.29	Fire-impacted sediment	<0.428>	NBV-NDR AIIND	NBV-NDR AIIND	0.001	0.034	NDR>BV	-	-	-	-	-
LAC	LA-4W	6.04		<0.877>	NBV-NDR AIIND	<0.129>	0.005	<0.314>	NDR>BV AIIND	-	-	-	-	-
LAC	LA-5	0.88		<0.202>	NBV-NDR AIIND	NBV-NDR AIIND	NDR>BV AIIND	0.057	NDR>BV AIIND	NDR>BV	NDR>BV	NDR>BV	NDR>BV	NDR>BV
LAC	LA-5E	0.09	Fire-impacted sediment	>1.183<	NBV-NDR AIIND	NBV-NDR AIIND	NDR>BV AIIND	0.036	<0.246>	-	-	-	NDR>BV	NDR>BV
PC	AC-1	19.08		<0.202>	NBV-NDR AIIND	NBV-NDR AIIND	NDR>BV AIIND	0.003	NDR>BV AIIND	-	-	-	NDR>BV	NDR>BV

Table E-1.0-11 (continued)

Canyon	Reach	Distance to Rio Grande (km)	Status	Cesium-137	Cobalt-60	Europium-152	Plutonium-238	Plutonium-239	Strontium-90	Thorium-228	Thorium-230	Thorium-232	Uranium-234	Uranium-238
BVs				0.9			0.006	0.068	1.04	2.28	2.29	2.33	2.59	2.29
Max HQ				83.396	0.172	0.182	0.761	176.818	14.035	1.45	0.522	0.528	0.341	0.193
SALs				5.3	1.2	2.7	49	44	5.7	2	5	5	63	86
PC	AC-2	18.77		NDR>BV	NBV-NDR AIIND	NBV-NDR AIIND	NDR>BV AIIND	0.028	NDR>BV AIIND	-	-	-	NDR>BV	NDR>BV
PC	AC-3	18.27		>6.132<	NBV-NDR AIIND	NBV-NDR AIIND	0.076	>10.841<	>5.351<	NDR>BV	NDR>BV	NDR>BV	0.042	NDR>BV
PC	ACS	18.62		>1.215<	NBV-NDR AIIND	NBV-NDR AIIND	0.051	>7.909<	<0.251>	-	-	-	<0.148>	0.043
PC	ACS	18.62	ACS removed	>27.925<	NBV-NDR AIIND	NBV-NDR AIIND	<0.761>	>176.818<	>14.035<	-	-	-	<0.341>	<0.193>
PC	ACS	18.62	ACS WC	-	-	-	-	-	-	-	-	-	-	-
PC	P-1E	17.81		<0.289>	NBV-NDR AIIND	0.099	0.042	>11.409<	<0.246>	NDR>BV	NDR>BV	NDR>BV	NDR>BV	NDR>BV
PC	P-1E	17.81	Fire-impacted sediment	<0.355>	NBV-NDR AIIND	AIIND	0.001	0.03	<0.144>	-	-	-	-	-
PC	P-1FW	18.51		-	-	-	-	-	-	-	-	-	-	-
PC	P-1W	18.26		0.086	NBV-NDR AIIND	NBV-NDR AIIND	NDR>BV AIIND	0.002	AIIND	NDR>BV	NDR>BV	NDR>BV	NDR>BV	NDR>BV
PC	P-1W	18.26	Fire-impacted sediment	>1.068<	NBV-NDR AIIND	NBV-NDR AIIND	NDR>BV AIIND	0.01	<0.204>	-	-	-	-	-
PC	P-2E	13.34		-	-	-	0.001	<0.183>	-	-	-	-	-	-
PC	P-2W	14.61		<0.106>	NBV-NDR AIIND	NBV-NDR AIIND	0.005	>1.668<	-	-	-	-	-	-
PC	P-2W	14.61	Fire-impacted sediment	<0.440>	NBV-NDR AIIND	NBV-NDR AIIND	AIIND	0.017	<0.204>	-	-	-	-	-
PC	P-3E	10.42		-	-	-	0.002	<0.180>	-	-	-	-	-	-
PC	P-3E	10.42	Fire-impacted sediment	<0.349>	NBV-NDR AIIND	NBV-NDR AIIND	AIIND	0.021	NDR>BV	-	-	-	-	-
PC	P-3W	11.4		<0.128>	NBV-NDR AIIND	NBV-NDR AIIND	0.003	>1.020<	-	-	-	-	-	-

Table E-1.0-11 (continued)

Canyon	Reach	Distance to Rio Grande (km)	Status	Cesium-137	Cobalt-60	Europium-152	Plutonium-238	Plutonium-239	Strontium-90	Thorium-228	Thorium-230	Thorium-232	Uranium-234	Uranium-238
BVs				0.9			0.006	0.068	1.04	2.28	2.29	2.33	2.59	2.29
Max HQ				83.396	0.172	0.182	0.761	176.818	14.035	1.45	0.522	0.528	0.341	0.193
SALs				5.3	1.2	2.7	49	44	5.7	2	5	5	63	86
PC	P-3W	11.4	Fire-impacted sediment	<0.374>	NBV-NDR AIIND	NBV-NDR AIIND	AIIND	0.02	NDR>BV	-	-	-	-	-
PC	P-4E	8.6		<0.149>	NBV-NDR AIIND	NBV-NDR AIIND	NDR>BV AIIND	<0.424>	AIIND	NDR>BV	NDR>BV	NDR>BV	NDR>BV	NDR>BV
PC	P-4E	8.6	Fire-impacted sediment	<0.543>	NBV-NDR AIIND	NBV-NDR AIIND	NDR>BV AIIND	0.025	<0.196>	-	-	-	-	-
PC	P-4W	9.49		NDR>BV	NBV-NDR AIIND	NBV-NDR AIIND	0.013	>3.875<	NDR>BV AIIND	NDR>BV	NDR>BV	NDR>BV	NDR>BV	NDR>BV
PC	WC	17.77		-	-	-	-	-	-	-	-	-	-	-

Table E-1.0-11 (continued)

Canyon	Reach	Distance to Rio Grande (km)	Status	Total Radionuclides HI	Aroclor-1248	Aroclor-1254	Aroclor-1260	Arsenic	Benz(a)anthracene	Benzo(a)pyrene	Benzo(b)fluoranthene	Dibenz(a,h)anthracene	Dieldrin	Indeno(1,2,3-cd)pyrene	Total Cancer HI
BVs								3.98							
Max HQ					23.182	28.182	15	18.205	9.032	95.161	10.806	2.903	1.683	6.129	
SALs					0.22	0.22	0.22	0.39	0.62	0.062	0.62	0.062	0.03	0.62	
Baseline	Baseline		Fire-impacted sediment	>1.949<	SW%D<5 AIIND	SW%D<5 AIIND	SW%D<5 AIIND	>12.051<	SW%D<5 AIIND	SW%D<5 AIIND	SW%D<5 AIIND	SW%D<5 AIIND	SW%D<5 AIIND	SW%D<5 AIIND	>12.156<
Baseline	Garcia Cyn		Fire-impacted sediment	>1.085<	-	-	-	>13.846<	-	-	-	-	-	-	>13.846<
Baseline	Guaje Cyn		Fire-impacted sediment	>1.398<	-	-	-	>10.769<	-	-	-	-	-	-	>10.769<
Baseline	Rendija Cyn		Fire-impacted sediment	>1.082<	-	-	-	>15.385<	SW%D<5 AIIND	SW%D<5 AIIND	SW%D<5 AIIND	SW%D<5 AIIND	-	SW%D<5 AIIND	>15.385<
DPC	DP-1C	16.29		0.001	SW%D<5 AIIND	SW%D<5 AIIND	<4.545>	NR>BV	<1.935>	>12.097<	<2.742>	SW%D<5 AIIND	-	AIIND	>21.498<
DPC	DP-1E	15.47		0.002	SW%D<5 AIIND	SW%D<5 AIIND	0.35	NR>BV	<1.548>	>13.387<	<1.935>	SW%D<5 AIIND	-	0.387	>17.823<
DPC	DP-1W	16.39		0.009	SW%D<5 AIIND	SW%D<5 AIIND	AIIND	NR>BV	<4.839>	>51.613<	<6.129>	SW%D<5 AIIND	SW%D<5 AIIND	<6.129>	>69.469<
DPC	DP-2	14.69		>40.845<	SW%D<5 AIIND	SW%D<5 AIIND	0.795	NR>BV	<1.242>	>11.613<	<1.613>	SW%D<5 AIIND	SW%D<5 AIIND	1	>16.481<
DPC	DP-2	14.69	Removed	>85.573<	-	-	-	-	-	-	-	-	-	-	-
DPC	DP-3	13.85		>41.359<	SW%D<5 AIIND	SW%D<5 AIIND	0.414	NR>BV	<1.065>	>11.613<	<2.097>	SW%D<5 AIIND	SW%D<5 AIIND	0.387	>15.746<
DPC	DP-4	13.12		>35.604<	SW%D<5 AIIND	SW%D<5 AIIND	0.186	NR>BV	0.468	<5.645>	1	SW%D<5 AIIND	SW%D<5 AIIND	0.452	<7.823>
DPC	DPTF	16.29		-	-	-	-	NR>BV	AIIND	AIIND	AIIND	SW%D<5 AIIND	-	AIIND	-
LAC	LA-0	19.5		-	SW%D<5 AIIND	AIIND	0.395	-	0.177	<1.935>	0.15	SW%D<5 AIIND	AIIND	AIIND	<2.744>
LAC	LA-1C	15.66		<0.202>	SW%D<5 AIIND	<2.136>	<3.909>	NR>BV	0.419	<3.548>	0.339	SW%D<5 AIIND	1	0.274	>11.834<

Table E-1.0-11 (continued)

Canyon	Reach	Distance to Rio Grande (km)	Status	Total Radionuclides HI	Aroclor-1248	Aroclor-1254	Aroclor-1260	Arsenic	Benz(a)anthracene	Benzo(a)pyrene	Benzo(b)fluoranthene	Dibenz(a,h)anthracene	Dieldrin	Indeno(1,2,3-cd)pyrene	Total Cancer HI
BVs								3.98							
Max HQ					23.182	28.182	15	18.205	9.032	95.161	10.806	2.903	1.683	6.129	
SALs					0.22	0.22	0.22	0.39	0.62	0.062	0.62	0.062	0.03	0.62	
LAC	LA-1E	14.81		>1.020<	SW%D<5 AIIND	AIIND	<1.818>	NR>BV	0.516	<3.871>	0.339	SW%D<5 AIIND	0.467	0.21	<7.351>
LAC	LA-1FW	18.36		-	SW%D<5 AIIND	AIIND	0.636	NR>BV	0.516	<5.161>	0.387	SW%D<5 AIIND	0.06	AIIND	<6.893>
LAC	LA-1W	17.18		<0.450>	SW%D<5 AIIND	<2.455>	0.3	NR>BV	0.148	<1.452>	AIIND	SW%D<5 AIIND	AIIND	AIIND	<4.392>
LAC	LA-1W+	17.47		0.014	SW%D<5 AIIND	<2.955>	0.682	NR>BV	0.339	<3.871>	0.403	SW%D<5 AIIND	AIIND	0.29	<8.628>
LAC	LA-2E	12.55		>10.070<	SW%D<5 AIIND	AIIND	<1.045>	<6.923>	0.594	>10.565<	<1.065>	SW%D<5 AIIND	AIIND	0.55	>20.841<
LAC	LA-2E	12.55	Removed	>43.827<	SW%D<5 AIIND	AIIND	<1.909>	>12.051<	0.219	<2.419>	0.408	SW%D<5 AIIND	AIIND	AIIND	>17.212<
LAC	LA-2FE	11.22		>25.963<	SW%D<5 AIIND	AIIND	<2.636>	NR>BV	0.468	<4.516>	0.371	SW%D<5 AIIND	0.767	0.29	<9.277>
LAC	LA-2W	13		>1.267<	SW%D<5 AIIND	AIIND	<1.545>	NR>BV	0.435	<3.871>	0.419	SW%D<5 AIIND	AIIND	0.306	<6.747>
LAC	LA-3E	8.75		>7.082<	SW%D<5 AIIND	AIIND	0.5	NR>BV	0.355	<4.516>	0.516	SW%D<5 AIIND	AIIND	0.323	<6.306>
LAC	LA-3FE	8.85	Fire-impacted sediment	>1.171<	-	-	-	>12.821<	0.403	<4.194>	0.532	SW%D<5 AIIND	-	AIIND	>18.040<
LAC	LA-3W	10.48		>9.914<	SW%D<5 AIIND	AIIND	<1.545>	NR>BV	0.323	<3.065>	0.403	SW%D<5 AIIND	0.467	0.371	<6.326>
LAC	LA-4E	5.03		<0.587>	SW%D<5 AIIND	SW%D<5 AIIND	SW%D<5 AIIND	NR>BV	-	-	-	-	SW%D<5 AIIND	-	-
LAC	LA-4FE	4.29	Fire-impacted sediment	<0.469>	-	-	-	NR>BV	0.074	SW%D<5 AIIND	SW%D<5 AIIND	SW%D<5 AIIND	-	SW%D<5 AIIND	0.092
LAC	LA-4W	6.04		>1.444<	SW%D<5 AIIND	SW%D<5 AIIND	SW%D<5 AIIND	NR>BV	-	-	-	-	SW%D<5 AIIND	-	0.003
LAC	LA-5	0.88		<0.261>	SW%D<5 AIIND	SW%D<5 AIIND	SW%D<5 AIIND	NR>BV AIIND	AIIND	SW%D<5 AIIND	SW%D<5 AIIND	SW%D<5 AIIND	SW%D<5 AIIND	SW%D<5 AIIND	0.04

Table E-1.0-11 (continued)

Canyon	Reach	Distance to Rio Grande (km)	Status	Total Radionuclides HI	Aroclor-1248	Aroclor-1254	Aroclor-1260	Arsenic	Benz(a)anthracene	Benzo(a)pyrene	Benzo(b)fluoranthene	Dibenz(a,h)anthracene	Dieldrin	Indeno(1,2,3-cd)pyrene	Total Cancer HI
BVs								3.98							
Max HQ					23.182	28.182	15	18.205	9.032	95.161	10.806	2.903	1.683	6.129	
SALs					0.22	0.22	0.22	0.39	0.62	0.062	0.62	0.062	0.03	0.62	
LAC	LA-5E	0.09	Fire-impacted sediment	>1.465<	-	-	-	NR>BV	-	-	-	-	-	-	-
PC	AC-1	19.08		<0.222>	AIIND	AIIND	0.591	>10.513<	<9.032>	>95.161<	>10.806<	SW%D<5	0.833	<3.387>	>131.410<
PC	AC-2	18.77		0.07	AIIND	AIIND	0.314	>13.077<	<4.194>	>48.387<	<8.548>	SW%D<5 AIIND	AIIND	<1.935>	>76.898<
PC	AC-3	18.27		>24.699<	AIIND	>28.182<	0.432	NR>BV	<2.903>	>24.194<	<4.677>	SW%D<5 AIIND	AIIND	1	>61.612<
PC	ACS	18.62		>9.910<	AIIND	<3.300>	0.691	<7.179>	0.242	<2.742>	0.21	SW%D<5 AIIND	<1.683>	0.194	>16.665<
PC	ACS	18.62	ACS removed	>222.685<	>23.182<	>25.455<	>15.000<	>18.205<	0.565	<5.000>	<1.065>	SW%D<5 AIIND	AIIND	AIIND	>89.004<
PC	ACS	18.62	ACS WC	-	-	-	-	-	-	-	-	-	-	-	-
PC	P-1E	17.81		>12.360<	SW%D<5 AIIND	<1.082>	0.532	NR>BV	<1.613>	>29.032<	<4.032>	<2.903>	AIIND	<1.065>	>40.629<
PC	P-1E	17.81	Fire-impacted sediment	<0.529>	-	-	-	NR>BV	-	-	-	-	-	-	0.027
PC	P-1FW	18.51		-	SW%D<5 AIIND	0.068	0.345	NR>BV	AIIND	AIIND	AIIND	AIIND	0.087	AIIND	0.532
PC	P-1W	18.26		0.088	SW%D<5 AIIND	AIIND	0.5	<8.974>	0.677	<6.935>	0.968	AIIND	AIIND	0.139	>18.336<
PC	P-1W	18.26	Fire-impacted sediment	>1.281<	-	-	-	>11.026<	-	-	-	-	-	-	>11.026<
PC	P-2E	13.34		<0.185>	-	-	-	-	-	-	-	-	-	-	-
PC	P-2W	14.61		>1.810<	SW%D<5 AIIND	AIIND	0.25	NR>BV	-	-	-	-	AIIND	-	0.25
PC	P-2W	14.61	Fire-impacted sediment	<0.662>	-	-	-	NR>BV	-	-	-	-	-	-	-

Table E-1.0-11 (continued)

Canyon	Reach	Distance to Rio Grande (km)	Status	Total Radionuclides HI	Aroclor-1248	Aroclor-1254	Aroclor-1260	Arsenic	Benz(a)anthracene	Benzo(a)pyrene	Benzo(b)fluoranthene	Dibenz(a,h)anthracene	Dieldrin	Indeno(1,2,3-cd)pyrene	Total Cancer HI
BVs								3.98							
Max HQ					23.182	28.182	15	18.205	9.032	95.161	10.806	2.903	1.683	6.129	
SALs					0.22	0.22	0.22	0.39	0.62	0.062	0.62	0.062	0.03	0.62	
PC	P-3E	10.42		<0.182>	-	-	-	-	-	-	-	-	-	-	-
PC	P-3E	10.42	Fire-impacted sediment	<0.370>	-	-	-	>11.026<	-	-	-	-	-	-	>11.026<
PC	P-3W	11.4		>1.152<	SW%D<5 AIIND	AIIND	AIIND	NR>BV	-	-	-	-	AIIND	-	-
PC	P-3W	11.4	Fire-impacted sediment	<0.397>	-	-	-	NR>BV	-	-	-	-	-	-	-
PC	P-4E	8.6		<0.573>	SW%D<5 AIIND	AIIND	AIIND	AIIND	0.056	AIIND	AIIND	AIIND	AIIND	AIIND	0.057
PC	P-4E	8.6	Fire-impacted sediment	<0.764>	-	-	-	>13.846<	-	-	-	-	-	-	>13.846<
PC	P-4W	9.49		>3.941<	SW%D<5 AIIND	AIIND	AIIND	>13.077<	0.982	>10.887<	<1.468>	AIIND	AIIND	0.734	>27.245<
PC	WC	17.77		-	SW%D<5 AIIND	AIIND	AIIND	NR>BV	AIIND	AIIND	AIIND	AIIND	AIIND	AIIND	0.005

- Notes: 1. Units are mg/kg for organic and inorganic chemicals and pCi/g for radionuclides.
2. <#> = HQ > 0.1 for non-carcinogens/radionuclides. HQ > 1 for carcinogens.
3. >#< = HQ > 1 for non-carcinogens/ radionuclides. HQ > 10 for carcinogens.
4. - = No data.
5. AIIND = Analyte never detected.
6. NBV-NDR = No BV, no detected result (inorganic chemicals and radionuclides). Not a COPC.
7. NDR>BV = No detected result > BV (radionuclides). Not a COPC.
8. NR>BV = No result > BV (inorganic chemicals). Not a COPC.
9. SW%D<5 = % detection in the subwatershed < 5%. Not a COPC.

Table E-1.0-12
Sediment: Tier 1 Human Health COPCs

Canyon	Reach	Distance to Rio Grande (km)	Status	Aluminum	Barium	Cadmium	Iron	Lead	Manganese	Mercury	Thallium	Uranium	Total Noncancer HI	Americium-241
Max HQ				0.455	0.106		1.591	0.39	0.282	0.121	1.098	0.707		2.256
SAL				74000	5200	70	23000	400	7800	23	6.1	16		39
Baseline	Baseline		Fire-impacted sediment	<0.455>	<0.106>	N	<0.680>	<0.120>	<0.282>	NR>BV	<0.115>	NR>BV	>2.002<	N
Baseline	Garcia Cyn		Fire-impacted sediment	NR>BV	N	NR>BV	NR>BV	N	N	NR>BV	NR>BV	NR>BV	N	NDR>BV AIIND
Baseline	Guaje Cyn		Fire-impacted sediment	NR>BV	N	N	NR>BV	N	N	NR>BV	NR>BV AIIND	-	N	NDR>BV AIIND
Baseline	Rendija Cyn		Fire-impacted sediment	NR>BV	N	NR>BV	NR>BV	N	N	NR>BV	NR>BV AIIND	-	N	NDR>BV AIIND
DPC	DP-1C	16.29		NR>BV	NR>BV	N	NR>BV	N	N	N	N	NR>BV	N	N
DPC	DP-1E	15.47		NR>BV	NR>BV	NR>BV	NR>BV	N	NR>BV	NR>BV	AIIND	NR>BV	N	NDR>BV AIIND
DPC	DP-1W	16.39		NR>BV	N	NR>BV	NR>BV	N	NR>BV	N	AIIND	NR>BV	N	N
DPC	DP-2	14.69		NR>BV	NR>BV	N	NR>BV	N	N	NR>BV	N	NR>BV	N	<0.472>
DPC	DP-3	13.85		NR>BV	NR>BV	N	NR>BV	N	NR>BV	NR>BV	AIIND	NR>BV	N	>1.821<
DPC	DP-4	13.12		NR>BV	NR>BV	NR>BV AIIND	NR>BV	N	NR>BV	NR>BV	NR>BV AIIND	NR>BV	N	<0.838>
DPC	DPTF	16.29		NR>BV	NR>BV	NR>BV	NR>BV	N	NR>BV	NR>BV AIIND	NR>BV AIIND	-	N	-
LAC	LA-0	19.5		-	-	-	-	-	-	-	-	-	N	-
LAC	LA-1C	15.66		NR>BV	N	AIIND	NR>BV	N	NR>BV	N	NR>BV AIIND	NR>BV	N	N
LAC	LA-1E	14.81		NR>BV	NR>BV	N	NR>BV	N	NR>BV	NR>BV	NR>BV AIIND	NR>BV	N	N
LAC	LA-1FW	18.36		NR>BV	NR>BV	NR>BV AIIND	NR>BV	N	NR>BV	NR>BV	NR>BV AIIND	NR>BV	N	NDR>BV
LAC	LA-1W	17.18		NR>BV	NR>BV	AIIND	NR>BV	N	NR>BV	N	NR>BV AIIND	NR>BV	N	N

Table E-1.0-12 (continued)

Canyon	Reach	Distance to Rio Grande (km)	Status	Aluminum	Barium	Cadmium	Iron	Lead	Manganese	Mercury	Thallium	Uranium	Total Noncancer HI	Americium-241
Max HQ				0.455	0.106		1.591	0.39	0.282	0.121	1.098	0.707		2.256
SAL				74000	5200	70	23000	400	7800	23	6.1	16		39
LAC	LA-1W+	17.47		NR>BV	NR>BV	NR>BV AIIND	NR>BV	N	NR>BV	NR>BV	NR>BV AIIND	NR>BV	N	-
LAC	LA-2E	12.55		NR>BV	N	N	NR>BV	N	NR>BV	N	NR>BV AIIND	N	N	<0.718>
LAC	LA-2FE	11.22		NR>BV	NR>BV	NR>BV	NR>BV	N	NR>BV	N	NR>BV AIIND	NR>BV	N	<0.469>
LAC	LA-2W	13		NR>BV	NR>BV	N	NR>BV	N	NR>BV	N	NR>BV	N	N	N
LAC	LA-3E	8.75		NR>BV	NR>BV	AIIND	NR>BV	N	NR>BV	N	NR>BV AIIND	NR>BV	N	<0.303>
LAC	LA-3FE	8.85	Fire-impacted sediment	NR>BV	N	N	<0.696>	<0.133>	<0.269>	NR>BV	N	NR>BV	>1.324<	N
LAC	LA-3W	10.48		NR>BV	NR>BV	NR>BV	NR>BV	N	NR>BV	NR>BV	NR>BV AIIND	NR>BV	N	<0.121>
LAC	LA-4E	5.03		NR>BV	NR>BV	AIIND	NR>BV	NR>BV	NR>BV	NR>BV	AIIND	-	-	N
LAC	LA-4FE	4.29	Fire-impacted sediment	NR>BV	N	NR>BV	NR>BV	N	N	NR>BV	NR>BV AIIND	-	N	N
LAC	LA-4W	6.04		NR>BV	NR>BV	N	NR>BV	N	NR>BV	NR>BV	NR>BV AIIND	-	N	<0.119>
LAC	LA-5	0.88		NR>BV	NR>BV	NR>BV AIIND	NR>BV	N	NR>BV	NR>BV AIIND	NR>BV AIIND	NR>BV	N	N
LAC	LA-5E	0.09	Fire-impacted sediment	NR>BV	N	N	NR>BV	N	N	NR>BV	NR>BV AIIND	NR>BV	N	NDR>BV AIIND
PC	AC-1	19.08		NR>BV	N	NR>BV	NR>BV	N	NR>BV	NR>BV	NR>BV	NR>BV	N	NDR>BV AIIND
PC	AC-2	18.77		NR>BV	NR>BV	NR>BV	NR>BV	N	N	NR>BV	NR>BV	NR>BV	N	N
PC	AC-3	18.27		NR>BV	NR>BV	N	NR>BV	N	N	N	NR>BV	NR>BV	N	>2.256<
PC	ACS	18.62		NR>BV	N	N	NR>BV	<0.390>	NR>BV	<0.121>	NR>BV	<0.707>	>1.330<	<0.256>
PC	P-1E	17.81		NR>BV	N	N	NR>BV	N	N	N	NR>BV AIIND	NR>BV	N	<0.274>

Table E-1.0-12 (continued)

Canyon	Reach	Distance to Rio Grande (km)	Status	Aluminum	Barium	Cadmium	Iron	Lead	Manganese	Mercury	Thallium	Uranium	Total Noncancer HI	Americium-241
Max HQ				0.455	0.106		1.591	0.39	0.282	0.121	1.098	0.707		2.256
SAL				74000	5200	70	23000	400	7800	23	6.1	16		39
PC	P-1E	17.81	Fire-impacted sediment	NR>BV	N	N	NR>BV	N	N	N	NR>BV AIIND	-	N	AIIND
PC	P-1FW	18.51		NR>BV	NR>BV	NR>BV AIIND	NR>BV	N	N	NR>BV	N	-	N	-
PC	P-1W	18.26		NR>BV	N	N	NR>BV	N	N	N	NR>BV	NR>BV	N	NDR>BV AIIND
PC	P-1W	18.26	Fire-impacted sediment	NR>BV	N	N	NR>BV	N	N	N	NR>BV AIIND	-	N	NDR>BV AIIND
PC	P-2E	13.34		-	-	-	-	-	-	-	-	-	-	-
PC	P-2W	14.61		NR>BV	N	AIIND	NR>BV	N	N	N	AIIND	-	N	N
PC	P-2W	14.61	Fire-impacted sediment	NR>BV	N	N	NR>BV	N	N	N	N	-	N	N
PC	P-3E	10.42		-	-	-	-	-	-	-	-	-	-	-
PC	P-3E	10.42	Fire-impacted sediment	NR>BV	N	NR>BV	NR>BV	N	N	NR>BV	NR>BV AIIND	-	N	NDR>BV AIIND
PC	P-3W	11.4		NR>BV	N	AIIND	NR>BV	N	N	AIIND	AIIND	-	N	AIIND
PC	P-3W	11.4	Fire-impacted sediment	NR>BV	N	N	NR>BV	N	N	N	N	-	N	N
PC	P-4E	8.6		NR>BV	N	N	>1.591<	N	<0.132>	NR>BV	>1.098<	-	>2.959<	NDR>BV AIIND
PC	P-4E	8.6	Fire-impacted sediment	NR>BV	N	N	<0.696>	N	<0.167>	NR>BV	AIIND	-	>1.122<	NDR>BV AIIND
PC	P-4W	9.49		<0.249>	N	N	<0.670>	N	NR>BV	N	AIIND	-	>1.117<	N
PC	WC	17.77		NR>BV	NR>BV	NR>BV AIIND	NR>BV	N	NR>BV	NR>BV	N	-	N	-

Table E-1.0-12 (continued)

Canyon	Reach	Distance to Rio Grande (km)	Status	Cesium-137	Cobalt-60	Europium-152	Plutonium-238	Plutonium-239,240	Strontium-90	Thorium-228	Thorium-230	Thorium-232	Uranium-234	Uranium-238
Max HQ				36.226	0.172	0.182		11.409	5.754	1.45	0.522	0.528	0.148	
SAL				5.3	1.2	2.7	49	44	5.7	2	5	5	63	86
Baseline	Baseline		Fire-impacted sediment	>1.558<	NBV-NDR AIIND	NBV-NDR AIIND	N	N	<0.351>	NDR>BV	NDR>BV	NDR>BV	NDR>BV	N
Baseline	Garcia Cyn		Fire-impacted sediment	<0.823>	NBV-NDR AIIND	NBV-NDR AIIND	NDR>BV AIIND	N	<0.258>	-	-	-	NDR>BV	NDR>BV
Baseline	Guaje Cyn		Fire-impacted sediment	>1.174<	NBV-NDR AIIND	NBV-NDR AIIND	NDR>BV AIIND	N	<0.219>	-	-	-	-	-
Baseline	Rendija Cyn		Fire-impacted sediment	<0.885>	NBV-NDR AIIND	NBV-NDR AIIND	NDR>BV AIIND	N	<0.189>	-	-	-	-	-
DPC	DP-1C	16.29		NDR>BV	NBV-NDR AIIND	NBV-NDR AIIND	NDR>BV AIIND	NDR>BV	NDR>BV AIIND	-	-	-	NDR>BV	NDR>BV
DPC	DP-1E	15.47		NDR>BV	NBV-NDR AIIND	NBV-NDR AIIND	NDR>BV AIIND	N	NDR>BV AIIND	-	-	-	NDR>BV	NDR>BV
DPC	DP-1W	16.39		NDR>BV	NBV-NDR AIIND	NBV-NDR AIIND	NDR>BV AIIND	NDR>BV	NDR>BV AIIND	-	-	-	NDR>BV	NDR>BV
DPC	DP-2	14.69		>34.340<	NBV-NDR AIIND	NBV-NDR AIIND	N	<0.253>	>5.754<	-	-	-	NDR>BV	NDR>BV
DPC	DP-3	13.85		>36.226<	NBV-NDR AIIND	NBV-NDR AIIND	N	<0.255>	>3.000<	-	-	-	NDR>BV	NDR>BV
DPC	DP-4	13.12		>28.113<	NBV-NDR AIIND	NBV-NDR AIIND	N	>1.098<	>5.456<	NDR>BV	NDR>BV	NDR>BV	N	N
DPC	DPTF	16.29		-	-	-	-	-	-	-	-	-	-	-
LAC	LA-0	19.5		-	-	-	-	-	-	-	-	-	-	-
LAC	LA-1C	15.66		NDR>BV	NBV-NDR AIIND	NBV-NDR AIIND	N	N	NDR>BV AIIND	-	-	-	NDR>BV	NDR>BV
LAC	LA-1E	14.81		<0.547>	NBV-NDR AIIND	NBV-NDR AIIND	N	<0.439>	-	-	-	-	NDR>BV	N
LAC	LA-1FW	18.36		NDR>BV AIIND	NBV-NDR AIIND	NBV-NDR AIIND	NDR>BV AIIND	NDR>BV	-	-	-	-	NDR>BV	NDR>BV
LAC	LA-1W	17.18		NDR>BV	NBV-NDR AIIND	NBV-NDR AIIND	N	N	-	-	-	-	NDR>BV	NDR>BV

Table E-1.0-12 (continued)

Canyon	Reach	Distance to Rio Grande (km)	Status	Cesium-137	Cobalt-60	Europium-152	Plutonium-238	Plutonium-239,240	Strontium-90	Thorium-228	Thorium-230	Thorium-232	Uranium-234	Uranium-238
Max HQ				36.226	0.172	0.182		11.409	5.754	1.45	0.522	0.528	0.148	
SAL				5.3	1.2	2.7	49	44	5.7	2	5	5	63	86
LAC	LA-1W+	17.47		-	-	-	NDR>BV AIIND	N	-	-	-	-	NDR>BV	NDR>BV
LAC	LA-2E	12.55		>7.170<	N	<0.176>	N	<0.145>	>1.211<	NDR>BV	<0.488>	NDR>BV	NDR>BV	N
LAC	LA-2FE	11.22		>21.509<	NBV-NDR AIIND	NBV-NDR AIIND	N	<0.352>	>3.614<	NDR>BV	NDR>BV	NDR>BV	NDR>BV	NDR>BV
LAC	LA-2W	13		<0.302>	NBV-NDR AIIND	NBV-NDR AIIND	N	<0.241>	<0.649>	NDR>BV	NDR>BV	NDR>BV	N	N
LAC	LA-3E	8.75		>2.604<	<0.172>	<0.182>	N	N	>1.233<	>1.450<	<0.522>	<0.528>	NDR>BV	NDR>BV
LAC	LA-3FE	8.85	Fire-impacted sediment	<0.900>	NBV-NDR AIIND	NBV-NDR AIIND	N	N	<0.218>	-	-	-	NDR>BV	NDR>BV
LAC	LA-3W	10.48		>8.057<	NBV-NDR AIIND	NBV-NDR AIIND	N	N	>1.667<	NDR>BV	NDR>BV	NDR>BV	NDR>BV	NDR>BV
LAC	LA-4E	5.03		N	NBV-NDR AIIND	N	N	N	NDR>BV AIIND	-	-	-	-	-
LAC	LA-4FE	4.29	Fire-impacted sediment	N	NBV-NDR AIIND	NBV-NDR AIIND	N	N	NDR>BV	-	-	-	-	-
LAC	LA-4W	6.04		<0.877>	NBV-NDR AIIND	<0.129>	N	<0.314>	NDR>BV AIIND	-	-	-	-	-
LAC	LA-5	0.88		N	NBV-NDR AIIND	NBV-NDR AIIND	NDR>BV AIIND	N	NDR>BV AIIND	NDR>BV	NDR>BV	NDR>BV	NDR>BV	NDR>BV
LAC	LA-5E	0.09	Fire-impacted sediment	>1.183<	NBV-NDR AIIND	NBV-NDR AIIND	NDR>BV AIIND	N	<0.246>	-	-	-	NDR>BV	NDR>BV
PC	AC-1	19.08		N	NBV-NDR AIIND	NBV-NDR AIIND	NDR>BV AIIND	N	NDR>BV AIIND	-	-	-	NDR>BV	NDR>BV
PC	AC-2	18.77		NDR>BV	NBV-NDR AIIND	NBV-NDR AIIND	NDR>BV AIIND	N	NDR>BV AIIND	-	-	-	NDR>BV	NDR>BV
PC	AC-3	18.27		>6.132<	NBV-NDR AIIND	NBV-NDR AIIND	N	>10.841<	>5.351<	NDR>BV	NDR>BV	NDR>BV	N	NDR>BV
PC	ACS	18.62		>1.215<	NBV-NDR AIIND	NBV-NDR AIIND	N	>7.909<	<0.251>	-	-	-	<0.148>	N
PC	P-1E	17.81		<0.289>	NBV-NDR AIIND	N	N	>11.409<	<0.246>	NDR>BV	NDR>BV	NDR>BV	NDR>BV	NDR>BV

Table E-1.0-12 (continued)

Canyon	Reach	Distance to Rio Grande (km)	Status	Cesium-137	Cobalt-60	Europium-152	Plutonium-238	Plutonium-239,240	Strontium-90	Thorium-228	Thorium-230	Thorium-232	Uranium-234	Uranium-238
Max HQ				36.226	0.172	0.182		11.409	5.754	1.45	0.522	0.528	0.148	
SAL				5.3	1.2	2.7	49	44	5.7	2	5	5	63	86
PC	P-1E	17.81	Fire-impacted sediment	N	NBV-NDR AIIND	AIIND	N	N	N	-	-	-	-	-
PC	P-1FW	18.51		-	-	-	-	-	-	-	-	-	-	-
PC	P-1W	18.26		N	NBV-NDR AIIND	NBV-NDR AIIND	NDR>BV AIIND	N	AIIND	NDR>BV	NDR>BV	NDR>BV	NDR>BV	NDR>BV
PC	P-1W	18.26	Fire-impacted sediment	>1.068<	NBV-NDR AIIND	NBV-NDR AIIND	NDR>BV AIIND	N	<0.204>	-	-	-	-	-
PC	P-2E	13.34		-	-	-	N	N	-	-	-	-	-	-
PC	P-2W	14.61		<0.106>	NBV-NDR AIIND	NBV-NDR AIIND	N	>1.668<	-	-	-	-	-	-
PC	P-2W	14.61	Fire-impacted sediment	N	NBV-NDR AIIND	NBV-NDR AIIND	AIIND	N	N	-	-	-	-	-
PC	P-3E	10.42		-	-	-	N	N	-	-	-	-	-	-
PC	P-3E	10.42	Fire-impacted sediment	N	NBV-NDR AIIND	NBV-NDR AIIND	AIIND	N	NDR>BV	-	-	-	-	-
PC	P-3W	11.4		<0.128>	NBV-NDR AIIND	NBV-NDR AIIND	N	>1.020<	-	-	-	-	-	-
PC	P-3W	11.4	Fire-impacted sediment	N	NBV-NDR AIIND	NBV-NDR AIIND	AIIND	N	NDR>BV	-	-	-	-	-
PC	P-4E	8.6		N	NBV-NDR AIIND	NBV-NDR AIIND	NDR>BV AIIND	N	AIIND	NDR>BV	NDR>BV	NDR>BV	NR>BV	NR>BV
PC	P-4E	8.6	Fire-impacted sediment	N	NBV-NDR AIIND	NBV-NDR AIIND	NDR>BV AIIND	N	N	-	-	-	-	-
PC	P-4W	9.49		NDR>BV	NBV-NDR AIIND	NBV-NDR AIIND	N	>3.875<	NDR>BV AIIND	NDR>BV	NDR>BV	NDR>BV	NR>BV	NR>BV
PC	WC	17.77		-	-	-	-	-	-	-	-	-	-	-

Table E-1.0-12 (continued)

Canyon	Reach	Distance to Rio Grande (km)	Status	Total Radionuclides HI	Aroclor-1248	Aroclor-1254	Aroclor-1260	Arsenic	Benz(a)anthracene	Benzo(a)pyrene	Benzo(b)fluoranthene	Dibenz(a,h)anthracene	Dieldrin	Indeno(1,2,3-cd)pyrene	Total Cancer HI
Max HQ						28.182	4.545	15.385	9.032	95.161	10.806	2.903	1.683	6.129	
SAL					0.22	0.22	0.22	0.39	0.62	0.062	0.62	0.062	0.03	0.62	
Baseline	Baseline		Fire-impacted sediment	>1.949<	SW%D<5 AIIND	SW%D<5 AIIND	SW%D<5 AIIND	>12.051<	SW%D<5 AIIND	SW%D<5 AIIND	SW%D<5 AIIND	SW%D<5 AIIND	SW%D<5 AIIND	SW%D<5 AIIND	>12.156<
Baseline	Garcia Cyn		Fire-impacted sediment	>1.085<	-	-	-	>13.846<	-	-	-	-	-	-	>13.846<
Baseline	Guaje Cyn		Fire-impacted sediment	>1.398<	-	-	-	>10.769<	-	-	-	-	-	-	>10.769<
Baseline	Rendija Cyn		Fire-impacted sediment	>1.082<	-	-	-	>15.385<	SW%D<5 AIIND	SW%D<5 AIIND	SW%D<5 AIIND	SW%D<5 AIIND	-	SW%D<5 AIIND	>15.385<
DPC	DP-1C	16.29		N	SW%D<5 AIIND	SW%D<5 AIIND	<4.545>	NR>BV	<1.935>	>12.097<	<2.742>	SW%D<5 AIIND	-	AIIND	>21.498<
DPC	DP-1E	15.47		N	SW%D<5 AIIND	SW%D<5 AIIND	N	NR>BV	<1.548>	>13.387<	<1.935>	SW%D<5 AIIND	-	N	>17.823<
DPC	DP-1W	16.39		N	SW%D<5 AIIND	SW%D<5 AIIND	AIIND	NR>BV	<4.839>	>51.613<	<6.129>	SW%D<5 AIIND	SW%D<5 AIIND	<6.129>	>69.469<
DPC	DP-2	14.69		>40.840<	SW%D<5 AIIND	SW%D<5 AIIND	N	NR>BV	<1.242>	>11.613<	<1.613>	SW%D<5 AIIND	SW%D<5 AIIND	N	>16.481<
DPC	DP-3	13.85		>41.359<	SW%D<5 AIIND	SW%D<5 AIIND	N	NR>BV	<1.065>	>11.613<	<2.097>	SW%D<5 AIIND	SW%D<5 AIIND	N	>15.746<
DPC	DP-4	13.12		>35.604<	SW%D<5 AIIND	SW%D<5 AIIND	N	NR>BV	N	N	N	SW%D<5 AIIND	SW%D<5 AIIND	N	N
DPC	DPTF	16.29		-	-	-	-	NR>BV	AIIND	AIIND	AIIND	SW%D<5 AIIND	-	AIIND	-
LAC	LA-0	19.5		-	SW%D<5 AIIND	AIIND	N	-	N	N	N	SW%D<5 AIIND	AIIND	AIIND	N
LAC	LA-1C	15.66		N	SW%D<5 AIIND	<2.136>	<3.909>	NR>BV	N	<3.548>	N	SW%D<5 AIIND	N	N	>11.834<
LAC	LA-1E	14.81		>1.020<	SW%D<5 AIIND	AIIND	N	NR>BV	N	N	N	SW%D<5 AIIND	N	N	N

Table E-1.0-12 (continued)

Canyon	Reach	Distance to Rio Grande (km)	Status	Total Radionuclides HI	Aroclor-1248	Aroclor-1254	Aroclor-1260	Arsenic	Benz(a)anthracene	Benzo(a)pyrene	Benzo(b)fluoranthene	Dibenz(a,h)anthracene	Dieldrin	Indeno(1,2,3-cd)pyrene	Total Cancer HI
Max HQ						28.182	4.545	15.385	9.032	95.161	10.806	2.903	1.683	6.129	
SAL					0.22	0.22	0.22	0.39	0.62	0.062	0.62	0.062	0.03	0.62	
LAC	LA-1FW	18.36		-	SW%D<5 AIIND	AIIND	N	NR>BV	N	N	N	SW%D<5 AIIND	N	AIIND	N
LAC	LA-1W	17.18		N	SW%D<5 AIIND	N	N	NR>BV	N	N	AIIND	SW%D<5 AIIND	AIIND	AIIND	N
LAC	LA-1W+	17.47		N	SW%D<5 AIIND	N	N	NR>BV	N	N	N	SW%D<5 AIIND	AIIND	N	N
LAC	LA-2E	12.55		>10.070<	SW%D<5 AIIND	AIIND	<1.045>	<6.923>	N	>10.565<	<1.065>	SW%D<5	AIIND	N	>20.841<
LAC	LA-2FE	11.22		>25.963<	SW%D<5 AIIND	AIIND	N	NR>BV	N	N	N	SW%D<5 AIIND	N	N	N
LAC	LA-2W	13		>1.267<	SW%D<5 AIIND	AIIND	N	NR>BV	N	N	N	SW%D<5 AIIND	AIIND	N	N
LAC	LA-3E	8.75		>7.082<	SW%D<5 AIIND	AIIND	N	NR>BV	N	N	N	SW%D<5 AIIND	AIIND	N	N
LAC	LA-3FE	8.85	Fire-impacted sediment	>1.171<	-	-	-	>12.821<	N	<4.194>	N	SW%D<5 AIIND	-	AIIND	>18.040<
LAC	LA-3W	10.48		>9.914<	SW%D<5 AIIND	AIIND	N	NR>BV	N	N	N	SW%D<5 AIIND	N	N	N
LAC	LA-4E	5.03		N	SW%D<5 AIIND	SW%D<5 AIIND	SW%D<5 AIIND	NR>BV	-	-	-	-	SW%D<5 AIIND	-	-
LAC	LA-4FE	4.29	Fire-impacted sediment	N	-	-	-	NR>BV	N	SW%D<5 AIIND	SW%D<5 AIIND	SW%D<5 AIIND	-	SW%D<5 AIIND	N
LAC	LA-4W	6.04		>1.444<	SW%D<5 AIIND	SW%D<5 AIIND	SW%D<5 AIIND	NR>BV	-	-	-	-	SW%D<5 AIIND	-	N
LAC	LA-5	0.88		N	SW%D<5 AIIND	SW%D<5 AIIND	SW%D<5 AIIND	NR>BV AIIND	AIIND	SW%D<5 AIIND	SW%D<5 AIIND	SW%D<5 AIIND	SW%D<5 AIIND	SW%D<5 AIIND	N
LAC	LA-5E	0.09	Fire-impacted sediment	>1.465<	-	-	-	NR>BV	-	-	-	-	-	-	-
PC	AC-1	19.08		N	AIIND	AIIND	N	>10.513<	<9.032>	>95.161<	>10.806<	SW%D<5	N	<3.387>	>131.410<

Table E-1.0-12 (continued)

Canyon	Reach	Distance to Rio Grande (km)	Status	Total Radionuclides HI	Aroclor-1248	Aroclor-1254	Aroclor-1260	Arsenic	Benz(a)anthracene	Benzo(a)pyrene	Benzo(b)fluoranthene	Dibenz(a,h)anthracene	Dieldrin	Indeno(1,2,3-cd)pyrene	Total Cancer HI
Max HQ						28.182	4.545	15.385	9.032	95.161	10.806	2.903	1.683	6.129	
SAL					0.22	0.22	0.22	0.39	0.62	0.062	0.62	0.062	0.03	0.62	
PC	AC-2	18.77		N	AIIND	AIIND	N	>13.077<	<4.194>	>48.387<	<8.548>	SW%D<5 AIIND	AIIND	<1.935>	>76.898<
PC	AC-3	18.27		>24.699<	AIIND	>28.182<	N	NR>BV	<2.903>	>24.194<	<4.677>	SW%D<5 AIIND	AIIND	N	>61.612<
PC	ACS	18.62		>9.910<	AIIND	<3.300>	N	<7.179>	N	<2.742>	N	SW%D<5 AIIND	<1.683>	N	>16.665<
PC	P-1E	17.81		>12.360<	SW%D<5 AIIND	<1.082>	N	NR>BV	<1.613>	>29.032<	<4.032>	<2.903>	AIIND	<1.065>	>40.629<
PC	P-1E	17.81	Fire-impacted sediment	N	-	-	-	NR>BV	-	-	-	-	-	-	N
PC	P-1FW	18.51		-	SW%D<5 AIIND	N	N	NR>BV	AIIND	AIIND	AIIND	AIIND	N	AIIND	N
PC	P-1W	18.26		N	SW%D<5 AIIND	AIIND	N	<8.974>	N	<6.935>	N	AIIND	AIIND	N	>18.336<
PC	P-1W	18.26	Fire-impacted sediment	>1.281<	-	-	-	>11.026<	-	-	-	-	-	-	>11.026<
PC	P-2E	13.34		N	-	-	-	-	-	-	-	-	-	-	-
PC	P-2W	14.61		>1.810<	SW%D<5 AIIND	AIIND	N	NR>BV	-	-	-	-	AIIND	-	N
PC	P-2W	14.61	Fire-impacted sediment	N	-	-	-	NR>BV	-	-	-	-	-	-	-
PC	P-3E	10.42		N	-	-	-	-	-	-	-	-	-	-	-
PC	P-3E	10.42	Fire-impacted sediment	N	-	-	-	>11.026<	-	-	-	-	-	-	>11.026<
PC	P-3W	11.4		>1.152<	SW%D<5 AIIND	AIIND	AIIND	NR>BV	-	-	-	-	AIIND	-	-
PC	P-3W	11.4	Fire-impacted sediment	N	-	-	-	NR>BV	-	-	-	-	-	-	-

Table E-1.0-12 (continued)

Canyon	Reach	Distance to Rio Grande (km)	Status	Total Radionuclides HI	Aroclor-1248	Aroclor-1254	Aroclor-1260	Arsenic	Benz(a)anthracene	Benzo(a)pyrene	Benzo(b)fluoranthene	Dibenz(a,h)anthracene	Dieldrin	Indeno(1,2,3-cd)pyrene	Total Cancer HI
Max HQ						28.182	4.545	15.385	9.032	95.161	10.806	2.903	1.683	6.129	
SAL					0.22	0.22	0.22	0.39	0.62	0.062	0.62	0.062	0.03	0.62	
PC	P-4E	8.6		N	SW%D<5 AIIND	AIIND	AIIND	AIIND	N	AIIND	AIIND	AIIND	AIIND	AIIND	N
PC	P-4E	8.6	Fire-impacted sediment	N	-	-	-	>13.846<	-	-	-	-	-	-	>13.846<
PC	P-4W	9.49		>3.941<	SW%D<5 AIIND	AIIND	AIIND	>13.077<	N	>10.887<	<1.468>	AIIND	AIIND	N	>27.245<
PC	WC	17.77		-	SW%D<5 AIIND	AIIND	AIIND	NR>BV	AIIND	AIIND	AIIND	AIIND	AIIND	AIIND	N

- Notes: 1. Units are mg/kg for organic and inorganic chemicals and pCi/g for radionuclides.
2. <#> = Retained as Tier 1 COPC.
3. >#< = Retained as Tier 1 COPC.
4. - = No data.
5. AIIND = Analyte never detected.
6. N = Analyte eliminated as a Tier 1 COPC.
7. NBV-NDR = No BV, no detected result (inorganic chemicals and radionuclides). Not a COPC.
8. NDR>BV = No detected result > BV (radionuclides). Not a COPC.
9. NR>BV = No result > BV (inorganic chemicals). Not a COPC.
10. SW%D<5 = % detection in the subwatershed < 5%. Not a COPC.

Table E-1.0-13
Sediment: Tier 2 Human Health Screening Summary

Canyon	Reach	Distance to Rio Grande (km)	Status	Aluminum	Barium	Iron	Lead	Manganese	Mercury	Thallium	Uranium	Total Noncancer HI	Americium-241
BVs				15400	127	13800	19.7	543	0.1	0.73	6.99		0.04
SALs				74000	5200	23000	400	7800	23	6.1	16		39
Max HQ				0.249	0.049	1.591	0.244	0.159	0.073	1.098	0.399		2.256
Baseline	Baseline		Fire-impacted sediment	<0.200>	0.049	<0.487>	0.075	<0.154>	NR>BV	0.055	NR>BV	>1.019<	N
Baseline	Garcia Cyn		Fire-impacted sediment	NR>BV	N	NR>BV	N	N	NR>BV	NR>BV	NR>BV	-	NDR>BV AIIND
Baseline	Guaje Cyn		Fire-impacted sediment	NR>BV	N	NR>BV	N	N	NR>BV	NR>BV AIIND	-	-	NDR>BV AIIND
Baseline	Rendija Cyn		Fire-impacted sediment	NR>BV	N	NR>BV	N	N	NR>BV	NR>BV AIIND	-	-	NDR>BV AIIND
DPC	DP-1C	16.29		NR>BV	NR>BV	NR>BV	N	N	N	N	NR>BV	-	N
DPC	DP-1E	15.47		NR>BV	NR>BV	NR>BV	N	NR>BV	NR>BV	AIIND	NR>BV	-	NDR>BV AIIND
DPC	DP-1W	16.39		NR>BV	N	NR>BV	N	NR>BV	N	AIIND	NR>BV	-	N
DPC	DP-2	14.69		NR>BV	NR>BV	NR>BV	N	N	NR>BV	N	NR>BV	-	<0.192>
DPC	DP-3	13.85		NR>BV	NR>BV	NR>BV	N	NR>BV	NR>BV	AIIND	NR>BV	-	<0.708>
DPC	DP-4	13.12		NR>BV	NR>BV	NR>BV	N	NR>BV	NR>BV	NR>BV AIIND	NR>BV	-	<0.838>
LAC	LA-1C	15.66		NR>BV	N	NR>BV	N	NR>BV	N	NR>BV AIIND	NR>BV	-	N
LAC	LA-1E	14.81		NR>BV	NR>BV	NR>BV	N	NR>BV	NR>BV	NR>BV AIIND	NR>BV	-	N
LAC	LA-2E	12.55		NR>BV	N	NR>BV	N	NR>BV	N	NR>BV AIIND	N	-	<0.259>
LAC	LA-2FE	11.22		NR>BV	NR>BV	NR>BV	N	NR>BV	N	NR>BV AIIND	NR>BV	-	0.083
LAC	LA-2W	13		NR>BV	NR>BV	NR>BV	N	NR>BV	N	NR>BV	N	-	N
LAC	LA-3E	8.75		NR>BV	NR>BV	NR>BV	N	NR>BV	N	NR>BV AIIND	NR>BV	-	0.082

Table E-1.0-13 (continued)

Canyon	Reach	Distance to Rio Grande (km)	Status	Aluminum	Barium	Iron	Lead	Manganese	Mercury	Thallium	Uranium	Total Noncancer HI	Americium-241
BVs				15400	127	13800	19.7	543	0.1	0.73	6.99		0.04
SALs				74000	5200	23000	400	7800	23	6.1	16		39
Max HQ				0.249	0.049	1.591	0.244	0.159	0.073	1.098	0.399		2.256
LAC	LA-3FE	8.85	Fire-impacted sediment	NR>BV	N	<0.591>	0.089	<0.159>	NR>BV	N	NR>BV	<0.840>	N
LAC	LA-3W	10.48		NR>BV	NR>BV	NR>BV	N	NR>BV	NR>BV	NR>BV AIIND	NR>BV	-	0.068
LAC	LA-4W	6.04		NR>BV	NR>BV	NR>BV	N	NR>BV	NR>BV	NR>BV AIIND	-	-	0.023
LAC	LA-5E	0.09	Fire-impacted sediment	NR>BV	N	NR>BV	N	N	NR>BV	NR>BV AIIND	NR>BV	-	NDR>BV AIIND
PC	AC-1	19.08		NR>BV	N	NR>BV	N	NR>BV	NR>BV	NR>BV	NR>BV	-	NDR>BV AIIND
PC	AC-2	18.77		NR>BV	NR>BV	NR>BV	N	N	NR>BV	NR>BV	NR>BV	-	N
PC	AC-3	18.27		NR>BV	NR>BV	NR>BV	N	N	N	NR>BV	NR>BV	-	>2.256<
PC	ACS	18.62		NR>BV	N	NR>BV	<0.244>	NR>BV	0.073	NR>BV	<0.399>	<0.716>	<0.108>
PC	P-1E	17.81		NR>BV	N	NR>BV	N	N	N	NR>BV AIIND	NR>BV	-	<0.274>
PC	P-1W	18.26		NR>BV	N	NR>BV	N	N	N	NR>BV	NR>BV	-	NDR>BV AIIND
PC	P-1W	18.26	Fire-impacted sediment	NR>BV	N	NR>BV	N	N	N	NR>BV AIIND	-	-	NDR>BV AIIND
PC	P-2W	14.61		NR>BV	N	NR>BV	N	N	N	AIIND	-	-	N
PC	P-3E	10.42	Fire-impacted sediment	NR>BV	N	NR>BV	N	N	NR>BV	NR>BV AIIND	-	-	NDR>BV AIIND
PC	P-3W	11.4		NR>BV	N	NR>BV	N	N	AIIND	AIIND	-	-	AIIND
PC	P-4E	8.6		NR>BV	N	>1.591<	N	<0.132>	NR>BV	>1.098<	-	>2.822<	NDR>BV AIIND
PC	P-4E	8.6	Fire-impacted sediment	NR>BV	N	<0.561>	N	<0.136>	NR>BV	AIIND	-	<0.697>	NDR>BV AIIND
PC	P-4W	9.49		<0.249>	N	<0.522>	N	NR>BV	N	AIIND	-	<0.770>	N

Table E-1.0-13 (continued)

Canyon	Reach	Distance to Rio Grande (km)	Status	Cesium-137	Cobalt-60	Europium-152	Plutonium-239,240	Strontium-90	Thorium-228	Thorium-230	Thorium-232	Uranium-234	Total Radionuclides HI
BVs				0.9			0.068	1.04	2.28	2.29	2.33	2.59	
SALs				5.3	1.2	2.7	44	5.7	2	5	5	63	
Max HQ				28.113	0.063	0.29	4.227	5.456	1.26	0.442	0.482	0.103	
Baseline	Baseline		Fire-impacted sediment	>1.062<	NBV-NDR AIIND	NBV-NDR AIIND	N	<0.281>	NDR>BV	NDR>BV	NDR>BV	NDR>BV	>1.343<
Baseline	Garcia Cyn		Fire-impacted sediment	<0.823>	NBV-NDR AIIND	NBV-NDR AIIND	N	<0.258>	-	-	-	NDR>BV	>1.081<
Baseline	Guaje Cyn		Fire-impacted sediment	<0.991>	NBV-NDR AIIND	NBV-NDR AIIND	N	<0.181>	-	-	-	-	>1.171<
Baseline	Rendija Cyn		Fire-impacted sediment	<0.717>	NBV-NDR AIIND	NBV-NDR AIIND	N	<0.155>	-	-	-	-	<0.872>
DPC	DP-1C	16.29		NDR>BV	NBV-NDR AIIND	NBV-NDR AIIND	NDR>BV	NDR>BV AIIND	-	-	-	NDR>BV	-
DPC	DP-1E	15.47		NDR>BV	NBV-NDR AIIND	NBV-NDR AIIND	N	NDR>BV AIIND	-	-	-	NDR>BV	-
DPC	DP-1W	16.39		NDR>BV	NBV-NDR AIIND	NBV-NDR AIIND	NDR>BV	NDR>BV AIIND	-	-	-	NDR>BV	-
DPC	DP-2	14.69		>21.321<	NBV-NDR AIIND	NBV-NDR AIIND	<0.127>	>3.509<	-	-	-	NDR>BV	>25.148<
DPC	DP-3	13.85		>17.019<	NBV-NDR AIIND	NBV-NDR AIIND	<0.255>	>2.912<	-	-	-	NDR>BV	>20.893<
DPC	DP-4	13.12		>28.113<	NBV-NDR AIIND	NBV-NDR AIIND	<0.480>	>5.456<	NDR>BV	NDR>BV	NDR>BV	N	>34.887<
LAC	LA-1C	15.66		NDR>BV	NBV-NDR AIIND	NBV-NDR AIIND	N	NDR>BV AIIND	-	-	-	NDR>BV	-
LAC	LA-1E	14.81		<0.547>	NBV-NDR AIIND	NBV-NDR AIIND	<0.129>	-	-	-	-	NDR>BV	<0.676>
LAC	LA-2E	12.55		>4.019<	N	<0.290>	0.098	<0.609>	NDR>BV	<0.438>	NDR>BV	NDR>BV	>5.712<
LAC	LA-2FE	11.22		>9.566<	NBV-NDR AIIND	NBV-NDR AIIND	0.085	>1.693<	NDR>BV	NDR>BV	NDR>BV	NDR>BV	>11.428<
LAC	LA-2W	13		<0.279>	NBV-NDR AIIND	NBV-NDR AIIND	0.077	<0.649>	NDR>BV	NDR>BV	NDR>BV	N	>1.005<
LAC	LA-3E	8.75		>1.302<	0.063	0.056	N	<0.558>	>1.260<	<0.442>	<0.482>	NDR>BV	>4.245<

Table E-1.0-13 (continued)

Canyon	Reach	Distance to Rio Grande (km)	Status	Cesium-137	Cobalt-60	Europium-152	Plutonium-239,240	Strontium-90	Thorium-228	Thorium-230	Thorium-232	Uranium-234	Total Radionuclides HI
BVs				0.9			0.068	1.04	2.28	2.29	2.33	2.59	
SALs				5.3	1.2	2.7	44	5.7	2	5	5	63	
Max HQ				28.113	0.063	0.29	4.227	5.456	1.26	0.442	0.482	0.103	
LAC	LA-3FE	8.85	Fire-impacted sediment	<0.508>	NBV-NDR AIIND	NBV-NDR AIIND	N	<0.142>	-	-	-	NDR>BV	<0.649>
LAC	LA-3W	10.48		>4.358<	NBV-NDR AIIND	NBV-NDR AIIND	N	<0.912>	NDR>BV	NDR>BV	NDR>BV	NDR>BV	>5.338<
LAC	LA-4W	6.04		<0.283>	NBV-NDR AIIND	0.081	<0.121>	NDR>BV AIIND	-	-	-	-	<0.508>
LAC	LA-5E	0.09	Fire-impacted sediment	>1.183<	NBV-NDR AIIND	NBV-NDR AIIND	N	<0.246>	-	-	-	NDR>BV	>1.429<
PC	AC-1	19.08		N	NBV-NDR AIIND	NBV-NDR AIIND	N	NDR>BV AIIND	-	-	-	NDR>BV	-
PC	AC-2	18.77		NDR>BV	NBV-NDR AIIND	NBV-NDR AIIND	N	NDR>BV AIIND	-	-	-	NDR>BV	-
PC	AC-3	18.27		>6.132<	NBV-NDR AIIND	NBV-NDR AIIND	>3.705<	>5.351<	NDR>BV	NDR>BV	NDR>BV	N	>17.444<
PC	ACS	18.62		>1.157<	NBV-NDR AIIND	NBV-NDR AIIND	>4.227<	<0.121>	-	-	-	<0.103>	>5.716<
PC	P-1E	17.81		<0.225>	NBV-NDR AIIND	N	>1.350<	<0.221>	NDR>BV	NDR>BV	NDR>BV	NDR>BV	>2.070<
PC	P-1W	18.26	Fire-impacted sediment	<0.764>	NBV-NDR AIIND	NBV-NDR AIIND	N	<0.162>	-	-	-	-	<0.926>
PC	P-2W	14.61		0.066	NBV-NDR AIIND	NBV-NDR AIIND	<0.309>	-	-	-	-	-	<0.375>
PC	P-3E	10.42	Fire-impacted sediment	N	NBV-NDR AIIND	NBV-NDR AIIND	N	NDR>BV	-	-	-	-	-
PC	P-3W	11.4		0.066	NBV-NDR AIIND	NBV-NDR AIIND	<0.121>	-	-	-	-	-	<0.187>
PC	P-4E	8.6		N	NBV-NDR AIIND	NBV-NDR AIIND	N	AIIND	NDR>BV	NDR>BV	NDR>BV	NR>BV	-
PC	P-4E	8.6	Fire-impacted sediment	N	NBV-NDR AIIND	NBV-NDR AIIND	N	N	-	-	-	-	-
PC	P-4W	9.49		NDR>BV	NBV-NDR AIIND	NBV-NDR AIIND	<0.382>	NDR>BV AIIND	NDR>BV	NDR>BV	NDR>BV	NR>BV	<0.382>

Table E-1.0-13 (continued)

Canyon	Reach	Distance to Rio Grande (km)	Status	Aroclor-1254	Aroclor-1260	Arsenic	Benz(a)anthracene	Benzo(a)pyrene	Benzo(b)fluoranthene	Dibenz(a,h)anthracene	Dieldrin	Indeno(1,2,3-cd)pyrene	Total Cancer HI
BVs						3.98							
SALs				0.22	0.22	0.39	0.62	0.062	0.62	0.062	0.03	0.62	
Max HQ				28.182	4.545	13.846	5.661	60.484	7.694	2.903	0.573	4.984	
Baseline	Baseline		Fire-impacted sediment	SW%D<5 AIIND	SW%D<5 AIIND	<7.564>	SW%D<5 AIIND	SW%D<5 AIIND	SW%D<5 AIIND	SW%D<5 AIIND	SW%D<5 AIIND	SW%D<5 AIIND	<7.564>
Baseline	Garcia Cyn		Fire-impacted sediment	-	-	>13.846<	-	-	-	-	-	-	>13.846<
Baseline	Guaje Cyn		Fire-impacted sediment	-	-	<8.718>	-	-	-	-	-	-	<8.718>
Baseline	Rendija Cyn		Fire-impacted sediment	-	-	>11.308<	SW%D<5 AIIND	SW%D<5 AIIND	SW%D<5 AIIND	SW%D<5 AIIND	-	SW%D<5 AIIND	>11.308<
DPC	DP-1C	16.29		SW%D<5 AIIND	<4.545>	NR>BV	0.727	>12.097<	0.853	SW%D<5 AIIND	-	AIIND	>18.223<
DPC	DP-1E	15.47		SW%D<5 AIIND	N	NR>BV	<1.068>	>10.613<	<1.661>	SW%D<5 AIIND	-	N	>13.342<
DPC	DP-1W	16.39		SW%D<5 AIIND	AIIND	NR>BV	<3.806>	>36.935<	<4.468>	SW%D<5 AIIND	SW%D<5 AIIND	<4.984>	>50.194<
DPC	DP-2	14.69		SW%D<5 AIIND	N	NR>BV	0.713	<6.887>	0.953	SW%D<5 AIIND	SW%D<5 AIIND	N	<8.553>
DPC	DP-3	13.85		SW%D<5 AIIND	N	NR>BV	<1.065>	>11.613<	<1.334>	SW%D<5 AIIND	SW%D<5 AIIND	N	>14.011<
DPC	DP-4	13.12		SW%D<5 AIIND	N	NR>BV	N	N	N	SW%D<5 AIIND	SW%D<5 AIIND	N	-
LAC	LA-1C	15.66		<2.136>	<2.241>	NR>BV	N	<3.323>	N	SW%D<5 AIIND	N	N	<7.700>
LAC	LA-1E	14.81		AIIND	N	NR>BV	N	N	N	SW%D<5 AIIND	N	N	-

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Table E-1.0-13 (continued)

Canyon	Reach	Distance to Rio Grande (km)	Status	Aroclor-1254	Aroclor-1260	Arsenic	Benz(a)anthracene	Benzo(a)pyrene	Benzo(b)fluoranthene	Dibenz(a,h)anthracene	Dieldrin	Indeno(1,2,3-cd)pyrene	Total Cancer Hi
BVs						3.98							
SALs				0.22	0.22	0.39	0.62	0.062	0.62	0.062	0.03	0.62	
Max HQ				28.182	4.545	13.846	5.661	60.484	7.694	2.903	0.573	4.984	
LAC	LA-2E	12.55		AIIND	<1.045>	<6.923>	N	<7.613>	0.948	SW%D<5	AIIND	N	>16.530<
LAC	LA-2FE	11.22		AIIND	N	NR>BV	N	N	N	SW%D<5	N	N	-
LAC	LA-2W	13		AIIND	N	NR>BV	N	N	N	SW%D<5	AIIND	N	-
LAC	LA-3E	8.75		AIIND	N	NR>BV	N	N	N	SW%D<5	AIIND	N	-
LAC	LA-3FE	8.85	Fire-impacted sediment	-	-	>11.513<	N	<4.194>	N	SW%D<5	-	AIIND	>15.706<
LAC	LA-3W	10.48		AIIND	N	NR>BV	N	N	N	SW%D<5	N	N	-
LAC	LA-4W	6.04		SW%D<5	SW%D<5	NR>BV	-	-	-	-	SW%D<5	-	-
LAC	LA-5E	0.09	Fire-impacted sediment	-	-	NR>BV	-	-	-	-	-	-	-
PC	AC-1	19.08		AIIND	N	>10.513<	<5.661>	>60.484<	<7.694>	SW%D<5	N	<2.290>	>86.642<
PC	AC-2	18.77		AIIND	N	>11.795<	<3.790>	>42.097<	<7.387>	SW%D<5	AIIND	<1.726>	>66.795<
PC	AC-3	18.27		>28.182<	N	NR>BV	<2.726>	>22.258<	<4.387>	SW%D<5	AIIND	N	>57.553<
PC	ACS	18.62		<3.082>	N	<5.385>	N	<1.610>	N	SW%D<5	0.573	N	>10.649<
PC	P-1E	17.81		<1.082>	N	NR>BV	<1.134>	>29.032<	<4.032>	<2.903>	AIIND	0.839	>39.022<
PC	P-1W	18.26		AIIND	N	<7.128>	N	<6.677>	N	AIIND	AIIND	N	>13.806<

Table E-1.0-13 (continued)

Canyon	Reach	Distance to Rio Grande (km)	Status	Aroclor-1254	Aroclor-1260	Arsenic	Benz(a)anthracene	Benzo(a)pyrene	Benzo(b)fluoranthene	Dibenz(a,h)anthracene	Dieldrin	Indeno(1,2,3-cd)pyrene	Total Cancer HI
BVs						3.98							
SALs				0.22	0.22	0.39	0.62	0.062	0.62	0.062	0.03	0.62	
Max HQ				28.182	4.545	13.846	5.661	60.484	7.694	2.903	0.573	4.984	
PC	P-1W	18.26	Fire-impacted sediment	-	-	<9.513>	-	-	-	-	-	-	<9.513>
PC	P-2W	14.61		AIIND	N	NR>BV	-	-	-	-	AIIND	-	-
PC	P-3E	10.42	Fire-impacted sediment	-	-	>11.026<	-	-	-	-	-	-	>11.026<
PC	P-3W	11.4		AIIND	AIIND	NR>BV	-	-	-	-	AIIND	-	-
PC	P-4E	8.6		AIIND	AIIND	AIIND	N	AIIND	AIIND	AIIND	AIIND	AIIND	-
PC	P-4E	8.6	Fire-impacted sediment	-	-	>10.718<	-	-	-	-	-	-	>10.718<
PC	P-4W	9.49		AIIND	AIIND	>12.487<	N	>10.887<	<1.468>	AIIND	AIIND	N	>24.842<

- Notes: 1. Units are mg/kg for organic and inorganic chemicals and pCi/g for radionuclides.
2. <#> = HQ > 0.1 for non-carcinogens/radionuclides. HQ > 1 for carcinogens.
3. >#< = HQ > 1 for non-carcinogens/ radionuclides. HQ > 10 for carcinogens.
4. - = No data.
5. AIIND = Analyte never detected.
6. N = Analyte eliminated as a Tier 1 COPC.
7. NBV-NDR = No BV, no detected result (inorganic chemicals and radionuclides). Not a COPC.
8. NDR>BV = No detected result > BV (radionuclides). Not a COPC.
9. NR>BV = No result > BV (inorganic chemicals). Not a COPC.
10. SW%D<5 = % detection in the subwatershed < 5%. Not a COPC.

Table E-1.0-14
Sediment: Tier 2 Human Health COPCs

Canyon	Reach	Distance to Rio Grande (km)	Status	Aluminum	Barium	Iron	Lead	Manganese	Mercury	Thallium	Uranium	Total Noncancer HI	Americium-241
Max HQ				0.2		1.591		0.154		1.098			2.256
SAL				74000	5200	23000	400	7800	23	6.1	16		39
Baseline	Baseline		Fire-impacted sediment	<0.200>	X	<0.487>	X	<0.154>	NR>BV	X	NR>BV	>1.019<	N
Baseline	Garcia Cyn		Fire-impacted sediment	NR>BV	N	NR>BV	N	N	NR>BV	NR>BV	NR>BV	-	NDR>BV AIIND
Baseline	Guaje Cyn		Fire-impacted sediment	NR>BV	N	NR>BV	N	N	NR>BV	NR>BV AIIND	-	-	NDR>BV AIIND
Baseline	Rendija Cyn		Fire-impacted sediment	NR>BV	N	NR>BV	N	N	NR>BV	NR>BV AIIND	-	-	NDR>BV AIIND
DPC	DP-1C	16.29		NR>BV	NR>BV	NR>BV	N	N	N	N	NR>BV	-	N
DPC	DP-1E	15.47		NR>BV	NR>BV	NR>BV	N	NR>BV	NR>BV	AIIND	NR>BV	-	NDR>BV AIIND
DPC	DP-1W	16.39		NR>BV	N	NR>BV	N	NR>BV	N	AIIND	NR>BV	-	N
DPC	DP-2	14.69		NR>BV	NR>BV	NR>BV	N	N	NR>BV	N	NR>BV	-	<0.192>
DPC	DP-3	13.85		NR>BV	NR>BV	NR>BV	N	NR>BV	NR>BV	AIIND	NR>BV	-	<0.708>
DPC	DP-4	13.12		NR>BV	NR>BV	NR>BV	N	NR>BV	NR>BV	NR>BV AIIND	NR>BV	-	<0.838>
LAC	LA-1C	15.66		NR>BV	N	NR>BV	N	NR>BV	N	NR>BV AIIND	NR>BV	-	N
LAC	LA-1E	14.81		NR>BV	NR>BV	NR>BV	N	NR>BV	NR>BV	NR>BV AIIND	NR>BV	-	N
LAC	LA-2E	12.55		NR>BV	N	NR>BV	N	NR>BV	N	NR>BV AIIND	N	-	<0.259>
LAC	LA-2FE	11.22		NR>BV	NR>BV	NR>BV	N	NR>BV	N	NR>BV AIIND	NR>BV	-	X
LAC	LA-2W	13		NR>BV	NR>BV	NR>BV	N	NR>BV	N	NR>BV	N	-	N
LAC	LA-3E	8.75		NR>BV	NR>BV	NR>BV	N	NR>BV	N	NR>BV AIIND	NR>BV	-	X

Table E-1.0-14 (continued)

Canyon	Reach	Distance to Rio Grande (km)	Status	Aluminum	Barium	Iron	Lead	Manganese	Mercury	Thallium	Uranium	Total Noncancer HI	Americium-241
Max HQ				0.2		1.591		0.154		1.098			2.256
SAL				74000	5200	23000	400	7800	23	6.1	16		39
LAC	LA-3FE	8.85	Fire-impacted sediment	NR>BV	N	X	X	X	NR>BV	N	NR>BV	X	N
LAC	LA-3W	10.48		NR>BV	NR>BV	NR>BV	N	NR>BV	NR>BV	NR>BV AIIND	NR>BV	-	X
LAC	LA-4W	6.04		NR>BV	NR>BV	NR>BV	N	NR>BV	NR>BV	NR>BV AIIND	-	-	X
LAC	LA-5E	0.09	Fire-impacted sediment	NR>BV	N	NR>BV	N	N	NR>BV	NR>BV AIIND	NR>BV	-	NDR>BV AIIND
PC	AC-1	19.08		NR>BV	N	NR>BV	N	NR>BV	NR>BV	NR>BV	NR>BV	-	NDR>BV AIIND
PC	AC-2	18.77		NR>BV	NR>BV	NR>BV	N	N	NR>BV	NR>BV	NR>BV	-	N
PC	AC-3	18.27		NR>BV	NR>BV	NR>BV	N	N	N	NR>BV	NR>BV	-	>2.256<
PC	ACS	18.62		NR>BV	N	NR>BV	X	NR>BV	X	NR>BV	X	X	<0.108>
PC	P-1E	17.81		NR>BV	N	NR>BV	N	N	N	NR>BV AIIND	NR>BV	-	<0.274>
PC	P-1W	18.26		NR>BV	N	NR>BV	N	N	N	NR>BV	NR>BV	-	NDR>BV AIIND
PC	P-1W	18.26	Fire-impacted sediment	NR>BV	N	NR>BV	N	N	N	NR>BV AIIND	-	-	NDR>BV AIIND
PC	P-2W	14.61		NR>BV	N	NR>BV	N	N	N	AIIND	-	-	N
PC	P-3E	10.42	Fire-impacted sediment	NR>BV	N	NR>BV	N	N	NR>BV	NR>BV AIIND	-	-	NDR>BV AIIND
PC	P-3W	11.4		NR>BV	N	NR>BV	N	N	AIIND	AIIND	-	-	AIIND
PC	P-4E	8.6		NR>BV	N	>1.591<	N	<0.132>	NR>BV	>1.098<	-	>2.822<	NDR>BV AIIND
PC	P-4E	8.6	Fire-impacted sediment	NR>BV	N	X	N	X	NR>BV	AIIND	-	X	NDR>BV AIIND
PC	P-4W	9.49		X	N	X	N	NR>BV	N	AIIND	-	X	N

Table E-1.0-14 (continued)

Canyon	Reach	Distance to Rio Grande (km)	Status	Cesium-137	Cobalt-60	Europium-152	Plutonium-239,240	Strontium-90	Thorium-228	Thorium-230	Thorium-232	Uranium-234	Total Radionuclides HI
Max HQ				28.113		0.29	4.227	5.456	1.26	0.442	0.482	0.103	
SAL				5.3	1.2	2.7	44	5.7	2	5	5	63	
Baseline	Baseline		Fire-impacted sediment	>1.062<	NBV-NDR AIIND	NBV-NDR AIIND	N	<0.281>	NDR>BV	NDR>BV	NDR>BV	NDR>BV	>1.343<
Baseline	Garcia Cyn		Fire-impacted sediment	<0.823>	NBV-NDR AIIND	NBV-NDR AIIND	N	<0.258>	-	-	-	NDR>BV	>1.081<
Baseline	Guaje Cyn		Fire-impacted sediment	<0.991>	NBV-NDR AIIND	NBV-NDR AIIND	N	<0.181>	-	-	-	-	>1.171<
Baseline	Rendija Cyn		Fire-impacted sediment	X	NBV-NDR AIIND	NBV-NDR AIIND	N	X	-	-	-	-	X
DPC	DP-1C	16.29		NDR>BV	NBV-NDR AIIND	NBV-NDR AIIND	NDR>BV	NDR>BV AIIND	-	-	-	NDR>BV	-
DPC	DP-1E	15.47		NDR>BV	NBV-NDR AIIND	NBV-NDR AIIND	N	NDR>BV AIIND	-	-	-	NDR>BV	-
DPC	DP-1W	16.39		NDR>BV	NBV-NDR AIIND	NBV-NDR AIIND	NDR>BV	NDR>BV AIIND	-	-	-	NDR>BV	-
DPC	DP-2	14.69		>21.321<	NBV-NDR AIIND	NBV-NDR AIIND	<0.127>	>3.509<	-	-	-	NDR>BV	>25.148<
DPC	DP-3	13.85		>17.019<	NBV-NDR AIIND	NBV-NDR AIIND	<0.255>	>2.912<	-	-	-	NDR>BV	>20.893<
DPC	DP-4	13.12		>28.113<	NBV-NDR AIIND	NBV-NDR AIIND	<0.480>	>5.456<	NDR>BV	NDR>BV	NDR>BV	N	>34.887<
LAC	LA-1C	15.66		NDR>BV	NBV-NDR AIIND	NBV-NDR AIIND	N	NDR>BV AIIND	-	-	-	NDR>BV	-
LAC	LA-1E	14.81		X	NBV-NDR AIIND	NBV-NDR AIIND	X	-	-	-	-	NDR>BV	X
LAC	LA-2E	12.55		>4.019<	N	<0.290>	X	<0.609>	NDR>BV	<0.438>	NDR>BV	NDR>BV	>5.712<
LAC	LA-2FE	11.22		>9.566<	NBV-NDR AIIND	NBV-NDR AIIND	X	>1.693<	NDR>BV	NDR>BV	NDR>BV	NDR>BV	>11.428<
LAC	LA-2W	13		<0.279>	NBV-NDR AIIND	NBV-NDR AIIND	X	<0.649>	NDR>BV	NDR>BV	NDR>BV	N	>1.005<
LAC	LA-3E	8.75		>1.302<	X	X	N	<0.558>	>1.260<	<0.442>	<0.482>	NDR>BV	>4.245<
LAC	LA-3FE	8.85	Fire-impacted sediment	X	NBV-NDR AIIND	NBV-NDR AIIND	N	X	-	-	-	NDR>BV	X

Table E-1.0-14 (continued)

Canyon	Reach	Distance to Rio Grande (km)	Status	Cesium-137	Cobalt-60	Europium-152	Plutonium-239,240	Strontium-90	Thorium-228	Thorium-230	Thorium-232	Uranium-234	Total Radionuclides HI
Max HQ				28.113		0.29	4.227	5.456	1.26	0.442	0.482	0.103	
SAL				5.3	1.2	2.7	44	5.7	2	5	5	63	
LAC	LA-3W	10.48		>4.358<	NBV-NDR AIIND	NBV-NDR AIIND	N	<0.912>	NDR>BV	NDR>BV	NDR>BV	NDR>BV	>5.338<
LAC	LA-4W	6.04		X	NBV-NDR AIIND	X	X	NDR>BV AIIND	-	-	-	-	X
LAC	LA-5E	0.09	Fire-impacted sediment	>1.183<	NBV-NDR AIIND	NBV-NDR AIIND	N	<0.246>	-	-	-	NDR>BV	>1.429<
PC	AC-1	19.08		N	NBV-NDR AIIND	NBV-NDR AIIND	N	NDR>BV AIIND	-	-	-	NDR>BV	-
PC	AC-2	18.77		NDR>BV	NBV-NDR AIIND	NBV-NDR AIIND	N	NDR>BV AIIND	-	-	-	NDR>BV	-
PC	AC-3	18.27		>6.132<	NBV-NDR AIIND	NBV-NDR AIIND	>3.705<	>5.351<	NDR>BV	NDR>BV	NDR>BV	N	>17.444<
PC	ACS	18.62		>1.157<	NBV-NDR AIIND	NBV-NDR AIIND	>4.227<	<0.121>	-	-	-	<0.103>	>5.716<
PC	P-1E	17.81		<0.225>	NBV-NDR AIIND	N	>1.350<	<0.221>	NDR>BV	NDR>BV	NDR>BV	NDR>BV	>2.070<
PC	P-1W	18.26		N	NBV-NDR AIIND	NBV-NDR AIIND	N	AIIND	NDR>BV	NDR>BV	NDR>BV	NDR>BV	-
PC	P-1W	18.26	Fire-impacted sediment	X	NBV-NDR AIIND	NBV-NDR AIIND	N	X	-	-	-	-	X
PC	P-2W	14.61		X	NBV-NDR AIIND	NBV-NDR AIIND	X	-	-	-	-	-	X
PC	P-3E	10.42	Fire-impacted sediment	N	NBV-NDR AIIND	NBV-NDR AIIND	N	NDR>BV	-	-	-	-	-
PC	P-3W	11.4		X	NBV-NDR AIIND	NBV-NDR AIIND	X	-	-	-	-	-	X
PC	P-4E	8.6		N	NBV-NDR AIIND	NBV-NDR AIIND	N	AIIND	NDR>BV	NDR>BV	NDR>BV	NR>BV	-
PC	P-4E	8.6	Fire-impacted sediment	N	NBV-NDR AIIND	NBV-NDR AIIND	N	N	-	-	-	-	-
PC	P-4W	9.49		NDR>BV	NBV-NDR AIIND	NBV-NDR AIIND	X	NDR>BV AIIND	NDR>BV	NDR>BV	NDR>BV	NR>BV	X

Table E-1.0-14 (continued)

Canyon	Reach	Distance to Rio Grande (km)	Status	Aroclor-1254	Aroclor-1260	Arsenic	Benz(a)anthracene	Benzo(a)pyrene	Benzo(b)fluoranthene	Dibenz(a,h)anthracene	Dieldrin	Indeno(1,2,3-cd)pyrene	Total Cancer HI
Max HQ				28.182	4.545	13.846	5.661	60.484	7.694	2.903		4.984	
SAL				0.22	0.22	0.39	0.62	0.062	0.62	0.062	0.03	0.62	
Baseline	Baseline		Fire-impacted sediment	SW%D<5 AIIND	SW%D<5 AIIND	X	SW%D<5 AIIND	SW%D<5 AIIND	SW%D<5 AIIND	SW%D<5 AIIND	SW%D<5 AIIND	SW%D<5 AIIND	X
Baseline	Garcia Cyn		Fire-impacted sediment	-	-	>13.846<	-	-	-	-	-	-	>13.846<
Baseline	Guaje Cyn		Fire-impacted sediment	-	-	X	-	-	-	-	-	-	X
Baseline	Rendija Cyn		Fire-impacted sediment	-	-	>11.308<	SW%D<5 AIIND	SW%D<5 AIIND	SW%D<5 AIIND	SW%D<5 AIIND	-	SW%D<5 AIIND	>11.308<
DPC	DP-1C	16.29		SW%D<5 AIIND	<4.545>	NR>BV	X	>12.097<	X	SW%D<5 AIIND	-	AIIND	>18.223<
DPC	DP-1E	15.47		SW%D<5 AIIND	N	NR>BV	<1.068>	>10.613<	<1.661>	SW%D<5 AIIND	-	N	>13.342<
DPC	DP-1W	16.39		SW%D<5 AIIND	AIIND	NR>BV	<3.806>	>36.935<	<4.468>	SW%D<5 AIIND	SW%D<5 AIIND	<4.984>	>50.194<
DPC	DP-2	14.69		SW%D<5 AIIND	N	NR>BV	X	X	X	SW%D<5 AIIND	SW%D<5 AIIND	N	X
DPC	DP-3	13.85		SW%D<5 AIIND	N	NR>BV	<1.065>	>11.613<	<1.334>	SW%D<5 AIIND	SW%D<5 AIIND	N	>14.011<
DPC	DP-4	13.12		SW%D<5 AIIND	N	NR>BV	N	N	N	SW%D<5 AIIND	SW%D<5 AIIND	N	-
LAC	LA-1C	15.66		X	X	NR>BV	N	X	N	SW%D<5 AIIND	N	N	X
LAC	LA-1E	14.81		AIIND	N	NR>BV	N	N	N	SW%D<5 AIIND	N	N	-
LAC	LA-2E	12.55		AIIND	<1.045>	<6.923>	N	<7.613>	X	SW%D<5 AIIND	AIIND	N	>16.530<

Table E-1.0-14 (continued)

Canyon	Reach	Distance to Rio Grande (km)	Status	Aroclor-1254	Aroclor-1260	Arsenic	Benz(a)anthracene	Benzo(a)pyrene	Benzo(b)fluoranthene	Dibenz(a,h)anthracene	Dieldrin	Indeno(1,2,3-cd)pyrene	Total Cancer HI
Max HQ				28.182	4.545	13.846	5.661	60.484	7.694	2.903		4.984	
SAL				0.22	0.22	0.39	0.62	0.062	0.62	0.062	0.03	0.62	
LAC	LA-2FE	11.22		AIIND	N	NR>BV	N	N	N	SW%D<5 AIIND	N	N	-
LAC	LA-2W	13		AIIND	N	NR>BV	N	N	N	SW%D<5 AIIND	AIIND	N	-
LAC	LA-3E	8.75		AIIND	N	NR>BV	N	N	N	SW%D<5 AIIND	AIIND	N	-
LAC	LA-3FE	8.85	Fire-impacted sediment	-	-	>11.513<	N	<4.194>	N	SW%D<5 AIIND	-	AIIND	>15.706<
LAC	LA-3W	10.48		AIIND	N	NR>BV	N	N	N	SW%D<5 AIIND	N	N	-
LAC	LA-4W	6.04		SW%D<5 AIIND	SW%D<5 AIIND	NR>BV	-	-	-	-	SW%D<5 AIIND	-	-
LAC	LA-5E	0.09	Fire-impacted sediment	-	-	NR>BV	-	-	-	-	-	-	-
PC	AC-1	19.08		AIIND	N	>10.513<	<5.661>	>60.484<	<7.694>	SW%D<5	N	<2.290>	>86.642<
PC	AC-2	18.77		AIIND	N	>11.795<	<3.790>	>42.097<	<7.387>	SW%D<5 AIIND	AIIND	<1.726>	>66.795<
PC	AC-3	18.27		>28.182<	N	NR>BV	<2.726>	>22.258<	<4.387>	SW%D<5 AIIND	AIIND	N	>57.553<
PC	ACS	18.62		<3.082>	N	<5.385>	N	<1.610>	N	SW%D<5 AIIND	X	N	>10.649<
PC	P-1E	17.81		<1.082>	N	NR>BV	<1.134>	>29.032<	<4.032>	<2.903>	AIIND	X	>39.022<
PC	P-1W	18.26		AIIND	N	<7.128>	N	<6.677>	N	AIIND	AIIND	N	>13.806<
PC	P-1W	18.26	Fire-impacted sediment	-	-	X	-	-	-	-	-	-	X
PC	P-2W	14.61		AIIND	N	NR>BV	-	-	-	-	AIIND	-	-

Table E-1.0-14 (continued)

Canyon	Reach	Distance to Rio Grande (km)	Status	Aroclor-1254	Aroclor-1260	Arsenic	Benz(a)anthracene	Benzo(a)pyrene	Benzo(b)fluoranthene	Dibenz(a,h)anthracene	Dieldrin	Indeno(1,2,3-cd)pyrene	Total Cancer HI
Max HQ				28.182	4.545	13.846	5.661	60.484	7.694	2.903		4.984	
SAL				0.22	0.22	0.39	0.62	0.062	0.62	0.062	0.03	0.62	
PC	P-3E	10.42	Fire-impacted sediment	-	-	>11.026<	-	-	-	-	-	-	>11.026<
PC	P-3W	11.4		AIIND	AIIND	NR>BV	-	-	-	-	AIIND	-	-
PC	P-4E	8.6		AIIND	AIIND	AIIND	N	AIIND	AIIND	AIIND	AIIND	AIIND	-
PC	P-4E	8.6	Fire-impacted sediment	-	-	>10.718<	-	-	-	-	-	-	>10.718<
PC	P-4W	9.49		AIIND	AIIND	>12.487<	N	>10.887<	<1.468>	AIIND	AIIND	N	>24.842<

- Notes: 1. Units are mg/kg for organic and inorganic chemicals and pCi/g for radionuclides.
- <#> = Retained as Tier 2 COPC.
 - >#< = Retained as Tier 2 COPC.
 - = No data.
 - AIIND = Analyte never detected.
 - N = Analyte eliminated as a Tier 1 COPC.
 - NBV-NDR = No BV, no detected result (inorganic chemicals and radionuclides). Not a COPC.
 - NDR>BV = No detected result > BV (radionuclides). Not a COPC.
 - NR>BV = No result > BV (inorganic chemicals). Not a COPC.
 - SW%D<5 = % detection in the subwatershed < 5%. Not a COPC.
 - X = Analyte eliminated as a Tier 2 COPC

Table E-1.0-15
Water: Organic COPCs

Hydrosegment	Field Preparation	Acenaphthene	Acenaphthylene	Acetone	Anthracene	beta-BHC	gamma-BHC	Benzene	Benz(a)anthracene	Benzo(a)pyrene	Benzo(b)fluoranthene	Benzo(g,h,i)perylene	Benzo(k)fluoranthene
LA, lower	Filtered	-	-	-	-	-	-	-	-	-	-	-	-
LA, lower	Unfiltered	+	+	[30]/7.1	+	+	[0.053]/0.0057	[5]/3.4	+	+	+	+	[12]/0.0191
LA, middle	Filtered	+	+	-	+	-	-	-	+	+	+	+	+
LA, middle	Unfiltered	+	+	[30]/30	+	[0.056]/0.1	+	+	+	+	+	+	[11]/0.031
LA, upper	Filtered	-	-	-	-	-	-	-	-	-	-	-	-
LA, upper	Unfiltered	<	+	[30]/14	+	+	+	[5]/0.45	+	+	+	+	+
Pueblo, lower	Filtered	-	-	-	-	-	-	-	-	-	-	-	-
Pueblo, lower	Unfiltered	+	+	[30]/30.4	+	[0.062]/0.014	[0.062]/0.024	+	+	+	+	+	+
Pueblo, middle	Filtered	-	-	-	-	-	-	-	-	-	-	-	-
Pueblo, middle	Unfiltered	[12]/0.63	[12]/0.63	[30]/12	[12]/0.61	+	+	+	[12]/0.79	[12]/0.63	[12]/0.58	[12]/0.58	[12]/0.77
Pueblo, upper	Filtered	-	-	-	-	-	-	-	-	-	-	-	-
Pueblo, upper	Unfiltered	+	+	+	+	+	+	+	+	+	+	+	[11]/0.0436

Table E-1.0-15 (continued)

Hydrosegment	Field Preparation	Benzoic Acid	Benzyl Alcohol	Bis-2(ethylhexyl)phthalate	Bromodichloromethane	Bromomethane	2-Butanone	Butylbenzylphthalate	Carbon Disulfide	Chloroform	2-Chloronaphthalene	Chrysene	4,4'-DDD	4,4'-DDE	4,4'-DDT
LA, lower	Filtered	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LA, lower	Unfiltered	+	+	+	+	+	+	+	[5]/1.2	+	+	+	+	[0.11]/0.074	[0.11]/0.32
LA, middle	Filtered	+	+	[10]/36	-	-	-	+	-	-	+	+	-	-	-
LA, middle	Unfiltered	[55]/24.8	[22]/3.5	[11]/3.5	[5]/0.21	[10]/2.7	[20]/1.9	[11.1]/7	+	[5]/2.8	+	+	+	+	[0.11]/0.028
LA, upper	Filtered	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LA, upper	Unfiltered	+	+	[11]/3.4	+	+	+	<	+	+	+	+	[0.11]/0.019	[0.11]/0.57	[0.11]/0.34
Pueblo, lower	Filtered	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pueblo, lower	Unfiltered	+	+	[12]/6.8	+	+	+	+	+	[5]/0.24	+	+	[0.12]/0.008	[0.12]/0.0068	[0.12]/0.013
Pueblo, middle	Filtered	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pueblo, middle	Unfiltered	+	+	[12]/3.2	+	+	+	+	+	+	[12]/0.6	[12]/0.69	+	+	+
Pueblo, upper	Filtered	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pueblo, upper	Unfiltered	+	+	[11]/0.2	+	+	+	+	+	+	+	+	+	+	+

Table E-1.0-15 (continued)

Hydrosegment	Field Preparation	Di-n-butylphthalate	Dibenz(a,h)anthracene	1,4-Dichlorobenzene	1,2-Dichloroethane	Dieldrin	Diethylphthalate	Endrin Aldehyde	Ethylbenzene	Fluoranthene	Fluorene	Indeno(1,2,3-cd)pyrene	4-Isopropyltoluene	Methylene Chloride
LA, lower	Filtered	-	-	-	-	-	-	-	-	-	-	-	-	-
LA, lower	Unfiltered	+	+	+	+	+	+	+	+	+	+	+	+	[5]/1.4
LA, middle	Filtered	+	+	+	-	-	+	-	-	+	+	+	-	-
LA, middle	Unfiltered	[11.1]/3.7	+	[11]/0.41	[5]/7.6	+	[11.1]/5.5	+	+	+	[11]/1.5	+	+	[12]/38
LA, upper	Filtered	-	-	-	-	-	-	-	-	-	-	-	-	-
LA, upper	Unfiltered	<	+	+	+	+	+	+	[5]/0.19	+	+	+	[5]/0.21	[14]/40
Pueblo, lower	Filtered	-	-	-	-	-	-	-	-	-	-	-	-	-
Pueblo, lower	Unfiltered	+	+	[10]/0.17	+	+	[12]/1.5	[0.12]/0.028	+	+	+	+	+	[5]/0.97
Pueblo, middle	Filtered	-	-	-	-	-	-	-	-	-	-	-	-	-
Pueblo, middle	Unfiltered	+	[12]/0.43	+	+	+	+	+	+	[12]/0.63	[12]/0.58	[12]/0.57	+	+
Pueblo, upper	Filtered	-	-	-	-	-	-	-	-	-	-	-	-	-
Pueblo, upper	Unfiltered	+	[11]/0.0235	+	+	[0.11]/0.0054	+	+	+	+	+	+	+	+

Table E-1.0-15 (continued)

Hydrosegment	Field Preparation	2-Methylnaphthalene	Naphthalene	Phenanthrene	Phenol	Pyrene	Total Petroleum Hydrocarbons, Diesel Range Organics	Toluene	Trichloroethene	1,2,4-Trimethylbenzene	Total Xylene	1,2-Xylene	1,3-Xylene+1,4-Xylene
LA, lower	Filtered	-	-	-	-	-	-	-	-	-	-	-	-
LA, lower	Unfiltered	+	+	+	+	+	-	+	[5]/1.7	+	+	+	+
LA, middle	Filtered	+	+	+	+	+	+	-	-	-	-	-	-
LA, middle	Unfiltered	+	+	+	[11.1]/3	+	[1000]/1400	[5]/0.63	+	+	+	+	+
LA, upper	Filtered	-	-	-	-	-	-	-	-	-	-	-	-
LA, upper	Unfiltered	+	+	+	+	+	-	[5]/1.2	+	[5]/0.3	[10]/1	[5]/0.32	[2]/0.72
Pueblo, lower	Filtered	-	-	-	-	-	-	-	-	-	-	-	-
Pueblo, lower	Unfiltered	+	+	+	+	+	-	[5]/0.85	+	+	+	+	+
Pueblo, middle	Filtered	-	-	-	-	-	-	-	-	-	-	-	-
Pueblo, middle	Unfiltered	[12]/0.58	[12]/0.56	[12]/0.68	+	[12]/0.68	-	+	+	+	+	+	-
Pueblo, upper	Filtered	-	-	-	-	-	-	-	-	-	-	-	-
Pueblo, upper	Unfiltered	+	+	+	+	+	-	+	+	+	+	+	+

Notes: 1. Units are µg/L.

- # = Maximum detect in the hydrosegment/field preparation bin. Frequency of detection for at least 1 water type in the hydrosegment/field preparation bin >= 5%.
- [#] = Maximum nondetect in the hydrosegment/field preparation bin. Frequency of detection for at least 1 water type in the hydrosegment/field preparation bin >= 5%.
- + = No detected results in the hydrosegment/field preparation bin.
- = No data.
- < = 0 < frequency of detection for at least 1 water type in the hydrosegment/field preparation bin <5%.

Table E-1.0-16
Water: Radionuclide COPCs

Hydro Segment	Field Preparation	Americium-241	Cesium-137	Europium-152	Plutonium-238	Plutonium-239	Strontium-90	Technetium-99	Tritium	Uranium-234	Uranium-235	Uranium-238
LA, lower	F	[8]/0.022	+	+	[0.04]/0.0218	[0.09]/0.0374	[0.74]/1.52	-	+	[NA]/5.25	[0.18]/0.199	[NA]/3.64
LA, lower	UF	[3.97]/0.0828	+	[19]/21.64	+	[3.97]/0.246	[3.97]/1.72	+	[170]/62.5828	[NA]/5.3	[3.97]/0.225	[NA]/3.97
LA, middle	F	[7]/0.0652	+	+	[0.051]/0.02	+	[0.102]/233	-	-	[0.131]/1.73	[0.14]/0.0504	[0.2]/0.957
LA, middle	UF	[6.6]/1.43	[8]/15.6	+	[0.039]/0.095	[0.08]/1.24	[1.6]/176.47	[3.7]/37.9	[250]/490	[0.148]/1.51	[0.18]/0.089	[0.2]/0.443
LA, upper	F	[0.33]/0.27	+	+	[0.03]/0.0198	<	[1.6]/17.4	-	+	[0.11]/0.881	[0.06]/0.0928	[0.09]/0.704
LA, upper	UF	[4.73]/0.0522	+	+	[0.026]/0.01	[0.0709]/0.201	[1]/17.6	+	[253]/549.196	[0.14]/1.5	[0.046]/0.0878	[0.051]/1.39
Pueblo, lower	F	[0.067]/0.0509	+	+	+	[0.06]/0.302	[1.9]/2.8	-	-	[0.048]/0.85	+	[0.04]/0.65
Pueblo, lower	UF	[0.064]/0.06	+	+	[0.041]/0.0108	[0.05]/0.89	[1.5]/2.27	+	[142]/17.21027	[0.043]/1.3	[0.046]/0.064	[0.05]/0.88
Pueblo, middle	F	[2]/0.149	+	+	+	[0.076]/3.51	[1.3]/19.6	-	-	[0.025]/7.5	[0.121]/0.263	[0.229]/3.8
Pueblo, middle	UF	[0.39]/0.134	+	+	[0.031]/0.171	[0.06]/7.11	[2.2]/19.2	+	[190]/85.25311	[0.069]/7.3	[0.049]/0.346	[0.02]/3.4
Pueblo, upper	F	[0.027]/0.0215	+	+	+	+	[1]/3.65	-	-	[0.06]/0.298	+	[0.042]/0.3
Pueblo, upper	UF	[0.064]/0.0408	+	+	+	[0.06]/0.057	[2.6]/7.6	+	[180]/75.9934	[0.048]/0.34	[0.061]/0.0237	[0.039]/0.297

Notes: 1. Units are pCi/L.

2. # = Maximum detect in the hydrosegment/field preparation bin. Frequency of detection for at least 1 water type in the hydrosegment/field preparation bin $\geq$ 5%.

3. [#] = Maximum nondetect in the hydrosegment/field preparation bin. Frequency of detection for at least 1 water type in the hydrosegment/field preparation bin $\geq$ 5%.

4. + = No detected results in the hydrosegment/field preparation bin.

5. - = No data.

6. < = 0 < frequency of detection for at least 1 water type in the hydrosegment/field preparation bin < 5%.

7. [NA] = Results are all detects in the hydrosegment/field preparation bin.

8. F = Filtered.

9. UF = unfiltered.

Table E-1.0-17
Water: Inorganic COPCs

Hydrosegment	Field Preparation	Aluminum	Ammonia	Ammonium	Antimony	Arsenic	Barium	Beryllium	Boron	Bromide	Cadmium	Calcium	Chloride
LA, lower	Filtered	[87.6]/670	[500]/1260	-	[50]/3	[11.8]/9.7	[NA]/372	[4]/0.19	[50]/263	[500]/357	+	[NA]/110000	[NA]/130000
LA, lower	Unfiltered	[180]/2400	[500]/1770	-	[50]/3.5	[6.6]/8.51	[NA]/395	[4]/0.35	[3.97]/262	+	[5]/0.23	[NA]/110000	[NA]/42000
LA, middle	Filtered	[186]/2100	[500]/17000	-	[20]/2.21	[4.57]/10.9	[NA]/232	[4]/0.09	[3.61]/242	[200]/1480	[5]/0.32	[NA]/110000	[NA]/270000
LA, middle	Unfiltered	[300]/6610	+	-	[20]/2.15	[4.57]/12.2	[NA]/234	[4]/0.34	[3.61]/252	+	[5]/0.38	[NA]/95000	[NA]/63000
LA, upper	Filtered	[150]/2440	[500]/330	-	<	[5]/4.02	[NA]/170	[4]/0.13	[22.7]/57.6	[600]/561	<	[NA]/44000	[NA]/110000
LA, upper	Unfiltered	[93]/42800	[100]/240	-	[50]/0.84	[5]/7.75	[NA]/467	[4]/1.63	[16.3]/55.8	[NA]/563	[5]/0.834	[NA]/54000	[NA]/6400
Pueblo, lower	Filtered	[97]/149	[NA]/21100	[NA]/1110	[2.8]/0.53	[4.57]/13	[NA]/164	[0.42]/0.043	[NA]/387	[200]/252	[1]/0.38	[NA]/39200	[NA]/52300
Pueblo, lower	Unfiltered	[229]/4000	[NA]/19000	-	[2.8]/0.347	[3.28]/14.9	[NA]/391	[0.86]/0.21	[NA]/396	+	[1]/0.238	[NA]/218000	[NA]/43000
Pueblo, middle	Filtered	[160]/590	[500]/150	-	[2.8]/0.243	[3.4]/3.6	[NA]/130	[0.28]/0.034	[38.6]/31.5	+	[0.22]/0.27	[NA]/55000	[NA]/220000
Pueblo, middle	Unfiltered	[28.7]/3200	[NA]/220	-	[2.8]/0.398	[3.4]/6.1	[NA]/230	[0.3]/0.13	[19.7]/90.6	-	[0.45]/0.35	[NA]/55000	-
Pueblo, upper	Filtered	[65.6]/210	[100]/4300	[NA]/170	[2.8]/4	[5]/3.5	[NA]/130	[0.23]/0.01	[60.1]/44.9	[20]/294	+	[NA]/58600	[NA]/59000
Pueblo, upper	Unfiltered	[79]/2600	[NA]/190	-	[2.8]/3	[5]/4.45	[NA]/170	[0.2]/0.12	[29.1]/44.2	-	+	[NA]/58700	-

Table E-1.0-17 (continued)

Hydrosegment	Field Preparation	Chromium	Cobalt	Copper	Cyanide, Amenable to Chlorination	Cyanide (Total)	Fluoride	Iron	Lead	Lithium	Magnesium	Manganese	Mercury
LA, lower	Filtered	[10]/2.4	[10]/3.6	[5]/11	-	+	[500]/610	[110]/570	[5]/3.78	-	[NA]/10500	[25]/303	+
LA, lower	Unfiltered	[10]/7.9	[10]/6.1	[5]/146	+	[10]/1.2	[500]/450	[190]/3750	[5]/4.1	-	[NA]/10900	[26.6]/330	+
LA, middle	Filtered	[10]/4.22	[20]/1.9	[20]/14.4	-	[10]/12	[50]/1600	[114]/2300	[5]/5	[NA]/12.1	[6900]/7240	[10]/830	[0.2]/0.33
LA, middle	Unfiltered	[10]/5.11	[20]/1.5	[20]/68.7	[5]/29.1	+	[NA]/1300	[190]/6700	[5]/8.3	[NA]/13.5	[6400]/7370	[10]/870	[0.2]/0.217
LA, upper	Filtered	[10]/16	[10]/4.2	[5.6]/5	-	+	[100]/613	[120]/3900	[5]/2.85	-	[NA]/9400	[25]/4800	[0.2]/0.12
LA, upper	Unfiltered	[10]/35	[10]/11	[5]/40.8	+	+	[NA]/611	[220]/24200	[5]/43.5	-	[NA]/12300	[25]/4600	<
Pueblo, lower	Filtered	[5]/1.76	[5]/11	[5]/36.2	-	+	[NA]/710	[110]/5850	[5]/1.35	-	[NA]/8450	[NA]/4000	+
Pueblo, lower	Unfiltered	[5]/4.77	[5]/30.2	[5]/43.5	+	[10]/25	[NA]/530	[181]/14100	[5]/18	-	[NA]/45400	[NA]/4100	[0.2]/0.11
Pueblo, middle	Filtered	[1.5]/2	[1.09]/2.8	[4]/4	-	+	[NA]/460	[400]/110	[1.6]/0.011	-	[NA]/6700	[NA]/5600	[0.2]/0.11
Pueblo, middle	Unfiltered	[5]/2.3	[1.3]/6.2	[5.1]/4.8	-	[10]/2.7	-	[370]/5200	[5]/11	-	[NA]/7300	[NA]/6200	[0.2]/0.021
Pueblo, upper	Filtered	[5]/8.1	[5]/2.6	[5]/2.6	-	+	[NA]/265	[320]/530	[5]/0.511	-	[NA]/10500	[NA]/2900	[0.2]/0.021
Pueblo, upper	Unfiltered	[5]/2.1	[5]/2.4	[1.93]/4.6	+	[10]/1.4	-	[130]/2800	[5]/9.5	-	[NA]/10500	[NA]/3000	[0.2]/0.021

Table E-1.0-17 (continued)

Hydrosegment	Field Preparation	Molybdenum	Nickel	Nitrate	Nitrate+Nitrite (as N)	Nitrite	P_Orthophosphate (as PO ₄)	Perchlorate	Phosphorus	Potassium	Selenium	Silicon
LA, lower	Filtered	[10]/12.6	[15]/9.9	[NA]/7400	[NA]/7500	[100]/3990	[NA]/2400	+	[100]/2750	[NA]/13300	[5]/4.3	[NA]/44740
LA, lower	Unfiltered	[10]/12.6	[15]/11.8	[NA]/7300	[NA]/7400	[100]/3070	[NA]/2100	[4]/4	[100]/2400	[NA]/13200	[5]/5.1	[NA]/45690
LA, middle	Filtered	[24]/2000	[40]/2.9	-	[50]/30000	-	-	+	[100]/960	[NA]/17700	[5]/3.8	-
LA, middle	Unfiltered	[23]/2000	[40]/5.1	-	[NA]/310	-	-	[4]/1.17	[100]/120	[NA]/17700	[5]/3.43	-
LA, upper	Filtered	[10]/140	[15]/2.5	+	[50]/820	+	-	[4.16]/15.3	[100]/188	[NA]/7700	[5]/3.8	[15000]/39870
LA, upper	Unfiltered	[10]/140	[15]/48.1	-	[50]/850	-	-	+	[100]/192	[NA]/12000	[5]/3.6	[NA]/39130
Pueblo, lower	Filtered	[4.5]/9.7	[5]/13	[200]/3100	[NA]/15500	+	[NA]/5300	[9.58]/8.91	[NA]/7400	[NA]/20500	[5]/3.4	-
Pueblo, lower	Unfiltered	[4.5]/9.36	[5]/43.8	[NA]/2900	[NA]/1300	+	[NA]/5200	+	[NA]/7300	[NA]/85100	[5]/3.86	-
Pueblo, middle	Filtered	[4.5]/4.5	[2.9]/3	-	[NA]/720	-	-	[4]/4.61	[100]/240	[NA]/8300	[2.93]/2.2	-
Pueblo, middle	Unfiltered	[4.5]/4.1	[5]/3.5	-	[NA]/76	-	-	+	[NA]/190	[NA]/13400	[2.93]/2.1	-
Pueblo, upper	Filtered	[4.5]/4.79	[5]/2.9	-	[50]/740	-	-	+	[100]/240	[NA]/11000	[5]/1.5	-
Pueblo, upper	Unfiltered	[4.5]/3.63	[3.5]/2.5	-	[50]/510	-	-	+	[NA]/780	[NA]/12000	[5]/1.7	-

Table E-1.0-17 (continued)

Hydrosegment	Field Preparation	Silicon Dioxide	Silver	Sodium	Strontium	Sulfate	Thallium	Titanium	Total Kjeldahl Nitrogen	Uranium	Vanadium	Zinc
LA, lower	Filtered	[NA]/39500	[5]/0.07	[NA]/74000	[NA]/157	[NA]/49000	[3.7]/3.8	+	-	[NA]/10.9	[10]/12	[36.9]/38
LA, lower	Unfiltered	[NA]/28400	[5]/2.9	[NA]/74000	-	[NA]/45000	[3.97]/3.4	[10]/52.1	-	[NA]/10.3	[10]/30.7	[27.6]/35.6
LA, middle	Filtered	[NA]/49600	[10]/0.61	[NA]/160000	[NA]/283	[NA]/250000	[5]/3.7	-	-	[0]/2.84	[10]/19.7	[20]/580
LA, middle	Unfiltered	[NA]/39300	[10]/2.35	[NA]/140000	[NA]/251	[NA]/7900	[6.8]/3.8	-	-	[0]/1.32	[10]/21.5	[20]/940
LA, upper	Filtered	[NA]/37700	[5]/0.89	[NA]/70800	[NA]/174	[NA]/25000	[3.7]/4.4	+	[NA]/460	[0]/2.11	[12.6]/9.9	[24.3]/21
LA, upper	Unfiltered	[NA]/32700	[5]/0.81	[NA]/87000	[NA]/174	[NA]/15200	[3.7]/2.6	+	-	[0]/4.17	[36.9]/25.8	[23]/138
Pueblo, lower	Filtered	[NA]/74900	[5]/1.26	[NA]/76600	[NA]/169	[1000]/87400	[3.7]/3.3	[NA]/0.2	-	[0]/1.93	[3.9]/21.8	[18.8]/43.3
Pueblo, lower	Unfiltered	[NA]/61100	[5]/2.34	[NA]/418000	[NA]/171	[NA]/23000	[3.7]/3	[NA]/0.2	-	[0]/2.62	[2.39]/22.7	[11.4]/213
Pueblo, middle	Filtered	[NA]/25800	[1.46]/0.06	[NA]/130000	[NA]/173	[NA]/26000	[3.7]/3.4	-	-	[0]/11.4	[3.91]/3.08	[21.2]/52
Pueblo, middle	Unfiltered	-	[1.72]/0.64	[NA]/120000	[NA]/177	-	[4.3]/2.9	[NA]/1.13	-	[0]/10.3	[3.91]/6.1	[20.8]/44
Pueblo, upper	Filtered	[NA]/23000	[5]/0.57	[NA]/56600	[NA]/173	[NA]/142000	[3.7]/3	-	-	[0]/0.892	[3.1]/4.2	[27.1]/12
Pueblo, upper	Unfiltered	[NA]/15100	[5]/0.47	[NA]/56700	[NA]/173	-	[3.7]/2.3	-	[NA]/300	[0]/0.883	[3.4]/4.9	[29.2]/25

Notes: 1. Units are µg/L.

2. # = Maximum detect in the hydrosegment/field preparation bin. Frequency of detection for at least 1 water type in the hydrosegment/field preparation bin $\geq$ 5%.

3. [#] = Maximum nondetect in the hydrosegment/field preparation bin. Frequency of detection for at least 1 water type in the hydrosegment/field preparation bin $\geq$ 5%.

4. + = No detected results in the hydrosegment/field preparation bin.

5. - = No data.

6. < = 0 < frequency of detection for at least 1 water type in the hydrosegment/field preparation bin < 5%.

7. [NA] = Results are all detects in the hydrosegment/field preparation bin.

Table E-1.0-18
Water ESLs

Analyte Name	ESL	Units
Americium-241	5.8	pCi/L
Cesium-137	1100	pCi/L
Europium-152	100	pCi/L
Plutonium-238	19	pCi/L
Plutonium-239	20	pCi/L
Strontium-90	570	pCi/L
Tritium	160000000	pCi/L
Uranium-234	22	pCi/L
Uranium-235	24	pCi/L
Uranium-238	24	pCi/L
Acenaphthene	23	µg/L
Acenaphthylene	30	µg/L
Acetone	11000	µg/L
Aluminum	87	µg/L
Anthracene	0.0013	µg/L
Antimony	100	µg/L
Arsenic	150	µg/L
Barium	3.8	µg/L
Benzene	45	µg/L
Benzo(a)anthracene	0.027	µg/L
Benzo(a)pyrene	0.014	µg/L
Benzo(b)fluoranthene	30	µg/L
Benzo(g,h,i)perylene	30	µg/L
Benzo(k)fluoranthene	30	µg/L
Benzoic Acid	41	µg/L
Beryllium	5.3	µg/L
BHC[beta-]	2.4	µg/L
BHC[gamma-]	0.08	µg/L
Bis(2-ethylhexyl)phthalate	32	µg/L
Boron	540	µg/L
Butanone[2-]	20000	µg/L
Butylbenzylphthalate	22	µg/L
Cadmium	0.15	µg/L
Chloride	230000	µg/L
Chloroform	180	µg/L
Chromium, Total	77	µg/L
Chrysene	30	µg/L
Cobalt	3	µg/L

Table E-1.0-18 (continued)

Analyte Name	ESL	Units
Copper	5	µg/L
Cyanide, Total	5.2	µg/L
DDE[4,4'-]	10	µg/L
DDT[4,4'-]	0.04	µg/L
Dibenz(a,h)anthracene	30	µg/L
Dichlorobenzene[1,4-]	15	µg/L
Dichloroethane[1,2-]	1100	µg/L
Dieldrin	0.056	µg/L
Endrin Aldehyde	0.036	µg/L
Fluoranthene	6.1	µg/L
Fluorene	3.9	µg/L
Fluoride	1600	µg/L
Indeno(1,2,3-cd)pyrene	30	µg/L
Lead	1.2	µg/L
Manganese	80	µg/L
Mercury	1.3	µg/L
Methylene Chloride	2200	µg/L
Methylnaphthalene[2-]	2	µg/L
Naphthalene	23	µg/L
Nickel	28	µg/L
Phenanthrene	6.3	µg/L
Phenol	110	µg/L
Pyrene	30	µg/L
Selenium	2	µg/L
Silver	0.36	µg/L
Strontium	620	µg/L
Thallium	18	µg/L
Titanium	70000	µg/L
Toluene	130	µg/L
Trichloroethene	350	µg/L
Uranium	1.8	µg/L
Vanadium	19	µg/L
Xylene (Total)	86	µg/L
Xylene[1,3-]+Xylene[1,4-]*	86	µg/L
Zinc	66	µg/L

*From Xylene (Total).

Table E-1.0-19
Water: Ecological Screening Summary

Canyon	Hydrosegment	Water Type	Field Preparation	Aluminum	Barium	Beryllium	Boron	Cadmium	Cobalt	Copper	Lead	Manganese	Nickel
Los Alamos	LA, lower	WGS	Filtered	<2.069>	>49.211<	0.002	<0.400>	:d: AIIND	<1.200>	<2.200>	>3.150<	0.135	<0.354>
Guaje	LA, lower	WS	Filtered	AIIND	>34.211<	AIIND	-	:d: AIIND	0.173	0.104	AIIND	<0.385>	0.1
Los Alamos	LA, lower	WS	Filtered	>7.701<	>28.421<	0.036	<0.487>	:d: AIIND	<1.033>	<1.886>	0.16	>3.788<	<0.314>
Los Alamos	LA, lower	WGS	Unfiltered	>7.356<	>47.895<	0.009	<0.396>	AIIND	<1.200>	<2.800>	0.121	0.175	<0.371>
Guaje	LA, lower	WS	Unfiltered	<0.679>	>34.211<	AIIND	-	<0.453>	0.177	0.22	AIIND	<0.436>	0.107
Los Alamos	LA, lower	WS	Unfiltered	>25.287<	>36.842<	0.066	<0.485>	<1.533>	<2.033>	<2.400>	>3.417<	>4.125<	<0.386>
DP	LA, middle	WGS	Filtered	>24.138<	>21.842<	AIIND	0.086	AIIND	AIIND	<0.534>	<2.500>	0.015	0.05
DP	LA, middle	WS	Filtered	>3.310<	>56.579<	0.008	<0.448>	<1.033>	<0.633>	<2.880>	<2.117>	>5.000<	0.104
Los Alamos	LA, middle	WS	Filtered	<2.161>	>11.368<	0.008	0.046	AIIND	AIIND	0.193	0.14	0.129	AIIND
DP	LA, middle	WGS	Unfiltered	>29.885<	>21.947<	0.057	0.076	AIIND	AIIND	<0.550>	>3.333<	0.22	0.096
DP	LA, middle	WS	Unfiltered	>75.977<	>25.316<	0.058	<0.467>	<2.533>	<0.500>	>13.740<	>6.917<	>5.250<	0.182
Los Alamos	LA, middle	WS	Unfiltered	-	-	-	-	-	-	-	-	-	-
Los Alamos	LA, upper	WS	Filtered	>13.103<	>44.737<	0.025	0.047	:d: AIIND	<1.400>	<0.354>	<2.375>	>60.000<	0.089
Los Alamos	LA, upper	WS	Unfiltered	>491.954<	>122.895<	<0.308>	0.055	>5.560<	>3.667<	>8.160<	>36.250<	>57.500<	<1.446>
Pueblo	Pueblo, lower	WS	Filtered	<1.713>	>22.368<	0.004	<0.717>	<1.667>	<1.117>	>7.240<	<1.125>	>24.375<	0.254
Pueblo	Pueblo, lower	WS	Unfiltered	>45.977<	>102.895<	0.04	<0.711>	<1.587>	>10.067<	>8.700<	>15.000<	>50.125<	<1.564>
Acid	Pueblo, middle	WS	Filtered	>6.782<	>34.211<	AIIND	0.039	<1.800>	0.27	<0.800>	AIIND	<1.750>	0.064
Pueblo	Pueblo, middle	WS	Filtered	<0.890>	>31.579<	0.006	0.058	<0.907>	<0.933>	0.28	0.009	>70.000<	0.107
Acid	Pueblo, middle	WS	Unfiltered	>22.989<	>34.211<	AIIND	0.039	<2.333>	<0.400>	<0.960>	>3.917<	<2.000>	0.114
Pueblo	Pueblo, middle	WS	Unfiltered	>36.782<	>60.526<	0.024	0.071	<1.140>	<2.067>	<0.940>	>9.167<	>77.500<	0.125
Pueblo	Pueblo, upper	WS	Filtered	<2.414>	>34.211<	0.002	0.055	:d: AIIND	<0.867>	<0.520>	<0.426>	>36.250<	0.104
Pueblo	Pueblo, upper	WS	Unfiltered	>29.885<	>44.737<	0.023	0.046	:d: AIIND	<0.800>	<0.920>	>7.917<	>37.500<	0.089

Table E-1.0-19 (continued)

Canyon	Hydrosegment	Water Type	Field Preparation	Selenium	Silver	Strontium	Uranium	Vanadium	Zinc	Cyanide (Total)	Chloride	Fluoride
Los Alamos	LA, lower	WGS	Filtered	<1.580>	0.056	-	<1.161>	<0.506>	0.074	:d: AIIND	0.222	0.263
Guaje	LA, lower	WS	Filtered	<0.700>	AIIND	-	-	<0.579>	AIIND	-	0.165	-
Los Alamos	LA, lower	WS	Filtered	<1.250>	0.194	0.253	<0.405>	<0.632>	<0.576>	-	0.209	<0.313>
Los Alamos	LA, lower	WGS	Unfiltered	<1.985>	0.083	-	<2.206>	<0.493>	<0.539>	AIIND	-	-
Guaje	LA, lower	WS	Unfiltered	<0.850>	AIIND	-	-	<0.526>	AIIND	-	-	-
Los Alamos	LA, lower	WS	Unfiltered	<2.550>	>8.056<	-	<0.489>	<0.747>	0.297	AIIND	-	-
DP	LA, middle	WGS	Filtered	AIIND	AIIND	<0.318>	0.203	0.189	<1.061>	AIIND	<0.461>	<0.688>
DP	LA, middle	WS	Filtered	<1.900>	AIIND	<0.456>	<0.898>	<1.037>	>8.788<	<2.308>	<1.070>	<0.457>
Los Alamos	LA, middle	WS	Filtered	<1.705>	AIIND	0.189	-	0.069	0.055	-	0.121	0.068
DP	LA, middle	WGS	Unfiltered	AIIND	AIIND	<0.318>	0.162	0.216	<0.758>	:d: AIIND	0.152	<0.688>
DP	LA, middle	WS	Unfiltered	<1.715>	AIIND	-	<0.735>	<1.132>	>14.242<	:d: AIIND	-	-
Los Alamos	LA, middle	WS	Unfiltered	AIIND	-	-	-	-	-	:d: AIIND	-	-
Los Alamos	LA, upper	WS	Filtered	AIIND	<2.472>	0.127	<1.172>	<0.521>	0.212	:d: AIIND	<0.404>	0.163
Los Alamos	LA, upper	WS	Unfiltered	<1.800>	<2.056>	0.129	<2.318>	<1.358>	<2.091>	:d: AIIND	0.028	0.081
Pueblo	Pueblo, lower	WS	Filtered	<0.495>	>3.500<	0.177	<1.073>	<1.147>	<0.656>	:d: AIIND	0.199	<0.400>
Pueblo	Pueblo, lower	WS	Unfiltered	<1.930>	>6.500<	0.184	<1.453>	<1.011>	>3.227<	>4.808<	-	-
Acid	Pueblo, middle	WS	Filtered	0.244	AIIND	0.279	>6.342<	0.147	<0.788>	:d: AIIND	<0.957>	0.288
Pueblo	Pueblo, middle	WS	Filtered	<1.100>	0.167	0.235	<0.353>	0.162	0.132	-	0.283	0.14
Acid	Pueblo, middle	WS	Unfiltered	0.159	<1.778>	0.285	>5.703<	0.237	<0.667>	AIIND	-	-
Pueblo	Pueblo, middle	WS	Unfiltered	<1.050>	<1.694>	0.24	0.129	<0.321>	<0.303>	<0.519>	-	-
Pueblo	Pueblo, upper	WS	Filtered	<0.700>	<1.583>	0.279	<0.495>	0.221	0.115	:d: AIIND	0.193	0.166
Pueblo	Pueblo, upper	WS	Unfiltered	<0.750>	<1.306>	0.279	<0.490>	0.258	<0.379>	0.269	-	-

Table E-1.0-19 (continued)

Canyon	Hydrosegment	Water Type	Field Preparation	Anthracene	gamma-BHC	Benz(a)anthracene	Benzo(a)pyrene	Benzic Acid	4,4'-DDT	Endrin Aldehyde	Fluorene	Plutonium-239	Uranium-234
Los Alamos	LA, lower	WGS	Filtered	-	-	-	-	-	-	-	-	0.002	0.053
Guaje	LA, lower	WS	Filtered	-	-	-	-	-	-	-	-	AIIND	-
Los Alamos	LA, lower	WS	Filtered	-	-	-	-	-	-	-	-	AIIND	0.019
Los Alamos	LA, lower	WGS	Unfiltered	:d: AIIND	AIIND	:d: AIIND	:d: AIIND	:d: AIIND	<2.250>	:d: AIIND	:d: AIIND	0.006	0.18
Guaje	LA, lower	WS	Unfiltered	-	-	-	-	-	-	-	-	AIIND	-
Los Alamos	LA, lower	WS	Unfiltered	:d: AIIND	0.071	:d: AIIND	:d: AIIND	:d: AIIND	>8.000<	:d: AIIND	:d: AIIND	0.012	0.019
DP	LA, middle	WGS	Filtered	:d: AIIND	-	:d: AIIND	:d: AIIND	:d: AIIND	-	-	:d: AIIND	:d: AIIND	0.029
DP	LA, middle	WS	Filtered	-	-	-	-	-	-	-	-	:d: AIIND	0.055
Los Alamos	LA, middle	WS	Filtered	-	-	-	-	-	-	-	-	:d: AIIND	0.004
DP	LA, middle	WGS	Unfiltered	:d: AIIND	:d: AIIND	:d: AIIND	:d: AIIND	AIIND	AIIND	:d: AIIND	AIIND	0.004	0.026
DP	LA, middle	WS	Unfiltered	:d: AIIND	:d: AIIND	:d: AIIND	:d: AIIND	<0.605>	<0.700>	:d: AIIND	<0.385>	AIIND	0.051
Los Alamos	LA, middle	WS	Unfiltered	:d: AIIND	-	:d: AIIND	:d: AIIND	AIIND	-	-	AIIND	0.02	0.023
Los Alamos	LA, upper	WS	Filtered	-	-	-	-	-	-	-	-	:d: AIIND	0.04
Los Alamos	LA, upper	WS	Unfiltered	:d: AIIND	:d: AIIND	:d: AIIND	:d: AIIND	:d: AIIND	>8.500<	:d: AIIND	:d: AIIND	0.005	0.068
Pueblo	Pueblo, lower	WS	Filtered	-	-	-	-	-	-	-	-	AIIND	0.039
Pueblo	Pueblo, lower	WS	Unfiltered	:d: AIIND	0.3	:d: AIIND	:d: AIIND	:d: AIIND	0.25	<0.778>	:d: AIIND	0.045	0.059
Acid	Pueblo, middle	WS	Filtered	-	-	-	-	-	-	-	-	0.176	<0.341>
Pueblo	Pueblo, middle	WS	Filtered	-	-	-	-	-	-	-	-	AIIND	0.015
Acid	Pueblo, middle	WS	Unfiltered	>438.462<	:d: AIIND	>24.074<	>45.000<	:d: AIIND	:d: AIIND	:d: AIIND	0.121	<0.356>	<0.332>
Pueblo	Pueblo, middle	WS	Unfiltered	>469.231<	:d: AIIND	>29.259<	>40.000<	:d: AIIND	:d: AIIND	:d: AIIND	0.149	0.009	0.005
Pueblo	Pueblo, upper	WS	Filtered	-	-	-	-	-	-	-	-	:d: AIIND	0.01
Pueblo	Pueblo, upper	WS	Unfiltered	:d: AIIND	:d: AIIND	:d: AIIND	:d: AIIND	:d: AIIND	:d: AIIND	:d: AIIND	:d: AIIND	0.003	0.015

Notes: 1. Units are µg/L for organic and inorganic chemicals and pCi/L for radionuclides.

2. <#> = HQ > 0.3.

3. >#< = HQ > 3.

4. - = No data.

5. AIIND = Analyte never detected in the hydrosegment/water type/field preparation bin.

6. :d: = Less than 5% detects for all water types within a hydrosegment/field preparation bin.

7. WGS = Springs.

8. WS = Surface water.

Table E-1.0-20
Water: COPECs

Canyon	Hydrosegment	Water Type	Field Preparation	Aluminum	Barium	Beryllium	Boron	Cadmium	Cobalt	Copper	Lead	Manganese	Nickel
Los Alamos	LA, lower	WGS	Filtered	<2.069>	>49.211<	N	<0.400>	:d: AIIND	<1.200>	<2.200>	>3.150<	N	<0.354>
Guaje	LA, lower	WS	Filtered	AIIND	>34.211<	AIIND	-	:d: AIIND	N	N	AIIND	<0.385>	N
Los Alamos	LA, lower	WS	Filtered	>7.701<	>28.421<	N	<0.487>	:d: AIIND	<1.033>	<1.886>	N	>3.788<	<0.314>
Los Alamos	LA, lower	WGS	Unfiltered	>7.356<	>47.895<	N	<0.396>	AIIND	<1.200>	<2.800>	N	N	<0.371>
Guaje	LA, lower	WS	Unfiltered	<0.679>	>34.211<	AIIND	-	<0.453>	N	N	AIIND	<0.436>	N
Los Alamos	LA, lower	WS	Unfiltered	>25.287<	>36.842<	N	<0.485>	<1.533>	<2.033>	<2.400>	>3.417<	>4.125<	<0.386>
DP	LA, middle	WGS	Filtered	>24.138<	>21.842<	AIIND	N	AIIND	AIIND	<0.534>	<2.500>	N	N
DP	LA, middle	WS	Filtered	>3.310<	>56.579<	N	<0.448>	<1.033>	<0.633>	<2.880>	<2.117>	>5.000<	N
Los Alamos	LA, middle	WS	Filtered	<2.161>	>11.368<	N	N	AIIND	AIIND	N	N	N	AIIND
DP	LA, middle	WGS	Unfiltered	>29.885<	>21.947<	N	N	AIIND	AIIND	<0.550>	>3.333<	N	N
DP	LA, middle	WS	Unfiltered	>75.977<	>25.316<	N	<0.467>	<2.533>	<0.500>	>13.740<	>6.917<	>5.250<	N
Los Alamos	LA, middle	WS	Unfiltered	-	-	-	-	-	-	-	-	-	-
Los Alamos	LA, upper	WS	Filtered	>13.103<	>44.737<	N	N	:d: AIIND	<1.400>	<0.354>	<2.375>	>60.000<	N
Los Alamos	LA, upper	WS	Unfiltered	>491.954<	>122.895<	<0.308>	N	>5.560<	>3.667<	>8.160<	>36.250<	>57.500<	<1.446>
Pueblo	Pueblo, lower	WS	Filtered	<1.713>	>22.368<	N	<0.717>	<1.667>	<1.117>	>7.240<	<1.125>	>24.375<	N
Pueblo	Pueblo, lower	WS	Unfiltered	>45.977<	>102.895<	N	<0.711>	<1.587>	>10.067<	>8.700<	>15.000<	>50.125<	<1.564>
Acid	Pueblo, middle	WS	Filtered	>6.782<	>34.211<	AIIND	N	<1.800>	N	<0.800>	AIIND	<1.750>	N
Pueblo	Pueblo, middle	WS	Filtered	<0.890>	>31.579<	N	N	<0.907>	<0.933>	N	N	>70.000<	N
Acid	Pueblo, middle	WS	Unfiltered	>22.989<	>34.211<	AIIND	N	<2.333>	<0.400>	<0.960>	>3.917<	<2.000>	N
Pueblo	Pueblo, middle	WS	Unfiltered	>36.782<	>60.526<	N	N	<1.140>	<2.067>	<0.940>	>9.167<	>77.500<	N
Pueblo	Pueblo, upper	WS	Filtered	<2.414>	>34.211<	N	N	:d: AIIND	<0.867>	<0.520>	<0.426>	>36.250<	N
Pueblo	Pueblo, upper	WS	Unfiltered	>29.885<	>44.737<	N	N	:d: AIIND	<0.800>	<0.920>	>7.917<	>37.500<	N

Table E-1.0-20 (continued)

Canyon	Hydrosegment	Water Type	Field Preparation	Selenium	Silver	Strontium	Uranium	Vanadium	Zinc	Cyanide (Total)	Chloride	Fluoride
Los Alamos	LA, lower	WGS	Filtered	<1.580>	N	-	<1.161>	<0.506>	N	:d: AIIND	N	N
Guaje	LA, lower	WS	Filtered	<0.700>	AIIND	-	-	<0.579>	AIIND	-	N	-
Los Alamos	LA, lower	WS	Filtered	<1.250>	N	N	<0.405>	<0.632>	<0.576>	-	N	<0.313>
Los Alamos	LA, lower	WGS	Unfiltered	<1.985>	N	-	<2.206>	<0.493>	<0.539>	AIIND	-	-
Guaje	LA, lower	WS	Unfiltered	<0.850>	AIIND	-	-	<0.526>	AIIND	-	-	-
Los Alamos	LA, lower	WS	Unfiltered	<2.550>	>8.056<	-	<0.489>	<0.747>	N	AIIND	-	-
DP	LA, middle	WGS	Filtered	AIIND	AIIND	<0.318>	N	N	<1.061>	AIIND	<0.461>	<0.688>
DP	LA, middle	WS	Filtered	<1.900>	AIIND	<0.456>	<0.898>	<1.037>	>8.788<	<2.308>	<1.070>	<0.457>
Los Alamos	LA, middle	WS	Filtered	<1.705>	AIIND	N	-	N	N	-	N	N
DP	LA, middle	WGS	Unfiltered	AIIND	AIIND	<0.318>	N	N	<0.758>	:d: AIIND	N	<0.688>
DP	LA, middle	WS	Unfiltered	<1.715>	AIIND	-	<0.735>	<1.132>	>14.242<	:d: AIIND	-	-
Los Alamos	LA, middle	WS	Unfiltered	AIIND	-	-	-	-	-	:d: AIIND	-	-
Los Alamos	LA, upper	WS	Filtered	AIIND	<2.472>	N	<1.172>	<0.521>	N	:d: AIIND	<0.404>	N
Los Alamos	LA, upper	WS	Unfiltered	<1.800>	<2.056>	N	<2.318>	<1.358>	<2.091>	:d: AIIND	N	N
Pueblo	Pueblo, lower	WS	Filtered	<0.495>	>3.500<	N	<1.073>	<1.147>	<0.656>	:d: AIIND	N	<0.400>
Pueblo	Pueblo, lower	WS	Unfiltered	<1.930>	>6.500<	N	<1.453>	<1.011>	>3.227<	>4.808<	-	-
Acid	Pueblo, middle	WS	Filtered	N	AIIND	N	>6.342<	N	<0.788>	:d: AIIND	<0.957>	N
Pueblo	Pueblo, middle	WS	Filtered	<1.100>	N	N	<0.353>	N	N	-	N	N
Acid	Pueblo, middle	WS	Unfiltered	N	<1.778>	N	>5.703<	N	<0.667>	AIIND	-	-
Pueblo	Pueblo, middle	WS	Unfiltered	<1.050>	<1.694>	N	N	<0.321>	<0.303>	<0.519>	-	-
Pueblo	Pueblo, upper	WS	Filtered	<0.700>	<1.583>	N	<0.495>	N	N	:d: AIIND	N	N
Pueblo	Pueblo, upper	WS	Unfiltered	<0.750>	<1.306>	N	<0.490>	N	<0.379>	N	-	-

Table E-1.0-20 (continued)

Canyon	Hydrosegment	Water Type	Field Preparation	Anthracene	gamma-BHC	Benz(a)anthracene	Benzo(a)pyrene	Benzoic Acid	4,4'-DDT	Endrin Aldehyde	Fluorene	Plutonium-239	Uranium-234
Los Alamos	LA, lower	WGS	Filtered	-	-	-	-	-	-	-	-	N	N
Guaje	LA, lower	WS	Filtered	-	-	-	-	-	-	-	-	AIIND	-
Los Alamos	LA, lower	WS	Filtered	-	-	-	-	-	-	-	-	AIIND	N
Los Alamos	LA, lower	WGS	Unfiltered	:d: AIIND	AIIND	:d: AIIND	:d: AIIND	:d: AIIND	<2.250>	:d: AIIND	:d: AIIND	N	N
Guaje	LA, lower	WS	Unfiltered	-	-	-	-	-	-	-	-	AIIND	-
Los Alamos	LA, lower	WS	Unfiltered	:d: AIIND	N	:d: AIIND	:d: AIIND	:d: AIIND	>8.000<	:d: AIIND	:d: AIIND	N	N
DP	LA, middle	WGS	Filtered	:d: AIIND	-	:d: AIIND	:d: AIIND	:d: AIIND	-	-	:d: AIIND	:d: AIIND	N
DP	LA, middle	WS	Filtered	-	-	-	-	-	-	-	-	:d: AIIND	N
Los Alamos	LA, middle	WS	Filtered	-	-	-	-	-	-	-	-	:d: AIIND	N
DP	LA, middle	WGS	Unfiltered	:d: AIIND	:d: AIIND	:d: AIIND	:d: AIIND	AIIND	AIIND	:d: AIIND	AIIND	N	N
DP	LA, middle	WS	Unfiltered	:d: AIIND	:d: AIIND	:d: AIIND	:d: AIIND	<0.605>	<0.700>	:d: AIIND	<0.385>	AIIND	N
Los Alamos	LA, middle	WS	Unfiltered	:d: AIIND	-	:d: AIIND	:d: AIIND	AIIND	-	-	AIIND	N	N
Los Alamos	LA, upper	WS	Filtered	-	-	-	-	-	-	-	-	:d: AIIND	N
Los Alamos	LA, upper	WS	Unfiltered	:d: AIIND	:d: AIIND	:d: AIIND	:d: AIIND	:d: AIIND	>8.500<	:d: AIIND	:d: AIIND	N	N
Pueblo	Pueblo, lower	WS	Filtered	-	-	-	-	-	-	-	-	AIIND	N
Pueblo	Pueblo, lower	WS	Unfiltered	:d: AIIND	N	:d: AIIND	:d: AIIND	:d: AIIND	N	<0.778>	:d: AIIND	N	N
Acid	Pueblo, middle	WS	Filtered	-	-	-	-	-	-	-	-	N	<0.341>
Pueblo	Pueblo, middle	WS	Filtered	-	-	-	-	-	-	-	-	AIIND	N
Acid	Pueblo, middle	WS	Unfiltered	>438.462<	:d: AIIND	>24.074<	>45.000<	:d: AIIND	:d: AIIND	:d: AIIND	N	<0.356>	<0.332>
Pueblo	Pueblo, middle	WS	Unfiltered	>469.231<	:d: AIIND	>29.259<	>40.000<	:d: AIIND	:d: AIIND	:d: AIIND	N	N	N
Pueblo	Pueblo, upper	WS	Filtered	-	-	-	-	-	-	-	-	:d: AIIND	N
Pueblo	Pueblo, upper	WS	Unfiltered	:d: AIIND	:d: AIIND	:d: AIIND	:d: AIIND	:d: AIIND	:d: AIIND	:d: AIIND	:d: AIIND	N	N

Notes: 1. Units are µg/L for organic and inorganic chemicals and pCi/L for radionuclides.

2. <#> = Retained as COPC.

3. >#< = Retained as COPC.

4. - = No data.

5. AIIND = Analyte never detected in the hydrosegment/water type/field preparation bin.

6. :d: = Less than 5% detects for all water types within a hydrosegment/field preparation bin.

7. N = Eliminated as a COPEC for this hydrosegment/water type/field preparation bin.

8. WGS = Springs.

9. WS = Surface water.

Table E-1.0-21
Water: Human Health SALs

Analyte Name	Type	Source	SAL	Std Reporting Units	Surrogate	Source of Surrogate
Americium-241	rad	DOE 5400.5	1.2	pCi/L		
Cesium-137	rad	DOE 5400.5	120	pCi/L		
Europium-152	rad	DOE 5400.5	800	pCi/L		
Plutonium-238	rad	DOE 5400.5	1.6	pCi/L		
Plutonium-239	rad	DOE 5400.5	1.2	pCi/L		
Strontium-90	rad	DOE 5400.5	40	pCi/L		
Technetium-99	rad	DOE 5400.5	4000	pCi/L		
Tritium	rad	DOE 5400.5	80000	pCi/L		
Uranium-234	rad	DOE 5400.5	20	pCi/L		
Uranium-235	rad	DOE 5400.5	24	pCi/L		
Uranium-238	rad	DOE 5400.5	24	pCi/L		
Acenaphthene	nc	EPA 2002, 73691	370	µg/L		
Acenaphthylene	nc		180	µg/L	Pyrene	NMED 2003, 81172
Acetone	nc	EPA 2002, 73691	610	µg/L		
Aluminum	nc	EPA 2002, 73691	37000	µg/L		
Ammonia		No SAL		µg/L		
Ammonium		No SAL		µg/L		
Anthracene	nc	EPA 2002, 73691	1800	µg/L		
Antimony	nc	EPA 2002, 73691	15	µg/L		
Arsenic	ca	EPA 2002, 73691	0.045	µg/L		
Barium	nc	EPA 2002, 73691	2600	µg/L		
Benzene	ca	EPA 2002, 73691	0.35	µg/L		
Benz(a)anthracene	ca	EPA 2002, 73691	0.092	µg/L		
Benzo(a)pyrene	ca	EPA 2002, 73691	0.0092	µg/L		
Benzo(b)fluoranthene	ca	EPA 2002, 73691	0.092	µg/L		
Benzo(g,h,i)perylene	nc		180	µg/L	Pyrene	LANL 2002, 72639
Benzo(k)fluoranthene	ca	EPA 2002, 73691	0.92	µg/L		
Benzoic Acid	nc	EPA 2002, 73691	150000	µg/L		
Benzyl Alcohol	nc	EPA 2002, 73691	11000	µg/L		
Beryllium	nc	EPA 2002, 73691	73	µg/L		
BHC[beta-]	ca	EPA 2002, 73691	0.037	µg/L		
BHC[gamma-]	ca	EPA 2002, 73691	0.052	µg/L		
Bis(2-ethylhexyl)phthalate	ca	EPA 2002, 73691	4.8	µg/L		
Boron	nc	EPA 2002, 73691	3300	µg/L		
Bromide		No SAL		µg/L		
Bromodichloromethane	ca	EPA 2002, 73691	0.18	µg/L		
Bromomethane	nc	EPA 2002, 73691	8.7	µg/L		
Butanone[2-]	nc	EPA 2002, 73691	1900	µg/L		

Table E-1.0-21 (continued)

Analyte Name	Type	Source	SAL	Std Reporting Units	Surrogate	Source of Surrogate
Butylbenzylphthalate	nc	EPA 2002, 73691	7300	µg/L		
Cadmium	nc	EPA 2002, 73691	18	µg/L		
Calcium		No SAL		µg/L		
Carbon Disulfide	nc	EPA 2002, 73691	1000	µg/L		
Chloride ^a		NMAC GW other stds for domestic water	250000	µg/L		
Chloroform	ca	EPA 2002, 73691	0.16	µg/L		
Chloronaphthalene[2-]	nc	EPA 2002, 73691	490	µg/L		
Chromium ^b	nc	EPA 2002, 73691	110	µg/L		
Chrysene	ca	EPA 2002, 73691	9.2	µg/L		
Cobalt	ca	EPA Region 9 2002, 76866	730	µg/L		
Copper	nc	EPA 2002, 73691	1400	µg/L		
Cyanide, Amenable to Chlorination	nc	EPA 2002, 73691	730	µg/L		
Cyanide, Total		No SAL		µg/L		
DDD[4,4'-]	ca	EPA 2002, 73691	0.28	µg/L		
DDE[4,4'-]	ca	EPA 2002, 73691	0.2	µg/L		
DDT[4,4'-]	ca	EPA 2002, 73691	0.2	µg/L		
Dibenz(a,h)anthracene	ca	EPA 2002, 73691	0.0092	µg/L		
Dichlorobenzene[1,4-]	ca	EPA 2002, 73691	0.47	µg/L		
Dichloroethane[1,2-]	ca	EPA 2002, 73691	0.12	µg/L		
Dieldrin	ca	EPA 2002, 73691	0.0042	µg/L		
Diethylphthalate	nc	EPA 2002, 73691	29000	µg/L		
Di-n-butylphthalate	nc	EPA 2002, 73691	3700	µg/L		
Endrin Aldehyde	nc		11	µg/L	Endrin	LANL 2002, 72639
Ethylbenzene	nc	EPA 2002, 73691	1300	µg/L		
Fluoranthene	nc	EPA 2002, 73691	1500	µg/L		
Fluorene	nc	EPA 2002, 73691	240	µg/L		
Fluoride	nc	EPA 2002, 73691	2200	µg/L		
Indeno(1,2,3-cd)pyrene	ca	EPA 2002, 73691	0.092	µg/L		
Iron	nc	EPA 2002, 73691	11000	µg/L		
Isopropyltoluene[4-]	nc		660	µg/L	Isopropyl-benzene	LANL 2002, 72639
Lead	nc	EPA 2002, 73691	15	µg/L		
Lithium	nc	EPA 2002, 73691	730	µg/L		
Magnesium		No SAL		µg/L		
Manganese	nc	EPA 2002, 73691	1700	µg/L		
Mercury	nc	EPA 2002, 73691	11	µg/L		
Methylene Chloride	ca	EPA 2002, 73691	4.3	µg/L		
Methylnaphthalene[2-]	nc		6.2	µg/L	Naphthalene	LANL 2002, 72639
Molybdenum	nc	EPA 2002, 73691	180	µg/L		
Naphthalene	nc	EPA 2002, 73691	6.2	µg/L		

Table E-1.0-21 (continued)

Analyte Name	Type	Source	SAL	Std Reporting Units	Surrogate	Source of Surrogate
Nickel	nc	EPA 2002, 73691	730	µg/L		
Nitrate	nc	EPA 2002, 73691	10000	µg/L		
Nitrate-Nitrite as N		No SAL		µg/L		
Nitrite	nc	EPA 2002, 73691	1000	µg/L		
Perchlorate	nc	EPA 2002, 73691	3.7	µg/L		
Phenanthrene	nc		180	µg/L	Pyrene	NMED 2003, 81172
Phenol	nc	EPA 2002, 73691	11000	µg/L		
Phosphorus, Orthophosphate (Expressed as PO ₄)		No SAL		µg/L		
Potassium		No SAL		µg/L		
Pyrene	nc	EPA 2002, 73691	180	µg/L		
Selenium	nc	EPA 2002, 73691	180	µg/L		
Silicon		No SAL		µg/L		
Silicon Dioxide		No SAL		µg/L		
Silver	nc	EPA 2002, 73691	180	µg/L		
Sodium		No SAL		µg/L		
Strontium	nc	EPA 2002, 73691	22000	µg/L		
Sulfate		No SAL		µg/L		
Thallium	nc	EPA Region 9 2002, 76866	2.6	µg/L		
Titanium		No SAL		µg/L		
Toluene	nc	EPA 2002, 73691	720	µg/L		
Total DDx		No SAL		µg/L		
Total Kjeldahl Nitrogen		No SAL		µg/L		
Total Naphthalene		No SAL		µg/L		
Total Petroleum Hydrocarbons Diesel Range Organics		No SAL		µg/L		
Total Phenol		No SAL		µg/L		
Total Phosphorus		No SAL		µg/L		
Total THM		No SAL		µg/L		
Trichloroethene	ca	EPA 2002, 73691	0.028	µg/L		
Trimethylbenzene[1,2,4-]	nc	EPA 2002, 73691	12	µg/L		
Uranium	nc	EPA Region 9 2002, 76866	7.3	µg/L		
Vanadium	nc	EPA 2002, 73691	260	µg/L		
Xylene[1,2-]	nc	EPA 2002, 73691	1400	µg/L		
Xylene[1,3-]			1400	µg/L	from Xylene (Total)	
Xylene[1,3-]+Xylene[1,4-]	nc		1400	µg/L	from Xylene (Total)	
Zinc	nc	EPA 2002, 73691	11000	µg/L		

Notes: ca = Carcinogen, nc = noncarcinogen, rad = radionuclides.

^a No EPA Region 6 SAL, use NMAC GW value.

^b Total chromium does not have an EPA Region 6 SAL used SAL for Cr+6.

Table E-1.0-22
Water: Tier 1 Human Health Screening Summary

Canyon	Hydrosegment	Water Type	Field Preparation	Lead	Arsenic	beta-BHC	Benzene	Benz(a)anthracene	Benzo(a)pyrene	Benzo(b)fluoranthene	Bis(2-ethylhexyl)phthalate	Bromodichloromethane	Chloroform	4,4'-DDE	4,4'-DDT
Max HQ				2.9	331.111	2.703	9.714	8.587	68.478	6.304	7.5	1.167	17.5	2.85	1.7
Screen Value				15	0.045	0.037	0.35	0.092	0.009	0.092	4.8	0.18	0.16	0.2	0.2
Los Alamos	LA, lower	WGA	Filtered	0.006	>215.556<	-	-	-	-	-	-	-	-	-	-
Los Alamos	LA, lower	WGS	Filtered	0.252	>135.556<	-	-	-	-	-	-	-	-	-	-
Guaje	LA, lower	WS	Filtered	AIIND	>122.222<	-	-	-	-	-	-	-	-	-	-
Los Alamos	LA, lower	WS	Filtered	0.013	>173.333<	-	-	-	-	-	-	-	-	-	-
Los Alamos	LA, lower	WGA	Unfiltered	0.172	>189.111<	:d: AIIND	<9.714>	:d: AIIND	:d: AIIND	:d: AIIND	:d: AIIND	:d: AIIND	:d: AIIND	AIIND	0.055
Los Alamos	LA, lower	WGS	Unfiltered	0.01	>153.333<	:d: AIIND	AIIND	:d: AIIND	:d: AIIND	:d: AIIND	:d: AIIND	:d: AIIND	:d: AIIND	AIIND	0.45
Guaje	LA, lower	WS	Unfiltered	AIIND	>140.000<	-	-	-	-	-	-	-	-	-	-
Los Alamos	LA, lower	WS	Unfiltered	0.273	>188.889<	:d: AIIND	AIIND	:d: AIIND	:d: AIIND	:d: AIIND	:d: AIIND	:d: AIIND	:d: AIIND	0.37	<1.600>
DP	LA, middle	WGA	Filtered	0.333	>73.333<	-	-	:d: AIIND	:d: AIIND	:d: AIIND	<7.500>	-	-	-	-
Los Alamos	LA, middle	WGA	Filtered	0.193	>102.444<	-	-	-	-	-	-	-	-	-	-
DP	LA, middle	WGS	Filtered	0.2	>40.000<	-	-	:d: AIIND	:d: AIIND	:d: AIIND	AIIND	-	-	-	-
DP	LA, middle	WS	Filtered	0.169	>242.222<	-	-	-	-	-	-	-	-	-	-
Los Alamos	LA, middle	WS	Filtered	0.011	AIIND	-	-	-	-	-	-	-	-	-	-
DP	LA, middle	WGA	Unfiltered	0.4	>177.778<	AIIND	:d: AIIND	:d: AIIND	:d: AIIND	:d: AIIND	AIIND	AIIND	AIIND	:d: AIIND	0.048
Los Alamos	LA, middle	WGA	Unfiltered	0.127	>110.000<	AIIND	:d: AIIND	:d: AIIND	:d: AIIND	:d: AIIND	0.729	AIIND	AIIND	:d: AIIND	0.041
DP	LA, middle	WGS	Unfiltered	0.267	>62.222<	AIIND	:d: AIIND	:d: AIIND	:d: AIIND	:d: AIIND	AIIND	AIIND	AIIND	:d: AIIND	AIIND
DP	LA, middle	WS	Unfiltered	0.553	>271.111<	<2.703>	:d: AIIND	:d: AIIND	:d: AIIND	:d: AIIND	0.708	<1.167>	>17.500<	:d: AIIND	0.14
Los Alamos	LA, middle	WS	Unfiltered	-	-	-	:d: AIIND	:d: AIIND	:d: AIIND	:d: AIIND	AIIND	AIIND	AIIND	-	-
Los Alamos	LA, upper	WGA	Filtered	0.127	>82.889<	-	-	-	-	-	-	-	-	-	-
Los Alamos	LA, upper	WS	Filtered	0.19	>89.333<	-	-	-	-	-	-	-	-	-	-

Table E-1.0-22 (continued)

Canyon	Hydrosegment	Water Type	Field Preparation	Lead	Arsenic	beta-BHC	Benzene	Benz(a)anthracene	Benzo(a)pyrene	Benzo(b)fluoranthene	Bis(2-ethylhexyl)phthalate	Bromodichloromethane	Chloroform	4,4'-DDE	4,4'-DDT
Max HQ				2.9	331.111	2.703	9.714	8.587	68.478	6.304	7.5	1.167	17.5	2.85	1.7
Screen Value				15	0.045	0.037	0.35	0.092	0.009	0.092	4.8	0.18	0.16	0.2	0.2
Los Alamos	LA, upper	WGA	Unfiltered	0.177	>85.556<	:d: AIIND	<1.286>	:d: AIIND	:d: AIIND	:d: AIIND	0.708	:d: AIIND	:d: AIIND	0.05	0.12
Los Alamos	LA, upper	WS	Unfiltered	2.9	>172.222<	:d: AIIND	AIIND	:d: AIIND	:d: AIIND	:d: AIIND	0.042	:d: AIIND	:d: AIIND	<2.850>	<1.700>
Pueblo	Pueblo, lower	WGA	Filtered	0.026	>244.444<	-	-	-	-	-	-	-	-	-	-
Pueblo	Pueblo, lower	WS	Filtered	0.09	>288.889<	-	-	-	-	-	-	-	-	-	-
Pueblo	Pueblo, lower	WGA	Unfiltered	0.185	>222.222<	AIIND	:d: AIIND	:d: AIIND	:d: AIIND	:d: AIIND	0.563	:d: AIIND	AIIND	0.034	0.065
Pueblo	Pueblo, lower	WS	Unfiltered	1.2	>331.111<	0.378	:d: AIIND	:d: AIIND	:d: AIIND	:d: AIIND	<1.417>	:d: AIIND	<1.500>	AIIND	0.05
Pueblo	Pueblo, middle	WGA	Filtered	AIIND	>64.444<	-	-	-	-	-	-	-	-	-	-
Acid	Pueblo, middle	WS	Filtered	AIIND	>80.000<	-	-	-	-	-	-	-	-	-	-
Pueblo	Pueblo, middle	WS	Filtered	0.001	>40.000<	-	-	-	-	-	-	-	-	-	-
Pueblo	Pueblo, middle	WGA	Unfiltered	AIIND	>53.333<	:d: AIIND	:d: AIIND	AIIND	AIIND	AIIND	AIIND	:d: AIIND	:d: AIIND	:d: AIIND	:d: AIIND
Acid	Pueblo, middle	WS	Unfiltered	0.313	>71.111<	:d: AIIND	:d: AIIND	<7.065>	>68.478<	<5.326>	0.667	:d: AIIND	:d: AIIND	:d: AIIND	:d: AIIND
Pueblo	Pueblo, middle	WS	Unfiltered	0.733	>135.556<	:d: AIIND	:d: AIIND	<8.587>	>60.870<	<6.304>	AIIND	:d: AIIND	:d: AIIND	:d: AIIND	:d: AIIND
Pueblo	Pueblo, upper	WGA	Filtered	AIIND	>35.556<	-	-	-	-	-	-	-	-	-	-
Pueblo	Pueblo, upper	WS	Filtered	0.034	>77.778<	-	-	-	-	-	-	-	-	-	-
Pueblo	Pueblo, upper	WGA	Unfiltered	0.003	>28.889<	:d: AIIND	:d: AIIND	:d: AIIND	:d: AIIND	:d: AIIND	0.042	:d: AIIND	:d: AIIND	:d: AIIND	:d: AIIND
Pueblo	Pueblo, upper	WS	Unfiltered	0.633	>98.889<	:d: AIIND	:d: AIIND	:d: AIIND	:d: AIIND	:d: AIIND	AIIND	:d: AIIND	:d: AIIND	:d: AIIND	:d: AIIND

Table E-1.0-22 (continued)

Canyon	Hydrosegment	Water Type	Field Preparation	Dibenz(a,h)anthracene	1,2-Dichloroethane	Dieldrin	Indeno(1,2,3-cd)pyrene	Methylene Chloride	Trichloroethene	Total Cancer HI	Aluminum	Antimony	Barium	Boron	Chromium
Max HQ				46.739	63.333	1.286	6.196	9.302	60.714		1.157	0.267	0.18	0.12	0.318
Screen Value				0.009	0.12	0.004	0.092	4.3	0.028		37000	15	2600	3300	110
Los Alamos	LA, lower	WGA	Filtered	-	-	-	-	-	-	>215.559<	0.001	AIIND	<0.143>	0.071	0.015
Los Alamos	LA, lower	WGS	Filtered	-	-	-	-	-	-	>135.56<	0.005	<0.200>	0.072	0.065	0.007
Guaje	LA, lower	WS	Filtered	-	-	-	-	-	-	>122.223<	AIIND	AIIND	0.05	-	0.014
Los Alamos	LA, lower	WS	Filtered	-	-	-	-	-	-	>173.338<	0.018	0.02	0.042	0.08	0.022
Los Alamos	LA, lower	WGA	Unfiltered	:d: AIIND	:d: AIIND	:d: AIIND	:d: AIIND	AIIND	>60.714<	>259.602<	0.065	<0.233>	<0.152>	0.072	0.072
Los Alamos	LA, lower	WGS	Unfiltered	:d: AIIND	:d: AIIND	:d: AIIND	:d: AIIND	0.326	AIIND	>154.114<	0.017	<0.200>	0.07	0.065	0.012
Guaje	LA, lower	WS	Unfiltered	-	-	-	-	-	-	>140.001<	0.002	AIIND	0.05	-	0.007
Los Alamos	LA, lower	WS	Unfiltered	:d: AIIND	:d: AIIND	:d: AIIND	:d: AIIND	AIIND	AIIND	>190.998<	0.059	0.08	0.054	0.079	0.043
DP	LA, middle	WGA	Filtered	:d: AIIND	-	-	:d: AIIND	-	-	>80.834<	0.008	AIIND	0.089	0.02	0.006
Los Alamos	LA, middle	WGA	Filtered	-	-	-	-	-	-	>102.444<	0.003	0.016	0.03	0.008	0.038
DP	LA, middle	WGS	Filtered	:d: AIIND	-	-	:d: AIIND	-	-	>40<	0.057	AIIND	0.032	0.014	AIIND
DP	LA, middle	WS	Filtered	-	-	-	-	-	-	>242.225<	0.008	<0.147>	0.083	0.073	0.034
Los Alamos	LA, middle	WS	Filtered	-	-	-	-	-	-	-	0.005	AIIND	0.017	0.008	0.01
DP	LA, middle	WGA	Unfiltered	:d: AIIND	AIIND	:d: AIIND	:d: AIIND	<8.837>	:d: AIIND	>187.536<	<0.127>	AIIND	0.09	0.02	0.023
Los Alamos	LA, middle	WGA	Unfiltered	:d: AIIND	AIIND	:d: AIIND	:d: AIIND	0.698	:d: AIIND	>111.501<	0.012	0.011	0.03	0.007	0.036
DP	LA, middle	WGS	Unfiltered	:d: AIIND	>63.333<	:d: AIIND	:d: AIIND	AIIND	:d: AIIND	>125.556<	0.07	AIIND	0.032	0.012	AIIND
DP	LA, middle	WS	Unfiltered	:d: AIIND	AIIND	:d: AIIND	:d: AIIND	0.326	:d: AIIND	>294.529<	<0.179>	<0.143>	0.037	0.076	0.046
Los Alamos	LA, middle	WS	Unfiltered	:d: AIIND	AIIND	-	:d: AIIND	AIIND	:d: AIIND	-	-	-	-	-	-
Los Alamos	LA, upper	WGA	Filtered	-	-	-	-	-	-	>82.891<	0.066	:d:	0.037	0.017	<0.145>
Los Alamos	LA, upper	WS	Filtered	-	-	-	-	-	-	>89.339<	0.031	:d: AIIND	0.065	0.008	0.016

Table E-1.0-22 (continued)

Canyon	Hydrosegment	Water Type	Field Preparation	Dibenz(a,h)anthracene	1,2-Dichloroethane	Dieldrin	Indeno(1,2,3-cd)pyrene	Methylene Chloride	Trichloroethene	Total Cancer HI	Aluminum	Antimony	Barium	Boron	Chromium
Max HQ				46.739	63.333	1.286	6.196	9.302	60.714		1.157	0.267	0.18	0.12	0.318
Screen Value				0.009	0.12	0.004	0.092	4.3	0.028		37000	15	2600	3300	110
Los Alamos	LA, upper	WGA	Unfiltered	:d: AIIND	:d: AIIND	:d: AIIND	:d: AIIND	<5.814>	:d: AIIND	>93.604<	<0.230>	0.056	0.046	0.017	<0.318>
Los Alamos	LA, upper	WS	Unfiltered	:d: AIIND	:d: AIIND	:d: AIIND	:d: AIIND	<9.302>	:d: AIIND	>186.163<	>1.157<	0.031	<0.180>	0.009	<0.171>
Pueblo	Pueblo, lower	WGA	Filtered	-	-	-	-	-	-	>244.46<	0.002	AIIND	0.063	<0.116>	0.015
Pueblo	Pueblo, lower	WS	Filtered	-	-	-	-	-	-	>288.893<	0.004	0.035	0.033	<0.117>	0.016
Pueblo	Pueblo, lower	WGA	Unfiltered	:d: AIIND	:d: AIIND	:d: AIIND	:d: AIIND	0.226	:d: AIIND	>223.152<	0.018	AIIND	0.077	<0.120>	0.036
Pueblo	Pueblo, lower	WS	Unfiltered	:d: AIIND	:d: AIIND	:d: AIIND	:d: AIIND	AIIND	:d: AIIND	>335.349<	<0.108>	0.023	<0.150>	<0.116>	0.043
Pueblo	Pueblo, middle	WGA	Filtered	-	-	-	-	-	-	>64.444<	AIIND	AIIND	0.02	-	AIIND
Acid	Pueblo, middle	WS	Filtered	-	-	-	-	-	-	>80.001<	0.016	0.016	0.05	0.006	0.018
Pueblo	Pueblo, middle	WS	Filtered	-	-	-	-	-	-	>40.004<	0.002	0.016	0.046	0.01	0.007
Pueblo	Pueblo, middle	WGA	Unfiltered	AIIND	:d: AIIND	:d: AIIND	AIIND	:d: AIIND	:d: AIIND	>53.334<	0.041	AIIND	0.028	0.027	0.014
Acid	Pueblo, middle	WS	Unfiltered	>46.739<	:d: AIIND	:d: AIIND	<5.109>	:d: AIIND	:d: AIIND	>205.402<	0.054	0.019	0.05	0.006	0.021
Pueblo	Pueblo, middle	WS	Unfiltered	AIIND	:d: AIIND	:d: AIIND	<6.196>	:d: AIIND	:d: AIIND	>218.389<	0.086	0.027	0.088	0.012	0.016
Pueblo	Pueblo, upper	WGA	Filtered	-	-	-	-	-	-	>35.559<	AIIND	<0.267>	0.026	0.014	0.026
Pueblo	Pueblo, upper	WS	Filtered	-	-	-	-	-	-	>77.781<	0.006	<0.247>	0.05	0.009	0.074
Pueblo	Pueblo, upper	WGA	Unfiltered	<2.554>	:d: AIIND	<1.286>	:d: AIIND	:d: AIIND	:d: AIIND	>32.819<	0.001	0.022	0.026	0.013	0.006
Pueblo	Pueblo, upper	WS	Unfiltered	AIIND	:d: AIIND	AIIND	:d: AIIND	:d: AIIND	:d: AIIND	>98.892<	0.07	<0.200>	0.065	0.008	0.019

Table E-1.0-22 (continued)

Canyon	Hydrosegment	Water Type	Field Preparation	Copper	Iron	Manganese	Molybdenum	Thallium	Uranium	Vanadium	Chloride	Fluoride	Nitrate	Nitrite
Max HQ				0.104	2.2	3.647	11.111	1.692	1.564	0.118	1.08	0.727	0.74	3.99
Screen Value				1400	11000	1700	180	2.6	7.3	260	250000	2200	10000	1000
Los Alamos	LA, lower	WGA	Filtered	0.006	0.004	0.039	0.033	>1.308<	>1.493<	0.037	<0.520>	<0.277>	<0.740>	>3.990<
Los Alamos	LA, lower	WGS	Filtered	0.008	0.004	0.006	0.044	>1.462<	<0.286>	0.037	<0.204>	<0.191>	-	-
Guaje	LA, lower	WS	Filtered	0	0.009	0.018	-	AllND	-	0.042	<0.152>	-	-	-
Los Alamos	LA, lower	WS	Filtered	0.007	0.052	<0.178>	0.07	<0.358>	0.1	0.046	<0.192>	<0.227>	-	-
Los Alamos	LA, lower	WGA	Unfiltered	<0.104>	<0.341>	<0.138>	0.044	>1.154<	>1.414<	<0.118>	<0.168>	<0.205>	<0.730>	>3.070<
Los Alamos	LA, lower	WGS	Unfiltered	0.01	0.033	0.008	0.044	>1.308<	<0.544>	0.036	-	-	-	-
Guaje	LA, lower	WS	Unfiltered	0.001	0.004	0.021	-	AllND	-	0.038	-	-	-	-
Los Alamos	LA, lower	WS	Unfiltered	0.009	<0.155>	<0.194>	0.07	<0.284>	<0.121>	0.055	-	-	-	-
DP	LA, middle	WGA	Filtered	0.002	0.095	<0.488>	0.03	AllND	0.092	0.01	>1.080<	<0.591>	-	-
Los Alamos	LA, middle	WGA	Filtered	0.002	0.006	0.024	>11.111<	>1.269<	<0.390>	0.019	<0.278>	<0.727>	-	-
DP	LA, middle	WGS	Filtered	0.002	0.085	0.001	0.018	>1.423<	0.05	0.014	<0.424>	<0.500>	-	-
DP	LA, middle	WS	Filtered	0.01	<0.209>	<0.235>	0.051	>1.231<	<0.221>	0.076	<0.984>	<0.332>	-	-
Los Alamos	LA, middle	WS	Filtered	0.001	0.008	0.006	0.062	<0.172>	-	0.005	<0.111>	0.049	-	-
DP	LA, middle	WGA	Unfiltered	0.003	<0.609>	<0.512>	0.012	AllND	0.097	0.026	<0.252>	<0.591>	-	-
Los Alamos	LA, middle	WGA	Unfiltered	0.001	0.019	0.002	>11.111<	<0.923>	0.062	0.018	-	-	-	-
DP	LA, middle	WGS	Unfiltered	0.002	<0.118>	0.01	0.021	>1.462<	0.04	0.016	<0.140>	<0.500>	-	-
DP	LA, middle	WS	Unfiltered	0.049	<0.423>	<0.247>	0.047	>1.115<	<0.181>	0.083	-	-	-	-
Los Alamos	LA, middle	WS	Unfiltered	-	-	-	-	-	-	-	-	-	-	-
Los Alamos	LA, upper	WGA	Filtered	0.004	<0.117>	<0.335>	<0.778>	>1.692<	0.078	0.017	<0.440>	<0.279>	:d: AllND	:d: AllND
Los Alamos	LA, upper	WS	Filtered	0.001	<0.355>	>2.824<	0.007	0.027	<0.289>	0.038	<0.372>	<0.118>	-	-
Los Alamos	LA, upper	WGA	Unfiltered	0.003	<0.336>	<0.541>	<0.778>	<0.808>	0.073	0.029	-	<0.278>	-	-
Los Alamos	LA, upper	WS	Unfiltered	0.029	>2.200<	>2.706<	0.021	>1.000<	<0.572>	0.099	0.026	0.059	-	-

Table E-1.0-22 (continued)

Canyon	Hydrosegment	Water Type	Field Preparation	Copper	Iron	Manganese	Molybdenum	Thallium	Uranium	Vanadium	Chloride	Fluoride	Nitrate	Nitrite
Max HQ				0.104	2.2	3.647	11.111	1.692	1.564	0.118	1.08	0.727	0.74	3.99
Screen Value				1400	11000	1700	180	2.6	7.3	260	250000	2200	10000	1000
Pueblo	Pueblo, lower	WGA	Filtered	0.004	<0.532>	>2.353<	0.015	>1.269<	0.095	0.032	<0.209>	<0.323>	<0.310>	nd: AIIND
Pueblo	Pueblo, lower	WS	Filtered	0.026	0.048	>1.147<	0.054	>1.038<	<0.265>	0.084	<0.183>	<0.291>	-	-
Pueblo	Pueblo, lower	WGA	Unfiltered	0.012	<0.509>	>2.412<	0.015	0.045	<0.108>	0.087	<0.172>	<0.241>	<0.290>	nd: AIIND
Pueblo	Pueblo, lower	WS	Unfiltered	0.031	>1.282<	>2.359<	0.052	>1.154<	<0.358>	0.074	-	-	-	-
Pueblo	Pueblo, middle	WGA	Filtered	0.002	AIIND	0	AIIND	AIIND	AIIND	0.009	<0.184>	<0.164>	-	-
Acid	Pueblo, middle	WS	Filtered	0.003	0.01	0.082	0.025	>1.308<	>1.564<	0.011	<0.880>	<0.209>	-	-
Pueblo	Pueblo, middle	WS	Filtered	0.001	0.006	>3.294<	AIIND	0.065	0.087	0.012	<0.260>	<0.102>	-	-
Pueblo	Pueblo, middle	WGA	Unfiltered	0.002	0.07	<0.209>	0.017	AIIND	<0.252>	0.019	-	-	-	-
Acid	Pueblo, middle	WS	Unfiltered	0.003	<0.109>	0.094	0.023	>1.115<	>1.406<	0.017	-	-	-	-
Pueblo	Pueblo, middle	WS	Unfiltered	0.003	<0.473>	>3.647<	0.009	AIIND	0.032	0.023	-	-	-	-
Pueblo	Pueblo, upper	WGA	Filtered	0.001	0.002	>1.300<	0.027	>1.154<	0.086	0.016	<0.236>	0.068	-	-
Pueblo	Pueblo, upper	WS	Filtered	0.002	0.048	>1.706<	0.024	<0.297>	<0.122>	0.016	<0.178>	<0.120>	-	-
Pueblo	Pueblo, upper	WGA	Unfiltered	0.002	0.005	>1.306<	0.02	<0.885>	0.097	0.013	-	-	-	-
Pueblo	Pueblo, upper	WS	Unfiltered	0.003	<0.255>	>1.765<	AIIND	AIIND	<0.121>	0.019	-	-	-	-

Notes: 1. WGA = Alluvial groundwater.
 2. WGS = Springs.
 3. WS = Surface water.

Table E-1.0-23
Water: Tier 1 Human Health COPCs

Canyon	Hydrosegment	Water Type	Field Preparation	Lead	Arsenic	beta-BHC	Benzene	Benz(a)anthracene	Benzo(a)pyrene	Benzo(b)fluoranthene	Bis(2-ethylhexyl)phthalate	Bromodichloromethane	Chloroform	4,4'-DDE	4,4'-DDT
Max HQ				2.9	331.111	2.703	9.714	8.587	68.478	6.304	7.5	1.167	17.5	2.85	1.7
Screen Value				15	0.045	0.037	0.35	0.092	0.009	0.092	4.8	0.18	0.16	0.2	0.2
Los Alamos	LA, lower	WGA	Filtered	0.006	>215.556<	-	-	-	-	-	-	-	-	-	-
Los Alamos	LA, lower	WGS	Filtered	0.252	>135.556<	-	-	-	-	-	-	-	-	-	-
Guaje	LA, lower	WS	Filtered	AIIND	>122.222<	-	-	-	-	-	-	-	-	-	-
Los Alamos	LA, lower	WS	Filtered	0.013	>173.333<	-	-	-	-	-	-	-	-	-	-
Los Alamos	LA, lower	WGA	Unfiltered	0.172	>189.111<	:d: AIIND	<9.714>	:d: AIIND	:d: AIIND	:d: AIIND	:d: AIIND	:d: AIIND	:d: AIIND	AIIND	N
Los Alamos	LA, lower	WGS	Unfiltered	0.01	>153.333<	:d: AIIND	AIIND	:d: AIIND	:d: AIIND	:d: AIIND	:d: AIIND	:d: AIIND	:d: AIIND	AIIND	N
Guaje	LA, lower	WS	Unfiltered	AIIND	>140.000<	-	-	-	-	-	-	-	-	-	-
Los Alamos	LA, lower	WS	Unfiltered	0.273	>188.889<	:d: AIIND	AIIND	:d: AIIND	:d: AIIND	:d: AIIND	:d: AIIND	:d: AIIND	:d: AIIND	N	<1.600>
DP	LA, middle	WGA	Filtered	0.333	>73.333<	-	-	:d: AIIND	:d: AIIND	:d: AIIND	<7.500>	-	-	-	-
Los Alamos	LA, middle	WGA	Filtered	0.193	>102.444<	-	-	-	-	-	-	-	-	-	-
DP	LA, middle	WGS	Filtered	0.2	>40.000<	-	-	:d: AIIND	:d: AIIND	:d: AIIND	AIIND	-	-	-	-
DP	LA, middle	WS	Filtered	0.169	>242.222<	-	-	-	-	-	-	-	-	-	-
Los Alamos	LA, middle	WS	Filtered	0.011	AIIND	-	-	-	-	-	-	-	-	-	-
DP	LA, middle	WGA	Unfiltered	0.4	>177.778<	AIIND	:d: AIIND	:d: AIIND	:d: AIIND	:d: AIIND	AIIND	AIIND	AIIND	:d: AIIND	N
Los Alamos	LA, middle	WGA	Unfiltered	0.127	>110.000<	AIIND	:d: AIIND	:d: AIIND	:d: AIIND	:d: AIIND	N	AIIND	AIIND	:d: AIIND	N
DP	LA, middle	WGS	Unfiltered	0.267	>62.222<	AIIND	:d: AIIND	:d: AIIND	:d: AIIND	:d: AIIND	AIIND	AIIND	AIIND	:d: AIIND	AIIND
DP	LA, middle	WS	Unfiltered	0.553	>271.111<	<2.703>	:d: AIIND	:d: AIIND	:d: AIIND	:d: AIIND	N	<1.167>	>17.500<	:d: AIIND	N
Los Alamos	LA, middle	WS	Unfiltered	-	-	-	:d: AIIND	:d: AIIND	:d: AIIND	:d: AIIND	AIIND	AIIND	AIIND	-	-
Los Alamos	LA, upper	WGA	Filtered	0.127	>82.889<	-	-	-	-	-	-	-	-	-	-
Los Alamos	LA, upper	WS	Filtered	0.19	>89.333<	-	-	-	-	-	-	-	-	-	-

Table E-1.0-23 (continued)

Canyon	Hydrosegment	Water Type	Field Preparation	Lead	Arsenic	beta-BHC	Benzene	Benz(a)anthracene	Benzo(a)pyrene	Benzo(b)fluoranthene	Bis(2-ethylhexyl)phthalate	Bromodichloromethane	Chloroform	4,4'-DDE	4,4'-DDT
Max HQ				2.9	331.111	2.703	9.714	8.587	68.478	6.304	7.5	1.167	17.5	2.85	1.7
Screen Value				15	0.045	0.037	0.35	0.092	0.009	0.092	4.8	0.18	0.16	0.2	0.2
Los Alamos	LA, upper	WGA	Unfiltered	0.177	>85.556<	:d: AIIND	<1.286>	:d: AIIND	:d: AIIND	:d: AIIND	N	:d: AIIND	:d: AIIND	N	N
Los Alamos	LA, upper	WS	Unfiltered	2.9	>172.222<	:d: AIIND	AIIND	:d: AIIND	:d: AIIND	:d: AIIND	N	:d: AIIND	:d: AIIND	<2.850>	<1.700>
Pueblo	Pueblo, lower	WGA	Filtered	0.026	>244.444<	-	-	-	-	-	-	-	-	-	-
Pueblo	Pueblo, lower	WS	Filtered	0.09	>288.889<	-	-	-	-	-	-	-	-	-	-
Pueblo	Pueblo, lower	WGA	Unfiltered	0.185	>222.222<	AIIND	:d: AIIND	:d: AIIND	:d: AIIND	:d: AIIND	N	:d: AIIND	AIIND	N	N
Pueblo	Pueblo, lower	WS	Unfiltered	1.2	>331.111<	N	:d: AIIND	:d: AIIND	:d: AIIND	:d: AIIND	<1.417>	:d: AIIND	<1.500>	AIIND	N
Pueblo	Pueblo, middle	WGA	Filtered	AIIND	>64.444<	-	-	-	-	-	-	-	-	-	-
Acid	Pueblo, middle	WS	Filtered	AIIND	>80.000<	-	-	-	-	-	-	-	-	-	-
Pueblo	Pueblo, middle	WS	Filtered	0.001	>40.000<	-	-	-	-	-	-	-	-	-	-
Pueblo	Pueblo, middle	WGA	Unfiltered	AIIND	>53.333<	:d: AIIND	:d: AIIND	AIIND	AIIND	AIIND	AIIND	:d: AIIND	:d: AIIND	:d: AIIND	:d: AIIND
Acid	Pueblo, middle	WS	Unfiltered	0.313	>71.111<	:d: AIIND	:d: AIIND	<7.065>	>68.478<	<5.326>	N	:d: AIIND	:d: AIIND	:d: AIIND	:d: AIIND
Pueblo	Pueblo, middle	WS	Unfiltered	0.733	>135.556<	:d: AIIND	:d: AIIND	<8.587>	>60.870<	<6.304>	AIIND	:d: AIIND	:d: AIIND	:d: AIIND	:d: AIIND
Pueblo	Pueblo, upper	WGA	Filtered	AIIND	>35.556<	-	-	-	-	-	-	-	-	-	-
Pueblo	Pueblo, upper	WS	Filtered	0.034	>77.778<	-	-	-	-	-	-	-	-	-	-
Pueblo	Pueblo, upper	WGA	Unfiltered	0.003	>28.889<	:d: AIIND	:d: AIIND	:d: AIIND	:d: AIIND	:d: AIIND	N	:d: AIIND	:d: AIIND	:d: AIIND	:d: AIIND
Pueblo	Pueblo, upper	WS	Unfiltered	0.633	>98.889<	:d: AIIND	:d: AIIND	:d: AIIND	:d: AIIND	:d: AIIND	AIIND	:d: AIIND	:d: AIIND	:d: AIIND	:d: AIIND

Table E-1.0-23 (continued)

Canyon	Hydrosegment	Water Type	Field Preparation	Dibenz(a,h)anthracene	1,2-Dichloroethane	Dieldrin	Indeno(1,2,3-cd)pyrene	Methylene Chloride	Trichloroethene	Total Cancer HI	Aluminum	Antimony	Barium	Boron	Chromium
Max HQ				46.739	63.333	1.286	6.196	9.302	60.714		1.157	0.267	0.18	0.12	0.318
Screen Value				0.009	0.12	0.004	0.092	4.3	0.028		37000	15	2600	3300	110
Los Alamos	LA, lower	WGA	Filtered	-	-	-	-	-	-	>215.559<	N	AIIND	<0.143>	N	N
Los Alamos	LA, lower	WGS	Filtered	-	-	-	-	-	-	>135.56<	N	<0.200>	N	N	N
Guaje	LA, lower	WS	Filtered	-	-	-	-	-	-	>122.223<	AIIND	AIIND	N	-	N
Los Alamos	LA, lower	WS	Filtered	-	-	-	-	-	-	>173.338<	N	N	N	N	N
Los Alamos	LA, lower	WGA	Unfiltered	:d: AIIND	:d: AIIND	:d: AIIND	:d: AIIND	AIIND	>60.714<	>259.602<	N	<0.233>	<0.152>	N	N
Los Alamos	LA, lower	WGS	Unfiltered	:d: AIIND	:d: AIIND	:d: AIIND	:d: AIIND	N	AIIND	>154.114<	N	<0.200>	N	N	N
Guaje	LA, lower	WS	Unfiltered	-	-	-	-	-	-	>140.001<	N	AIIND	N	-	N
Los Alamos	LA, lower	WS	Unfiltered	:d: AIIND	:d: AIIND	:d: AIIND	:d: AIIND	AIIND	AIIND	>190.998<	N	N	N	N	N
DP	LA, middle	WGA	Filtered	:d: AIIND	-	-	:d: AIIND	-	-	>80.834<	N	AIIND	N	N	N
Los Alamos	LA, middle	WGA	Filtered	-	-	-	-	-	-	>102.444<	N	N	N	N	N
DP	LA, middle	WGS	Filtered	:d: AIIND	-	-	:d: AIIND	-	-	>40<	N	AIIND	N	N	AIIND
DP	LA, middle	WS	Filtered	-	-	-	-	-	-	>242.225<	N	<0.147>	N	N	N
Los Alamos	LA, middle	WS	Filtered	-	-	-	-	-	-	-	N	AIIND	N	N	N
DP	LA, middle	WGA	Unfiltered	:d: AIIND	AIIND	:d: AIIND	:d: AIIND	<8.837>	:d: AIIND	>187.536<	<0.127>	AIIND	N	N	N
Los Alamos	LA, middle	WGA	Unfiltered	:d: AIIND	AIIND	:d: AIIND	:d: AIIND	N	:d: AIIND	>111.501<	N	N	N	N	N
DP	LA, middle	WGS	Unfiltered	:d: AIIND	>63.333<	:d: AIIND	:d: AIIND	AIIND	:d: AIIND	>125.556<	N	AIIND	N	N	AIIND
DP	LA, middle	WS	Unfiltered	:d: AIIND	AIIND	:d: AIIND	:d: AIIND	N	:d: AIIND	>294.529<	<0.179>	<0.143>	N	N	N
Los Alamos	LA, middle	WS	Unfiltered	:d: AIIND	AIIND	-	:d: AIIND	AIIND	:d: AIIND	-	-	-	-	-	-
Los Alamos	LA, upper	WGA	Filtered	-	-	-	-	-	-	>82.891<	N	:d:	N	N	<0.145>
Los Alamos	LA, upper	WS	Filtered	-	-	-	-	-	-	>89.339<	N	:d: AIIND	N	N	N
Los Alamos	LA, upper	WGA	Unfiltered	:d: AIIND	:d: AIIND	:d: AIIND	:d: AIIND	<5.814>	:d: AIIND	>93.604<	<0.230>	N	N	N	<0.318>
Los Alamos	LA, upper	WS	Unfiltered	:d: AIIND	:d: AIIND	:d: AIIND	:d: AIIND	<9.302>	:d: AIIND	>186.163<	>1.157<	N	<0.180>	N	<0.171>

Table E-1.0-23 (continued)

Canyon	Hydrosegment	Water Type	Field Preparation	Dibenz(a,h)anthracene	1,2-Dichloroethane	Dieldrin	Indeno(1,2,3-cd)pyrene	Methylene Chloride	Trichloroethene	Total Cancer HI	Aluminum	Antimony	Barium	Boron	Chromium
Max HQ				46.739	63.333	1.286	6.196	9.302	60.714		1.157	0.267	0.18	0.12	0.318
Screen Value				0.009	0.12	0.004	0.092	4.3	0.028		37000	15	2600	3300	110
Pueblo	Pueblo, lower	WGA	Filtered	-	-	-	-	-	-	>244.46<	N	AIIND	N	<0.116>	N
Pueblo	Pueblo, lower	WS	Filtered	-	-	-	-	-	-	>288.893<	N	N	N	<0.117>	N
Pueblo	Pueblo, lower	WGA	Unfiltered	:d: AIIND	:d: AIIND	:d: AIIND	:d: AIIND	N	:d: AIIND	>223.152<	N	AIIND	N	<0.120>	N
Pueblo	Pueblo, lower	WS	Unfiltered	:d: AIIND	:d: AIIND	:d: AIIND	:d: AIIND	AIIND	:d: AIIND	>335.349<	<0.108>	N	<0.150>	<0.116>	N
Pueblo	Pueblo, middle	WGA	Filtered	-	-	-	-	-	-	>64.444<	AIIND	AIIND	N	-	AIIND
Acid	Pueblo, middle	WS	Filtered	-	-	-	-	-	-	>80.001<	N	N	N	N	N
Pueblo	Pueblo, middle	WS	Filtered	-	-	-	-	-	-	>40.004<	N	N	N	N	N
Pueblo	Pueblo, middle	WGA	Unfiltered	AIIND	:d: AIIND	:d: AIIND	AIIND	:d: AIIND	:d: AIIND	>53.334<	N	AIIND	N	N	N
Acid	Pueblo, middle	WS	Unfiltered	>46.739<	:d: AIIND	:d: AIIND	<5.109>	:d: AIIND	:d: AIIND	>205.402<	N	N	N	N	N
Pueblo	Pueblo, middle	WS	Unfiltered	AIIND	:d: AIIND	:d: AIIND	<6.196>	:d: AIIND	:d: AIIND	>218.389<	N	N	N	N	N
Pueblo	Pueblo, upper	WGA	Filtered	-	-	-	-	-	-	>35.559<	AIIND	<0.267>	N	N	N
Pueblo	Pueblo, upper	WS	Filtered	-	-	-	-	-	-	>77.781<	N	<0.247>	N	N	N
Pueblo	Pueblo, upper	WGA	Unfiltered	<2.554>	:d: AIIND	<1.286>	:d: AIIND	:d: AIIND	:d: AIIND	>32.819<	N	N	N	N	N
Pueblo	Pueblo, upper	WS	Unfiltered	AIIND	:d: AIIND	AIIND	:d: AIIND	:d: AIIND	:d: AIIND	>98.892<	N	<0.200>	N	N	N

Table E-1.0-23 (continued)

Canyon	Hydrosegment	Water Type	Field Preparation	Copper	Iron	Manganese	Molybdenum	Thallium	Uranium	Vanadium	Chloride	Fluoride	Nitrate	Nitrite
Max HQ				0.104	2.2	3.647	11.111	1.692	1.564	0.118	1.08	0.727	0.74	3.99
Screen Value				1400	11000	1700	180	2.6	7.3	260	250000	2200	10000	1000
Los Alamos	LA, lower	WGA	Filtered	N	N	N	N	>1.308<	>1.493<	N	<0.520>	<0.277>	<0.740>	>3.990<
Los Alamos	LA, lower	WGS	Filtered	N	N	N	N	>1.462<	<0.286>	N	<0.204>	<0.191>	-	-
Guaje	LA, lower	WS	Filtered	N	N	N	-	AIIND	-	N	N	-	-	-
Los Alamos	LA, lower	WS	Filtered	N	N	<0.178>	N	<0.358>	N	N	<0.192>	<0.227>	-	-
Los Alamos	LA, lower	WGA	Unfiltered	<0.104>	<0.341>	<0.138>	N	>1.154<	>1.414<	<0.118>	<0.168>	<0.205>	<0.730>	>3.070<
Los Alamos	LA, lower	WGS	Unfiltered	N	N	N	N	>1.308<	<0.544>	N	-	-	-	-
Guaje	LA, lower	WS	Unfiltered	N	N	N	-	AIIND	-	N	-	-	-	-
Los Alamos	LA, lower	WS	Unfiltered	N	<0.155>	<0.194>	N	<0.284>	<0.121>	N	-	-	-	-
DP	LA, middle	WGA	Filtered	N	N	<0.488>	N	AIIND	N	N	>1.080<	<0.591>	-	-
Los Alamos	LA, middle	WGA	Filtered	N	N	N	>11.111<	>1.269<	<0.390>	N	<0.278>	<0.727>	-	-
DP	LA, middle	WGS	Filtered	N	N	N	N	>1.423<	N	N	<0.424>	<0.500>	-	-
DP	LA, middle	WS	Filtered	N	<0.209>	<0.235>	N	>1.231<	<0.221>	N	<0.984>	<0.332>	-	-
Los Alamos	LA, middle	WS	Filtered	N	N	N	N	N	-	N	N	N	-	-
DP	LA, middle	WGA	Unfiltered	N	<0.609>	<0.512>	N	AIIND	N	N	<0.252>	<0.591>	-	-
Los Alamos	LA, middle	WGA	Unfiltered	N	N	N	>11.111<	<0.923>	N	N	-	-	-	-
DP	LA, middle	WGS	Unfiltered	N	<0.118>	N	N	>1.462<	N	N	<0.140>	<0.500>	-	-
DP	LA, middle	WS	Unfiltered	N	<0.423>	<0.247>	N	>1.115<	<0.181>	N	-	-	-	-
Los Alamos	LA, middle	WS	Unfiltered	N	-	-	-	-	-	-	-	-	-	-
Los Alamos	LA, upper	WGA	Filtered	N	<0.117>	<0.335>	<0.778>	>1.692<	N	N	<0.440>	<0.279>	:d: AIIND	:d: AIIND
Los Alamos	LA, upper	WS	Filtered	N	<0.355>	>2.824<	N	N	<0.289>	N	<0.372>	<0.118>	-	-
Los Alamos	LA, upper	WGA	Unfiltered	N	<0.336>	<0.541>	<0.778>	<0.808>	N	N	-	<0.278>	-	-
Los Alamos	LA, upper	WS	Unfiltered	N	>2.200<	>2.706<	N	>1.000<	<0.572>	N	N	N	-	-

Table E-1.0-23 (continued)

Canyon	Hydrosegment	Water Type	Field Preparation	Copper	Iron	Manganese	Molybdenum	Thallium	Uranium	Vanadium	Chloride	Fluoride	Nitrate	Nitrite
Max HQ				0.104	2.2	3.647	11.111	1.692	1.564	0.118	1.08	0.727	0.74	3.99
Screen Value				1400	11000	1700	180	2.6	7.3	260	250000	2200	10000	1000
Pueblo	Pueblo, lower	WGA	Filtered	N	<0.532>	>2.353<	N	>1.269<	N	N	<0.209>	<0.323>	<0.310>	:d: AIIND
Pueblo	Pueblo, lower	WS	Filtered	N	N	>1.147<	N	>1.038<	<0.265>	N	<0.183>	<0.291>	-	-
Pueblo	Pueblo, lower	WGA	Unfiltered	N	<0.509>	>2.412<	N	N	<0.108>	N	<0.172>	<0.241>	<0.290>	:d: AIIND
Pueblo	Pueblo, lower	WS	Unfiltered	N	>1.282<	>2.359<	N	>1.154<	<0.358>	N	-	-	-	-
Pueblo	Pueblo, middle	WGA	Filtered	N	AIIND	N	AIIND	AIIND	AIIND	N	N	N	-	-
Acid	Pueblo, middle	WS	Filtered	N	N	N	N	>1.308<	>1.564<	N	<0.880>	<0.209>	-	-
Pueblo	Pueblo, middle	WS	Filtered	N	N	>3.294<	AIIND	N	N	N	<0.260>	<0.102>	-	-
Pueblo	Pueblo, middle	WGA	Unfiltered	N	N	N	N	AIIND	N	N	-	-	-	-
Acid	Pueblo, middle	WS	Unfiltered	N	<0.109>	N	N	>1.115<	>1.406<	N	-	-	-	-
Pueblo	Pueblo, middle	WS	Unfiltered	N	<0.473>	>3.647<	N	AIIND	N	N	-	-	-	-
Pueblo	Pueblo, upper	WGA	Filtered	N	N	>1.300<	N	>1.154<	N	N	<0.236>	N	-	-
Pueblo	Pueblo, upper	WS	Filtered	N	N	>1.706<	N	<0.297>	<0.122>	N	<0.178>	<0.120>	-	-
Pueblo	Pueblo, upper	WGA	Unfiltered	N	N	>1.306<	N	<0.885>	N	N	-	-	-	-
Pueblo	Pueblo, upper	WS	Unfiltered	N	<0.255>	>1.765<	AIIND	AIIND	<0.121>	N	-	-	-	-

Table E-1.0-23 (continued)

Canyon	Hydrosegment	Water Type	Field Preparation	Perchlorate	Bromomethane	Total Noncancer HI	Americium-241	Cesium-137	Plutonium-238	Plutonium-239	Strontium-90	Uranium-234	Uranium-238	Total Radionuclides HI
Max HQ				4.135	0.31		1.192			5.925	5.825	0.375	0.158	
Screen Value				3.7	8.7		1.2	120	1.6	1.2	40	20	24	
Los Alamos	LA, lower	WGA	Filtered	:d: AIIND	-	>8.712<	AIIND	:d: AIIND	AIIND	AIIND	N	N	N	N
Los Alamos	LA, lower	WGS	Filtered	:d: AIIND	-	>2.623<	AIIND	:d: AIIND	AIIND	N	N	N	N	N
Guaje	LA, lower	WS	Filtered	:d: AIIND	-	N	AIIND	:d: AIIND	AIIND	AIIND	AIIND	-	-	-
Los Alamos	LA, lower	WS	Filtered	:d: AIIND	-	>1.45<	N	:d: AIIND	N	AIIND	N	N	N	N
Los Alamos	LA, lower	WGA	Unfiltered	AIIND	:d: AIIND	>8.131<	AIIND	:d: AIIND	:d: AIIND	N	AIIND	N	N	N
Los Alamos	LA, lower	WGS	Unfiltered	AIIND	:d: AIIND	>2.387<	N	:d: AIIND	:d: AIIND	N	AIIND	N	N	N
Guaje	LA, lower	WS	Unfiltered	-	-	N	AIIND	:d: AIIND	:d: AIIND	AIIND	AIIND	-	-	-
Los Alamos	LA, lower	WS	Unfiltered	>1.081<	:d: AIIND	>2.373<	N	:d: AIIND	:d: AIIND	N	N	N	N	N
DP	LA, middle	WGA	Filtered	:d: AIIND	-	>2.548<	N	:d: AIIND	AIIND	:d: AIIND	>5.825<	N	N	>5.954<
Los Alamos	LA, middle	WGA	Filtered	:d: AIIND	-	>13.981<	N	:d: AIIND	N	:d: AIIND	>1.023<	N	N	>1.143<
DP	LA, middle	WGS	Filtered	:d: AIIND	-	>2.653<	N	:d: AIIND	AIIND	:d: AIIND	>2.975<	N	N	>3.038<
DP	LA, middle	WS	Filtered	:d: AIIND	-	>3.811<	N	:d: AIIND	AIIND	:d: AIIND	>1.915<	N	N	>2.043<
Los Alamos	LA, middle	WS	Filtered	-	-	N	AIIND	:d: AIIND	AIIND	:d: AIIND	N	N	N	N
DP	LA, middle	WGA	Unfiltered	-	AIIND	>2.461<	>1.192<	AIIND	N	>1.033<	>4.412<	N	N	>6.801<
Los Alamos	LA, middle	WGA	Unfiltered	<0.316>	AIIND	>12.63<	N	AIIND	N	N	>1.180<	N	N	>1.276<
DP	LA, middle	WGS	Unfiltered	AIIND	<0.310>	>2.774<	AIIND	AIIND	N	N	>2.825<	N	N	>2.929<
DP	LA, middle	WS	Unfiltered	AIIND	AIIND	>2.859<	N	AIIND	AIIND	AIIND	>2.380<	N	N	>2.508<
Los Alamos	LA, middle	WS	Unfiltered	AIIND	AIIND	-	N	N	N	N	N	N	N	N
Los Alamos	LA, upper	WGA	Filtered	>4.135<	-	>8.185<	N	:d: AIIND	AIIND	:d:	N	N	N	N
Los Alamos	LA, upper	WS	Filtered	>3.108<	-	>7.285<	AIIND	:d: AIIND	N	:d: AIIND	N	N	N	N
Los Alamos	LA, upper	WGA	Unfiltered	:d: AIIND	:d: AIIND	>3.663<	N	:d: AIIND	N	N	N	N	N	N
Los Alamos	LA, upper	WS	Unfiltered	:d: AIIND	:d: AIIND	>8.448<	N	:d: AIIND	N	N	N	N	N	N

Table E-1.0-23 (continued)

Canyon	Hydrosegment	Water Type	Field Preparation	Perchlorate	Bromomethane	Total Noncancer HI	Americium-241	Cesium-137	Plutonium-238	Plutonium-239	Strontium-90	Uranium-234	Uranium-238	Total Radionuclides HI
Max HQ				4.135	0.31		1.192			5.925	5.825	0.375	0.158	
Screen Value				3.7	8.7		1.2	120	1.6	1.2	40	20	24	
Pueblo	Pueblo, lower	WGA	Filtered	>2.408<	-	>7.814<	N	:d: AIIND	:d: AIIND	N	N	N	N	N
Pueblo	Pueblo, lower	WS	Filtered	AIIND	-	>3.386<	N	:d: AIIND	:d: AIIND	AIIND	N	N	N	N
Pueblo	Pueblo, lower	WGA	Unfiltered	:d: AIIND	:d: AIIND	>4.219<	N	:d: AIIND	N	N	N	N	N	N
Pueblo	Pueblo, lower	WS	Unfiltered	:d: AIIND	:d: AIIND	>5.939<	N	:d: AIIND	N	N	N	N	N	N
Pueblo	Pueblo, middle	WGA	Filtered	AIIND	-	N	AIIND	:d: AIIND	:d: AIIND	AIIND	AIIND	AIIND	AIIND	-
Acid	Pueblo, middle	WS	Filtered	AIIND	-	>4.241<	<0.124>	:d: AIIND	:d: AIIND	>2.925<	<0.490>	<0.375>	<0.158>	>4.083<
Pueblo	Pueblo, middle	WS	Filtered	>1.246<	-	>5.188<	N	:d: AIIND	:d: AIIND	AIIND	N	N	N	N
Pueblo	Pueblo, middle	WGA	Unfiltered	-	:d: AIIND	N	N	:d: AIIND	AIIND	N	N	N	N	N
Acid	Pueblo, middle	WS	Unfiltered	:d: AIIND	:d: AIIND	>3.117<	<0.112>	:d: AIIND	AIIND	>5.925<	<0.480>	<0.365>	<0.142>	>7.038<
Pueblo	Pueblo, middle	WS	Unfiltered	:d: AIIND	:d: AIIND	>4.662<	N	:d: AIIND	N	N	N	N	N	N
Pueblo	Pueblo, upper	WGA	Filtered	:d: AIIND	-	>3.236<	AIIND	:d: AIIND	:d: AIIND	:d: AIIND	N	N	N	N
Pueblo	Pueblo, upper	WS	Filtered	:d: AIIND	-	>2.924<	N	:d: AIIND	:d: AIIND	:d: AIIND	N	N	N	N
Pueblo	Pueblo, upper	WGA	Unfiltered	:d: AIIND	:d: AIIND	>2.409<	AIIND	:d: AIIND	:d: AIIND	AIIND	N	N	N	N
Pueblo	Pueblo, upper	WS	Unfiltered	:d: AIIND	:d: AIIND	>2.553<	N	:d: AIIND	:d: AIIND	N	N	N	N	N

Notes: 1. Units are µg/L for organic and inorganic chemicals and pCi/L for radionuclides.

2. <#> = Retained as Tier 1 COPC for this hydrosegment/water type/field preparation bin.

3. >#< = Retained as Tier 1 COPC for this hydrosegment/water type/field preparation bin.

4. - = No data.

5. AIIND = Analyte never detected in the hydrosegment/water type/field preparation bin.

6. :d: = Less than 5% detects for all water types within a hydrosegment/field preparation bin.

7. N = Eliminated as a Tier 1 Human Health COPC for this hydrosegment/water type/field preparation bin.

Table E-1.0-24
Water: Tier 2 Human Health Screening Summary

Canyon	Hydrosegment	Water Type	Field Preparation	Location	Station Name	Distance from Rio Grande (km)	Distance from LA Confluence (km)	Distance from Pueblo (km)	Arsenic	beta-BHC	Benzene	Benz(a)anthracene	Benzo(a)pyrene	Benzo(b)fluoranthene	Bis(2-ethylhexyl)phthalate	Bromodichloromethane
Max HQ									331.111	2.703	9.714	8.587	68.478	6.304	7.5	1.167
Screen Value									0.045	0.037	0.35	0.092	0.009	0.092	4.8	0.18
Los Alamos	LA, lower	WGA	Filtered													
Los Alamos	LA, lower	WGA	Filtered	LA-00002	LLAO-5	0.22			>46.000<							
Los Alamos	LA, lower	WGA	Filtered	LA-00045	LLAO-2	4.16			>86.667<							
Los Alamos	LA, lower	WGA	Filtered	LA-00046	LLAO-4	0.33			>35.556<							
Los Alamos	LA, lower	WGA	Filtered	LA-00215	LLAO-1b	5.25			>195.778<							
Los Alamos	LA, lower	WGS	Filtered													
Los Alamos	LA, lower	WGS	Filtered	BG-00081	LA Spring	6.04			AllU							
Los Alamos	LA, lower	WGS	Filtered	LA-00219	Basalt Spring	6.38			>117.333<							
Los Alamos	LA, lower	WGS	Filtered	LA-10179	Otowi Spring	0			>100.000<							
Guaje	LA, lower	WS	Filtered													
Guaje	LA, lower	WS	Filtered	GU-10004	Guaje SW at LA Confluence	2.55			>122.222<							
Los Alamos	LA, lower	WS	Filtered													
Los Alamos	LA, lower	WS	Filtered	LA-00218	Reach LA-4E SW	5.22			>114.222<							
Los Alamos	LA, lower	WS	Filtered	LA-10057	LA SW at Guaje Confluence	2.5			>173.333<							
Los Alamos	LA, lower	WS	Filtered	LA-10058	Lower Reach LA-5 SW	0.3			>100.000<							

Table E-1.0-24 (continued)

Canyon	Hydrosegment	Water Type	Field Preparation	Location	Station Name	Distance from Rio Grande (km)	Distance from LA Confluence (km)	Distance from Pueblo (km)	Arsenic	beta-BHC	Benzene	Benz(a)anthracene	Benzo(a)pyrene	Benzo(b)fluoranthene	Bis(2-ethylhexyl)phthalate	Bromodichloromethane
Max HQ									331.111	2.703	9.714	8.587	68.478	6.304	7.5	1.167
Screen Value									0.045	0.037	0.35	0.092	0.009	0.092	4.8	0.18
Los Alamos	LA, lower	WGA	Unfiltered							d: AIIND		d: AIIND	d: AIIND	d: AIIND	d: AIIND	d: AIIND
Los Alamos	LA, lower	WGA	Unfiltered	LA-00002	LLAO-5	0.22			>45.778<		AIIU					
Los Alamos	LA, lower	WGA	Unfiltered	LA-00045	LLAO-2	4.16			>77.778<		-					
Los Alamos	LA, lower	WGA	Unfiltered	LA-00046	LLAO-4	0.33			>40.000<		NA					
Los Alamos	LA, lower	WGA	Unfiltered	LA-00215	LLAO-1b	5.25			>164.000<		<9.714>					
Los Alamos	LA, lower	WGS	Unfiltered							d: AIIND	AIIND	d: AIIND	d: AIIND	d: AIIND	d: AIIND	d: AIIND
Los Alamos	LA, lower	WGS	Unfiltered	BG-00081	LA Spring	6.04			AIIU							
Los Alamos	LA, lower	WGS	Unfiltered	LA-00219	Basalt Spring	6.38			>114.222<							
Los Alamos	LA, lower	WGS	Unfiltered	LA-10179	Otowi Spring	0			>102.444<							
Guaje	LA, lower	WS	Unfiltered													
Guaje	LA, lower	WS	Unfiltered	GU-10004	Guaje SW at LA Confluence	2.55			>140.000<							
Los Alamos	LA, lower	WS	Unfiltered							d: AIIND	AIIND	d: AIIND	d: AIIND	d: AIIND	d: AIIND	d: AIIND
Los Alamos	LA, lower	WS	Unfiltered	LA-00218	Reach LA-4E SW	5.22			>142.444<							
Los Alamos	LA, lower	WS	Unfiltered	LA-02-20908	Eco				>118.222<							
Los Alamos	LA, lower	WS	Unfiltered	LA-02-20909	Eco				>80.222<							
Los Alamos	LA, lower	WS	Unfiltered	LA-10057	LA SW at Guaje Confluence	2.5			>173.333<							

Table E-1.0-24 (continued)

Canyon	Hydrosegment	Water Type	Field Preparation	Location	Station Name	Distance from Rio Grande (km)	Distance from LA Confluence (km)	Distance from Pueblo (km)	Arsenic	beta-BHC	Benzene	Benz(a)anthracene	Benzo(a)pyrene	Benzo(b)fluoranthene	Bis(2-ethylhexyl)phthalate	Bromodichloromethane
Max HQ									331.111	2.703	9.714	8.587	68.478	6.304	7.5	1.167
Screen Value									0.045	0.037	0.35	0.092	0.009	0.092	4.8	0.18
Los Alamos	LA, lower	WS	Unfiltered	LA-10058	Lower Reach LA-5 SW	0.3			>48.889<							
DP	LA, middle	WGA	Filtered									:d: AIIND	:d: AIIND	:d: AIIND		
DP	LA, middle	WGA	Filtered	21-01811	LAUZ-1	14.49	1.6		>70.667<						<4.583>	
DP	LA, middle	WGA	Filtered	21-01812	LAUZ-2	14.31	1.42		>73.333<						<7.500>	
Los Alamos	LA, middle	WGA	Filtered													
Los Alamos	LA, middle	WGA	Filtered	LA-10035	LAO-3a	12.76			>102.444<							
Los Alamos	LA, middle	WGA	Filtered	LA-10067	LAO-2	12.93			AIIU							
Los Alamos	LA, middle	WGA	Filtered	LA-10068	LAO-4	11.8			>60.000<							
Los Alamos	LA, middle	WGA	Filtered	LA-10069	LAO-4.5c	10.86			>30.667<							
Los Alamos	LA, middle	WGA	Filtered	LA-10070	LAO-6a	9.87			AIIU							
DP	LA, middle	WGS	Filtered									:d: AIIND	:d: AIIND	:d: AIIND	AIIND	
DP	LA, middle	WGS	Filtered	21-01854	DP Spring	13.32	0.43		>40.000<							
DP	LA, middle	WS	Filtered													
DP	LA, middle	WS	Filtered	21-10929	Reach DP-1W SW	16.42	3.53		>220.000<							
DP	LA, middle	WS	Filtered	21-11226	Reach DP-1C SW	16.25	3.36		>147.556<							
DP	LA, middle	WS	Filtered	21-11269	Reach DP-2 SW	14.53	1.64		AIIU							

Table E-1.0-24 (continued)

Canyon	Hydrosegment	Water Type	Field Preparation	Location	Station Name	Distance from Rio Grande (km)	Distance from LA Confluence (km)	Distance from Pueblo (km)	Arsenic	beta-BHC	Benzene	Benz(a)anthracene	Benzo(a)pyrene	Benzo(b)fluoranthene	Bis(2-ethylhexyl)phthalate	Bromodichloromethane
Max HQ									331.111	2.703	9.714	8.587	68.478	6.304	7.5	1.167
Screen Value									0.045	0.037	0.35	0.092	0.009	0.092	4.8	0.18
DP	LA, middle	WGA	Unfiltered							AIIND	:d: AIIND	:d: AIIND	:d: AIIND	:d: AIIND	AIIND	AIIND
DP	LA, middle	WGA	Unfiltered	21-01811	LAUZ-1	14.49	1.6		>71.778<							
DP	LA, middle	WGA	Unfiltered	21-01812	LAUZ-2	14.31	1.42		>177.778<							
Los Alamos	LA, middle	WGA	Unfiltered							AIIND	:d: AIIND	:d: AIIND	:d: AIIND	:d: AIIND	N	AIIND
Los Alamos	LA, middle	WGA	Unfiltered	LA-10035	LAO-3a	12.76			>110.000<							
Los Alamos	LA, middle	WGA	Unfiltered	LA-10067	LAO-2	12.93			AIIU							
Los Alamos	LA, middle	WGA	Unfiltered	LA-10068	LAO-4	11.8			>70.222<							
Los Alamos	LA, middle	WGA	Unfiltered	LA-10069	LAO-4.5c	10.86			>29.333<							
Los Alamos	LA, middle	WGA	Unfiltered	LA-10070	LAO-6a	9.87			AIIU							
DP	LA, middle	WGS	Unfiltered							AIIND	:d: AIIND	:d: AIIND	:d: AIIND	:d: AIIND	AIIND	AIIND
DP	LA, middle	WGS	Unfiltered	21-01854	DP Spring	13.32	0.43		>62.222<							
DP	LA, middle	WS	Unfiltered								:d: AIIND	:d: AIIND	:d: AIIND	:d: AIIND	N	
DP	LA, middle	WS	Unfiltered	21-10929	Reach DP-1W SW	16.42	3.53		>244.444<	<2.703>						<1.167>
DP	LA, middle	WS	Unfiltered	21-11226	Reach DP-1C SW	16.25	3.36		>193.333<	AIIU						AIIU
DP	LA, middle	WS	Unfiltered	21-11269	Reach DP-2 SW	14.53	1.64		-	-						AIIU
DP	LA, middle	WS	Unfiltered	LA-02-20913	Eco				>78.000<	AIIU						-

Table E-1.0-24 (continued)

Canyon	Hydrosegment	Water Type	Field Preparation	Location	Station Name	Distance from Rio Grande (km)	Distance from LA Confluence (km)	Distance from Pueblo (km)	Arsenic	beta-BHC	Benzene	Benz(a)anthracene	Benzo(a)pyrene	Benzo(b)fluoranthene	Bis(2-ethylhexyl)phthalate	Bromodichloromethane
Max HQ									331.111	2.703	9.714	8.587	68.478	6.304	7.5	1.167
Screen Value									0.045	0.037	0.35	0.092	0.009	0.092	4.8	0.18
Los Alamos	LA, upper	WGA	Filtered													
Los Alamos	LA, upper	WGA	Filtered	02-01022	LAO-0.91	15.92			>40.000<							
Los Alamos	LA, upper	WGA	Filtered	02-01076	LAO-1	15.66			>82.889<							
Los Alamos	LA, upper	WGA	Filtered	41-01002	LAO-0.6	16.49			>15.778<							
Los Alamos	LA, upper	WGA	Filtered	41-01003	LAO-0.3	17.11			>48.444<							
Los Alamos	LA, upper	WGA	Filtered	41-01004	LAO-C	17.97			>50.889<							
Los Alamos	LA, upper	WGA	Filtered	41-01045	LAO-B	20.34			>30.222<							
Los Alamos	LA, upper	WGA	Filtered	LA-00001	LAO-1.6g	13.41			>28.667<							
Los Alamos	LA, upper	WGA	Filtered	LA-10008	LAO-1.2	14.62			AllU							
Los Alamos	LA, upper	WGA	Filtered	LA-10066	LAO-0.7	16.34			>74.667<							
Los Alamos	LA, upper	WS	Filtered													
Los Alamos	LA, upper	WS	Filtered	LA-10005	SW at LAO-0.6	16.48			>46.667<							
Los Alamos	LA, upper	WS	Filtered	LA-10006	Reach LA-Bkgd SW	20.31			AllU							
Los Alamos	LA, upper	WS	Filtered	LA-10033	Los Alamos Reservoir	22.15			>62.222<							
Los Alamos	LA, upper	WS	Filtered	LA-10034	Los Alamos Creek below LA Reservoir	22.11			AllU							
Los Alamos	LA, upper	WS	Filtered	LA-10040	SW at E026	19.3			AllU							

Table E-1.0-24 (continued)

Canyon	Hydrosegment	Water Type	Field Preparation	Location	Station Name	Distance from Rio Grande (km)	Distance from LA Confluence (km)	Distance from Pueblo (km)	Arsenic	beta-BHC	Benzene	Benz(a)anthracene	Benzo(a)pyrene	Benzo(b)fluoranthene	Bis(2-ethylhexyl)phthalate	Bromodichloromethane
Max HQ									331.111	2.703	9.714	8.587	68.478	6.304	7.5	1.167
Screen Value									0.045	0.037	0.35	0.092	0.009	0.092	4.8	0.18
Los Alamos	LA, upper	WS	Filtered	LA-10064	Reach LA-1W SW	17.1			>89.333<							
Los Alamos	LA, upper	WS	Filtered	LA-10065	Reach LA-1C SW	15.7			AIU							
Los Alamos	LA, upper	WS	Filtered	LA-10126	Los Alamos Creek upstream of LA Reservoir	22.36			AIU							
Los Alamos	LA, upper	WGA	Unfiltered							:d: AIIND		:d: AIIND	:d: AIIND	:d: AIIND	N	:d: AIIND
Los Alamos	LA, upper	WGA	Unfiltered	02-01022	LAO-0.91	15.92			>37.778<		-					
Los Alamos	LA, upper	WGA	Unfiltered	02-01076	LAO-1	15.66			>85.556<		AIU					
Los Alamos	LA, upper	WGA	Unfiltered	41-01002	LAO-0.6	16.49			>24.889<		-					
Los Alamos	LA, upper	WGA	Unfiltered	41-01003	LAO-0.3	17.11			>25.778<		AIU					
Los Alamos	LA, upper	WGA	Unfiltered	41-01004	LAO-C	17.97			>53.556<		AIU					
Los Alamos	LA, upper	WGA	Unfiltered	41-01045	LAO-B	20.34			<9.778>		<1.286>					
Los Alamos	LA, upper	WGA	Unfiltered	LA-00001	LAO-1.6g	13.41			>63.778<		AIU					
Los Alamos	LA, upper	WGA	Unfiltered	LA-10008	LAO-1.2	14.62			AIU		-					
Los Alamos	LA, upper	WGA	Unfiltered	LA-10066	LAO-0.7	16.34			>83.778<		AIU					
Los Alamos	LA, upper	WS	Unfiltered							:d: AIIND	AIIND	:d: AIIND	:d: AIIND	:d: AIIND	N	:d: AIIND
Los Alamos	LA, upper	WS	Unfiltered	LA-02-20914	Eco				>50.444<							

Table E-1.0-24 (continued)

Canyon	Hydrosegment	Water Type	Field Preparation	Location	Station Name	Distance from Rio Grande (km)	Distance from LA Confluence (km)	Distance from Pueblo (km)	Arsenic	beta-BHC	Benzene	Benz(a)anthracene	Benzo(a)pyrene	Benzo(b)fluoranthene	Bis(2-ethylhexyl)phthalate	Bromodichloromethane
Max HQ									331.111	2.703	9.714	8.587	68.478	6.304	7.5	1.167
Screen Value									0.045	0.037	0.35	0.092	0.009	0.092	4.8	0.18
Los Alamos	LA, upper	WS	Unfiltered	LA-02-20915	Eco				>64.444<							
Los Alamos	LA, upper	WS	Unfiltered	LA-10005	SW at LAO-0.6	16.48			>77.778<							
Los Alamos	LA, upper	WS	Unfiltered	LA-10006	Reach LA-Bkgd SW	20.31			AllU							
Los Alamos	LA, upper	WS	Unfiltered	LA-10033	Los Alamos Reservoir	22.15			>33.333<							
Los Alamos	LA, upper	WS	Unfiltered	LA-10034	Los Alamos Creek below LA Reservoir	22.11			AllU							
Los Alamos	LA, upper	WS	Unfiltered	LA-10040	SW at E026	19.3			>91.111<							
Los Alamos	LA, upper	WS	Unfiltered	LA-10064	Reach LA-1W SW	17.1			>172.222<							
Los Alamos	LA, upper	WS	Unfiltered	LA-10065	Reach LA-1C SW	15.7			AllU							
Los Alamos	LA, upper	WS	Unfiltered	LA-10126	Los Alamos Creek upstream of LA Reservoir	22.36			AllU							
Pueblo	Pueblo, lower	WGA	Filtered													
Pueblo	Pueblo, lower	WGA	Filtered	PU-00177	PAO-5N	8.94	1.37		>213.333<							
Pueblo	Pueblo, lower	WGA	Filtered	PU-00182	PAO-4	10.21	2.64		>155.333<							
Pueblo	Pueblo, lower	WGA	Filtered	PU-10228	APCO-1	8.94	1.37		>144.667<							
Pueblo	Pueblo, lower	WS	Filtered													
Pueblo	Pueblo, lower	WS	Filtered	PU-10229	Pueblo at State Road 502	7.67	0.1		>151.111<							

Table E-1.0-24 (continued)

Canyon	Hydrosegment	Water Type	Field Preparation	Location	Station Name	Distance from Rio Grande (km)	Distance from LA Confluence (km)	Distance from Pueblo (km)	Arsenic	beta-BHC	Benzene	Benz(a)anthracene	Benzo(a)pyrene	Benzo(b)fluoranthene	Bis(2-ethylhexyl)phthalate	Bromodichloromethane
Max HQ									331.111	2.703	9.714	8.587	68.478	6.304	7.5	1.167
Screen Value									0.045	0.037	0.35	0.092	0.009	0.092	4.8	0.18
Pueblo	Pueblo, lower	WS	Filtered	PU-10230	Pueblo 3	10.01	2.44		>251.111<							
Pueblo	Pueblo, lower	WGA	Unfiltered						AIIND	:d: AIIND	:d: AIIND	:d: AIIND	:d: AIIND	:d: AIIND	N	:d: AIIND
Pueblo	Pueblo, lower	WGA	Unfiltered	PU-00177	PAO-5N	8.94	1.37		>214.444<							
Pueblo	Pueblo, lower	WGA	Unfiltered	PU-00182	PAO-4	10.21	2.64		>164.667<							
Pueblo	Pueblo, lower	WGA	Unfiltered	PU-10228	APCO-1	8.94	1.37		>158.667<							
Pueblo	Pueblo, lower	WS	Unfiltered						N	:d: AIIND	:d: AIIND	:d: AIIND	:d: AIIND	:d: AIIND		:d: AIIND
Pueblo	Pueblo, lower	WS	Unfiltered	PU-02-20920	Eco				>331.111<							
Pueblo	Pueblo, lower	WS	Unfiltered	PU-10229	Pueblo at State Road 502	7.67	0.1		>186.667<						0.313	
Pueblo	Pueblo, lower	WS	Unfiltered	PU-10230	Pueblo 3	10.01	2.44		>231.111<						<1.417>	
Pueblo	Pueblo, middle	WGA	Filtered													
Pueblo	Pueblo, middle	WGA	Filtered	PU-00181	PAO-3	13.44	5.87		>64.444<							
Acid	Pueblo, middle	WS	Filtered													
Acid	Pueblo, middle	WS	Filtered	00-10241	Reach AC-2 SW	18.78		0.72	AIU							
Acid	Pueblo, middle	WS	Filtered	PU-10155	Lower Reach AC-3 SW	18.08		0.02	>48.889<							
Acid	Pueblo, middle	WS	Filtered	PU-10175	Upper Reach ACS SW	18.67		0.61	>80.000<							
Acid	Pueblo, middle	WS	Filtered	PU-10176	Lower Reach ACS SW	18.52		0.46	>37.778<							

Table E-1.0-24 (continued)

Canyon	Hydrosegment	Water Type	Field Preparation	Location	Station Name	Distance from Rio Grande (km)	Distance from LA Confluence (km)	Distance from Pueblo (km)	Arsenic	beta-BHC	Benzene	Benz(a)anthracene	Benzo(a)pyrene	Benzo(b)fluoranthene	Bis(2-ethylhexyl)phthalate	Bromodichloromethane
Max HQ									331.111	2.703	9.714	8.587	68.478	6.304	7.5	1.167
Screen Value									0.045	0.037	0.35	0.092	0.009	0.092	4.8	0.18
Pueblo	Pueblo, middle	WS	Filtered													
Pueblo	Pueblo, middle	WS	Filtered	PU-10071	Upper Reach P-1E SW	17.91	10.34		>40.000<							
Pueblo	Pueblo, middle	WS	Filtered	PU-10231	Pueblo 2	14.74	7.17		AIU							
Pueblo	Pueblo, middle	WGA	Unfiltered							:d: AIIND	:d: AIIND	AIIND	AIIND	AIIND	AIIND	:d: AIIND
Pueblo	Pueblo, middle	WGA	Unfiltered	PU-00181	PAO-3	13.44	5.87		>53.333<							
Pueblo	Pueblo, middle	WGA	Unfiltered	PU-10174	PAO-2	17.85	10.28		AIU							
Acid	Pueblo, middle	WS	Unfiltered							:d: AIIND	:d: AIIND				N	:d: AIIND
Acid	Pueblo, middle	WS	Unfiltered	00-10241	Reach AC-2 SW	18.78		0.72	>66.667<			AIU	AIU	AIU		
Acid	Pueblo, middle	WS	Unfiltered	PU-10155	Lower Reach AC-3 SW	18.08		0.02	AIU			<7.065>	>68.478<	<5.326>		
Acid	Pueblo, middle	WS	Unfiltered	PU-10175	Upper Reach ACS SW	18.67		0.61	>71.111<			AIU	AIU	AIU		
Acid	Pueblo, middle	WS	Unfiltered	PU-10176	Lower Reach ACS SW	18.52		0.46	>40.000<			AIU	AIU	AIU		
Pueblo	Pueblo, middle	WS	Unfiltered							:d: AIIND	:d: AIIND				AIIND	:d: AIIND
Pueblo	Pueblo, middle	WS	Unfiltered	PU-10071	Upper Reach P-1E SW	17.91	10.34		>135.556<			AIU	AIU	AIU		
Pueblo	Pueblo, middle	WS	Unfiltered	PU-10231	Pueblo 2	14.74	7.17		AIU			<8.587>	>60.870<	<6.304>		
Pueblo	Pueblo, upper	WGA	Filtered													
Pueblo	Pueblo, upper	WGA	Filtered	PU-00178	PAO-1				>35.556<							

Table E-1.0-24 (continued)

Canyon	Hydrosegment	Water Type	Field Preparation	Location	Station Name	Distance from Rio Grande (km)	Distance from LA Confluence (km)	Distance from Pueblo (km)	Arsenic	beta-BHC	Benzene	Benz(a)anthracene	Benzo(a)pyrene	Benzo(b)fluoranthene	Bis(2-ethylhexyl)phthalate	Bromodichloromethane
Max HQ									331.111	2.703	9.714	8.587	68.478	6.304	7.5	1.167
Screen Value									0.045	0.037	0.35	0.092	0.009	0.092	4.8	0.18
Pueblo	Pueblo, upper	WS	Filtered													
Pueblo	Pueblo, upper	WS	Filtered	PU-10068	Reach P-1FW SW	18.76	11.19		>11.556<							
Pueblo	Pueblo, upper	WS	Filtered	PU-10069	Upper Reach P-1W SW	18.36	10.79		>77.778<							
Pueblo	Pueblo, upper	WS	Filtered	PU-10070	Lower Reach P-1W SW	18.07	10.5		>66.667<							
Pueblo	Pueblo, upper	WGA	Unfiltered							:d: AIIND	:d: AIIND	:d: AIIND	:d: AIIND	:d: AIIND	N	:d: AIIND
Pueblo	Pueblo, upper	WGA	Unfiltered	PU-00178	PAO-1				>28.889<							
Pueblo	Pueblo, upper	WS	Unfiltered							:d: AIIND	:d: AIIND	:d: AIIND	:d: AIIND	:d: AIIND	AIIND	:d: AIIND
Pueblo	Pueblo, upper	WS	Unfiltered	PU-10068	Reach P-1FW SW	18.76	11.19		>75.556<							

Table E-1.0-24 (continued)

Canyon	Hydrosegment	Water Type	Field Preparation	Location	Station Name	Distance from Rio Grande (km)	Distance from LA Confluence (km)	Distance from Pueblo (km)	Arsenic	beta-BHC	Benzene	Benz(a)anthracene	Benzo(a)pyrene	Benzo(b)fluoranthene	Bis(2-ethylhexyl)phthalate	Bromodichloromethane
Max HQ									331.111	2.703	9.714	8.587	68.478	6.304	7.5	1.167
Screen Value									0.045	0.037	0.35	0.092	0.009	0.092	4.8	0.18
Pueblo	Pueblo, upper	WS	Unfiltered	PU-10069	Upper Reach P-1W SW	18.36	10.79		>95.556<							
Pueblo	Pueblo, upper	WS	Unfiltered	PU-10070	Lower Reach P-1W SW	18.07	10.5		>80.667<							

Notes: 1. Rows shaded with gray identify data subsets defined by canyon, hydrosegment, water type, and field preparation. If a cell in an analyte column is empty in a shaded row, that analyte has been carried forward into the Tier 2 human health screen, and HQs are provided for each location in the data subset. Codes in the shaded row explain why an analyte was not carried forward from the Tier 1 to the Tier 2 human health screen. An empty, unshaded cell in an analyte column indicates that the analyte was not carried forward to the human health risk assessment.

- Units are µg/L for organic and inorganic chemicals and pCi/L for radionuclides.
- <#> = HQ/HI > 0.1 for non-carcinogens/radionuclides. HQ/HI > 1 for carcinogens.
- >#< = HQ/HI > 1 for non-carcinogens/ radionuclides. HQ/HI > 10 for carcinogens.
- = No data.
- AIIND = Analyte never detected in the hydrosegment/water type/field preparation bin.
- AIIU = Analyte never detected in this location/field preparation bin.
- :d: = Less than 5% detects for all water types within a hydrosegment/field preparation bin.
- N = Eliminated as a Tier 1 Human Health COPC for this hydrosegment/water type/field preparation bin.
- NA = No HQs to sum for this analyte type in this location/field preparation bin.
- SW = Surface water.
- WGA = Alluvial groundwater.
- WGS = Springs.
- WS = Surface water.

Table E-1.0-25
Water: Tier 2 Human Health COPCs

Canyon	Hydrosegment	Water Type	Field Preparation	Location	Station Name	Distance from Rio Grande (km)	Distance from LA Confluence (km)	Distance from Pueblo (km)	Arsenic	beta-BHC	Benzene	Benz(a)anthracene	Benzo(a)pyrene	Benzo(b)fluoranthene	Bis(2-ethylhexyl)phthalate	Bromodichloromethane
Max HQ									331.111	2.703	9.714	8.587	68.478	6.304	7.5	1.167
Screen Value									0.045	0.037	0.35	0.092	0.009	0.092	4.8	0.18
Los Alamos	LA, lower	WGA	Filtered	LA-00002	LLAO-5	0.22			>46.000<							
Los Alamos	LA, lower	WGA	Filtered	LA-00045	LLAO-2	4.16			>86.667<							
Los Alamos	LA, lower	WGA	Filtered	LA-00046	LLAO-4	0.33			>35.556<							
Los Alamos	LA, lower	WGA	Filtered	LA-00215	LLAO-1b	5.25			>195.778<							
Los Alamos	LA, lower	WGS	Filtered	BG-00081	LA Spring	6.04			AllU							
Los Alamos	LA, lower	WGS	Filtered	LA-00219	Basalt Spring	6.38			>117.333<							
Los Alamos	LA, lower	WGS	Filtered	LA-10179	Otowi Spring	0			>100.000<							
Guaje	LA, lower	WS	Filtered	GU-10004	Guaje SW at LA Confluence	2.55			>122.222<							
Los Alamos	LA, lower	WS	Filtered	LA-00218	Reach LA-4E SW	5.22			>114.222<							
Los Alamos	LA, lower	WS	Filtered	LA-10057	LA SW at Guaje Confluence	2.5			>173.333<							
Los Alamos	LA, lower	WS	Filtered	LA-10058	Lower Reach LA-5 SW	0.3			>100.000<							
Los Alamos	LA, lower	WGA	Unfiltered	LA-00002	LLAO-5	0.22			>45.778<		AllU					
Los Alamos	LA, lower	WGA	Unfiltered	LA-00045	LLAO-2	4.16			>77.778<	-						
Los Alamos	LA, lower	WGA	Unfiltered	LA-00046	LLAO-4	0.33			>40.000<	NA						
Los Alamos	LA, lower	WGA	Unfiltered	LA-00215	LLAO-1b	5.25			>164.000<	<9.714>						

Table E-1.0-25 (continued)

Canyon	Hydrosegment	Water Type	Field Preparation	Location	Station Name	Distance from Rio Grande (km)	Distance from LA Confluence (km)	Distance from Pueblo (km)	Arsenic	beta-BHC	Benzene	Benz(a)anthracene	Benzo(a)pyrene	Benzo(b)fluoranthene	Bis(2-ethylhexyl)phthalate	Bromodichloromethane
Max HQ									331.111	2.703	9.714	8.587	68.478	6.304	7.5	1.167
Screen Value									0.045	0.037	0.35	0.092	0.009	0.092	4.8	0.18
Los Alamos	LA, lower	WGS	Unfiltered	BG-00081	LA Spring	6.04			AllU							
Los Alamos	LA, lower	WGS	Unfiltered	LA-00219	Basalt Spring	6.38			>114.222<							
Los Alamos	LA, lower	WGS	Unfiltered	LA-10179	Otowi Spring	0			>102.444<							
Guaje	LA, lower	WS	Unfiltered	GU-10004	Guaje SW at LA Confluence	2.55			>140.000<							
Los Alamos	LA, lower	WS	Unfiltered	LA-00218	Reach LA-4E SW	5.22			>142.444<							
Los Alamos	LA, lower	WS	Unfiltered	LA-02-20908	Eco				>118.222<							
Los Alamos	LA, lower	WS	Unfiltered	LA-02-20909	Eco				>80.222<							
Los Alamos	LA, lower	WS	Unfiltered	LA-10057	LA SW at Guaje Confluence	2.5			>173.333<							
Los Alamos	LA, lower	WS	Unfiltered	LA-10058	Lower Reach LA-5 SW	0.3			>48.889<							
DP	LA, middle	WGA	Filtered	21-01811	LAUZ-1	14.49	1.6		>70.667<						<4.583>	
DP	LA, middle	WGA	Filtered	21-01812	LAUZ-2	14.31	1.42		>73.333<						<7.500>	
Los Alamos	LA, middle	WGA	Filtered	LA-10035	LAO-3a	12.76			>102.444<							
Los Alamos	LA, middle	WGA	Filtered	LA-10067	LAO-2	12.93			AllU							
Los Alamos	LA, middle	WGA	Filtered	LA-10068	LAO-4	11.8			>60.000<							
Los Alamos	LA, middle	WGA	Filtered	LA-10069	LAO-4.5c	10.86			>30.667<							
Los Alamos	LA, middle	WGA	Filtered	LA-10070	LAO-6a	9.87			AllU							

Table E-1.0-25 (continued)

Canyon	Hydrosegment	Water Type	Field Preparation	Location	Station Name	Distance from Rio Grande (km)	Distance from LA Confluence (km)	Distance from Pueblo (km)	Arsenic	beta-BHC	Benzene	Benz(a)anthracene	Benzo(a)pyrene	Benzo(b)fluoranthene	Bis(2-ethylhexyl)phthalate	Bromodichloromethane
Max HQ									331.111	2.703	9.714	8.587	68.478	6.304	7.5	1.167
Screen Value									0.045	0.037	0.35	0.092	0.009	0.092	4.8	0.18
DP	LA, middle	WGS	Filtered	21-01854	DP Spring	13.32	0.43		>40.000<							
DP	LA, middle	WS	Filtered	21-10929	Reach DP-1W SW	16.42	3.53		>220.000<							
DP	LA, middle	WS	Filtered	21-11226	Reach DP-1C SW	16.25	3.36		>147.556<							
DP	LA, middle	WS	Filtered	21-11269	Reach DP-2 SW	14.53	1.64		AllU							
DP	LA, middle	WGA	Unfiltered	21-01811	LAUZ-1	14.49	1.6		>71.778<							
DP	LA, middle	WGA	Unfiltered	21-01812	LAUZ-2	14.31	1.42		>177.778<							
Los Alamos	LA, middle	WGA	Unfiltered	LA-10035	LAO-3a	12.76			>110.000<							
Los Alamos	LA, middle	WGA	Unfiltered	LA-10067	LAO-2	12.93			AllU							
Los Alamos	LA, middle	WGA	Unfiltered	LA-10068	LAO-4	11.8			>70.222<							
Los Alamos	LA, middle	WGA	Unfiltered	LA-10069	LAO-4.5c	10.86			>29.333<							
Los Alamos	LA, middle	WGA	Unfiltered	LA-10070	LAO-6a	9.87			AllU							
DP	LA, middle	WGS	Unfiltered	21-01854	DP Spring	13.32	0.43		>62.222<							
DP	LA, middle	WS	Unfiltered	21-10929	Reach DP-1W SW	16.42	3.53		>244.444<	<2.703>						<1.167>
DP	LA, middle	WS	Unfiltered	21-11226	Reach DP-1C SW	16.25	3.36		>193.333<	AllU						AllU
DP	LA, middle	WS	Unfiltered	21-11269	Reach DP-2 SW	14.53	1.64		-	-						AllU
DP	LA, middle	WS	Unfiltered	LA-02-20913	Eco				>78.000<	AllU						-

Table E-1.0-25 (continued)

Canyon	Hydrosegment	Water Type	Field Preparation	Location	Station Name	Distance from Rio Grande (km)	Distance from LA Confluence (km)	Distance from Pueblo (km)	Arsenic	beta-BHC	Benzene	Benz(a)anthracene	Benzo(a)pyrene	Benzo(b)fluoranthene	Bis(2-ethylhexyl)phthalate	Bromodichloromethane
Max HQ									331.111	2.703	9.714	8.587	68.478	6.304	7.5	1.167
Screen Value									0.045	0.037	0.35	0.092	0.009	0.092	4.8	0.18
Los Alamos	LA, upper	WGA	Filtered	02-01022	LAO-0.91	15.92			>40.000<							
Los Alamos	LA, upper	WGA	Filtered	02-01076	LAO-1	15.66			>82.889<							
Los Alamos	LA, upper	WGA	Filtered	41-01002	LAO-0.6	16.49			>15.778<							
Los Alamos	LA, upper	WGA	Filtered	41-01003	LAO-0.3	17.11			>48.444<							
Los Alamos	LA, upper	WGA	Filtered	41-01004	LAO-C	17.97			>50.889<							
Los Alamos	LA, upper	WGA	Filtered	41-01045	LAO-B	20.34			>30.222<							
Los Alamos	LA, upper	WGA	Filtered	LA-00001	LAO-1.6g	13.41			>28.667<							
Los Alamos	LA, upper	WGA	Filtered	LA-10008	LAO-1.2	14.62			AllU							
Los Alamos	LA, upper	WGA	Filtered	LA-10066	LAO-0.7	16.34			>74.667<							
Los Alamos	LA, upper	WS	Filtered	LA-10005	SW at LAO-0.6	16.48			>46.667<							
Los Alamos	LA, upper	WS	Filtered	LA-10006	Reach LA-Bkgd SW	20.31			AllU							
Los Alamos	LA, upper	WS	Filtered	LA-10033	Los Alamos Reservoir	22.15			>62.222<							
Los Alamos	LA, upper	WS	Filtered	LA-10034	Los Alamos Creek below LA Reservoir	22.11			AllU							
Los Alamos	LA, upper	WS	Filtered	LA-10040	SW at E026	19.3			AllU							
Los Alamos	LA, upper	WS	Filtered	LA-10064	Reach LA-1W SW	17.1			>89.333<							
Los Alamos	LA, upper	WS	Filtered	LA-10065	Reach LA-1C SW	15.7			AllU							

Table E-1.0-25 (continued)

Canyon	Hydrosegment	Water Type	Field Preparation	Location	Station Name	Distance from Rio Grande (km)	Distance from LA Confluence (km)	Distance from Pueblo (km)	Arsenic	beta-BHC	Benzene	Benz(a)anthracene	Benzo(a)pyrene	Benzo(b)fluoranthene	Bis(2-ethylhexyl)phthalate	Bromodichloromethane
Max HQ									331.111	2.703	9.714	8.587	68.478	6.304	7.5	1.167
Screen Value									0.045	0.037	0.35	0.092	0.009	0.092	4.8	0.18
Los Alamos	LA, upper	WS	Filtered	LA-10126	Los Alamos Creek upstream of LA Reservoir	22.36			AllU							
Los Alamos	LA, upper	WGA	Unfiltered	02-01022	LAO-0.91	15.92			>37.778<		-					
Los Alamos	LA, upper	WGA	Unfiltered	02-01076	LAO-1	15.66			>85.556<		AllU					
Los Alamos	LA, upper	WGA	Unfiltered	41-01002	LAO-0.6	16.49			>24.889<		-					
Los Alamos	LA, upper	WGA	Unfiltered	41-01003	LAO-0.3	17.11			>25.778<		AllU					
Los Alamos	LA, upper	WGA	Unfiltered	41-01004	LAO-C	17.97			>53.556<		AllU					
Los Alamos	LA, upper	WGA	Unfiltered	41-01045	LAO-B	20.34			<9.778>		<1.286>					
Los Alamos	LA, upper	WGA	Unfiltered	LA-00001	LAO-1.6g	13.41			>63.778<		AllU					
Los Alamos	LA, upper	WGA	Unfiltered	LA-10008	LAO-1.2	14.62			AllU		-					
Los Alamos	LA, upper	WGA	Unfiltered	LA-10066	LAO-0.7	16.34			>83.778<		AllU					
Los Alamos	LA, upper	WS	Unfiltered	LA-02-20914	Eco				>50.444<							
Los Alamos	LA, upper	WS	Unfiltered	LA-02-20915	Eco				>64.444<							
Los Alamos	LA, upper	WS	Unfiltered	LA-10005	SW at LAO-0.6	16.48			>77.778<							
Los Alamos	LA, upper	WS	Unfiltered	LA-10006	Reach LA-Bkgd SW	20.31			AllU							
Los Alamos	LA, upper	WS	Unfiltered	LA-10033	Los Alamos Reservoir	22.15			>33.333<							

Table E-1.0-25 (continued)

Canyon	Hydrosegment	Water Type	Field Preparation	Location	Station Name	Distance from Rio Grande (km)	Distance from LA Confluence (km)	Distance from Pueblo (km)	Arsenic	beta-BHC	Benzene	Benz(a)anthracene	Benzo(a)pyrene	Benzo(b)fluoranthene	Bis(2-ethylhexyl)phthalate	Bromodichloromethane
Max HQ									331.111	2.703	9.714	8.587	68.478	6.304	7.5	1.167
Screen Value									0.045	0.037	0.35	0.092	0.009	0.092	4.8	0.18
Los Alamos	LA, upper	WS	Unfiltered	LA-10034	Los Alamos Creek below LA Reservoir	22.11			AllU							
Los Alamos	LA, upper	WS	Unfiltered	LA-10040	SW at E026	19.3			>91.111<							
Los Alamos	LA, upper	WS	Unfiltered	LA-10064	Reach LA-1W SW	17.1			>172.222<							
Los Alamos	LA, upper	WS	Unfiltered	LA-10065	Reach LA-1C SW	15.7			AllU							
Los Alamos	LA, upper	WS	Unfiltered	LA-10126	Los Alamos Creek upstream of LA Reservoir	22.36			AllU							
Pueblo	Pueblo, lower	WGA	Filtered	PU-00177	PAO-5N	8.94	1.37		>213.333<							
Pueblo	Pueblo, lower	WGA	Filtered	PU-00182	PAO-4	10.21	2.64		>155.333<							
Pueblo	Pueblo, lower	WGA	Filtered	PU-10228	APCO-1	8.94	1.37		>144.667<							
Pueblo	Pueblo, lower	WS	Filtered	PU-10229	Pueblo at State Road 502	7.67	0.1		>151.111<							
Pueblo	Pueblo, lower	WS	Filtered	PU-10230	Pueblo 3	10.01	2.44		>251.111<							
Pueblo	Pueblo, lower	WGA	Unfiltered	PU-00177	PAO-5N	8.94	1.37		>214.444<							
Pueblo	Pueblo, lower	WGA	Unfiltered	PU-00182	PAO-4	10.21	2.64		>164.667<							
Pueblo	Pueblo, lower	WGA	Unfiltered	PU-10228	APCO-1	8.94	1.37		>158.667<							
Pueblo	Pueblo, lower	WS	Unfiltered	PU-02-20920	Eco				>331.111<						-	
Pueblo	Pueblo, lower	WS	Unfiltered	PU-10229	Pueblo at State Road 502	7.67	0.1		>186.667<						X	

Table E-1.0-25 (continued)

Canyon	Hydrosegment	Water Type	Field Preparation	Location	Station Name	Distance from Rio Grande (km)	Distance from LA Confluence (km)	Distance from Pueblo (km)	Arsenic	beta-BHC	Benzene	Benz(a)anthracene	Benzo(a)pyrene	Benzo(b)fluoranthene	Bis(2-ethylhexyl)phthalate	Bromodichloromethane
Max HQ									331.111	2.703	9.714	8.587	68.478	6.304	7.5	1.167
Screen Value									0.045	0.037	0.35	0.092	0.009	0.092	4.8	0.18
Pueblo	Pueblo, lower	WS	Unfiltered	PU-10230	Pueblo 3	10.01	2.44		>231.111<						<1.417>	
Pueblo	Pueblo, middle	WGA	Filtered	PU-00181	PAO-3	13.44	5.87		>64.444<							
Acid	Pueblo, middle	WS	Filtered	00-10241	Reach AC-2 SW	18.78		0.72	AIU							
Acid	Pueblo, middle	WS	Filtered	PU-10155	Lower Reach AC-3 SW	18.08		0.02	>48.889<							
Acid	Pueblo, middle	WS	Filtered	PU-10175	Upper Reach ACS SW	18.67		0.61	>80.000<							
Acid	Pueblo, middle	WS	Filtered	PU-10176	Lower Reach ACS SW	18.52		0.46	>37.778<							
Pueblo	Pueblo, middle	WS	Filtered	PU-10071	Upper Reach P-1E SW	17.91	10.34		>40.000<							
Pueblo	Pueblo, middle	WS	Filtered	PU-10231	Pueblo 2	14.74	7.17		AIU							
Pueblo	Pueblo, middle	WGA	Unfiltered	PU-00181	PAO-3	13.44	5.87		>53.333<							
Pueblo	Pueblo, middle	WGA	Unfiltered	PU-10174	PAO-2	17.85	10.28		AIU							
Acid	Pueblo, middle	WS	Unfiltered	00-10241	Reach AC-2 SW	18.78		0.72	>66.667<			AIU	AIU	AIU		
Acid	Pueblo, middle	WS	Unfiltered	PU-10155	Lower Reach AC-3 SW	18.08		0.02	AIU			<7.065>	>68.478<	<5.326>		
Acid	Pueblo, middle	WS	Unfiltered	PU-10175	Upper Reach ACS SW	18.67		0.61	>71.111<			AIU	AIU	AIU		
Acid	Pueblo, middle	WS	Unfiltered	PU-10176	Lower Reach ACS SW	18.52		0.46	>40.000<			AIU	AIU	AIU		
Pueblo	Pueblo, middle	WS	Unfiltered	PU-10071	Upper Reach P-1E SW	17.91	10.34		>135.556<			AIU	AIU	AIU		

Table E-1.0-25 (continued)

Canyon	Hydrosegment	Water Type	Field Preparation	Location	Station Name	Distance from Rio Grande (km)	Distance from LA Confluence (km)	Distance from Pueblo (km)	Arsenic	beta-BHC	Benzene	Benz(a)anthracene	Benzo(a)pyrene	Benzo(b)fluoranthene	Bis(2-ethylhexyl)phthalate	Bromodichloromethane
Max HQ									331.111	2.703	9.714	8.587	68.478	6.304	7.5	1.167
Screen Value									0.045	0.037	0.35	0.092	0.009	0.092	4.8	0.18
Pueblo	Pueblo, middle	WS	Unfiltered	PU-10231	Pueblo 2	14.74	7.17		AllU			<8.587>	>60.870<	<6.304>		
Pueblo	Pueblo, upper	WGA	Filtered	PU-00178	PAO-1				>35.556<							
Pueblo	Pueblo, upper	WS	Filtered	PU-10068	Reach P-1FW SW	18.76	11.19		>11.556<							
Pueblo	Pueblo, upper	WS	Filtered	PU-10069	Upper Reach P-1W SW	18.36	10.79		>77.778<							
Pueblo	Pueblo, upper	WS	Filtered	PU-10070	Lower Reach P-1W SW	18.07	10.5		>66.667<							
Pueblo	Pueblo, upper	WGA	Unfiltered	PU-00178	PAO-1				>28.889<							
Pueblo	Pueblo, upper	WS	Unfiltered	PU-10068	Reach P-1FW SW	18.76	11.19		>75.556<							
Pueblo	Pueblo, upper	WS	Unfiltered	PU-10069	Upper Reach P-1W SW	18.36	10.79		>95.556<							
Pueblo	Pueblo, upper	WS	Unfiltered	PU-10070	Lower Reach P-1W SW	18.07	10.5		>80.667<							

Table E-1.0-25 (continued)

Canyon	Hydrosegment	Water Type	Field Preparation	Location	Station Name	Distance from Rio Grande (km)	Distance from LA Confluence (km)	Distance from Pueblo (km)	Chloroform	4,4'-DDE	4,4'-DDT	Dibenz(a,h)anthracene	1,2-Dichloroethane	Dieldrin	Indeno(1,2,3-cd)pyrene
Max HQ									17.5	2.85	1.7	46.739	63.333	1.286	6.196
Screen Value									0.16	0.2	0.2	0.009	0.12	0.004	0.092
Los Alamos	LA, lower	WGA	Filtered	LA-00002	LLAO-5	0.22									
Los Alamos	LA, lower	WGA	Filtered	LA-00045	LLAO-2	4.16									
Los Alamos	LA, lower	WGA	Filtered	LA-00046	LLAO-4	0.33									
Los Alamos	LA, lower	WGA	Filtered	LA-00215	LLAO-1b	5.25									
Los Alamos	LA, lower	WGS	Filtered	BG-00081	LA Spring	6.04									
Los Alamos	LA, lower	WGS	Filtered	LA-00219	Basalt Spring	6.38									
Los Alamos	LA, lower	WGS	Filtered	LA-10179	Otowi Spring	0									
Guaje	LA, lower	WS	Filtered	GU-10004	Guaje SW at LA Confluence	2.55									
Los Alamos	LA, lower	WS	Filtered	LA-00218	Reach LA-4E SW	5.22									
Los Alamos	LA, lower	WS	Filtered	LA-10057	LA SW at Guaje Confluence	2.5									
Los Alamos	LA, lower	WS	Filtered	LA-10058	Lower Reach LA-5 SW	0.3									
Los Alamos	LA, lower	WGA	Unfiltered	LA-00002	LLAO-5	0.22									
Los Alamos	LA, lower	WGA	Unfiltered	LA-00045	LLAO-2	4.16									
Los Alamos	LA, lower	WGA	Unfiltered	LA-00046	LLAO-4	0.33									
Los Alamos	LA, lower	WGA	Unfiltered	LA-00215	LLAO-1b	5.25									
Los Alamos	LA, lower	WGS	Unfiltered	BG-00081	LA Spring	6.04									

Table E-1.0-25 (continued)

Canyon	Hydrosegment	Water Type	Field Preparation	Location	Station Name	Distance from Rio Grande (km)	Distance from LA Confluence (km)	Distance from Pueblo (km)	Chloroform	4,4'-DDE	4,4'-DDT	Dibenz(a,h)anthracene	1,2-Dichloroethane	Dieldrin	Indeno(1,2,3-cd)pyrene
Max HQ									17.5	2.85	1.7	46.739	63.333	1.286	6.196
Screen Value									0.16	0.2	0.2	0.009	0.12	0.004	0.092
Los Alamos	LA, lower	WGS	Unfiltered	LA-00219	Basalt Spring	6.38									
Los Alamos	LA, lower	WGS	Unfiltered	LA-10179	Otowi Spring	0									
Guaje	LA, lower	WS	Unfiltered	GU-10004	Guaje SW at LA Confluence	2.55									
Los Alamos	LA, lower	WS	Unfiltered	LA-00218	Reach LA-4E SW	5.22					X				
Los Alamos	LA, lower	WS	Unfiltered	LA-02-20908	Eco						X				
Los Alamos	LA, lower	WS	Unfiltered	LA-02-20909	Eco						<1.600>				
Los Alamos	LA, lower	WS	Unfiltered	LA-10057	LA SW at Guaje Confluence	2.5									
Los Alamos	LA, lower	WS	Unfiltered	LA-10058	Lower Reach LA-5 SW	0.3					-				
DP	LA, middle	WGA	Filtered	21-01811	LAUZ-1	14.49	1.6								
DP	LA, middle	WGA	Filtered	21-01812	LAUZ-2	14.31	1.42								
Los Alamos	LA, middle	WGA	Filtered	LA-10035	LAO-3a	12.76									
Los Alamos	LA, middle	WGA	Filtered	LA-10067	LAO-2	12.93									
Los Alamos	LA, middle	WGA	Filtered	LA-10068	LAO-4	11.8									
Los Alamos	LA, middle	WGA	Filtered	LA-10069	LAO-4.5c	10.86									
Los Alamos	LA, middle	WGA	Filtered	LA-10070	LAO-6a	9.87									
DP	LA, middle	WGS	Filtered	21-01854	DP Spring	13.32	0.43								

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Table E-1.0-25 (continued)

Canyon	Hydrosegment	Water Type	Field Preparation	Location	Station Name	Distance from Rio Grande (km)	Distance from LA Confluence (km)	Distance from Pueblo (km)	Chloroform	4,4'-DDE	4,4'-DDT	Dibenz(a,h)anthracene	1,2-Dichloroethane	Dieldrin	Indeno(1,2,3-cd)pyrene
Max HQ									17.5	2.85	1.7	46.739	63.333	1.286	6.196
Screen Value									0.16	0.2	0.2	0.009	0.12	0.004	0.092
DP	LA, middle	WS	Filtered	21-10929	Reach DP-1W SW	16.42	3.53								
DP	LA, middle	WS	Filtered	21-11226	Reach DP-1C SW	16.25	3.36								
DP	LA, middle	WS	Filtered	21-11269	Reach DP-2 SW	14.53	1.64								
DP	LA, middle	WGA	Unfiltered	21-01811	LAUZ-1	14.49	1.6								
DP	LA, middle	WGA	Unfiltered	21-01812	LAUZ-2	14.31	1.42								
Los Alamos	LA, middle	WGA	Unfiltered	LA-10035	LAO-3a	12.76									
Los Alamos	LA, middle	WGA	Unfiltered	LA-10067	LAO-2	12.93									
Los Alamos	LA, middle	WGA	Unfiltered	LA-10068	LAO-4	11.8									
Los Alamos	LA, middle	WGA	Unfiltered	LA-10069	LAO-4.5c	10.86									
Los Alamos	LA, middle	WGA	Unfiltered	LA-10070	LAO-6a	9.87									
DP	LA, middle	WGS	Unfiltered	21-01854	DP Spring	13.32	0.43						>63.333<		
DP	LA, middle	WS	Unfiltered	21-10929	Reach DP-1W SW	16.42	3.53		>17.500<						
DP	LA, middle	WS	Unfiltered	21-11226	Reach DP-1C SW	16.25	3.36		AllU						
DP	LA, middle	WS	Unfiltered	21-11269	Reach DP-2 SW	14.53	1.64		AllU						
DP	LA, middle	WS	Unfiltered	LA-02-20913	Eco				-						
Los Alamos	LA, upper	WGA	Filtered	02-01022	LAO-0.91	15.92									

Table E-1.0-25 (continued)

Canyon	Hydrosegment	Water Type	Field Preparation	Location	Station Name	Distance from Rio Grande (km)	Distance from LA Confluence (km)	Distance from Pueblo (km)	Chloroform	4,4'-DDE	4,4'-DDT	Dibenz(a,h)anthracene	1,2-Dichloroethane	Dieldrin	Indeno(1,2,3-cd)pyrene
Max HQ									17.5	2.85	1.7	46.739	63.333	1.286	6.196
Screen Value									0.16	0.2	0.2	0.009	0.12	0.004	0.092
Los Alamos	LA, upper	WGA	Filtered	02-01076	LAO-1	15.66									
Los Alamos	LA, upper	WGA	Filtered	41-01002	LAO-0.6	16.49									
Los Alamos	LA, upper	WGA	Filtered	41-01003	LAO-0.3	17.11									
Los Alamos	LA, upper	WGA	Filtered	41-01004	LAO-C	17.97									
Los Alamos	LA, upper	WGA	Filtered	41-01045	LAO-B	20.34									
Los Alamos	LA, upper	WGA	Filtered	LA-00001	LAO-1.6g	13.41									
Los Alamos	LA, upper	WGA	Filtered	LA-10008	LAO-1.2	14.62									
Los Alamos	LA, upper	WGA	Filtered	LA-10066	LAO-0.7	16.34									
Los Alamos	LA, upper	WS	Filtered	LA-10005	SW at LAO-0.6	16.48									
Los Alamos	LA, upper	WS	Filtered	LA-10006	Reach LA-Bkgd SW	20.31									
Los Alamos	LA, upper	WS	Filtered	LA-10033	Los Alamos Reservoir	22.15									
Los Alamos	LA, upper	WS	Filtered	LA-10034	Los Alamos Creek below LA Reservoir	22.11									
Los Alamos	LA, upper	WS	Filtered	LA-10040	SW at E026	19.3									
Los Alamos	LA, upper	WS	Filtered	LA-10064	Reach LA-1W SW	17.1									
Los Alamos	LA, upper	WS	Filtered	LA-10065	Reach LA-1C SW	15.7									

Table E-1.0-25 (continued)

Canyon	Hydrosegment	Water Type	Field Preparation	Location	Station Name	Distance from Rio Grande (km)	Distance from LA Confluence (km)	Distance from Pueblo (km)	Chloroform	4,4'-DDE	4,4'-DDT	Dibenz(a,h)anthracene	1,2-Dichloroethane	Dieldrin	Indeno(1,2,3-cd)pyrene
Max HQ									17.5	2.85	1.7	46.739	63.333	1.286	6.196
Screen Value									0.16	0.2	0.2	0.009	0.12	0.004	0.092
Los Alamos	LA, upper	WS	Filtered	LA-10126	Los Alamos Creek upstream of LA Reservoir	22.36									
Los Alamos	LA, upper	WGA	Unfiltered	02-01022	LAO-0.91	15.92									
Los Alamos	LA, upper	WGA	Unfiltered	02-01076	LAO-1	15.66									
Los Alamos	LA, upper	WGA	Unfiltered	41-01002	LAO-0.6	16.49									
Los Alamos	LA, upper	WGA	Unfiltered	41-01003	LAO-0.3	17.11									
Los Alamos	LA, upper	WGA	Unfiltered	41-01004	LAO-C	17.97									
Los Alamos	LA, upper	WGA	Unfiltered	41-01045	LAO-B	20.34									
Los Alamos	LA, upper	WGA	Unfiltered	LA-00001	LAO-1.6g	13.41									
Los Alamos	LA, upper	WGA	Unfiltered	LA-10008	LAO-1.2	14.62									
Los Alamos	LA, upper	WGA	Unfiltered	LA-10066	LAO-0.7	16.34									
Los Alamos	LA, upper	WS	Unfiltered	LA-02-20914	Eco					<2.850>	<1.700>				
Los Alamos	LA, upper	WS	Unfiltered	LA-02-20915	Eco					X	X				
Los Alamos	LA, upper	WS	Unfiltered	LA-10005	SW at LAO-0.6	16.48				-					
Los Alamos	LA, upper	WS	Unfiltered	LA-10006	Reach LA-Bkgd SW	20.31				-					
Los Alamos	LA, upper	WS	Unfiltered	LA-10033	Los Alamos Reservoir	22.15				Allu	Allu				

Table E-1.0-25 (continued)

Canyon	Hydrosegment	Water Type	Field Preparation	Location	Station Name	Distance from Rio Grande (km)	Distance from LA Confluence (km)	Distance from Pueblo (km)	Chloroform	4,4'-DDE	4,4'-DDT	Dibenz(a,h)anthracene	1,2-Dichloroethane	Dieldrin	Indeno(1,2,3-cd)pyrene
Max HQ									17.5	2.85	1.7	46.739	63.333	1.286	6.196
Screen Value									0.16	0.2	0.2	0.009	0.12	0.004	0.092
Los Alamos	LA, upper	WS	Unfiltered	LA-10034	Los Alamos Creek below LA Reservoir	22.11				AllU	AllU				
Los Alamos	LA, upper	WS	Unfiltered	LA-10040	SW at E026	19.3				-					
Los Alamos	LA, upper	WS	Unfiltered	LA-10064	Reach LA-1W SW	17.1				AllU	X				
Los Alamos	LA, upper	WS	Unfiltered	LA-10065	Reach LA-1C SW	15.7				AllU	X				
Los Alamos	LA, upper	WS	Unfiltered	LA-10126	Los Alamos Creek upstream of LA Reservoir	22.36				AllU	X				
Pueblo	Pueblo, lower	WGA	Filtered	PU-00177	PAO-5N	8.94	1.37								
Pueblo	Pueblo, lower	WGA	Filtered	PU-00182	PAO-4	10.21	2.64								
Pueblo	Pueblo, lower	WGA	Filtered	PU-10228	APCO-1	8.94	1.37								
Pueblo	Pueblo, lower	WS	Filtered	PU-10229	Pueblo at State Road 502	7.67	0.1								
Pueblo	Pueblo, lower	WS	Filtered	PU-10230	Pueblo 3	10.01	2.44								
Pueblo	Pueblo, lower	WGA	Unfiltered	PU-00177	PAO-5N	8.94	1.37								
Pueblo	Pueblo, lower	WGA	Unfiltered	PU-00182	PAO-4	10.21	2.64								
Pueblo	Pueblo, lower	WGA	Unfiltered	PU-10228	APCO-1	8.94	1.37								
Pueblo	Pueblo, lower	WS	Unfiltered	PU-02-20920	Eco				-						
Pueblo	Pueblo, lower	WS	Unfiltered	PU-10229	Pueblo at State Road 502	7.67	0.1		AllU						

Table E-1.0-25 (continued)

Canyon	Hydrosegment	Water Type	Field Preparation	Location	Station Name	Distance from Rio Grande (km)	Distance from LA Confluence (km)	Distance from Pueblo (km)	Chloroform	4,4'-DDE	4,4'-DDT	Dibenz(a,h)anthracene	1,2-Dichloroethane	Dieldrin	Indeno(1,2,3-cd)pyrene
Max HQ									17.5	2.85	1.7	46.739	63.333	1.286	6.196
Screen Value									0.16	0.2	0.2	0.009	0.12	0.004	0.092
Pueblo	Pueblo, lower	WS	Unfiltered	PU-10230	Pueblo 3	10.01	2.44		<1.500>						
Pueblo	Pueblo, middle	WGA	Filtered	PU-00181	PAO-3	13.44	5.87								
Acid	Pueblo, middle	WS	Filtered	00-10241	Reach AC-2 SW	18.78		0.72							
Acid	Pueblo, middle	WS	Filtered	PU-10155	Lower Reach AC-3 SW	18.08		0.02							
Acid	Pueblo, middle	WS	Filtered	PU-10175	Upper Reach ACS SW	18.67		0.61							
Acid	Pueblo, middle	WS	Filtered	PU-10176	Lower Reach ACS SW	18.52		0.46							
Pueblo	Pueblo, middle	WS	Filtered	PU-10071	Upper Reach P-1E SW	17.91	10.34								
Pueblo	Pueblo, middle	WS	Filtered	PU-10231	Pueblo 2	14.74	7.17								
Pueblo	Pueblo, middle	WGA	Unfiltered	PU-00181	PAO-3	13.44	5.87								
Pueblo	Pueblo, middle	WGA	Unfiltered	PU-10174	PAO-2	17.85	10.28								
Acid	Pueblo, middle	WS	Unfiltered	00-10241	Reach AC-2 SW	18.78		0.72				AllU			AllU
Acid	Pueblo, middle	WS	Unfiltered	PU-10155	Lower Reach AC-3 SW	18.08		0.02				>46.739<			<5.109>
Acid	Pueblo, middle	WS	Unfiltered	PU-10175	Upper Reach ACS SW	18.67		0.61				AllU			AllU
Acid	Pueblo, middle	WS	Unfiltered	PU-10176	Lower Reach ACS SW	18.52		0.46				AllU			AllU
Pueblo	Pueblo, middle	WS	Unfiltered	PU-10071	Upper Reach P-1E SW	17.91	10.34								AllU

Table E-1.0-25 (continued)

Canyon	Hydrosegment	Water Type	Field Preparation	Location	Station Name	Distance from Rio Grande (km)	Distance from LA Confluence (km)	Distance from Pueblo (km)	Chloroform	4,4'-DDE	4,4'-DDT	Dibenz(a,h)anthracene	1,2-Dichloroethane	Dieldrin	Indeno(1,2,3-cd)pyrene
Max HQ									17.5	2.85	1.7	46.739	63.333	1.286	6.196
Screen Value									0.16	0.2	0.2	0.009	0.12	0.004	0.092
Pueblo	Pueblo, middle	WS	Unfiltered	PU-10231	Pueblo 2	14.74	7.17								<6.196>
Pueblo	Pueblo, upper	WGA	Filtered	PU-00178	PAO-1										
Pueblo	Pueblo, upper	WS	Filtered	PU-10068	Reach P-1FW SW	18.76	11.19								
Pueblo	Pueblo, upper	WS	Filtered	PU-10069	Upper Reach P-1W SW	18.36	10.79								
Pueblo	Pueblo, upper	WS	Filtered	PU-10070	Lower Reach P-1W SW	18.07	10.5								
Pueblo	Pueblo, upper	WGA	Unfiltered	PU-00178	PAO-1							<2.554>		<1.286>	
Pueblo	Pueblo, upper	WS	Unfiltered	PU-10068	Reach P-1FW SW	18.76	11.19								
Pueblo	Pueblo, upper	WS	Unfiltered	PU-10069	Upper Reach P-1W SW	18.36	10.79								
Pueblo	Pueblo, upper	WS	Unfiltered	PU-10070	Lower Reach P-1W SW	18.07	10.5								

Table E-1.0-25 (continued)

Canyon	Hydrosegment	Water Type	Field Preparation	Location	Station Name	Distance from Rio Grande (km)	Distance from LA Confluence (km)	Distance from Pueblo (km)	Methylene Chloride	Trichloroethene	Total Cancer HI	Aluminum	Antimony	Barium	Boron
Max HQ									9.302	60.714		1.157	0.267	0.18	0.12
Screen Value									4.3	0.028		37000	15	2600	3300
Los Alamos	LA, lower	WGA	Filtered	LA-00002	LLAO-5	0.22					>46.000<			<0.110>	
Los Alamos	LA, lower	WGA	Filtered	LA-00045	LLAO-2	4.16					>86.667<			X	
Los Alamos	LA, lower	WGA	Filtered	LA-00046	LLAO-4	0.33					>35.556<			X	
Los Alamos	LA, lower	WGA	Filtered	LA-00215	LLAO-1b	5.25					>195.778<			X	
Los Alamos	LA, lower	WGS	Filtered	BG-00081	LA Spring	6.04					NA		AllU		
Los Alamos	LA, lower	WGS	Filtered	LA-00219	Basalt Spring	6.38					>117.333<		<0.200>		
Los Alamos	LA, lower	WGS	Filtered	LA-10179	Otowi Spring	0					>100.000<		AllU		
Guaje	LA, lower	WS	Filtered	GU-10004	Guaje SW at LA Confluence	2.55					>122.222<				
Los Alamos	LA, lower	WS	Filtered	LA-00218	Reach LA-4E SW	5.22					>114.222<				
Los Alamos	LA, lower	WS	Filtered	LA-10057	LA SW at Guaje Confluence	2.5					>173.333<				
Los Alamos	LA, lower	WS	Filtered	LA-10058	Lower Reach LA-5 SW	0.3					>100.000<				
Los Alamos	LA, lower	WGA	Unfiltered	LA-00002	LLAO-5	0.22				AllU	>45.778<		<0.233>	<0.110>	
Los Alamos	LA, lower	WGA	Unfiltered	LA-00045	LLAO-2	4.16			-		>77.778<		AllU	X	
Los Alamos	LA, lower	WGA	Unfiltered	LA-00046	LLAO-4	0.33			-		>40.000<		AllU	X	
Los Alamos	LA, lower	WGA	Unfiltered	LA-00215	LLAO-1b	5.25				>60.714<	>234.429<		AllU	X	
Los Alamos	LA, lower	WGS	Unfiltered	BG-00081	LA Spring	6.04					NA		AllU		
Los Alamos	LA, lower	WGS	Unfiltered	LA-00219	Basalt Spring	6.38					>114.222<		<0.200>		

Table E-1.0-25 (continued)

Canyon	Hydrosegment	Water Type	Field Preparation	Location	Station Name	Distance from Rio Grande (km)	Distance from LA Confluence (km)	Distance from Pueblo (km)	Methylene Chloride	Trichloroethene	Total Cancer HI	Aluminum	Antimony	Barium	Boron
Max HQ									9.302	60.714		1.157	0.267	0.18	0.12
Screen Value									4.3	0.028		37000	15	2600	3300
Los Alamos	LA, lower	WGS	Unfiltered	LA-10179	Otowi Spring	0					>102.444<		AIU		
Guaje	LA, lower	WS	Unfiltered	GU-10004	Guaje SW at LA Confluence	2.55					>140.000<				
Los Alamos	LA, lower	WS	Unfiltered	LA-00218	Reach LA-4E SW	5.22					>142.492<				
Los Alamos	LA, lower	WS	Unfiltered	LA-02-20908	Eco						>118.297<				
Los Alamos	LA, lower	WS	Unfiltered	LA-02-20909	Eco						>81.822<				
Los Alamos	LA, lower	WS	Unfiltered	LA-10057	LA SW at Guaje Confluence	2.5					>173.333<				
Los Alamos	LA, lower	WS	Unfiltered	LA-10058	Lower Reach LA-5 SW	0.3					>48.889<				
DP	LA, middle	WGA	Filtered	21-01811	LAUZ-1	14.49	1.6				>75.250<				
DP	LA, middle	WGA	Filtered	21-01812	LAUZ-2	14.31	1.42				>80.833<				
Los Alamos	LA, middle	WGA	Filtered	LA-10035	LAO-3a	12.76					>102.444<				
Los Alamos	LA, middle	WGA	Filtered	LA-10067	LAO-2	12.93					NA				
Los Alamos	LA, middle	WGA	Filtered	LA-10068	LAO-4	11.8					>60.000<				
Los Alamos	LA, middle	WGA	Filtered	LA-10069	LAO-4.5c	10.86					>30.667<				
Los Alamos	LA, middle	WGA	Filtered	LA-10070	LAO-6a	9.87					NA				
DP	LA, middle	WGS	Filtered	21-01854	DP Spring	13.32	0.43				>40.000<				
DP	LA, middle	WS	Filtered	21-10929	Reach DP-1W SW	16.42	3.53				>220.000<		AIU		
DP	LA, middle	WS	Filtered	21-11226	Reach DP-1C SW	16.25	3.36				>147.556<		<0.147>		

Table E-1.0-25 (continued)

Canyon	Hydrosegment	Water Type	Field Preparation	Location	Station Name	Distance from Rio Grande (km)	Distance from LA Confluence (km)	Distance from Pueblo (km)	Methylene Chloride	Trichloroethene	Total Cancer HI	Aluminum	Antimony	Barium	Boron
Max HQ									9.302	60.714		1.157	0.267	0.18	0.12
Screen Value									4.3	0.028		37000	15	2600	3300
DP	LA, middle	WS	Filtered	21-11269	Reach DP-2 SW	14.53	1.64				NA		X		
DP	LA, middle	WGA	Unfiltered	21-01811	LAUZ-1	14.49	1.6		<8.837>		>80.615<	X			
DP	LA, middle	WGA	Unfiltered	21-01812	LAUZ-2	14.31	1.42		Allu		>177.778<	X			
Los Alamos	LA, middle	WGA	Unfiltered	LA-10035	LAO-3a	12.76					>110.000<				
Los Alamos	LA, middle	WGA	Unfiltered	LA-10067	LAO-2	12.93					NA				
Los Alamos	LA, middle	WGA	Unfiltered	LA-10068	LAO-4	11.8					>70.222<				
Los Alamos	LA, middle	WGA	Unfiltered	LA-10069	LAO-4.5c	10.86					>29.333<				
Los Alamos	LA, middle	WGA	Unfiltered	LA-10070	LAO-6a	9.87					NA				
DP	LA, middle	WGS	Unfiltered	21-01854	DP Spring	13.32	0.43				>125.556<				
DP	LA, middle	WS	Unfiltered	21-10929	Reach DP-1W SW	16.42	3.53				>265.814<	X	Allu		
DP	LA, middle	WS	Unfiltered	21-11226	Reach DP-1C SW	16.25	3.36				>193.333<	<0.179>	<0.143>		
DP	LA, middle	WS	Unfiltered	21-11269	Reach DP-2 SW	14.53	1.64				NA	-	-		
DP	LA, middle	WS	Unfiltered	LA-02-20913	Eco						>78.000<	X	X		
Los Alamos	LA, upper	WGA	Filtered	02-01022	LAO-0.91	15.92					>40.000<				
Los Alamos	LA, upper	WGA	Filtered	02-01076	LAO-1	15.66					>82.889<				
Los Alamos	LA, upper	WGA	Filtered	41-01002	LAO-0.6	16.49					>15.778<				
Los Alamos	LA, upper	WGA	Filtered	41-01003	LAO-0.3	17.11					>48.444<				

Table E-1.0-25 (continued)

Canyon	Hydrosegment	Water Type	Field Preparation	Location	Station Name	Distance from Rio Grande (km)	Distance from LA Confluence (km)	Distance from Pueblo (km)	Methylene Chloride	Trichloroethene	Total Cancer HI	Aluminum	Antimony	Barium	Boron
Max HQ									9.302	60.714		1.157	0.267	0.18	0.12
Screen Value									4.3	0.028		37000	15	2600	3300
Los Alamos	LA, upper	WGA	Filtered	41-01004	LAO-C	17.97					>50.889<				
Los Alamos	LA, upper	WGA	Filtered	41-01045	LAO-B	20.34					>30.222<				
Los Alamos	LA, upper	WGA	Filtered	LA-00001	LAO-1.6g	13.41					>28.667<				
Los Alamos	LA, upper	WGA	Filtered	LA-10008	LAO-1.2	14.62					NA				
Los Alamos	LA, upper	WGA	Filtered	LA-10066	LAO-0.7	16.34					>74.667<				
Los Alamos	LA, upper	WS	Filtered	LA-10005	SW at LAO-0.6	16.48					>46.667<				
Los Alamos	LA, upper	WS	Filtered	LA-10006	Reach LA-Bkgd SW	20.31					NA				
Los Alamos	LA, upper	WS	Filtered	LA-10033	Los Alamos Reservoir	22.15					>62.222<				
Los Alamos	LA, upper	WS	Filtered	LA-10034	Los Alamos Creek below LA Reservoir	22.11					NA				
Los Alamos	LA, upper	WS	Filtered	LA-10040	SW at E026	19.3					NA				
Los Alamos	LA, upper	WS	Filtered	LA-10064	Reach LA-1W SW	17.1					>89.333<				
Los Alamos	LA, upper	WS	Filtered	LA-10065	Reach LA-1C SW	15.7					NA				
Los Alamos	LA, upper	WS	Filtered	LA-10126	Los Alamos Creek upstream of LA Reservoir	22.36					NA				
Los Alamos	LA, upper	WGA	Unfiltered	02-01022	LAO-0.91	15.92			-		>37.778<	X			
Los Alamos	LA, upper	WGA	Unfiltered	02-01076	LAO-1	15.66			X		>86.114<	X			
Los Alamos	LA, upper	WGA	Unfiltered	41-01002	LAO-0.6	16.49			-		>24.889<	X			
Los	LA,	WGA	Unfiltered	41-01003	LAO-0.3	17.11			<3.721>		>29.499<	X			

Table E-1.0-25 (continued)

Canyon	Hydrosegment	Water Type	Field Preparation	Location	Station Name	Distance from Rio Grande (km)	Distance from LA Confluence (km)	Distance from Pueblo (km)	Methylene Chloride	Trichloroethene	Total Cancer HI	Aluminum	Antimony	Barium	Boron
Max HQ									9.302	60.714		1.157	0.267	0.18	0.12
Screen Value									4.3	0.028		37000	15	2600	3300
Alamos	upper														
Los Alamos	LA, upper	WGA	Unfiltered	41-01004	LAO-C	17.97			X		>53.928<	X			
Los Alamos	LA, upper	WGA	Unfiltered	41-01045	LAO-B	20.34			<3.488>		>14.552<	X			
Los Alamos	LA, upper	WGA	Unfiltered	LA-00001	LAO-1.6g	13.41			<5.814>		>69.592<	X			
Los Alamos	LA, upper	WGA	Unfiltered	LA-10008	LAO-1.2	14.62			-		NA	X			
Los Alamos	LA, upper	WGA	Unfiltered	LA-10066	LAO-0.7	16.34			X		>83.978<	X			
Los Alamos	LA, upper	WS	Unfiltered	LA-02-20914	Eco				-		>54.994<	X		X	
Los Alamos	LA, upper	WS	Unfiltered	LA-02-20915	Eco				-		>64.974<	<0.133>		X	
Los Alamos	LA, upper	WS	Unfiltered	LA-10005	SW at LAO-0.6	16.48			-		>77.778<	X		X	
Los Alamos	LA, upper	WS	Unfiltered	LA-10006	Reach LA-Bkgd SW	20.31			-		NA	X		X	
Los Alamos	LA, upper	WS	Unfiltered	LA-10033	Los Alamos Reservoir	22.15			<8.605>		>41.938<	X		X	
Los Alamos	LA, upper	WS	Unfiltered	LA-10034	Los Alamos Creek below LA Reservoir	22.11			Allu		NA	X		X	
Los Alamos	LA, upper	WS	Unfiltered	LA-10040	SW at E026	19.3			-		>91.111<	>1.157<		<0.180>	
Los Alamos	LA, upper	WS	Unfiltered	LA-10064	Reach LA-1W SW	17.1			<9.302>		>182.015<	<0.751>		<0.147>	
Los Alamos	LA, upper	WS	Unfiltered	LA-10065	Reach LA-1C SW	15.7			X		X	<0.405>		X	
Los Alamos	LA, upper	WS	Unfiltered	LA-10126	Los Alamos Creek upstream of LA Reservoir	22.36			X		X	X		X	
Pueblo	Pueblo, lower	WGA	Filtered	PU-00177	PAO-5N	8.94	1.37				>213.333<				<0.115>

Table E-1.0-25 (continued)

Canyon	Hydrosegment	Water Type	Field Preparation	Location	Station Name	Distance from Rio Grande (km)	Distance from LA Confluence (km)	Distance from Pueblo (km)	Methylene Chloride	Trichloroethene	Total Cancer HI	Aluminum	Antimony	Barium	Boron
Max HQ									9.302	60.714		1.157	0.267	0.18	0.12
Screen Value									4.3	0.028		37000	15	2600	3300
Pueblo	Pueblo, lower	WGA	Filtered	PU-00182	PAO-4	10.21	2.64				>155.333<				<0.116>
Pueblo	Pueblo, lower	WGA	Filtered	PU-10228	APCO-1	8.94	1.37				>144.667<				<0.114>
Pueblo	Pueblo, lower	WS	Filtered	PU-10229	Pueblo at State Road 502	7.67	0.1				>151.111<				<0.117>
Pueblo	Pueblo, lower	WS	Filtered	PU-10230	Pueblo 3	10.01	2.44				>251.111<				<0.105>
Pueblo	Pueblo, lower	WGA	Unfiltered	PU-00177	PAO-5N	8.94	1.37				>214.444<				<0.120>
Pueblo	Pueblo, lower	WGA	Unfiltered	PU-00182	PAO-4	10.21	2.64				>164.667<				<0.120>
Pueblo	Pueblo, lower	WGA	Unfiltered	PU-10228	APCO-1	8.94	1.37				>158.667<				<0.114>
Pueblo	Pueblo, lower	WS	Unfiltered	PU-02-20920	Eco						>331.111<	X		<0.150>	-
Pueblo	Pueblo, lower	WS	Unfiltered	PU-10229	Pueblo at State Road 502	7.67	0.1				>186.979<	<0.108>		X	<0.116>
Pueblo	Pueblo, lower	WS	Unfiltered	PU-10230	Pueblo 3	10.01	2.44				>234.028<	X		X	<0.105>
Pueblo	Pueblo, middle	WGA	Filtered	PU-00181	PAO-3	13.44	5.87				>64.444<				
Acid	Pueblo, middle	WS	Filtered	00-10241	Reach AC-2 SW	18.78		0.72			NA				
Acid	Pueblo, middle	WS	Filtered	PU-10155	Lower Reach AC-3 SW	18.08		0.02			>48.889<				
Acid	Pueblo, middle	WS	Filtered	PU-10175	Upper Reach ACS SW	18.67		0.61			>80.000<				
Acid	Pueblo, middle	WS	Filtered	PU-10176	Lower Reach ACS SW	18.52		0.46			>37.778<				
Pueblo	Pueblo, middle	WS	Filtered	PU-10071	Upper Reach P-1E SW	17.91	10.34				>40.000<				
Pueblo	Pueblo, middle	WS	Filtered	PU-10231	Pueblo 2	14.74	7.17				NA				

Table E-1.0-25 (continued)

Canyon	Hydrosegment	Water Type	Field Preparation	Location	Station Name	Distance from Rio Grande (km)	Distance from LA Confluence (km)	Distance from Pueblo (km)	Methylene Chloride	Trichloroethene	Total Cancer HI	Aluminum	Antimony	Barium	Boron
Max HQ									9.302	60.714		1.157	0.267	0.18	0.12
Screen Value									4.3	0.028		37000	15	2600	3300
Pueblo	Pueblo, middle	WGA	Unfiltered	PU-00181	PAO-3	13.44	5.87				>53.333<				
Pueblo	Pueblo, middle	WGA	Unfiltered	PU-10174	PAO-2	17.85	10.28				NA				
Acid	Pueblo, middle	WS	Unfiltered	00-10241	Reach AC-2 SW	18.78		0.72			>66.667<				
Acid	Pueblo, middle	WS	Unfiltered	PU-10155	Lower Reach AC-3 SW	18.08		0.02			>132.717<				
Acid	Pueblo, middle	WS	Unfiltered	PU-10175	Upper Reach ACS SW	18.67		0.61			>71.111<				
Acid	Pueblo, middle	WS	Unfiltered	PU-10176	Lower Reach ACS SW	18.52		0.46			>40.000<				
Pueblo	Pueblo, middle	WS	Unfiltered	PU-10071	Upper Reach P-1E SW	17.91	10.34				>135.556<				
Pueblo	Pueblo, middle	WS	Unfiltered	PU-10231	Pueblo 2	14.74	7.17				>81.957<				
Pueblo	Pueblo, upper	WGA	Filtered	PU-00178	PAO-1						>35.556<		<0.267>		
Pueblo	Pueblo, upper	WS	Filtered	PU-10068	Reach P-1FW SW	18.76	11.19				>11.556<		AllU		
Pueblo	Pueblo, upper	WS	Filtered	PU-10069	Upper Reach P-1W SW	18.36	10.79				>77.778<		<0.247>		
Pueblo	Pueblo, upper	WS	Filtered	PU-10070	Lower Reach P-1W SW	18.07	10.5				>66.667<		<0.162>		
Pueblo	Pueblo, upper	WGA	Unfiltered	PU-00178	PAO-1						>32.729<				
Pueblo	Pueblo, upper	WS	Unfiltered	PU-10068	Reach P-1FW SW	18.76	11.19				>75.556<		AllU		
Pueblo	Pueblo, upper	WS	Unfiltered	PU-10069	Upper Reach P-1W SW	18.36	10.79				>95.556<		<0.200>		
Pueblo	Pueblo, upper	WS	Unfiltered	PU-10070	Lower Reach P-1W SW	18.07	10.5				>80.667<		X		

Table E-1.0-25 (continued)

Canyon	Hydrosegment	Water Type	Field Preparation	Location	Station Name	Distance from Rio Grande (km)	Distance from LA Confluence (km)	Distance from Pueblo (km)	Chromium	Copper	Iron	Manganese	Molybdenum	Thallium	Uranium
Max HQ									0.171		2.2	3.647	11.111	1.692	1.562
Screen Value									110	1400	11000	1700	180	2.6	7.3
Los Alamos	LA, lower	WGA	Filtered	LA-00002	LLAO-5	0.22								<0.808>	>1.288<
Los Alamos	LA, lower	WGA	Filtered	LA-00045	LLAO-2	4.16								AllU	X
Los Alamos	LA, lower	WGA	Filtered	LA-00046	LLAO-4	0.33								AllU	X
Los Alamos	LA, lower	WGA	Filtered	LA-00215	LLAO-1b	5.25								<0.996>	<0.124>
Los Alamos	LA, lower	WGS	Filtered	BG-00081	LA Spring	6.04								AllU	X
Los Alamos	LA, lower	WGS	Filtered	LA-00219	Basalt Spring	6.38								>1.462<	<0.167>
Los Alamos	LA, lower	WGS	Filtered	LA-10179	Otowi Spring	0								AllU	X
Guaje	LA, lower	WS	Filtered	GU-10004	Guaje SW at LA Confluence	2.55									
Los Alamos	LA, lower	WS	Filtered	LA-00218	Reach LA-4E SW	5.22						X		X	
Los Alamos	LA, lower	WS	Filtered	LA-10057	LA SW at Guaje Confluence	2.5						X		AllU	
Los Alamos	LA, lower	WS	Filtered	LA-10058	Lower Reach LA-5 SW	0.3						X		AllU	
Los Alamos	LA, lower	WGA	Unfiltered	LA-00002	LLAO-5	0.22				X	X	X		>1.077<	>1.208<
Los Alamos	LA, lower	WGA	Unfiltered	LA-00045	LLAO-2	4.16				AllU	X	X		AllU	X
Los Alamos	LA, lower	WGA	Unfiltered	LA-00046	LLAO-4	0.33				AllU	AllU	AllU		X	X
Los Alamos	LA, lower	WGA	Unfiltered	LA-00215	LLAO-1b	5.25				X	<0.341>	<0.138>		>1.154<	<0.142>
Los Alamos	LA, lower	WGS	Unfiltered	BG-00081	LA Spring	6.04								AllU	X
Los Alamos	LA, lower	WGS	Unfiltered	LA-00219	Basalt Spring	6.38								>1.308<	<0.144>

Table E-1.0-25 (continued)

Canyon	Hydrosegment	Water Type	Field Preparation	Location	Station Name	Distance from Rio Grande (km)	Distance from LA Confluence (km)	Distance from Pueblo (km)	Chromium	Copper	Iron	Manganese	Molybdenum	Thallium	Uranium
Max HQ									0.171		2.2	3.647	11.111	1.692	1.562
Screen Value									110	1400	11000	1700	180	2.6	7.3
Los Alamos	LA, lower	WGS	Unfiltered	LA-10179	Otowi Spring	0								AllU	X
Guaje	LA, lower	WS	Unfiltered	GU-10004	Guaje SW at LA Confluence	2.55									
Los Alamos	LA, lower	WS	Unfiltered	LA-00218	Reach LA-4E SW	5.22					X	X		X	X
Los Alamos	LA, lower	WS	Unfiltered	LA-02-20908	Eco						X	X		X	-
Los Alamos	LA, lower	WS	Unfiltered	LA-02-20909	Eco						X	X		X	-
Los Alamos	LA, lower	WS	Unfiltered	LA-10057	LA SW at Guaje Confluence	2.5					X	X		AllU	-
Los Alamos	LA, lower	WS	Unfiltered	LA-10058	Lower Reach LA-5 SW	0.3					<0.155>	<0.194>		AllU	-
DP	LA, middle	WGA	Filtered	21-01811	LAUZ-1	14.49	1.6					X			
DP	LA, middle	WGA	Filtered	21-01812	LAUZ-2	14.31	1.42					<0.481>			
Los Alamos	LA, middle	WGA	Filtered	LA-10035	LAO-3a	12.76							>10.944<	>1.269<	X
Los Alamos	LA, middle	WGA	Filtered	LA-10067	LAO-2	12.93							>11.111<	AllU	X
Los Alamos	LA, middle	WGA	Filtered	LA-10068	LAO-4	11.8							>3.233<	AllU	X
Los Alamos	LA, middle	WGA	Filtered	LA-10069	LAO-4.5c	10.86							<0.182>	AllU	<0.389>
Los Alamos	LA, middle	WGA	Filtered	LA-10070	LAO-6a	9.87							X	AllU	-
DP	LA, middle	WGS	Filtered	21-01854	DP Spring	13.32	0.43							>1.423<	
DP	LA, middle	WS	Filtered	21-10929	Reach DP-1W SW	16.42	3.53				X	<0.235>		>1.231<	<0.222>
DP	LA, middle	WS	Filtered	21-11226	Reach DP-1C SW	16.25	3.36				<0.189>	<0.165>		>1.154<	<0.130>

Table E-1.0-25 (continued)

Canyon	Hydrosegment	Water Type	Field Preparation	Location	Station Name	Distance from Rio Grande (km)	Distance from LA Confluence (km)	Distance from Pueblo (km)	Chromium	Copper	Iron	Manganese	Molybdenum	Thallium	Uranium
Max HQ									0.171		2.2	3.647	11.111	1.692	1.562
Screen Value									110	1400	11000	1700	180	2.6	7.3
DP	LA, middle	WS	Filtered	21-11269	Reach DP-2 SW	14.53	1.64				X	X		<0.194>	-
DP	LA, middle	WGA	Unfiltered	21-01811	LAUZ-1	14.49	1.6				X	X			
DP	LA, middle	WGA	Unfiltered	21-01812	LAUZ-2	14.31	1.42				<0.545>	<0.512>			
Los Alamos	LA, middle	WGA	Unfiltered	LA-10035	LAO-3a	12.76							>10.944<	AllU	
Los Alamos	LA, middle	WGA	Unfiltered	LA-10067	LAO-2	12.93							>11.111<	AllU	
Los Alamos	LA, middle	WGA	Unfiltered	LA-10068	LAO-4	11.8							>3.256<	<0.923>	
Los Alamos	LA, middle	WGA	Unfiltered	LA-10069	LAO-4.5c	10.86							X	AllU	
Los Alamos	LA, middle	WGA	Unfiltered	LA-10070	LAO-6a	9.87							X	AllU	
DP	LA, middle	WGS	Unfiltered	21-01854	DP Spring	13.32	0.43				<0.118>			>1.462<	
DP	LA, middle	WS	Unfiltered	21-10929	Reach DP-1W SW	16.42	3.53				X	X		X	X
DP	LA, middle	WS	Unfiltered	21-11226	Reach DP-1C SW	16.25	3.36				<0.407>	<0.165>		>1.115<	<0.158>
DP	LA, middle	WS	Unfiltered	21-11269	Reach DP-2 SW	14.53	1.64				-	-		-	-
DP	LA, middle	WS	Unfiltered	LA-02-20913	Eco						X	X		X	-
Los Alamos	LA, upper	WGA	Filtered	02-01022	LAO-0.91	15.92			X		X	AllU	-	AllU	
Los Alamos	LA, upper	WGA	Filtered	02-01076	LAO-1	15.66			X		X	X	X	X	
Los Alamos	LA, upper	WGA	Filtered	41-01002	LAO-0.6	16.49			X		X	X	-	AllU	
Los Alamos	LA, upper	WGA	Filtered	41-01003	LAO-0.3	17.11			AllU		X	X	X	AllU	

Table E-1.0-25 (continued)

Canyon	Hydrosegment	Water Type	Field Preparation	Location	Station Name	Distance from Rio Grande (km)	Distance from LA Confluence (km)	Distance from Pueblo (km)	Chromium	Copper	Iron	Manganese	Molybdenum	Thallium	Uranium
Max HQ									0.171		2.2	3.647	11.111	1.692	1.562
Screen Value									110	1400	11000	1700	180	2.6	7.3
Los Alamos	LA, upper	WGA	Filtered	41-01004	LAO-C	17.97			X		X	X	X	X	
Los Alamos	LA, upper	WGA	Filtered	41-01045	LAO-B	20.34			AllU		X	X	X	<0.143>	
Los Alamos	LA, upper	WGA	Filtered	LA-00001	LAO-1.6g	13.41			X		X	X	<0.778>	<0.245>	
Los Alamos	LA, upper	WGA	Filtered	LA-10008	LAO-1.2	14.62			<0.145>		AllU	AllU	-	>1.692<	
Los Alamos	LA, upper	WGA	Filtered	LA-10066	LAO-0.7	16.34			AllU		X	X	X	X	
Los Alamos	LA, upper	WS	Filtered	LA-10005	SW at LAO-0.6	16.48					X	>1.471<			AllU
Los Alamos	LA, upper	WS	Filtered	LA-10006	Reach LA-Bkgd SW	20.31					X	X			-
Los Alamos	LA, upper	WS	Filtered	LA-10033	Los Alamos Reservoir	22.15					X	>2.824<			X
Los Alamos	LA, upper	WS	Filtered	LA-10034	Los Alamos Creek below LA Reservoir	22.11					X	X			X
Los Alamos	LA, upper	WS	Filtered	LA-10040	SW at E026	19.3					AllU	X			-
Los Alamos	LA, upper	WS	Filtered	LA-10064	Reach LA-1W SW	17.1					X	X			X
Los Alamos	LA, upper	WS	Filtered	LA-10065	Reach LA-1C SW	15.7					<0.355>	<0.132>			<0.277>
Los Alamos	LA, upper	WS	Filtered	LA-10126	Los Alamos Creek upstream of LA Reservoir	22.36					AllU	X			X
Los Alamos	LA, upper	WGA	Unfiltered	02-01022	LAO-0.91	15.92			X		X	X	-	AllU	
Los Alamos	LA, upper	WGA	Unfiltered	02-01076	LAO-1	15.66			X		X	X	X	AllU	
Los Alamos	LA, upper	WGA	Unfiltered	41-01002	LAO-0.6	16.49			X		X	X	-	X	

Table E-1.0-25 (continued)

Canyon	Hydrosegment	Water Type	Field Preparation	Location	Station Name	Distance from Rio Grande (km)	Distance from LA Confluence (km)	Distance from Pueblo (km)	Chromium	Copper	Iron	Manganese	Molybdenum	Thallium	Uranium
Max HQ									0.171		2.2	3.647	11.111	1.692	1.562
Screen Value									110	1400	11000	1700	180	2.6	7.3
Los Alamos	LA, upper	WGA	Unfiltered	41-01003	LAO-0.3	17.11			X		X	X	X	AllU	
Los Alamos	LA, upper	WGA	Unfiltered	41-01004	LAO-C	17.97			X		X	X	X	X	
Los Alamos	LA, upper	WGA	Unfiltered	41-01045	LAO-B	20.34			AllU		X	X	X	X	
Los Alamos	LA, upper	WGA	Unfiltered	LA-00001	LAO-1.6g	13.41			X		X	X	<0.778>	<0.808>	
Los Alamos	LA, upper	WGA	Unfiltered	LA-10008	LAO-1.2	14.62			X		X	X	-	AllU	
Los Alamos	LA, upper	WGA	Unfiltered	LA-10066	LAO-0.7	16.34			X		X	X	X	X	
Los Alamos	LA, upper	WS	Unfiltered	LA-02-20914	Eco				AllU		<0.197>	<0.965>		<0.162>	-
Los Alamos	LA, upper	WS	Unfiltered	LA-02-20915	Eco				X		<0.300>	<0.747>		<0.116>	-
Los Alamos	LA, upper	WS	Unfiltered	LA-10005	SW at LAO-0.6	16.48			X		<0.127>	>1.529<		AllU	X
Los Alamos	LA, upper	WS	Unfiltered	LA-10006	Reach LA-Bkgd SW	20.31			AllU		<0.136>	<0.882>		AllU	-
Los Alamos	LA, upper	WS	Unfiltered	LA-10033	Los Alamos Reservoir	22.15			X		X	>2.706<		<0.185>	X
Los Alamos	LA, upper	WS	Unfiltered	LA-10034	Los Alamos Creek below LA Reservoir	22.11			AllU		X	X		AllU	X
Los Alamos	LA, upper	WS	Unfiltered	LA-10040	SW at E026	19.3			<0.171>		>2.200<	>1.253<		<1.000>	-
Los Alamos	LA, upper	WS	Unfiltered	LA-10064	Reach LA-1W SW	17.1			<0.165>		>1.300<	<0.935>		<0.162>	<0.571>
Los Alamos	LA, upper	WS	Unfiltered	LA-10065	Reach LA-1C SW	15.7			X		<0.663>	<0.428>		X	<0.471>
Los Alamos	LA, upper	WS	Unfiltered	LA-10126	Los Alamos Creek upstream of LA Reservoir	22.36			AllU		X	X		AllU	X
Pueblo	Pueblo, lower	WGA	Filtered	PU-00177	PAO-5N	8.94	1.37				<0.150>	>2.129<		X	

Table E-1.0-25 (continued)

Canyon	Hydrosegment	Water Type	Field Preparation	Location	Station Name	Distance from Rio Grande (km)	Distance from LA Confluence (km)	Distance from Pueblo (km)	Chromium	Copper	Iron	Manganese	Molybdenum	Thallium	Uranium
Max HQ									0.171		2.2	3.647	11.111	1.692	1.562
Screen Value									110	1400	11000	1700	180	2.6	7.3
Pueblo	Pueblo, lower	WGA	Filtered	PU-00182	PAO-4	10.21	2.64				<0.306>	>1.047<		>1.269<	
Pueblo	Pueblo, lower	WGA	Filtered	PU-10228	APCO-1	8.94	1.37				<0.144>	>1.494<		AllU	
Pueblo	Pueblo, lower	WS	Filtered	PU-10229	Pueblo at State Road 502	7.67	0.1					>1.088<		>1.038<	<0.264>
Pueblo	Pueblo, lower	WS	Filtered	PU-10230	Pueblo 3	10.01	2.44					<0.665>		<0.923>	X
Pueblo	Pueblo, lower	WGA	Unfiltered	PU-00177	PAO-5N	8.94	1.37			X		>2.118<			X
Pueblo	Pueblo, lower	WGA	Unfiltered	PU-00182	PAO-4	10.21	2.64				<0.509>	>1.112<			X
Pueblo	Pueblo, lower	WGA	Unfiltered	PU-10228	APCO-1	8.94	1.37				<0.164>	>1.476<			<0.108>
Pueblo	Pueblo, lower	WS	Unfiltered	PU-02-20920	Eco						>1.282<	>2.359<		X	-
Pueblo	Pueblo, lower	WS	Unfiltered	PU-10229	Pueblo at State Road 502	7.67	0.1				<0.545>	>1.035<		X	<0.359>
Pueblo	Pueblo, lower	WS	Unfiltered	PU-10230	Pueblo 3	10.01	2.44				<0.232>	<0.729>		>1.154<	X
Pueblo	Pueblo, middle	WGA	Filtered	PU-00181	PAO-3	13.44	5.87								
Acid	Pueblo, middle	WS	Filtered	00-10241	Reach AC-2 SW	18.78		0.72						AllU	X
Acid	Pueblo, middle	WS	Filtered	PU-10155	Lower Reach AC-3 SW	18.08		0.02						>1.308<	X
Acid	Pueblo, middle	WS	Filtered	PU-10175	Upper Reach ACS SW	18.67		0.61						AllU	>1.562<
Acid	Pueblo, middle	WS	Filtered	PU-10176	Lower Reach ACS SW	18.52		0.46						AllU	X
Pueblo	Pueblo, middle	WS	Filtered	PU-10071	Upper Reach P-1E SW	17.91	10.34					>3.294<			
Pueblo	Pueblo, middle	WS	Filtered	PU-10231	Pueblo 2	14.74	7.17					X			

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Table E-1.0-25 (continued)

Canyon	Hydrosegment	Water Type	Field Preparation	Location	Station Name	Distance from Rio Grande (km)	Distance from LA Confluence (km)	Distance from Pueblo (km)	Chromium	Copper	Iron	Manganese	Molybdenum	Thallium	Uranium
Max HQ									0.171		2.2	3.647	11.111	1.692	1.562
Screen Value									110	1400	11000	1700	180	2.6	7.3
Pueblo	Pueblo, middle	WGA	Unfiltered	PU-00181	PAO-3	13.44	5.87								
Pueblo	Pueblo, middle	WGA	Unfiltered	PU-10174	PAO-2	17.85	10.28								
Acid	Pueblo, middle	WS	Unfiltered	00-10241	Reach AC-2 SW	18.78		0.72			<0.109>			>1.115<	Allu
Acid	Pueblo, middle	WS	Unfiltered	PU-10155	Lower Reach AC-3 SW	18.08		0.02			X			X	X
Acid	Pueblo, middle	WS	Unfiltered	PU-10175	Upper Reach ACS SW	18.67		0.61			X			Allu	>1.411<
Acid	Pueblo, middle	WS	Unfiltered	PU-10176	Lower Reach ACS SW	18.52		0.46			X			Allu	X
Pueblo	Pueblo, middle	WS	Unfiltered	PU-10071	Upper Reach P-1E SW	17.91	10.34				<0.473>	>3.647<			
Pueblo	Pueblo, middle	WS	Unfiltered	PU-10231	Pueblo 2	14.74	7.17				X	X			
Pueblo	Pueblo, upper	WGA	Filtered	PU-00178	PAO-1							<0.724>		>1.154<	
Pueblo	Pueblo, upper	WS	Filtered	PU-10068	Reach P-1FW SW	18.76	11.19					<0.782>		<0.264>	X
Pueblo	Pueblo, upper	WS	Filtered	PU-10069	Upper Reach P-1W SW	18.36	10.79					>1.471<		<0.297>	X
Pueblo	Pueblo, upper	WS	Filtered	PU-10070	Lower Reach P-1W SW	18.07	10.5					<0.586>		<0.123>	<0.122>
Pueblo	Pueblo, upper	WGA	Unfiltered	PU-00178	PAO-1							>1.306<		<0.885>	
Pueblo	Pueblo, upper	WS	Unfiltered	PU-10068	Reach P-1FW SW	18.76	11.19				<0.255>	<0.929>			X
Pueblo	Pueblo, upper	WS	Unfiltered	PU-10069	Upper Reach P-1W SW	18.36	10.79				X	>1.524<			X
Pueblo	Pueblo, upper	WS	Unfiltered	PU-10070	Lower Reach P-1W SW	18.07	10.5				X	X			X

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Table E-1.0-25 (continued)

Canyon	Hydrosegment	Water Type	Field Preparation	Location	Station Name	Distance from Rio Grande (km)	Distance from LA Confluence (km)	Distance from Pueblo (km)	Vanadium	Chloride	Fluoride	Nitrate	Nitrite	Perchlorate	Bromomethane
Max HQ										0.984	0.727	0.74	3.99	4.135	0.31
Screen Value									260	250000	2200	10000	1000	3.7	8.7
Los Alamos	LA, lower	WGA	Filtered	LA-00002	LLAO-5	0.22				<0.444>	<0.179>	-	>3.990<		
Los Alamos	LA, lower	WGA	Filtered	LA-00045	LLAO-2	4.16				-	AllU	-	-		
Los Alamos	LA, lower	WGA	Filtered	LA-00046	LLAO-4	0.33				X	X	-	X		
Los Alamos	LA, lower	WGA	Filtered	LA-00215	LLAO-1b	5.25				<0.162>	<0.277>	<0.740>	AllU		
Los Alamos	LA, lower	WGS	Filtered	BG-00081	LA Spring	6.04				X	X				
Los Alamos	LA, lower	WGS	Filtered	LA-00219	Basalt Spring	6.38				<0.160>	<0.191>				
Los Alamos	LA, lower	WGS	Filtered	LA-10179	Otowi Spring	0				X	X				
Guaje	LA, lower	WS	Filtered	GU-10004	Guaje SW at LA Confluence	2.55									
Los Alamos	LA, lower	WS	Filtered	LA-00218	Reach LA-4E SW	5.22				X	X				
Los Alamos	LA, lower	WS	Filtered	LA-10057	LA SW at Guaje Confluence	2.5				X	-				
Los Alamos	LA, lower	WS	Filtered	LA-10058	Lower Reach LA-5 SW	0.3				X	X				
Los Alamos	LA, lower	WGA	Unfiltered	LA-00002	LLAO-5	0.22			X	-	AllU	-	>3.070<		
Los Alamos	LA, lower	WGA	Unfiltered	LA-00045	LLAO-2	4.16			AllU	-	AllU	-	-		
Los Alamos	LA, lower	WGA	Unfiltered	LA-00046	LLAO-4	0.33			X	-	AllU	-	X		
Los Alamos	LA, lower	WGA	Unfiltered	LA-00215	LLAO-1b	5.25			X	<0.168>	<0.205>	<0.730>	AllU		
Los Alamos	LA, lower	WGS	Unfiltered	BG-00081	LA Spring	6.04									
Los Alamos	LA, lower	WGS	Unfiltered	LA-00219	Basalt Spring	6.38									

Table E-1.0-25 (continued)

Canyon	Hydrosegment	Water Type	Field Preparation	Location	Station Name	Distance from Rio Grande (km)	Distance from LA Confluence (km)	Distance from Pueblo (km)	Vanadium	Chloride	Fluoride	Nitrate	Nitrite	Perchlorate	Bromomethane
Max HQ										0.984	0.727	0.74	3.99	4.135	0.31
Screen Value									260	250000	2200	10000	1000	3.7	8.7
Los Alamos	LA, lower	WGS	Unfiltered	LA-10179	Otowi Spring	0									
Guaje	LA, lower	WS	Unfiltered	GU-10004	Guaje SW at LA Confluence	2.55									
Los Alamos	LA, lower	WS	Unfiltered	LA-00218	Reach LA-4E SW	5.22								AIU	
Los Alamos	LA, lower	WS	Unfiltered	LA-02-20908	Eco									-	
Los Alamos	LA, lower	WS	Unfiltered	LA-02-20909	Eco									-	
Los Alamos	LA, lower	WS	Unfiltered	LA-10057	LA SW at Guaje Confluence	2.5								-	
Los Alamos	LA, lower	WS	Unfiltered	LA-10058	Lower Reach LA-5 SW	0.3								>1.081<	
DP	LA, middle	WGA	Filtered	21-01811	LAUZ-1	14.49	1.6			<0.844>	<0.316>				
DP	LA, middle	WGA	Filtered	21-01812	LAUZ-2	14.31	1.42			<0.252>	<0.591>				
Los Alamos	LA, middle	WGA	Filtered	LA-10035	LAO-3a	12.76				<0.211>	<0.297>				
Los Alamos	LA, middle	WGA	Filtered	LA-10067	LAO-2	12.93				<0.278>	<0.273>				
Los Alamos	LA, middle	WGA	Filtered	LA-10068	LAO-4	11.8				<0.170>	<0.727>				
Los Alamos	LA, middle	WGA	Filtered	LA-10069	LAO-4.5c	10.86				<0.186>	<0.727>				
Los Alamos	LA, middle	WGA	Filtered	LA-10070	LAO-6a	9.87				X	X				
DP	LA, middle	WGS	Filtered	21-01854	DP Spring	13.32	0.43			<0.424>	<0.500>				
DP	LA, middle	WS	Filtered	21-10929	Reach DP-1W SW	16.42	3.53			<0.189>	<0.311>				
DP	LA, middle	WS	Filtered	21-11226	Reach DP-1C SW	16.25	3.36			<0.548>	<0.234>				

Table E-1.0-25 (continued)

Canyon	Hydrosegment	Water Type	Field Preparation	Location	Station Name	Distance from Rio Grande (km)	Distance from LA Confluence (km)	Distance from Pueblo (km)	Vanadium	Chloride	Fluoride	Nitrate	Nitrite	Perchlorate	Bromomethane
Max HQ										0.984	0.727	0.74	3.99	4.135	0.31
Screen Value									260	250000	2200	10000	1000	3.7	8.7
DP	LA, middle	WS	Filtered	21-11269	Reach DP-2 SW	14.53	1.64			<0.984>	<0.132>				
DP	LA, middle	WGA	Unfiltered	21-01811	LAUZ-1	14.49	1.6			X	X				
DP	LA, middle	WGA	Unfiltered	21-01812	LAUZ-2	14.31	1.42			<0.252>	<0.591>				
Los Alamos	LA, middle	WGA	Unfiltered	LA-10035	LAO-3a	12.76								<0.316>	
Los Alamos	LA, middle	WGA	Unfiltered	LA-10067	LAO-2	12.93								AllU	
Los Alamos	LA, middle	WGA	Unfiltered	LA-10068	LAO-4	11.8								AllU	
Los Alamos	LA, middle	WGA	Unfiltered	LA-10069	LAO-4.5c	10.86								AllU	
Los Alamos	LA, middle	WGA	Unfiltered	LA-10070	LAO-6a	9.87								AllU	
DP	LA, middle	WGS	Unfiltered	21-01854	DP Spring	13.32	0.43			<0.140>	<0.500>				<0.310>
DP	LA, middle	WS	Unfiltered	21-10929	Reach DP-1W SW	16.42	3.53								
DP	LA, middle	WS	Unfiltered	21-11226	Reach DP-1C SW	16.25	3.36								
DP	LA, middle	WS	Unfiltered	21-11269	Reach DP-2 SW	14.53	1.64								
DP	LA, middle	WS	Unfiltered	LA-02-20913	Eco										
Los Alamos	LA, upper	WGA	Filtered	02-01022	LAO-0.91	15.92				X	X			-	
Los Alamos	LA, upper	WGA	Filtered	02-01076	LAO-1	15.66				X	X			AllU	
Los Alamos	LA, upper	WGA	Filtered	41-01002	LAO-0.6	16.49				X	X			AllU	
Los Alamos	LA, upper	WGA	Filtered	41-01003	LAO-0.3	17.11				X	X			AllU	

Table E-1.0-25 (continued)

Canyon	Hydrosegment	Water Type	Field Preparation	Location	Station Name	Distance from Rio Grande (km)	Distance from LA Confluence (km)	Distance from Pueblo (km)	Vanadium	Chloride	Fluoride	Nitrate	Nitrite	Perchlorate	Bromomethane
Max HQ										0.984	0.727	0.74	3.99	4.135	0.31
Screen Value									260	250000	2200	10000	1000	3.7	8.7
Los Alamos	LA, upper	WGA	Filtered	41-01004	LAO-C	17.97				X	X			AIU	
Los Alamos	LA, upper	WGA	Filtered	41-01045	LAO-B	20.34				X	X			>4.135<	
Los Alamos	LA, upper	WGA	Filtered	LA-00001	LAO-1.6g	13.41				<0.162>	<0.246>			AIU	
Los Alamos	LA, upper	WGA	Filtered	LA-10008	LAO-1.2	14.62				<0.140>	-			AIU	
Los Alamos	LA, upper	WGA	Filtered	LA-10066	LAO-0.7	16.34				X	X			AIU	
Los Alamos	LA, upper	WS	Filtered	LA-10005	SW at LAO-0.6	16.48				<0.372>	X			AIU	
Los Alamos	LA, upper	WS	Filtered	LA-10006	Reach LA-Bkgd SW	20.31				X	-			AIU	
Los Alamos	LA, upper	WS	Filtered	LA-10033	Los Alamos Reservoir	22.15				X	X			AIU	
Los Alamos	LA, upper	WS	Filtered	LA-10034	Los Alamos Creek below LA Reservoir	22.11				X	AIU			AIU	
Los Alamos	LA, upper	WS	Filtered	LA-10040	SW at E026	19.3				-	-			-	
Los Alamos	LA, upper	WS	Filtered	LA-10064	Reach LA-1W SW	17.1				X	X			AIU	
Los Alamos	LA, upper	WS	Filtered	LA-10065	Reach LA-1C SW	15.7				<0.204>	<0.114>			AIU	
Los Alamos	LA, upper	WS	Filtered	LA-10126	Los Alamos Creek upstream of LA Reservoir	22.36				X	AIU			>3.108<	
Los Alamos	LA, upper	WGA	Unfiltered	02-01022	LAO-0.91	15.92					-				
Los Alamos	LA, upper	WGA	Unfiltered	02-01076	LAO-1	15.66					-				
Los Alamos	LA, upper	WGA	Unfiltered	41-01002	LAO-0.6	16.49					-				
Los Alamos	LA, upper	WGA	Unfiltered	41-01003	LAO-0.3	17.11					-				

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Table E-1.0-25 (continued)

Canyon	Hydrosegment	Water Type	Field Preparation	Location	Station Name	Distance from Rio Grande (km)	Distance from LA Confluence (km)	Distance from Pueblo (km)	Vanadium	Chloride	Fluoride	Nitrate	Nitrite	Perchlorate	Bromomethane
Max HQ										0.984	0.727	0.74	3.99	4.135	0.31
Screen Value									260	250000	2200	10000	1000	3.7	8.7
Los Alamos	LA, upper	WGA	Unfiltered	41-01004	LAO-C	17.97					-				
Los Alamos	LA, upper	WGA	Unfiltered	41-01045	LAO-B	20.34					-				
Los Alamos	LA, upper	WGA	Unfiltered	LA-00001	LAO-1.6g	13.41					<0.278>				
Los Alamos	LA, upper	WGA	Unfiltered	LA-10008	LAO-1.2	14.62					-				
Los Alamos	LA, upper	WGA	Unfiltered	LA-10066	LAO-0.7	16.34					-				
Los Alamos	LA, upper	WS	Unfiltered	LA-02-20914	Eco										
Los Alamos	LA, upper	WS	Unfiltered	LA-02-20915	Eco										
Los Alamos	LA, upper	WS	Unfiltered	LA-10005	SW at LAO-0.6	16.48									
Los Alamos	LA, upper	WS	Unfiltered	LA-10006	Reach LA-Bkgd SW	20.31									
Los Alamos	LA, upper	WS	Unfiltered	LA-10033	Los Alamos Reservoir	22.15									
Los Alamos	LA, upper	WS	Unfiltered	LA-10034	Los Alamos Creek below LA Reservoir	22.11									
Los Alamos	LA, upper	WS	Unfiltered	LA-10040	SW at E026	19.3									
Los Alamos	LA, upper	WS	Unfiltered	LA-10064	Reach LA-1W SW	17.1									
Los Alamos	LA, upper	WS	Unfiltered	LA-10065	Reach LA-1C SW	15.7									
Los Alamos	LA, upper	WS	Unfiltered	LA-10126	Los Alamos Creek upstream of LA Reservoir	22.36									
Pueblo	Pueblo, lower	WGA	Filtered	PU-00177	PAO-5N	8.94	1.37			<0.175>	<0.255>	<0.310>		>1.670<	
Pueblo	Pueblo, lower	WGA	Filtered	PU-00182	PAO-4	10.21	2.64			<0.170>	<0.302>	Allu		>1.551<	

Table E-1.0-25 (continued)

Canyon	Hydrosegment	Water Type	Field Preparation	Location	Station Name	Distance from Rio Grande (km)	Distance from LA Confluence (km)	Distance from Pueblo (km)	Vanadium	Chloride	Fluoride	Nitrate	Nitrite	Perchlorate	Bromomethane
Max HQ										0.984	0.727	0.74	3.99	4.135	0.31
Screen Value									260	250000	2200	10000	1000	3.7	8.7
Pueblo	Pueblo, lower	WGA	Filtered	PU-10228	APCO-1	8.94	1.37			<0.209>	<0.205>	-		AIU	
Pueblo	Pueblo, lower	WS	Filtered	PU-10229	Pueblo at State Road 502	7.67	0.1			<0.183>	<0.177>				
Pueblo	Pueblo, lower	WS	Filtered	PU-10230	Pueblo 3	10.01	2.44			<0.174>	<0.274>				
Pueblo	Pueblo, lower	WGA	Unfiltered	PU-00177	PAO-5N	8.94	1.37			<0.172>	<0.177>	<0.290>			
Pueblo	Pueblo, lower	WGA	Unfiltered	PU-00182	PAO-4	10.21	2.64			<0.164>	<0.241>	X			
Pueblo	Pueblo, lower	WGA	Unfiltered	PU-10228	APCO-1	8.94	1.37			-	-	-			
Pueblo	Pueblo, lower	WS	Unfiltered	PU-02-20920	Eco										
Pueblo	Pueblo, lower	WS	Unfiltered	PU-10229	Pueblo at State Road 502	7.67	0.1								
Pueblo	Pueblo, lower	WS	Unfiltered	PU-10230	Pueblo 3	10.01	2.44								
Pueblo	Pueblo, middle	WGA	Filtered	PU-00181	PAO-3	13.44	5.87								
Acid	Pueblo, middle	WS	Filtered	00-10241	Reach AC-2 SW	18.78		0.72		<0.880>	X				
Acid	Pueblo, middle	WS	Filtered	PU-10155	Lower Reach AC-3 SW	18.08		0.02		<0.660>	<0.105>				
Acid	Pueblo, middle	WS	Filtered	PU-10175	Upper Reach ACS SW	18.67		0.61		<0.400>	<0.209>				
Acid	Pueblo, middle	WS	Filtered	PU-10176	Lower Reach ACS SW	18.52		0.46		X	X				
Pueblo	Pueblo, middle	WS	Filtered	PU-10071	Upper Reach P-1E SW	17.91	10.34			<0.260>	<0.1>			>1.246<	
Pueblo	Pueblo, middle	WS	Filtered	PU-10231	Pueblo 2	14.74	7.17			X	X			-	
Pueblo	Pueblo, middle	WGA	Unfiltered	PU-00181	PAO-3	13.44	5.87								

Table E-1.0-25 (continued)

Canyon	Hydrosegment	Water Type	Field Preparation	Location	Station Name	Distance from Rio Grande (km)	Distance from LA Confluence (km)	Distance from Pueblo (km)	Vanadium	Chloride	Fluoride	Nitrate	Nitrite	Perchlorate	Bromomethane
Max HQ										0.984	0.727	0.74	3.99	4.135	0.31
Screen Value									260	250000	2200	10000	1000	3.7	8.7
Pueblo	Pueblo, middle	WGA	Unfiltered	PU-10174	PAO-2	17.85	10.28								
Acid	Pueblo, middle	WS	Unfiltered	00-10241	Reach AC-2 SW	18.78		0.72							
Acid	Pueblo, middle	WS	Unfiltered	PU-10155	Lower Reach AC-3 SW	18.08		0.02							
Acid	Pueblo, middle	WS	Unfiltered	PU-10175	Upper Reach ACS SW	18.67		0.61							
Acid	Pueblo, middle	WS	Unfiltered	PU-10176	Lower Reach ACS SW	18.52		0.46							
Pueblo	Pueblo, middle	WS	Unfiltered	PU-10071	Upper Reach P-1E SW	17.91	10.34								
Pueblo	Pueblo, middle	WS	Unfiltered	PU-10231	Pueblo 2	14.74	7.17								
Pueblo	Pueblo, upper	WGA	Filtered	PU-00178	PAO-1					<0.214>					
Pueblo	Pueblo, upper	WS	Filtered	PU-10068	Reach P-1FW SW	18.76	11.19			<0.156>	X				
Pueblo	Pueblo, upper	WS	Filtered	PU-10069	Upper Reach P-1W SW	18.36	10.79			<0.156>	X				
Pueblo	Pueblo, upper	WS	Filtered	PU-10070	Lower Reach P-1W SW	18.07	10.5			<0.169>	<0.120>				
Pueblo	Pueblo, upper	WGA	Unfiltered	PU-00178	PAO-1										
Pueblo	Pueblo, upper	WS	Unfiltered	PU-10068	Reach P-1FW SW	18.76	11.19								
Pueblo	Pueblo, upper	WS	Unfiltered	PU-10069	Upper Reach P-1W SW	18.36	10.79								
Pueblo	Pueblo, upper	WS	Unfiltered	PU-10070	Lower Reach P-1W SW	18.07	10.5								

Table E-1.0-25 (continued)

Canyon	Hydrosegment	Water Type	Field Preparation	Location	Station Name	Distance from Rio Grande (km)	Distance from LA Confluence (km)	Distance from Pueblo (km)	Total Noncancer HI	Americium-241	Plutonium-239	Strontium-90	Uranium-234	Uranium-238	Total Radionuclides HI
Max HQ										1.017	5.925	4.725	0.375	0.158	
Screen Value										1.2	1.2	40	20	24	
Los Alamos	LA, lower	WGA	Filtered	LA-00002	LLAO-5	0.22			>6.818<						NA
Los Alamos	LA, lower	WGA	Filtered	LA-00045	LLAO-2	4.16			X						NA
Los Alamos	LA, lower	WGA	Filtered	LA-00046	LLAO-4	0.33			X						NA
Los Alamos	LA, lower	WGA	Filtered	LA-00215	LLAO-1b	5.25			>2.345<						NA
Los Alamos	LA, lower	WGS	Filtered	BG-00081	LA Spring	6.04			X						NA
Los Alamos	LA, lower	WGS	Filtered	LA-00219	Basalt Spring	6.38			>2.179<						NA
Los Alamos	LA, lower	WGS	Filtered	LA-10179	Otowi Spring	0			X						NA
Guaje	LA, lower	WS	Filtered	GU-10004	Guaje SW at LA Confluence	2.55			NA						NA
Los Alamos	LA, lower	WS	Filtered	LA-00218	Reach LA-4E SW	5.22			X						NA
Los Alamos	LA, lower	WS	Filtered	LA-10057	LA SW at Guaje Confluence	2.5			X						NA
Los Alamos	LA, lower	WS	Filtered	LA-10058	Lower Reach LA-5 SW	0.3			X						NA
Los Alamos	LA, lower	WGA	Unfiltered	LA-00002	LLAO-5	0.22			>5.745<						NA
Los Alamos	LA, lower	WGA	Unfiltered	LA-00045	LLAO-2	4.16			X						NA
Los Alamos	LA, lower	WGA	Unfiltered	LA-00046	LLAO-4	0.33			X						NA
Los Alamos	LA, lower	WGA	Unfiltered	LA-00215	LLAO-1b	5.25			>3.080<						NA
Los Alamos	LA, lower	WGS	Unfiltered	BG-00081	LA Spring	6.04			X						NA
Los Alamos	LA, lower	WGS	Unfiltered	LA-00219	Basalt Spring	6.38			>1.652<						NA

Table E-1.0-25 (continued)

Canyon	Hydrosegment	Water Type	Field Preparation	Location	Station Name	Distance from Rio Grande (km)	Distance from LA Confluence (km)	Distance from Pueblo (km)	Total Noncancer HI	Americium-241	Plutonium-239	Strontium-90	Uranium-234	Uranium-238	Total Radionuclides HI
Max HQ										1.017	5.925	4.725	0.375	0.158	
Screen Value										1.2	1.2	40	20	24	
Los Alamos	LA, lower	WGS	Unfiltered	LA-10179	Otowi Spring	0			X						NA
Guaje	LA, lower	WS	Unfiltered	GU-10004	Guaje SW at LA Confluence	2.55			NA						NA
Los Alamos	LA, lower	WS	Unfiltered	LA-00218	Reach LA-4E SW	5.22			X						NA
Los Alamos	LA, lower	WS	Unfiltered	LA-02-20908	Eco				X						NA
Los Alamos	LA, lower	WS	Unfiltered	LA-02-20909	Eco				X						NA
Los Alamos	LA, lower	WS	Unfiltered	LA-10057	LA SW at Guaje Confluence	2.5			X						NA
Los Alamos	LA, lower	WS	Unfiltered	LA-10058	Lower Reach LA-5 SW	0.3			>1.430<						NA
DP	LA, middle	WGA	Filtered	21-01811	LAUZ-1	14.49	1.6		>1.184<			>4.225<			>4.225<
DP	LA, middle	WGA	Filtered	21-01812	LAUZ-2	14.31	1.42		>1.324<			>4.725<			>4.725<
Los Alamos	LA, middle	WGA	Filtered	LA-10035	LAO-3a	12.76			>12.783<			>1.023<			>1.023<
Los Alamos	LA, middle	WGA	Filtered	LA-10067	LAO-2	12.93			>11.662<			X			X
Los Alamos	LA, middle	WGA	Filtered	LA-10068	LAO-4	11.8			>4.164<			X			X
Los Alamos	LA, middle	WGA	Filtered	LA-10069	LAO-4.5c	10.86			>1.485<			X			X
Los Alamos	LA, middle	WGA	Filtered	LA-10070	LAO-6a	9.87			X			X			X
DP	LA, middle	WGS	Filtered	21-01854	DP Spring	13.32	0.43		>2.347<			>2.825<			>2.825<
DP	LA, middle	WS	Filtered	21-10929	Reach DP-1W SW	16.42	3.53		>2.253<			AllU			NA
DP	LA, middle	WS	Filtered	21-11226	Reach DP-1C SW	16.25	3.36		>2.567<			AllU			NA

Table E-1.0-25 (continued)

Canyon	Hydrosegment	Water Type	Field Preparation	Location	Station Name	Distance from Rio Grande (km)	Distance from LA Confluence (km)	Distance from Pueblo (km)	Total Noncancer HI	Americium-241	Plutonium-239	Strontium-90	Uranium-234	Uranium-238	Total Radionuclides HI
Max HQ										1.017	5.925	4.725	0.375	0.158	
Screen Value										1.2	1.2	40	20	24	
DP	LA, middle	WS	Filtered	21-11269	Reach DP-2 SW	14.53	1.64		>1.425<			>1.915<			>1.915<
DP	LA, middle	WGA	Unfiltered	21-01811	LAUZ-1	14.49	1.6		X	>1.017<	>1.033<	>3.675<			>5.725<
DP	LA, middle	WGA	Unfiltered	21-01812	LAUZ-2	14.31	1.42		>1.930<	AllU	<0.120>	>2.473<			>2.593<
Los Alamos	LA, middle	WGA	Unfiltered	LA-10035	LAO-3a	12.76			>11.261<			>1.180<			>1.180<
Los Alamos	LA, middle	WGA	Unfiltered	LA-10067	LAO-2	12.93			>11.111<			X			X
Los Alamos	LA, middle	WGA	Unfiltered	LA-10068	LAO-4	11.8			>4.179<			X			X
Los Alamos	LA, middle	WGA	Unfiltered	LA-10069	LAO-4.5c	10.86			X			X			X
Los Alamos	LA, middle	WGA	Unfiltered	LA-10070	LAO-6a	9.87			X			X			X
DP	LA, middle	WGS	Unfiltered	21-01854	DP Spring	13.32	0.43		>2.530<			>2.750<			>2.750<
DP	LA, middle	WS	Unfiltered	21-10929	Reach DP-1W SW	16.42	3.53		X			X			X
DP	LA, middle	WS	Unfiltered	21-11226	Reach DP-1C SW	16.25	3.36		>2.167<			AllU			NA
DP	LA, middle	WS	Unfiltered	21-11269	Reach DP-2 SW	14.53	1.64		NA			>2.380<			>2.380<
DP	LA, middle	WS	Unfiltered	LA-02-20913	Eco				X			AllU			NA
Los Alamos	LA, upper	WGA	Filtered	02-01022	LAO-0.91	15.92			X						NA
Los Alamos	LA, upper	WGA	Filtered	02-01076	LAO-1	15.66			X						NA
Los Alamos	LA, upper	WGA	Filtered	41-01002	LAO-0.6	16.49			X						NA
Los Alamos	LA, upper	WGA	Filtered	41-01003	LAO-0.3	17.11			X						NA

Table E-1.0-25 (continued)

Canyon	Hydrosegment	Water Type	Field Preparation	Location	Station Name	Distance from Rio Grande (km)	Distance from LA Confluence (km)	Distance from Pueblo (km)	Total Noncancer HI	Americium-241	Plutonium-239	Strontium-90	Uranium-234	Uranium-238	Total Radionuclides HI
Max HQ										1.017	5.925	4.725	0.375	0.158	
Screen Value										1.2	1.2	40	20	24	
Los Alamos	LA, upper	WGA	Filtered	41-01004	LAO-C	17.97			X						NA
Los Alamos	LA, upper	WGA	Filtered	41-01045	LAO-B	20.34			>4.417<						NA
Los Alamos	LA, upper	WGA	Filtered	LA-00001	LAO-1.6g	13.41			>1.464<						NA
Los Alamos	LA, upper	WGA	Filtered	LA-10008	LAO-1.2	14.62			>1.978<						NA
Los Alamos	LA, upper	WGA	Filtered	LA-10066	LAO-0.7	16.34			X						NA
Los Alamos	LA, upper	WS	Filtered	LA-10005	SW at LAO-0.6	16.48			>1.926<						NA
Los Alamos	LA, upper	WS	Filtered	LA-10006	Reach LA-Bkgd SW	20.31			X						NA
Los Alamos	LA, upper	WS	Filtered	LA-10033	Los Alamos Reservoir	22.15			>3.036<						NA
Los Alamos	LA, upper	WS	Filtered	LA-10034	Los Alamos Creek below LA Reservoir	22.11			X						NA
Los Alamos	LA, upper	WS	Filtered	LA-10040	SW at E026	19.3			X						NA
Los Alamos	LA, upper	WS	Filtered	LA-10064	Reach LA-1W SW	17.1			X						NA
Los Alamos	LA, upper	WS	Filtered	LA-10065	Reach LA-1C SW	15.7			>1.081<						NA
Los Alamos	LA, upper	WS	Filtered	LA-10126	Los Alamos Creek upstream of LA Reservoir	22.36			>3.136<						NA
Los Alamos	LA, upper	WGA	Unfiltered	02-01022	LAO-0.91	15.92			X						NA
Los Alamos	LA, upper	WGA	Unfiltered	02-01076	LAO-1	15.66			X						NA
Los Alamos	LA, upper	WGA	Unfiltered	41-01002	LAO-0.6	16.49			X						NA

Table E-1.0-25 (continued)

Canyon	Hydrosegment	Water Type	Field Preparation	Location	Station Name	Distance from Rio Grande (km)	Distance from LA Confluence (km)	Distance from Pueblo (km)	Total Noncancer HI	Americium-241	Plutonium-239	Strontium-90	Uranium-234	Uranium-238	Total Radionuclides HI
Max HQ										1.017	5.925	4.725	0.375	0.158	
Screen Value										1.2	1.2	40	20	24	
Los Alamos	LA, upper	WGA	Unfiltered	41-01003	LAO-0.3	17.11			X						NA
Los Alamos	LA, upper	WGA	Unfiltered	41-01004	LAO-C	17.97			X						NA
Los Alamos	LA, upper	WGA	Unfiltered	41-01045	LAO-B	20.34			X						NA
Los Alamos	LA, upper	WGA	Unfiltered	LA-00001	LAO-1.6g	13.41			>1.954<						NA
Los Alamos	LA, upper	WGA	Unfiltered	LA-10008	LAO-1.2	14.62			X						NA
Los Alamos	LA, upper	WGA	Unfiltered	LA-10066	LAO-0.7	16.34			X						NA
Los Alamos	LA, upper	WS	Unfiltered	LA-02-20914	Eco				>1.483<						NA
Los Alamos	LA, upper	WS	Unfiltered	LA-02-20915	Eco				>1.385<						NA
Los Alamos	LA, upper	WS	Unfiltered	LA-10005	SW at LAO-0.6	16.48			>1.762<						NA
Los Alamos	LA, upper	WS	Unfiltered	LA-10006	Reach LA-Bkgd SW	20.31			>1.066<						NA
Los Alamos	LA, upper	WS	Unfiltered	LA-10033	Los Alamos Reservoir	22.15			>3.152<						NA
Los Alamos	LA, upper	WS	Unfiltered	LA-10034	Los Alamos Creek below LA Reservoir	22.11			X						NA
Los Alamos	LA, upper	WS	Unfiltered	LA-10040	SW at E026	19.3			>5.960<						NA
Los Alamos	LA, upper	WS	Unfiltered	LA-10064	Reach LA-1W SW	17.1			>4.031<						NA
Los Alamos	LA, upper	WS	Unfiltered	LA-10065	Reach LA-1C SW	15.7			>2.193<						NA
Los Alamos	LA, upper	WS	Unfiltered	LA-10126	Los Alamos Creek upstream of LA Reservoir	22.36			X						NA

Table E-1.0-25 (continued)

Canyon	Hydrosegment	Water Type	Field Preparation	Location	Station Name	Distance from Rio Grande (km)	Distance from LA Confluence (km)	Distance from Pueblo (km)	Total Noncancer HI	Americium-241	Plutonium-239	Strontium-90	Uranium-234	Uranium-238	Total Radionuclides HI
Max HQ										1.017	5.925	4.725	0.375	0.158	
Screen Value										1.2	1.2	40	20	24	
Pueblo	Pueblo, lower	WGA	Filtered	PU-00177	PAO-5N	8.94	1.37		>4.850<						NA
Pueblo	Pueblo, lower	WGA	Filtered	PU-00182	PAO-4	10.21	2.64		>4.762<						NA
Pueblo	Pueblo, lower	WGA	Filtered	PU-10228	APCO-1	8.94	1.37		>2.165<						NA
Pueblo	Pueblo, lower	WS	Filtered	PU-10229	Pueblo at State Road 502	7.67	0.1		>2.869<						NA
Pueblo	Pueblo, lower	WS	Filtered	PU-10230	Pueblo 3	10.01	2.44		>2.217<						NA
Pueblo	Pueblo, lower	WGA	Unfiltered	PU-00177	PAO-5N	8.94	1.37		>3.053<						NA
Pueblo	Pueblo, lower	WGA	Unfiltered	PU-00182	PAO-4	10.21	2.64		>2.197<						NA
Pueblo	Pueblo, lower	WGA	Unfiltered	PU-10228	APCO-1	8.94	1.37		>1.862<						NA
Pueblo	Pueblo, lower	WS	Unfiltered	PU-02-20920	Eco				>3.845<						NA
Pueblo	Pueblo, lower	WS	Unfiltered	PU-10229	Pueblo at State Road 502	7.67	0.1		>2.257<						NA
Pueblo	Pueblo, lower	WS	Unfiltered	PU-10230	Pueblo 3	10.01	2.44		>2.384<						NA
Pueblo	Pueblo, middle	WGA	Filtered	PU-00181	PAO-3	13.44	5.87		NA						NA
Acid	Pueblo, middle	WS	Filtered	00-10241	Reach AC-2 SW	18.78		0.72	>1.008<	AIU	AIU	AIU	X	X	X
Acid	Pueblo, middle	WS	Filtered	PU-10155	Lower Reach AC-3 SW	18.08		0.02	>2.073<	AIU	X	X	X	X	X
Acid	Pueblo, middle	WS	Filtered	PU-10175	Upper Reach ACS SW	18.67		0.61	>2.171<	AIU	>2.925<	AIU	<0.375>	<0.158>	>3.458<
Acid	Pueblo, middle	WS	Filtered	PU-10176	Lower Reach ACS SW	18.52		0.46	X	<0.124>	>1.517<	X	X	AIU	>1.741<

Table E-1.0-25 (continued)

Canyon	Hydrosegment	Water Type	Field Preparation	Location	Station Name	Distance from Rio Grande (km)	Distance from LA Confluence (km)	Distance from Pueblo (km)	Total Noncancer HI	Americium-241	Plutonium-239	Strontium-90	Uranium-234	Uranium-238	Total Radionuclides HI
Max HQ										1.017	5.925	4.725	0.375	0.158	
Screen Value										1.2	1.2	40	20	24	
Pueblo	Pueblo, middle	WS	Filtered	PU-10071	Upper Reach P-1E SW	17.91	10.34		>4.900<						NA
Pueblo	Pueblo, middle	WS	Filtered	PU-10231	Pueblo 2	14.74	7.17		X						NA
Pueblo	Pueblo, middle	WGA	Unfiltered	PU-00181	PAO-3	13.44	5.87		NA						NA
Pueblo	Pueblo, middle	WGA	Unfiltered	PU-10174	PAO-2	17.85	10.28		NA						NA
Acid	Pueblo, middle	WS	Unfiltered	00-10241	Reach AC-2 SW	18.78		0.72	>1.224<	AIU	AIU	AIU	AIU	AIU	NA
Acid	Pueblo, middle	WS	Unfiltered	PU-10155	Lower Reach AC-3 SW	18.08		0.02	X	<0.112>	>2.150<	<0.480>	X	X	>2.770<
Acid	Pueblo, middle	WS	Unfiltered	PU-10175	Upper Reach ACS SW	18.67		0.61	>1.464<	AIU	>5.925<	AIU	<0.365>	<0.142>	>6.432<
Acid	Pueblo, middle	WS	Unfiltered	PU-10176	Lower Reach ACS SW	18.52		0.46	X	AIU	>4.308<	X	X	X	>4.431<
Pueblo	Pueblo, middle	WS	Unfiltered	PU-10071	Upper Reach P-1E SW	17.91	10.34		>4.120<						NA
Pueblo	Pueblo, middle	WS	Unfiltered	PU-10231	Pueblo 2	14.74	7.17		X						NA
Pueblo	Pueblo, upper	WGA	Filtered	PU-00178	PAO-1				>2.358<						NA
Pueblo	Pueblo, upper	WS	Filtered	PU-10068	Reach P-1FW SW	18.76	11.19		>1.312<						NA
Pueblo	Pueblo, upper	WS	Filtered	PU-10069	Upper Reach P-1W SW	18.36	10.79		>2.280<						NA
Pueblo	Pueblo, upper	WS	Filtered	PU-10070	Lower Reach P-1W SW	18.07	10.5		>1.283<						NA
Pueblo	Pueblo, upper	WGA	Unfiltered	PU-00178	PAO-1				>2.190<						NA
Pueblo	Pueblo, upper	WS	Unfiltered	PU-10068	Reach P-1FW SW	18.76	11.19		>1.209<						NA

Table E-1.0-25 (continued)

Canyon	Hydrosegment	Water Type	Field Preparation	Location	Station Name	Distance from Rio Grande (km)	Distance from LA Confluence (km)	Distance from Pueblo (km)	Total Noncancer HI	Americium-241	Plutonium-239	Strontium-90	Uranium-234	Uranium-238	Total Radionuclides HI
Max HQ										1.017	5.925	4.725	0.375	0.158	
Screen Value										1.2	1.2	40	20	24	
Pueblo	Pueblo, upper	WS	Unfiltered	PU-10069	Upper Reach P-1W SW	18.36	10.79		>1.832<						NA
Pueblo	Pueblo, upper	WS	Unfiltered	PU-10070	Lower Reach P-1W SW	18.07	10.5		X						NA

- Notes:
1. A blanks in an analyte column means not a Tier 2 COPC.
 2. Units are µg/L for organic and inorganic chemicals and pCi/L for radionuclides.
 3. <#> = Retained as Tier 2 COPC for this location/field preparation bin.
 4. >#< = Retained as Tier 2 COPC for this location/field preparation bin.
 5. - = No data.
 6. AliU = Analyte never detected in this location/field preparation bin.
 7. NA = No HQs to sum for this analyte type in this location/field preparation bin.
 8. SW = Surface water.
 9. X = Eliminated as a Tier 2 Human Health COPC for this location/field preparation bin.

Table E-2.1-1
Benzo(b)fluoranthene in Reach DP-2 Sediments

Original Data (mg/kg)	Detect Status	Estimated Values for Nondetects	Combined Data for Estimating UCLs
0.140	Detect		0.140
0.180	Detect		0.180
0.240	Nondetect	0.157	0.157
0.260	Detect		0.260
0.286	Nondetect	0.185	0.185
0.360	Detect		0.360
0.379	Nondetect	0.209	0.209
0.420	Detect		0.420
0.480	Detect		0.480
0.840	Nondetect	0.252	0.252
0.860	Detect		0.860
1.00	Detect		1.00

Table E-2.2-1a
Reach DP-2 Surface Weighted Average and UCL for Cesium-137
Averages, Variances, and Fractional Weights for Each Bin

Geomorphic Unit and Sediment Facies	Number of Samples	Average (pCi/g)	Variance	Fractional Weight
c1 coarse	1	0.27	0	0.16
c2 and c3a fine	4	4.68	2.38	0.19
c3b fine	12	33.5	5720	0.14
f1 fine	9	25.3	607	0.51

Table E-2.2-1b
Reach DP-2 Surface Weighted Average and UCL for Cesium-137
Summary Statistics for the Weighted and Unweighted Averages and UCLs

Statistic	Value
Weighted average	18.5 pCi/g
Weighted standard error of the mean	5.17
Degrees of freedom	15
Weighted UCL	27.5 pCi/g
Unweighted average	22.5 pCi/g
Unweighted standard error of the mean	5.83
Degrees of freedom	25
Unweighted UCL	32.4 pCi/g

Table E-5.3-1
Exposure Parameters for Soil and Water Risk Calculations

	Units	Residential Use RME		Trail Use RME		Resource Use RME		Construction Worker RME		Extended Backyard	
		Value	References/Notes*	Value	References/Notes*	Value	References/Notes*	Value	References/Notes*	Value	References/Notes*
IR_child	mg/d	200	EPA 1997a (note 1)	0	not evaluated	0	not evaluated	0	not evaluated	71.4	EPA 1997a (note 34)
IR_adult	mg/d	100	EPA 1991 (note 2)	12.5	note 58	100	EPA 1991 (note 2)	330	EPA 2002 (note 30)	-	adult not evaluated
EF_child	d/yr	350	EPA 1991	0	not evaluated	0	not evaluated	0	not evaluated	200	(note 35)
EF_adult	d/yr	350	EPA 1991	200	(note 60)	75	(note 18)	250	EPA 1991; EPA 2002	-	adult not evaluated
ED_adult_carc	yr	24	EPA 1991	30	EPA 1991	30	EPA 1991	1	(note 31)	-	adult not evaluated
ED_adult_nc	yr	30	EPA 1991	30	EPA 1991	30	EPA 1991	1	(note 31)	-	adult not evaluated
BW_child	kg	15	EPA 1991; 1997a (note 3)	-	not evaluated	-	not evaluated	-	pathway not applicable	31	EPA 1997a (note 36)
Inh_child	m ³ /hr	0.346	EPA 1997a (note 4)	0	not evaluated	0	not evaluated	0	not evaluated	1.2	EPA 1997a (note 37)
Inh_adult	m ³ /hr	0.833	EPA 1991 (note 5)	1.6	EPA 1997a (note 19)	1.6	EPA 1997a (note 19)	0.83	EPA 2001 (note 57)	-	adult not evaluated
ET_child	hr/d	24	(note 6)	0	not evaluated	0	not evaluated	0	0-6 yr not evaluated	1	(note 35)
ET_adult	hr/d	24	(note 6)	1	(note 20)	1	(note 20)	8	EPA 1991	-	adult not evaluated
PEF	m ³ /kg	10000000	(note 7)	1.30E+09	NMED 2000	10000000	(note 7)	10000000	(note 7)	5000000	(note 38)
SA_adult	cm ²	5700	EPA 2001 (note 8)	3200	(note 61)	5700	EPA 2001 (note 8)	3300	EPA 2002 (note 27)	-	adult not evaluated
SA_child	cm ²	2800	EPA 2001 (note 8)	-	not evaluated	-	not evaluated	0	not evaluated	3360	EPA 2001 (note 39)
AF_adult	mg/cm ² -d	0.07	EPA 2001 (note 9)	0.07	EPA 2001 (note 9)	0.07	EPA 2001 (note 9)	0.3	EPA 2001&2 (note 32)	-	adult not evaluated
AF_child	mg/cm ² -d	0.2	EPA 2001 (note 9)	-	not evaluated	-	not evaluated	-	not evaluated	0.2	EPA 2001 (note 9)

*References and notes follow Table E-5.3-1.

Table E-5.3-1 (continued)

	Units	Residential Use RME		Trail Use RME		Resource Use RME		Construction Worker RME		Extended Backyard	
		Value	References/Notes*	Value	References/Notes*	Value	References/Notes*	Value	References/Notes*	Value	References/Notes*
IR_veg	g/kg-d	1.2	EPA 1997b (note 10)	0	pathway incomplete	1.2	EPA 1997b (note 10)	0	pathway incomplete	0	pathway incomplete
IR_fruit	g/kg-d	1.4	EPA 1997b (note 10)	0	pathway incomplete	1.4	EPA 1997b (note 10)	0	pathway incomplete	0	pathway incomplete
fract_veg	unitless	1	(note 11)	-	pathway incomplete	0.1	(note 21)	-	pathway incomplete	-	pathway incomplete
fract_fruit	unitless	1	(note 11)	-	pathway incomplete	0.1	(note 21)	-	pathway incomplete	-	pathway incomplete
depth_cz	m	1	(note 12)	-	pathway incomplete	1	(note 12)	-	pathway incomplete	-	pathway incomplete
depth_root	m	1	(note 12)	-	pathway incomplete	1	(note 12)	-	pathway incomplete	-	pathway incomplete
IR_meat	g/kg-d	-	pathway incomplete	0	pathway incomplete	2.2	EPA 1997b (note 22)	0	pathway incomplete	0	pathway incomplete
fract_meat	unitless	-	pathway incomplete	-	pathway incomplete	1	(note 23)	-	pathway incomplete	-	pathway incomplete
fract_range	unitless	-	pathway incomplete	-	pathway incomplete	1	(note 23)	-	pathway incomplete	-	pathway incomplete
ET_in	hr/d	18	(note 6)	0	(note 20)	0	(note 20)	0	(note 33)	0	(note 35)
ET_out	hr/d	6	(note 6)	1	(note 20)	1	(note 20)	8	(note 33)	1	(note 35)
GWIng_child	l/d	1.5	EPA 1997a (note 48)	-	not evaluated	-	not evaluated	-	not evaluated	-	not evaluated
GWIng_adult	l/d	2	EPA 1997a (note 49)	0	pathway incomplete	0	pathway incomplete	-	not evaluated	-	not evaluated
SWIng_child	l/d	0	pathway incomplete	0	pathway incomplete	0	pathway incomplete	-	not evaluated	0.35	EPA 1997a (note 62)
SWIng_adult	l/d	0	pathway incomplete	0.2	EPA 1997a (note 50)	0.2	EPA 1997a (note 50)	-	not evaluated	-	no SW use evaluated
ET_gw_child	hr/d	1	EPA 1997c (note 52)	-	not evaluated	-	not evaluated	-	not evaluated	-	not evaluated
ET_gw_adult	hr/d	0.58	EPA 1997c (note 53)	-	not evaluated	-	not evaluated	-	not evaluated	-	not evaluated
ET_sw_child	hr/d	0	pathway incomplete	0	pathway incomplete	0	pathway incomplete	-	not evaluated	1	(note 51)

Table E-5.3-1 (continued)

	Units	Residential Use RME		Trail Use RME		Resource Use RME		Construction Worker RME		Extended Backyard	
		Value	References/Notes*	Value	References/Notes*	Value	References/Notes*	Value	References/Notes*	Value	References/Notes*
ET_sw_adult	hr/d	0	pathway incomplete	1	(note 51)	1	(note 51)	-	not evaluated	-	no SW use evaluated
EF_sw_child	d/yr	0	pathway incomplete	0	pathway incomplete	0	pathway incomplete	-	not evaluated	20	(note 51)
EF_sw_adult	d/yr	0	pathway incomplete	20	(note 51)	20	(note 51)	-	not evaluated	-	no SW use evaluated
EF_swderm_child	d/yr	0	pathway incomplete	0	pathway incomplete	0	pathway incomplete	-	not evaluated	20	(note 51)
EF_swderm_adult	d/yr	0	pathway incomplete	20	(note 51)	20	(note 51)	-	not evaluated	-	no SW use evaluated
SA_gw_child	cm ²	6600	EPA 2001 (note 54)	-	not evaluated	-	not evaluated	-	not evaluated	-	not evaluated
SA_gw_adult	cm ²	18000	EPA 2001 (note 54)	-	not evaluated	-	not evaluated	-	not evaluated	-	not evaluated
SA_sw_child	cm ²	0	pathway incomplete	0	pathway incomplete	0	pathway incomplete	-	not evaluated	3140	EPA 2001 (note 55)
SA_sw_adult	cm ²	0	pathway incomplete	2130	EPA 2001 (note 56)	2130	EPA 2001 (note 56)	-	not evaluated	-	no SW use evaluated
ED_child	yr	6	EPA 1991	0	not evaluated	0	not evaluated	0	not evaluated	6	(note 35)
BW_adult	kg	70	EPA 1991 (note 13)	70	EPA 1991 (note 13)	70	EPA 1991 (note 13)	70	EPA 1991 (note 13)	-	adult not evaluated
AT_carc	yr	70	(note 14)	70	(note 14)	70	(note 14)	70	(note 14)	70	(note 14)
AT_child_nc	yr	6	equal to ED	-	not evaluated	-	not evaluated	-	not evaluated	6	equal to ED
AT_adult_nc	yr	30	equal to ED	30	equal to ED	30	equal to ED	1	equal to ED	-	adult not evaluated
EF_plant	d/yr	365	(note 15)	-	pathway incomplete	365	(note 15)	-	pathway incomplete	-	pathway incomplete
BW_plant	kg	60	(note 16)	-	pathway incomplete	60	(note 16)	-	pathway incomplete	-	pathway incomplete
UR_fodder	kg/d	-	pathway incomplete	-	pathway incomplete	50	Baes et al. 1984 (note 24)	-	pathway incomplete	-	pathway incomplete
UR_soil	kg/d	-	pathway incomplete	-	pathway incomplete	0.1	(note 25)	-	pathway incomplete	-	pathway incomplete

Table E-5.3-1 (continued)

	Units	Residential Use RME		Trail Use RME		Resource Use RME		Construction Worker RME		Extended Backyard	
		Value	References/Notes*	Value	References/Notes*	Value	References/Notes*	Value	References/Notes*	Value	References/Notes*
EF_meat	d/yr	-	pathway incomplete	-	pathway incomplete	365	(note 15)	-	pathway incomplete	-	pathway incomplete
BW_meat	kg	-	pathway incomplete	-	pathway incomplete	60	(note 16)	-	pathway incomplete	-	pathway incomplete
DRF	unitless	0.7	Yu et al. 1993 (note 17)	0.7	Yu et al. 1993 (note 17)	0.7	Yu et al. 1993 (note 17)	0.7	Yu et al. 1993 (note 17)	0.7	Yu et al. 1993, note 17

Notes:

1. Conservative estimate of the mean chronic daily incidental soil ingestion rate.
2. Recommended value for general use. More recent guidance (EPA 1997a) suggests 50 mg/day as a central tendency value but provides no guidance for an upper bound value.
3. More recent guidance (EPA 1997a) provides revised estimates of body weight for children, by year. 15 kg is approximately the average weight of a 3-year-old child in EPA 1997a.
4. Derived from 8.3 m³/day, for long-term exposure of children ages 3-5 - Section 5.2.4 (recommendations).
5. Derived from recommended value of 20 m³/day. More recent guidance (EPA 1997a) for long-term exposure of adults is about 2/3 of this rate. The older estimate is used for consistency with EPA derivation of RfC and unit risk values in IRIS.
6. 100% of time is assumed to be spent at the residence.
7. PEF calculated for a 30-acre source. Calculation documented in worksheet 'PEF'.
8. Recommended value for both RME and CTE residential conditions; RAGS, Part E, Section 3.2 (Sept 2001). Child area corresponds to short sleeves, short pants, and no shoes; adult area corresponds to short sleeves, short pants, and shoes.
9. Recommended RME value; RAGS, Part E, Section 3.2 (Sept 2001). Adult AF value based on 50th %ile for high-exposure activity (gardening); child AF pertains to both 95th %ile for day-care children (average activity) or 50th %ile for children playing in wet soil (high-exposure activity).
10. 75th percentile of seasonally adjusted consumer intake of homegrown vegetables and fruits for Western U.S. Corrected by 18% average preparation loss for corn, pumpkin, peppers, and tomatoes (Tables 13-33 and 13-7) and by 23% average preparation loss for apples, pears, and peaches (Tables 13-33 and 13-6).
11. IR_veg and IR_fruit are specified for homegrown produce specifically.
12. Specifying equal values for root zone and contaminated zone implies 100% of garden plant and fruit tree roots occur in contaminated soil.
13. More recent guidance (EPA 1997a) recommends 71.8 kg. The older estimate is used for consistency with EPA derivation of toxicity values in IRIS.
14. Recent guidance (EPA 1997c) recommends 75 years. A 70-year lifetime is used for consistency with EPA derivation of toxicity values in IRIS.
15. An exposure frequency of 365 day/year is used for biotic products because intake values are annual averages.
16. From guidance in EPA 1997b, Section 9.2.2. Used for radionuclide dose calculations only.
17. Applies assumption that indoor external irradiation is 70% of ambient level; Yu et al. 1993, pg 130.
18. Assumes an individual is in the affected area three days every two weeks, 50 weeks per year.
19. Recommended value for adults engaged in short-term moderately strenuous activities, such as fast walking or slow running, wood working, yard work, etc. (Table 5-23).
20. Best professional judgment for a protective estimate of time spent hiking outdoors in affected area.
21. Assumes 10% of homegrown fruits and vegetables that might be consumed in a year are instead gathered from wild plants in affected area.
22. 75th percentile value of annual-average home-produced beef intake for Western U.S., corrected by 24% mean preparation loss for beef; Tables 13-36 and 13-5.

23. Protectively assumes that affected area is 100% of cattle range and that no supplemental feed is used.
24. Wet feed consumption rate; Baes et al, pg 49.
25. Accounts for direct soil ingestion by cattle during grazing; value suggested by Espanola Natural Resource Conservation Service office.
26. Central tendency value; no recommendation for upper bound in EPA 1997a. Recommended as a default value for a typical workplace in EPA 1991.
27. From Equation 5-1, default value for exposed skin surface area for construction worker scenario.
28. RME value for adult residential is used. Assumed that workplace soil loading more typical of residential conditions than outdoors labor.
29. Chronic occupational exposure in one location implies office, warehouse or similar indoor environment.
30. From Exhibit 5-1, soil ingestion rate default value for construction worker.
31. From Exhibit 5-1, default value for exposure duration for construction worker scenario.
32. Default value in Equation 5-1 of EPA 2002 and 95th percentile value for construction workers in Exhibit C-3 of EPA 2001.
33. All exposure assumed to occur outdoors (ie, no shielding of contaminated soil).
34. Daily value is assumed to be 400 mg/day (recommended upper percentile soil ingestion rate for children; EPA 1997a). 71.4 mg/day calculated as 400 mg/day / 5.6 hours/day. This soil ingestion value is based on three assumptions: 1) daily exposure of 1 hour in the affected area, 2) equal rates of soil ingestion in all outdoor activities with total outdoor time of 5.6 hr/day (EPA 1997c, Section 15.4.1), and 3) no soil ingestion occurring in indoor environments.
35. Annual exposure intensity for a child age 6 - 12 years was subjectively defined as 1 hour/day for 7 months, or approximately 200 hours/year, based on frequent use of the impacted area as an "extended backyard" during periods of relatively warmer weather.
36. EPA 1997a, Table 7-3 - Mean value for ages 6, 7, 8, 9, 10, and 11 (assumes child of age 6 - 12 years).
37. Recommended value for children engaged in short-term moderately strenuous activities, including play (Table 5-23).
38. Equivalent to dust loading of 0.0002 g/m3. This value was reported for farmyards and includes short periods at high dust loading (Gilbert 1983). Some physical disturbance is consistent with the possible disturbance of the sediments during play. Protective value for adult trail users.
39. Based on the area of face, forearms, hands, lower legs, and feet for children in the age groups between 6 - <7 and 11 - <12 - Exhibit C-1 of EPA 2001.
40. Daily value is assumed to be 200 mg/day (or 0.5 * recommended upper percentile soil ingestion rate for small children; EPA 1997a).
35. 7 mg/day calculated as 200 mg/day / 5.6 hours/day. This soil ingestion value is based on three assumptions: 1) daily exposure of 1 hour in the affected area, 2) equal rates of soil ingestion in all outdoor activities with total outdoor time of 5.6 hr/day (EPA 1997c, Section 15.4.1), and 3) no soil ingestion occurring in indoor environments.
41. Daily value is assumed to be 100 mg/day (or same as note 2). 17.9 mg/day calculated as 100 mg/day / 5.6 hours/day. This soil ingestion value is based on three assumptions: 1) daily exposure of 1 hour in the affected area, 2) equal rates of soil ingestion in all outdoor activities with total outdoor time of 5.6 hr/day (EPA 1997c, Section 15.4.1), and 3) no soil ingestion occurring in indoor environments.
42. Daily value is assumed to be 100 mg/day (or same as note 2). 66.7 mg/day calculated as 100 mg/day / 1.5 hours/day. This soil ingestion value is based on three assumptions: 1) daily exposure of 1 hour in the affected area, 2) equal rates of soil ingestion in all outdoor activities with total outdoor time of 1.5 hr/day (EPA 1997c), and 3) no soil ingestion occurring in indoor environments.
43. Daily value is assumed to be 50 mg/day (EPA 1997a). 33.3 mg/day calculated as 50 mg/day / 1.5 hours/day. This soil ingestion value is based on three assumptions: 1) daily exposure of 1 hour in the affected area, 2) equal rates of soil ingestion in all outdoor activities with total outdoor time of 1.5 hr/day (EPA 1997c), and 3) no soil ingestion occurring in indoor environments.
44. Annual exposure intensity for a child age 6 - 12 years was subjectively defined as 1 hour/day, 2 days per week, for 7 months, or approximately 60 hours/year, based on occasional use of the impacted area as an "extended backyard" during periods of relatively warmer weather.
45. Assumes an individual is in the affected area one day every week, 50 weeks per year.
46. Best professional judgment for estimate of average time spent hiking outdoors in affected area.
47. RAGS, Part E, Exhibit C-3 (Sept 2001) and summary Exhibit 3-5. Adult AF value based on geometric mean for average exposure activity (groundskeeper); child AF based on geometric mean for children ages 8-12 playing in dry soil.
48. 90th percentile value for children age 1 - 5 (Section 3.6 - Recommendations, Table 3-33, EPA 1997a).
49. Corresponds to 84th percentile of adult intake rate distribution (90th percentile is 2.35), selected to avoid necessity of revising IRIS cancer slope factors developed on presumption of 2 L/day intake (Section 3.6 - Recommendations, EPA 1997a).
50. From Table 3-27, hourly water intake rates for young adult males per activity level. RME value corresponds to medium activity at 85 degrees,

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51. Best professional judgment corresponding to drinking water ingestion and dermal water contact on 10% of site visits; 1 hour of wet skin is assumed for dermal contact.
53. 95th percentile value for ages 1 - 4, Table 15-30, EPA 1997c.
53. 95th percentile value for adults; recommendations for baths and showers, Section 15.4, EPA 1997c.
54. Recommended value for showering/bathing in both RME and CTE assessments; RAGS, Part E, Exhibit 3-2 (Sept 2001).
55. Based on the 50th percentile area of forearms, hands, lower legs, and feet for male and female children in the age groups between 6 - <7 and 11 - <12 - Exhibit C-1 of EPA 2001.
56. Based on the 50th percentile area of hands and feet for male and female adults - Exhibit C-1 of EPA 2001.
57. From NMED comments on the Canon de Valle HH risk assessment, Phase III RFI.
58. 100 mg/d * 0.125 soil fro the contaminated site. Consistent with Canon de Valle Phase III RFI.
59. 50 mg/d * 0.625 soil from the contaminated site. Consistent with Canon de Valle Phase III RFI.
60. Assumes 4 day per week, 50 weeks per year.
61. Surface area assumes that individual is wearing short sleeve shirt, pants, and shoes. The upper 95% exposed skin are is limited to head, hands, and arms.
62. From Table 3-27, hourly water intake rates for young adult males per activity level. RME value corresponds to medium activity at 95 degrees,

References:

- (EPA 1991) United States Environmental Protection Agency. 1991. Risk Assessment Guidance for Superfund: Volume I - Human Health Evaluation Manual Supplemental Guidance Standard Default Exposure Factors. OSWER Directive 9285.6-03. Office of Emergency and Remedial Response, Washington, D.C.
- (EPA 1997a) Exposure Factors Handbook, Volume I, General Factors. EPA/600/P-95/002Fa. Office of Research and Development, Washington, D.C.
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- (EPA 1997c) Exposure Factors Handbook, Volume III, Activity Factors. EPA/600/P-95/002Fc. Office of Research and Development, Washington, D.C.
- EPA 2001. Risk Assessment Guidance for Superfund (RAGS), Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Interim. EPA/540/R/99/005, OSWER 9285.7-02EP, September 2001.
- (Baes et al. 1984) Baes, C. F., III, Sharp, R. D., Sjoreen, A. L., and Shor, R. W. 1984. A Review and Analysis of Parameters for Assessing Transport of Environmentally Released Radionuclides through Agriculture. ORNL-5786. Oak Ridge National Laboratory, Oak Ridge, Tennessee.
- (Yu et al. 1993) Yu, C., et al, Manual for Implementing Residual Radioactive Material Guidelines Using RESRAD, Version 5.0. Environmental Assessment Division, Argonne National Laboratory, Argonne, Illinois.
- NMED 2000. New Mexico Environment Department, Hazardous Waste Bureau and Ground Water Quality Bureau, Voluntary Remediation Program Technical Background Document for Development of Soil Screening Levels, December 18, 2000
- EPA 2002. Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, OSWER 9355.4-24, Office of Solid Waste and Emergency Response, December 2002

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Table E-5.3-2
RESRAD Input Values For Calculations of RBCs

	Resident, Adult RME	Resident, Child RME	Trail User RME	Resource User RME	Construction RME	Extended Backyard RME
Inhalation rate (m ³ /year)	7300	3032	14025	14025	14025	10519
Mass loading (g/year)	0.0001	0.0001	0.0002	0.0001	0.0001	0.0002
Indoor time	0.719	0.719	0.0	0.0	0.0	0.0
Outdoor time	0.24	0.24	0.00856	0.00856	0.228	0.0228
Produce consumption (kg/year)	57	57	n/a ^a	57	n/a	n/a
Fraction produce on-site	1	1	n/a	0.1	n/a	n/a
Meat consumption (kg/year)	n/a	n/a	n/a	48	n/a	n/a
Fraction meat on-site	n/a	n/a	n/a	1.0	n/a	n/a
Soil ingestion ^b (g/year)	36.5 ^c	73 ^d	585 ^e	585 ^e	305 ^f	626 ^g

^a n/a = Not applicable.

^b The soil ingestion rate is defined to compensate for the time-based occupancy factor applied by RESRAD in calculating exposure from the soil ingestion pathway. Site-related soil ingestion is calculated as [(daily overall soil ingestion rate / daily overall soil exposure period) x annual on-site exposure frequency] / annual site utilization fraction.

^c [(0.1 g/day / 24 hr/day) x 8400 hr/year] / 0.959 annual site utilization fraction.

^d [(0.2 g/day / 24 hr/day) x 8400 hr/year] / 0.959 annual site utilization fraction.

^e [(0.1 g/day / 1.5 hr/day) x 75 hr/year] / 0.00856 annual site utilization fraction. 1.5 hr/day is an estimate of time spent outdoors for an adult (EPA 1997, 66598).

^f [(0.33 g/day / 9.5 hr/day) x 2000 hr/year] / 0.228 annual site utilization fraction. 9.5 hr/day is the sum of an 8-hour work day and an estimate of time spent outdoors for an adult (EPA 1997, 66598).

^g [(0.4 g/day / 5.6 hr/day) x 200 hr/year] / 0.0228 annual site utilization fraction. 5.6 hr/day is an estimate of time spent outdoors for a child (EPA 1997, 66598).

Table E-5.3-3
Toxicity Values for Inorganic and Organic Chemicals

Contaminant	Analyte Code	CAS-ID	Oral RfD (mg/kg-d)	Source	Inhal RfD (mg/kg-d)	Source	Oral SF (mg/kg-d) ⁻¹	Source	Inhal SF (mg/kg-d) ⁻¹	Source	Cancer Class	Dermal RfD (mg/kg-d)	Dermal SF (mg/kg-d) ⁻¹	GI ABS Frac
Aluminum	AL	7429-90-5	1.0E+00	PPRTV	1.4E-03	PPRTV						1.0E+00		1
Antimony	SB	7440-36-0	4.0E-04	IRIS								6.0E-05		0.15
Arsenic	AS	7440-38-2	3.0E-04	IRIS			1.5E+00	IRIS	1.5E+01	IRIS	A	3.0E-04	1.50E+00	1
Barium	BA	7440-39-3	7.0E-02	IRIS	7.0E-02	R-R ext.						4.9E-03		0.07
Boron	B	7440-42-8	9.0E-02	IRIS	5.7E-03	HEAST						9.0E-02		1
Chromium	CR	7440-47-3	1.8E-02	IRIS					4.2E+01	IRIS	A (Cr VI)	2.7E-04		0.015
Iron	FE	7439-89-6	3.0E-01	NCEA								3.0E-01		1
Manganese	MN	7439-96-5	1.4E-01	IRIS	1.4E-05	IRIS						5.6E-03		0.04
Molybdenum	MO	7439-98-7	5.0E-03	IRIS								5.0E-03		1
Thallium	TL	7440-28-0	8.0E-05	IRIS								8.0E-05		1
Uranium	U		3.0E-03	IRIS								3.0E-03		1
Fluoride	F	7782-41-4	6.0E-02	IRIS								6.0E-02		1
Nitrate (as N)	NO3	14797-55-8	1.6E+00	IRIS								1.6E+00		1
Nitrite	NO2	14797-65-0	1.0E-01	IRIS								1.0E-01		1
Perchlorate	CLO4(-1)	14797-73-0	1.0E-04	NCEA								1.0E-04		1
BHC[beta-]	319-85-7	319-85-7					1.8E+00	IRIS	1.8E+00	IRIS	C		1.80E+00	1
DDT[4,4]	50-29-3	50-29-3	5.0E-04	IRIS			3.4E-01	IRIS	3.4E-01	IRIS	B2	5.0E-04	3.40E-01	1
Aroclor-1254	11097-69-1	11097-69-1	2.0E-05	IRIS	2.0E-05	R-R ext.						2.0E-05		1
Aroclor-1260	11096-82-5	11096-82-5					2.0E+00	IRIS	2.0E+00	IRIS	B2		2.00E+00	1
Benz(a)anthracene	56-55-3	56-55-3					7.3E-01	NCEA	3.1E-01	NCEA	B2		7.30E-01	1
Benzo(a)pyrene	50-32-8	50-32-8					7.3E+00	IRIS	3.1E+00	NCEA	B2		7.30E+00	1
Benzo(b)fluoranthene	205-99-2	205-99-2					7.3E-01	NCEA	3.1E-01	NCEA	B2		7.30E-01	1
Bis(2-ethylhexyl)phthalate	117-81-7	117-81-7	2.0E-02	IRIS			1.4E-02	IRIS	1.4E-02	R-R ext.	B2	2.0E-02	1.40E-02	1
Dibenz(a,h)anthracene	53-70-3	53-70-3					7.3E+00	NCEA	3.1E+00	NCEA	B2		7.30E+00	1
Indeno(1,2,3-cd)pyrene	193-39-5	193-39-5					7.3E-01	NCEA	3.1E-01	NCEA	B2		7.30E-01	1

Notes on table:

IRIS: Integrated Risk Information System (EPA 2003, 76870)

HEAST: Health Effects Assessment Summary Tables (EPA 1997, 58968)

NCEA: National Center for Environmental Assessment

PPRTV: Provisional Peer-Reviewed Toxicity Value

R-R ext.: Value based on route-to-route extrapolation from oral to inhalation

Notes on toxicity values:

Gastrointestinal absorption factors from Exhibit 4-1 (RAGS Part E, Sept. 2001).

Inhalation SF for chromium as 6:1 ratio of CrIII to CrVI; SF of 42 published in IRIS.

Oral RfD for chromium also assumes a 6:1 ratio of CrIII to CrVI (RfD for Cr III is 1.5; RfD for Cr VI is 0.003). Calculation: $[1 / ((1/6 * 1/0.003) + (5/6 * 1/1.5))]$.

Manganese oral RfD uses modifying factor of 3, as recommended in IRIS.

Perchlorate referenced to NCEA from within Region 6 screening tables (Excel workbook: Nov. 2002)

Thallium as thallium sulfate, chloride, or carbonate.

Aroclor-1260 SF based on upper-bound value for 'high risk and persistence'. Inhalation SF based on oral SF, per recommendations in IRIS.

Chromium dermal RfD Abs Frac assumes 1:6 ratio of VI:III forms; GI abs fraction is $1/6(0.035) + (5/6)(0.013) = 0.015$.

Uranium as soluble salts.

Oral RfD is for fluorine (soluble fluoride).

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Table E-5.3-4
Toxicity Values for Radionuclides

Contaminant	Analyte Code	Ing DCF ^a (mrem/pCi)	Source	Inhal DCF (mrem/pCi)	Source	External DCF (mrem-g/pCi-yr ^b)	Source
Americium-241	AM-241	3.64E-03	RES 6.21 ^c	4.44E-01	RES 6.21	4.37E-02	RES 6.21
Cesium-137+D	CS-137	5.00E-05	RES 6.21	3.19E-05	RES 6.21	3.41E+00	RES 6.21
Europium-152	EU-152	6.48E-06	RES 6.21	2.21E-04	RES 6.21	7.01E+00	RES 6.21
Plutonium-239,240	PU-239	3.54E-03	RES 6.21	4.29E-01	RES 6.21	2.95E-04	RES 6.21
Strontium-90+D	SR-90	1.53E-04	RES 6.21	1.31E-03	RES 6.21	2.46E-02	RES 6.21
Uranium-234	U-234	2.83E-04	RES 6.21	1.32E-01	RES 6.21	4.02E-04	RES 6.21
Uranium-238+D	U-238	2.69E-04	RES 6.21	1.18E-01	RES 6.21	1.37E-01	RES 6.21

Note: RESRAD DCFs provided as "+D" for radionuclides with short-lived daughters.

^a DCF = Dose conversion factor.

^b Converted from volume to mass in RESRAD using an assumption of 1.25 g/cm³ sediment density.

^c RES 6.21 = RESRAD Version 6.21. Values are consistent with DCFs published in Federal Guidance Reports 11 (EPA 1988, 50123) and 12 (EPA 1993, 62798).

Table E-5.3-5
Analyte-Specific Parameter Values for Calculating Dermal Absorption and Biotic Uptake

Contaminant	Analyte Code	CAS-ID	ABS (unitless)	K _p (cm/hr)	F _{abs} (unitless)	T _{event} (hr/event)	K _{p-s} (unitless)	K _{f-s} (unitless)	TF _{meat} (mg/kg per mg/day)
Aluminum	AL	7429-90-5	0	0.001	n/a*	n/a	5.0E-04	7.3E-04	1.5E-03
Antimony	SB	7440-36-0	0	0.001	n/a	n/a	1.0E-02	1.8E-02	1.0E-03
Arsenic	AS	7440-38-2	0.03	0.001	n/a	n/a	8.0E-02	3.6E-02	1.5E-03
Barium	BA	7440-39-3	0	0.001	n/a	n/a	5.0E-03	1.8E-02	2.0E-04
Boron	B	7440-42-8	0	0.001	n/a	n/a	5.0E-01	7.3E-01	8.0E-04
Chromium	CR	7440-47-3	0	0.001	n/a	n/a	2.5E-04	1.8E-02	9.0E-03
Iron	FE	7439-89-6	0	0.001	n/a	n/a	1.0E-03	5.5E-04	2.0E-02
Manganese	MN	7439-96-5	0	0.001	n/a	n/a	3.0E-01	1.7E-01	5.0E-04
Molybdenum	MO	7439-98-7	0	0.001	n/a	n/a	1.3E-01	7.4E-02	1.0E-03
Thallium	TL	7440-28-0	0	0.001	n/a	n/a	5.0E-04	7.3E-04	4.0E-02
Uranium	U		0	0.001	n/a	n/a	2.5E-03	1.8E-02	3.4E-04
Fluoride	F	7782-41-4	0	0.001	n/a	n/a	2.0E-02	1.8E-02	2.0E-02
Nitrate (as N)	NO3	14797-55-8	0	0.001	n/a	n/a	0.0E+00	0.0E+00	0.0E+00
Nitrite	NO2	14797-65-0	0	0.001	n/a	n/a	0.0E+00	0.0E+00	0.0E+00
Perchlorate	CLO4(-1)	14797-73-0	0	0.001	n/a	n/a	0.0E+00	0.0E+00	0.0E+00
BHC[beta-]	319-85-7	319-85-7	0.1	0.0116	1.0	4.465	3.06E-02	4.42E-02	1.27E-03
DDT[4,4]	50-29-3	50-29-3	0.03	0.27	0.7	0.0	8.20E-04	1.19E-03	8.19E-01
Aroclor-1254	11097-69-1	11097-69-1	0.14	0.43	0.5	0.0	1.11E-03	1.61E-03	4.74E-01
Aroclor-1260	11096-82-5	11096-82-5	0.14	0.43	0.5	0.0	5.73E-04	8.27E-04	1.56E+00
Benz(a)anthracene	56-55-3	56-55-3	0.13	0.47	1.0	2.03	2.48E-03	3.58E-03	1.14E-01
Benzo(a)pyrene	50-32-8	50-32-8	0.13	0.70	1.0	2.69	1.43E-03	2.07E-03	3.02E-01
Benzo(b)fluoranthene	205-99-2	205-99-2	0.13	0.70	1.0	2.77	1.27E-03	1.84E-03	3.74E-01
Bis(2-ethylhexyl)phthalate	117-81-7	117-81-7	0.1	1.07	1.0	16.16	2.94E-04	4.25E-04	5.12E+00
Dibenz(a,h)anthracene	53-70-3	53-70-3	0.13	1.5	0.6	3.88	6.63E-04	9.58E-04	1.20E+00
Indeno(1,2,3-cd)pyrene	193-39-5	193-39-5	0.13	1.0	0.6	3.78	6.99E-04	1.01E-03	1.09E+00
Americium-241	AM-241	86954-36-1	n/a	n/a	n/a	n/a	1.0E-03	7.3E-04	5.0E-05
Cesium-137+D	CS-137	10045-97-3	n/a	n/a	n/a	n/a	4.0E-02	3.6E-02	3.0E-02
Europium-152	EU-152	14683-23-9	n/a	n/a	n/a	n/a	2.5E-03	1.8E-02	2.0E-03
Plutonium-239,240	PU-239	15117-48-3	n/a	n/a	n/a	n/a	1.0E-03	4.9E-05	1.0E-04
Strontium-90+D	SR-90	10098-97-2	n/a	n/a	n/a	n/a	3.0E-01	3.6E-01	8.0E-03
Uranium-234	U-234	13966-29-5	n/a	n/a	n/a	n/a	2.5E-03	1.8E-02	3.4E-04
Uranium-238+D	U-238	7440-61-1	n/a	n/a	n/a	n/a	2.5E-03	1.8E-02	3.4E-04

*n/a = Not applicable.

Table E-5.3-6
Sediment Pathway RBCs for RMEs

COPC	Trail User	Extended Backyard	Resource User	Construction Worker	Residential
Carcinogens, 10^{-5} risk, mg/kg					
Aroclor-1254	34	19.9	0.164	76.2	0.908
Aroclor-1260	34	19.9	0.164	76.2	0.908
Arsenic	103	46.8	0.473	130	0.0733
Benz(a)anthracene	98.1	56.9	0.376	214	2.75
Benzo(a)pyrene	9.81	5.69	0.0196	21.4	0.359
Benzo(b)fluoranthene	98.1	56.9	0.168	214	3.77
Dibenz(a,h)anthracene	9.81	5.69	0.00682	21.4	0.464
Indeno(1,2,3-cd)pyrene	98.1	56.9	0.0737	214	4.58
Noncarcinogens, HQ = 1, mg/kg					
Aroclor-1254	58.3	6.83	0.106	4.36	0.964
Arsenic	1990	185	10.9	85.2	1.35
Radionuclides, 15 mrem/yr, pCi/g					
Americium-241	1500	270	330	53	29
Cesium-137	210	210	56	21	6.1
Plutonium-239	1700	280	310	56	32
Strontium-90	17000	5600	10	950	5.7
Uranium-234	13000	2700	1400	480	160

Table E-5.3-7
Water Pathway RBCs for RMEs

COPC	Trail User	Extended Backyard	Resource User	Residential
Carcinogens, 10⁻⁵ risk, µg/L				
Arsenic	98.3	60.6	98.3	0.377
Bis(2-ethylhexyl)phthalate	83.5	124	83.5	0.59
Dibenz(a,h)anthracene	0.384	0.561	0.384	0.00268
BHC[beta-]	48	39.1	48	0.227
Benz(a)anthracene	9.86	13.8	9.86	0.0672
Benzo(a)pyrene	0.587	0.846	0.587	0.00407
Benzo(b)fluoranthene	5.78	8.35	5.78	0.0401
DDT[4,4'-]	438	268	438	1.67
Indeno(1,2,3-cd)pyrene	5.78	8.34	5.78	0.0401
Noncarcinogens, HQ = 1, µg/L				
Antimony	2390	610	2390	4.05
Arsenic	1900	481	1900	3.11
Barium	388000	100000	388000	687
Bis(2-ethylhexyl)phthalate	1000	301	1000	3.92
Boron	569000	144000	569000	934
Chromium	67200	18200	67200	145
Fluoride	379000	96100	379000	623
Iron	1900000	481000	1900000	3110
Manganese	706000	185000	706000	1320
Molybdenum	31600	8010	31600	51.9
Nitrate	10100000	2560000	10100000	16600
Nitrite	632000	160000	632000	1040
Perchlorate	632	160	632	1.04
Thallium	506	128	506	0.831
Uranium	19000	4810	19000	31.1
Aluminum	6320000	1600000	6320000	10400
DDT[4,4'-]	3190	808	3190	5.21
Radionuclides, 4 mrem/yr, pCi/L				
Americium-241	275	157	275	1.57
Plutonium-239	282	161	282	1.61
Strontium-90	6540	3730	6540	37.3
Uranium-234	3530	2020	3530	20.2
Uranium-238	3720	2120	3720	21.2

Table E-5.3-8
Construction-Worker Sediment Exposure Pathways, COPC to RBC Ratio Sums

Reach	Carcinogen Sum ^a	Noncarcinogen Sum	Radionuclide Sum ^b
AC-1	0.227	0.0422	— ^c
AC-2	0.147	0.0419	—
AC-3	0.0394	0.255	1.17
ACS	0.0229	0.0676	1.99
DP-1C	0.0205	—	—
DP-1E	0.0384	—	—
DP-1W	0.135	—	—
DP-2	—	—	2.03
DP-3	0.00839	—	1.69
DP-4	—	—	0.654
LA-2E	0.0306	0.0243	0.616
LA-2FE	—	—	0.865
LA-2W	—	—	0.0211
LA-3E	—	—	0.198
LA-3W	—	—	0.418
P-1E	0.014	0.0012	0.34
P-1W	0.0184	0.0217	—
P-4W	0.0157	0.00325	—

^a Convert to risk: Value x (1x10⁻⁶).

^b Convert to dose: Value x 15 mrem.

^c — = COPC class not carried forward for this reach from Section 6 of this report.

Table E-5.3-9
Resource-User Sediment Exposure Pathways, COPC to RBC Ratio Sums

Reach	Carcinogen Sum ^a	Noncarcinogen Sum	Radionuclide Sum ^b
AC-1	231	0.33	— ^c
AC-2	143	0.327	—
AC-3	33.4	10.5	0.512
ACS	11.8	2.07	0.421
DP-1C	19.2	—	—
DP-1E	40.9	—	—
DP-1W	167	—	—
DP-2	—	—	1.34
DP-3	9.03	—	0.896
DP-4	—	—	0.438
LA-2E	20	0.19	0.561
LA-2FE	—	—	0.604
LA-2W	—	—	0.346
LA-3E	—	—	0.199
LA-3W	—	—	0.362
—	—	—	—
P-1E	15.4	0.0492	0.149
P-1W	8.5	0.169	—
P-4W	15.7	0.0254	—

^a Convert to risk: Value x (1x10⁻⁶).

^b Convert to dose: Value x 15 mrem.

^c — = COPC class not carried forward for this reach from Section 6 of this report.

Table E-5.3-10
Residential-Sediment Exposure Pathways, COPC to RBC Ratio Sums

Reach	Carcinogen Sum ^a	Noncarcinogen Sum	Radionuclide Sum ^b
AC-1	61.1	2.66	— ^c
AC-2	55.9	2.64	—
AC-3	2.73	1.15	2.78
ACS	25.6	1.56	3.7
DP-1C	1.34	—	—
DP-1E	2.33	—	—
DP-1W	8	—	—
DP-2	—	—	7.77
DP-3	0.507	—	5.93
DP-4	—	—	2.5
LA-2E	29.1	1.53	2.58
LA-2FE	—	—	3.46
LA-2W	—	—	0.655
LA-3E	—	—	0.898
LA-3W	—	—	1.79
—	—	—	—
P-1E	0.839	0.0054	0.776
P-1W	25.5	1.37	—
P-4W	4.58	0.205	—

^a Convert to risk: Value x (1x10⁻⁵).

^b Convert to dose: Value x 15 mrem.

^c — = COPC class not carried forward for this reach from Section 6 of this report.

Table E-5.3-11
Sediment Volume Weighted Averages and UCLs Exposure Pathway EPC to RBC Ratios

Subreach	Analyte	Risk Class ^a	Average ^b	95% UCL	Construction Worker Ratio	Residential Ratio	Resource-User Ratio
AC-1	Arsenic	ca	3.31	3.6	0.0277	49.1	7.61
AC-1	Benz(a)anthracene	ca	1.67	3.18	0.0149	1.15	8.45
AC-1	Benzo(a)pyrene	ca	1.8	3.39	0.159	9.44	173
AC-1	Benzo(b)fluoranthene	ca	2.43	4.3	0.0201	1.14	25.6
AC-1	Indeno(1,2,3-cd)pyrene	ca	0.669	1.23	0.00576	0.269	16.7
AC-1	Arsenic	nc	3.31	3.6	0.0422	2.66	0.33
AC-2	Arsenic	ca	3.15	3.57	0.0274	48.7	7.55
AC-2	Benz(a)anthracene	ca	1.17	1.76	0.00824	0.639	4.68
AC-2	Benzo(a)pyrene	ca	1.24	1.97	0.0923	5.48	101
AC-2	Benzo(b)fluoranthene	ca	2.11	3.41	0.016	0.904	20.3
AC-2	Indeno(1,2,3-cd)pyrene	ca	0.524	0.735	0.00344	0.161	9.97
AC-2	Arsenic	nc	3.15	3.57	0.0419	2.64	0.327
AC-3	Aroclor-1254	ca	0.331	1.11	0.0146	1.22	6.79
AC-3	Benz(a)anthracene	ca	0.451	— ^c	0.00211	0.164	1.2
AC-3	Benzo(a)pyrene	ca	0.411	—	0.0192	1.14	21
AC-3	Benzo(b)fluoranthene	ca	0.745	—	0.00349	0.198	4.43
AC-3	Aroclor-1254	nc	0.331	1.11	0.255	1.15	10.5
AC-3	Americium-241	rad	5.11	13.8	0.26	0.476	0.0418
AC-3	Cesium-137	rad	1.08	2.77	0.132	0.454	0.0495
AC-3	Plutonium-239	rad	29.5	43.3	0.773	1.35	0.14
AC-3	Strontium-90	rad	1.18	2.81	0.00296	0.493	0.281
ACS	Aroclor-1254	ca	0.134	0.201	0.00264	0.221	1.23
ACS	Arsenic	ca	1.69	1.83	0.0141	25	3.87
ACS	Benzo(a)pyrene	ca	0.132	—	0.00618	0.367	6.74
ACS	Aroclor-1254	nc	0.134	0.201	0.0461	0.209	1.9
ACS	Arsenic	nc	1.69	1.83	0.0215	1.35	0.168
ACS	Americium-241	rad	2.4	3.17	0.0598	0.109	0.00961
ACS	Cesium-137	rad	0.949	1.42	0.0676	0.233	0.0254
ACS	Plutonium-239	rad	81.3	104	1.86	3.25	0.335
ACS	Strontium-90	rad	0.354	0.483	0.000508	0.0847	0.0483
ACS	Uranium-234	rad	3.03	3.77	0.00785	0.0236	0.00269
DP-1C	Aroclor-1260	ca	0.389	—	0.0051	0.429	2.38
DP-1C	Benzo(a)pyrene	ca	0.329	—	0.0154	0.916	16.8
DP-1E	Benz(a)anthracene	ca	0.446	0.658	0.00308	0.239	1.75
DP-1E	Benzo(a)pyrene	ca	0.677	—	0.0317	1.88	34.5
DP-1E	Benzo(b)fluoranthene	ca	0.495	0.772	0.00362	0.205	4.59
DP-1W	Benz(a)anthracene	ca	1.07	2.01	0.00941	0.73	5.34
DP-1W	Benzo(a)pyrene	ca	1.24	2.15	0.101	5.98	110
DP-1W	Benzo(b)fluoranthene	ca	1.48	2.63	0.0123	0.697	15.7

Table E-5.3-11 (continued)

Subreach	Analyte	Risk Class ^a	Average ^b	95% UCL	Construction-Worker Ratio	Residential Ratio	Resource User Ratio
DP-1W	Indeno(1,2,3-cd)pyrene	ca	2.68	—	0.0126	0.586	36.4
DP-2	Americium-241	rad	3.38	4.58	0.0864	0.158	0.0139
DP-2	Cesium-137	rad	27.7	39.2	1.87	6.43	0.7
DP-2	Plutonium-239	rad	3.33	3.79	0.0677	0.118	0.0122
DP-2	Strontium-90	rad	4.5	6.09	0.00641	1.07	0.609
DP-3	Benz(a)anthracene	ca	0.136	—	0.000637	0.0494	0.362
DP-3	Benzo(a)pyrene	ca	0.14	—	0.00656	0.39	7.14
DP-3	Benzo(b)fluoranthene	ca	0.256	—	0.0012	0.0679	1.52
DP-3	Americium-241	rad	8.41	13.1	0.247	0.452	0.0397
DP-3	Cesium-137	rad	21.6	29.6	1.41	4.85	0.529
DP-3	Plutonium-239	rad	1.39	1.83	0.0327	0.0572	0.0059
DP-3	Strontium-90	rad	1.99	3.22	0.00339	0.565	0.322
DP-4	Americium-241	rad	1.27	2.22	0.0419	0.0766	0.00673
DP-4	Cesium-137	rad	9.18	12.3	0.586	2.02	0.22
DP-4	Plutonium-239	rad	0.897	1.36	0.0243	0.0425	0.00439
DP-4	Strontium-90	rad	1.58	2.07	0.00218	0.363	0.207
LA-2E	Aroclor-1260	ca	0.0392	0.051	0.000669	0.0562	0.312
LA-2E	Arsenic	ca	2.07	—	0.0159	28.3	4.38
LA-2E	Benzo(a)pyrene	ca	0.181	0.3	0.0141	0.835	15.3
LA-2E	Arsenic	nc	2.07	—	0.0243	1.53	0.19
LA-2E	Americium-241	rad	3.32	4.67	0.0881	0.161	0.0142
LA-2E	Cesium-137	rad	8.9	11	0.524	1.8	0.196
LA-2E	Strontium-90	rad	2.59	3.5	0.00368	0.614	0.35
LA-2FE	Cesium-137	rad	15.2	18.1	0.862	2.97	0.323
LA-2FE	Strontium-90	rad	2.35	2.81	0.00296	0.493	0.281
LA-2W	Cesium-137	rad	0.343	0.369	0.0176	0.0605	0.00659
LA-2W	Strontium-90	rad	1.55	3.39	0.00357	0.595	0.339
LA-3E	Cesium-137	rad	3.47	4.14	0.197	0.679	0.0739
LA-3E	Strontium-90	rad	0.749	1.25	0.00132	0.219	0.125
LA-3W	Cesium-137	rad	5.99	8.73	0.416	1.43	0.156
LA-3W	Strontium-90	rad	1.44	2.06	0.00217	0.361	0.206
P-1E	Aroclor-1254	ca	0.00521	—	0.0000683	0.00574	0.0318
P-1E	Benz(a)anthracene	ca	0.169	—	0.000792	0.0614	0.449
P-1E	Benzo(a)pyrene	ca	0.244	—	0.0114	0.679	12.5
P-1E	Benzo(b)fluoranthene	ca	0.319	—	0.00149	0.0846	1.9
P-1E	Dibenz(a,h)anthracene	ca	0.00394	—	0.000185	0.00849	0.578
P-1E	Aroclor-1254	nc	0.00521	—	0.0012	0.0054	0.0492
P-1E	Americium-241	rad	0.403	0.492	0.00928	0.017	0.00149
P-1E	Cesium-137	rad	0.433	0.438	0.0209	0.0718	0.00782
P-1E	Plutonium-239	rad	13.6	17.3	0.309	0.541	0.0558
P-1E	Strontium-90	rad	0.834	—	0.000878	0.146	0.0834

Table E-5.3-11 (continued)

Subreach	Analyte	Risk Class ^a	Average ^b	95% UCL	Construction-Worker Ratio	Residential Ratio	Resource User Ratio
P-1W	Arsenic	ca	1.73	1.85	0.0142	25.3	3.91
P-1W	Benzo(a)pyrene	ca	0.0697	0.0899	0.00421	0.25	4.59
P-1W	Arsenic	nc	1.73	1.85	0.0217	1.37	0.169
P-4W	Arsenic	ca	0.277	—	0.00213	3.78	0.586
P-4W	Benzo(a)pyrene	ca	0.255	—	0.0119	0.71	13
P-4W	Benzo(b)fluoranthene	ca	0.346	—	0.00162	0.0917	2.06
P-4W	Arsenic	nc	0.277	—	0.00325	0.205	0.0254

^a rad = Radionuclide; ca = carcinogen; nc = noncarcinogen.

^b Units: Organic and Inorganic chemicals, mg/kg; radionuclides, pCi/g.

^c — = UCL is not calculated because of limited data.

Table E-5.3-12
Resource-User Surface Water Exposure Pathways, COPC to RBC Ratio Sums

Location	Carcinogen Sums ^a	Noncarcinogen Sums	Radionuclide Sums ^b
00-10241	0.0305	0.00795	— ^c
21-01854	0.0285	0.0126	0.0168
21-10929	0.114	0.0058	—
21-11226	0.0885	0.0151	—
21-11269	—	—	0.0146
GU-10004	0.0641	0.00332	—
LA-00218	0.0652	0.00338	—
LA-00219	0.0523	0.0107	—
LA-02-20908	0.0541	0.00281	—
LA-02-20909	0.0374	0.002	—
LA-02-20913	0.0357	0.00185	—
LA-02-20914	0.0239	0.00561	—
LA-02-20915	0.0295	0.00644	—
LA-10005	0.0356	0.00627	—
LA-10006	—	0.00292	—
LA-10033	0.0153	0.00826	—
LA-10040	0.0417	0.0313	—
LA-10057	0.0793	0.00411	—
LA-10058	0.0224	0.00885	—
LA-10064	0.0788	0.0206	—
LA-10065	—	0.00743	—
LA-10126	—	—	—
LA-10179	0.0469	0.00243	—
PU-02-20920	0.152	0.022	—
PU-10068	0.0346	0.00551	—
PU-10069	0.0437	0.00719	—
PU-10070	0.0369	0.00191	—
PU-10071	0.062	0.0147	—
PU-10155	2.43	—	0.0126
PU-10175	0.0325	0.00223	0.0281
PU-10176	0.0183	0.000949	0.0183
PU-10229	0.0854	0.0115	—
PU-10230	0.187	0.0219	—
PU-10231	1.23	—	—

^a Convert to risk: Value x (1x10⁻⁵).

^b Convert to dose: Value x 4 mrem.

^c — = COPC class is not carried forward for this location from Section 6 of this report.

Table E-5.3-13
Residential Groundwater Exposure Pathways,
COPC to RBC Ratio Sums, Filtered and Unfiltered Samples

Field Preparation	Location	Carcinogen Sum ^a	Noncarcinogen Sum	Radionuclide Sum ^b
Filtered	02-01022	4.78	0.578	— ^c
Filtered	02-01076	9.9	1.2	—
Filtered	21-01811	45.8	7.75	4.52
Filtered	21-01812	69.8	13	5.06
Filtered	41-01002	1.88	0.228	—
Filtered	41-01003	5.79	0.7	—
Filtered	41-01004	6.08	0.735	—
Filtered	41-01045	3.61	15.6	—
Filtered	LA-00001	3.42	4.74	—
Filtered	LA-00002	5.5	8.39	—
Filtered	LA-00045	10.4	1.25	—
Filtered	LA-00046	4.25	0.514	—
Filtered	LA-00215	23.4	7.41	—
Filtered	LA-10008	—	5.41	—
Filtered	LA-10035	12.2	44.4	1.1
Filtered	LA-10066	8.92	1.08	—
Filtered	LA-10067	—	39.5	—
Filtered	LA-10068	7.17	14.6	—
Filtered	LA-10069	3.66	3.73	—
Filtered	PU-00177	25.5	13.8	—
Filtered	PU-00178	4.25	6.05	—
Filtered	PU-00181	7.7	0.931	—
Filtered	PU-00182	18.6	15.7	—
Filtered	PU-10228	17.3	5.65	—
Unfiltered	02-01022	4.51	0.546	—
Unfiltered	02-01076	10.2	1.24	—
Unfiltered	21-01811	8.57	1.04	5.33
Unfiltered	21-01812	21.2	7.24	2.75
Unfiltered	41-01002	2.97	0.36	—
Unfiltered	41-01003	3.08	0.372	—
Unfiltered	41-01004	6.4	0.774	—
Unfiltered	41-01045	1.17	0.141	—
Unfiltered	LA-00001	7.62	7.13	—
Unfiltered	LA-00002	5.47	8.55	—
Unfiltered	LA-00045	9.29	1.12	—
Unfiltered	LA-00046	4.78	0.578	—

Table E-5.3-13 (continued)

Field Preparation	Location	Carcinogen Sum ^a	Noncarcinogen Sum	Radionuclide Sum ^b
Unfiltered	LA-00215	19.6	8.56	—
Unfiltered	LA-10008	—	—	—
Unfiltered	LA-10035	13.1	40.7	1.26
Unfiltered	LA-10066	10	1.21	—
Unfiltered	LA-10067	—	38.5	—
Unfiltered	LA-10068	8.39	15.2	—
Unfiltered	LA-10069	3.5	0.424	—
Unfiltered	PU-00177	25.6	7.06	—
Unfiltered	PU-00178	12.2	4.87	—
Unfiltered	PU-00181	6.37	0.77	—
Unfiltered	PU-00182	19.7	6.89	—
Unfiltered	PU-10228	19	5.21	—

^a Convert to risk: Value x (1×10^{-5}) .

^b Convert to dose: Value x 4 mrem.

^c — = COPC class is not carried forward for this location from Section 6 of this report.

Table E-5.3-14
Residential Groundwater Exposure Pathways
Without Arsenic, COPC to RBC Ratio Sums, Filtered and Unfiltered Samples

Field Preparation	Location	Noncarcinogen Sum	Radionuclide Sum ^a
Filtered	21-01811	1.12	4.52
Filtered	21-01812	2.71	5.06
Filtered	41-01045	15.2	— ^b
Filtered	LA-00001	4.33	—
Filtered	LA-00002	7.72	—
Filtered	LA-00215	4.58	—
Filtered	LA-10008	5.41	—
Filtered	LA-10035	43	1.1
Filtered	LA-10067	39.5	—
Filtered	LA-10068	13.8	—
Filtered	LA-10069	3.29	—
Filtered	PU-00177	10.7	—
Filtered	PU-00178	5.53	—
Filtered	PU-00182	13.4	—
Filtered	PU-10228	3.56	—
Unfiltered	21-01811	—	5.33
Unfiltered	21-01812	4.67	2.75
Unfiltered	41-01045	—	—
Unfiltered	LA-00001	6.21	—
Unfiltered	LA-00002	7.89	—
Unfiltered	LA-00215	6.19	—
Unfiltered	LA-10008	—	—
Unfiltered	LA-10035	39.1	1.26
Unfiltered	LA-10067	38.5	—
Unfiltered	LA-10068	14.2	—
Unfiltered	LA-10069	—	—
Unfiltered	PU-00177	3.96	—
Unfiltered	PU-00178	4.46	—
Unfiltered	PU-00182	4.51	—
Unfiltered	PU-10228	2.91	—

^a Convert to dose: Value x 4 mrem.

^b — = COPC class is not carried forward for this location from Section 6 of this report.

Table E-5.3-15
Surface Water Ratios of EPCs to RBCs

Location	Name	Canyon	Class ^a	Analyte	Units	Number of Samples	EPC ^b	Trail User RBC Ratio	Extended Backyard RBC Ratio
00-10241	Reach AC-2 SW	Acid	ca	Arsenic	µg/L	2	3	0.0305	0.0495
00-10241	Reach AC-2 SW	Acid	nc	Arsenic	µg/L	2	3	0.00158	0.00624
00-10241	Reach AC-2 SW	Acid	nc	Iron	µg/L	2	1200	0.000633	0.0025
00-10241	Reach AC-2 SW	Acid	nc	Thallium	µg/L	2	2.9	0.00574	0.0226
21-01854	DP Spring	DP	ca	Arsenic	µg/L	5	2.8	0.0285	0.0462
21-01854	DP Spring	DP	nc	Arsenic	µg/L	5	2.8	0.00148	0.00583
21-01854	DP Spring	DP	nc	Fluoride	µg/L	1	1100	0.0029	0.0114
21-01854	DP Spring	DP	nc	Iron	µg/L	5	1300	0.000686	0.0027
21-01854	DP Spring	DP	nc	Thallium	µg/L	5	3.8	0.00752	0.0296
21-01854	DP Spring	DP	rad	Strontium-90	pCi/L	5	110	0.0168	0.0295
21-10929	Reach DP-1W SW	DP	ca	Arsenic	µg/L	4	11	0.112	0.182
21-10929	Reach DP-1W SW	DP	ca	BHC[beta-]	µg/L	4	0.1	0.00208	0.00256
21-10929	Reach DP-1W SW	DP	nc	Arsenic	µg/L	4	11	0.0058	0.0229
21-11226	Reach DP-1C SW	DP	ca	Arsenic	µg/L	4	8.7	0.0885	0.144
21-11226	Reach DP-1C SW	DP	nc	Aluminum	µg/L	4	6610	0.00105	0.00413
21-11226	Reach DP-1C SW	DP	nc	Antimony	µg/L	4	2.15	0.000901	0.00352
21-11226	Reach DP-1C SW	DP	nc	Arsenic	µg/L	4	8.7	0.00459	0.0181
21-11226	Reach DP-1C SW	DP	nc	Iron	µg/L	4	4480	0.00236	0.00932
21-11226	Reach DP-1C SW	DP	nc	Manganese	µg/L	4	280	0.000396	0.00151
21-11226	Reach DP-1C SW	DP	nc	Thallium	µg/L	4	2.9	0.00574	0.0226
21-11226	Reach DP-1C SW	DP	nc	Uranium	µg/L	4	1.15	0.0000607	0.000239
21-11269	Reach DP-2 SW	DP	rad	Strontium-90	pCi/L	1	95.2	0.0146	0.0255
GU-10004	Guaje at LA confluence	Guaje	ca	Arsenic	µg/L	2	6.3	0.0641	0.104
GU-10004	Guaje at LA confluence	Guaje	nc	Arsenic	µg/L	2	6.3	0.00332	0.0131
LA-00218	Reach LA-4 SW	Los Alamos	ca	Arsenic	µg/L	8	6.41	0.0652	0.106
LA-00218	Reach LA-4 SW	Los Alamos	nc	Arsenic	µg/L	8	6.41	0.00338	0.0133
LA-00219	Basalt Spring	Los Alamos	ca	Arsenic	µg/L	8	5.14	0.0523	0.0849
LA-00219	Basalt Spring	Los Alamos	nc	Antimony	µg/L	8	3	0.00126	0.00492
LA-00219	Basalt Spring	Los Alamos	nc	Arsenic	µg/L	8	5.14	0.00271	0.0107
LA-00219	Basalt Spring	Los Alamos	nc	Thallium	µg/L	8	3.4	0.00672	0.0265

Table E-5.3-15 (continued)

Location	Name	Canyon	Class ^a	Analyte	Units	Number of Samples	EPC ^b	Trail User RBC Ratio	Extended Backyard RBC Ratio
LA-00219	Basalt Spring	Los Alamos	nc	Uranium	µg/L	3	1.05	0.0000552	0.000218
LA-02-20908	Eco	Los Alamos	ca	Arsenic	µg/L	1	5.32	0.0541	0.0878
LA-02-20908	Eco	Los Alamos	nc	Arsenic	µg/L	1	5.32	0.00281	0.0111
LA-02-20909	Eco	Los Alamos	ca	Arsenic	µg/L	1	3.61	0.0367	0.0596
LA-02-20909	Eco	Los Alamos	ca	DDT[4,4'-]	µg/L	1	0.32	0.00073	0.00119
LA-02-20909	Eco	Los Alamos	nc	Arsenic	µg/L	1	3.61	0.0019	0.00751
LA-02-20909	Eco	Los Alamos	nc	DDT[4,4'-]	µg/L	1	0.32	0.0001	0.000396
LA-02-20913	Eco	DP	ca	Arsenic	µg/L	1	3.51	0.0357	0.0579
LA-02-20913	Eco	DP	nc	Arsenic	µg/L	1	3.51	0.00185	0.0073
LA-02-20914	Eco	Los Alamos	ca	Arsenic	µg/L	1	2.27	0.0231	0.0375
LA-02-20914	Eco	Los Alamos	ca	DDT[4,4'-]	µg/L	1	0.34	0.000776	0.00127
LA-02-20914	Eco	Los Alamos	nc	Arsenic	µg/L	1	2.27	0.0012	0.00472
LA-02-20914	Eco	Los Alamos	nc	DDT[4,4'-]	µg/L	1	0.34	0.000106	0.000421
LA-02-20914	Eco	Los Alamos	nc	Iron	µg/L	1	2170	0.00114	0.00452
LA-02-20914	Eco	Los Alamos	nc	Manganese	µg/L	1	1640	0.00232	0.00887
LA-02-20914	Eco	Los Alamos	nc	Thallium	µg/L	1	0.422	0.000835	0.00329
LA-02-20915	Eco	Los Alamos	ca	Arsenic	µg/L	1	2.9	0.0295	0.0479
LA-02-20915	Eco	Los Alamos	nc	Aluminum	µg/L	1	4910	0.000777	0.00306
LA-02-20915	Eco	Los Alamos	nc	Arsenic	µg/L	1	2.9	0.00153	0.00603
LA-02-20915	Eco	Los Alamos	nc	Iron	µg/L	1	3300	0.00174	0.00687
LA-02-20915	Eco	Los Alamos	nc	Manganese	µg/L	1	1270	0.0018	0.00687
LA-02-20915	Eco	Los Alamos	nc	Thallium	µg/L	1	0.302	0.000597	0.00236
LA-10005	SW at LAO-0.6	Los Alamos	ca	Arsenic	µg/L	3	3.5	0.0356	0.0578
LA-10005	SW at LAO-0.6	Los Alamos	nc	Arsenic	µg/L	3	3.5	0.00185	0.00728
LA-10005	SW at LAO-0.6	Los Alamos	nc	Iron	µg/L	3	1400	0.000738	0.00291
LA-10005	SW at LAO-0.6	Los Alamos	nc	Manganese	µg/L	3	2600	0.00368	0.0141
LA-10006	Upper Reach LA-0 SW	Los Alamos	nc	Iron	µg/L	2	1500	0.000791	0.00312
LA-10006	Upper Reach LA-0 SW	Los Alamos	nc	Manganese	µg/L	2	1500	0.00212	0.00812
LA-10033	LA Reservoir	Los Alamos	ca	Arsenic	µg/L	2	1.5	0.0153	0.0248
LA-10033	LA Reservoir	Los Alamos	nc	Arsenic	µg/L	2	1.5	0.000791	0.00312
LA-10033	LA Reservoir	Los Alamos	nc	Manganese	µg/L	2	4600	0.00651	0.0249

Table E-5.3-15 (continued)

Location	Name	Canyon	Class ^a	Analyte	Units	Number of Samples	EPC ^b	Trail User RBC Ratio	Extended Backyard RBC Ratio
LA-10033	LA Reservoir	Los Alamos	nc	Thallium	µg/L	2	0.482	0.000953	0.00376
LA-10040	At E026	Los Alamos	ca	Arsenic	µg/L	1	4.1	0.0417	0.0677
LA-10040	At E026	Los Alamos	nc	Aluminum	µg/L	1	42800	0.00677	0.0267
LA-10040	At E026	Los Alamos	nc	Arsenic	µg/L	1	4.1	0.00216	0.00853
LA-10040	At E026	Los Alamos	nc	Barium	µg/L	1	467	0.0012	0.00466
LA-10040	At E026	Los Alamos	nc	Chromium	µg/L	1	18.8	0.00028	0.00103
LA-10040	At E026	Los Alamos	nc	Iron	µg/L	1	24200	0.0128	0.0504
LA-10040	At E026	Los Alamos	nc	Manganese	µg/L	1	2130	0.00302	0.0115
LA-10040	At E026	Los Alamos	nc	Thallium	µg/L	1	2.6	0.00514	0.0203
LA-10057	Upper Reach LA-5 SW	Los Alamos	ca	Arsenic	µg/L	2	7.8	0.0793	0.129
LA-10057	Upper Reach LA-5 SW	Los Alamos	nc	Arsenic	µg/L	2	7.8	0.00411	0.0162
LA-10058	Lower Reach LA-5 SW (at delta)	Los Alamos	ca	Arsenic	µg/L	1	2.2	0.0224	0.0363
LA-10058	Lower Reach LA-5 SW (at delta)	Los Alamos	nc	Arsenic	µg/L	1	2.2	0.00116	0.00458
LA-10058	Lower Reach LA-5 SW (at delta)	Los Alamos	nc	Iron	µg/L	1	1700	0.000897	0.00354
LA-10058	Lower Reach LA-5 SW (at delta)	Los Alamos	nc	Manganese	µg/L	1	330	0.000467	0.00179
LA-10058	Lower Reach LA-5 SW (at delta)	Los Alamos	nc	Perchlorate	µg/L	1	4	0.00633	0.025
LA-10064	Reach LA-1W SW	Los Alamos	ca	Arsenic	µg/L	3	7.75	0.0788	0.128
LA-10064	Reach LA-1W SW	Los Alamos	nc	Aluminum	µg/L	3	27800	0.0044	0.0174
LA-10064	Reach LA-1W SW	Los Alamos	nc	Arsenic	µg/L	3	7.75	0.00409	0.0161
LA-10064	Reach LA-1W SW	Los Alamos	nc	Barium	µg/L	3	381	0.000982	0.0038
LA-10064	Reach LA-1W SW	Los Alamos	nc	Chromium	µg/L	3	18.1	0.000269	0.000994
LA-10064	Reach LA-1W SW	Los Alamos	nc	Iron	µg/L	3	14300	0.00754	0.0298
LA-10064	Reach LA-1W SW	Los Alamos	nc	Manganese	µg/L	3	1590	0.00225	0.0086
LA-10064	Reach LA-1W SW	Los Alamos	nc	Thallium	µg/L	3	0.42	0.000831	0.00328
LA-10064	Reach LA-1W SW	Los Alamos	nc	Uranium	µg/L	3	4.17	0.00022	0.000868
LA-10065	Reach LA-1C SW	Los Alamos	nc	Aluminum	µg/L	3	15000	0.00237	0.00936
LA-10065	Reach LA-1C SW	Los Alamos	nc	Iron	µg/L	3	7290	0.00384	0.0152
LA-10065	Reach LA-1C SW	Los Alamos	nc	Manganese	µg/L	3	728	0.00103	0.00394
LA-10065	Reach LA-1C SW	Los Alamos	nc	Uranium	µg/L	3	3.44	0.000182	0.000716
LA-10179	Otowi Spring	Los Alamos	ca	Arsenic	µg/L	1	4.61	0.0469	0.0761
LA-10179	Otowi Spring	Los Alamos	nc	Arsenic	µg/L	1	4.61	0.00243	0.00959

Table E-5.3-15 (continued)

Location	Name	Canyon	Class ^a	Analyte	Units	Number of Samples	EPC ^b	Trail User RBC Ratio	Extended Backyard RBC Ratio
PU-02-20920	Eco	Pueblo	ca	Arsenic	µg/L	1	14.9	0.152	0.246
PU-02-20920	Eco	Pueblo	nc	Arsenic	µg/L	1	14.9	0.00786	0.031
PU-02-20920	Eco	Pueblo	nc	Barium	µg/L	1	391	0.00101	0.0039
PU-02-20920	Eco	Pueblo	nc	Iron	µg/L	1	14100	0.00744	0.0293
PU-02-20920	Eco	Pueblo	nc	Manganese	µg/L	1	4010	0.00568	0.0217
PU-10068	Reach P-1 Far West SW	Pueblo	ca	Arsenic	µg/L	4	3.4	0.0346	0.0561
PU-10068	Reach P-1 Far West SW	Pueblo	nc	Arsenic	µg/L	4	3.4	0.00179	0.00707
PU-10068	Reach P-1 Far West SW	Pueblo	nc	Iron	µg/L	4	2800	0.00148	0.00583
PU-10068	Reach P-1 Far West SW	Pueblo	nc	Manganese	µg/L	4	1580	0.00224	0.00855
PU-10069	Upper Reach P-1W SW	Pueblo	ca	Arsenic	µg/L	4	4.3	0.0437	0.071
PU-10069	Upper Reach P-1W SW	Pueblo	nc	Antimony	µg/L	4	3	0.00126	0.00492
PU-10069	Upper Reach P-1W SW	Pueblo	nc	Arsenic	µg/L	4	4.3	0.00227	0.00895
PU-10069	Upper Reach P-1W SW	Pueblo	nc	Manganese	µg/L	4	2590	0.00367	0.014
PU-10070	Lower Reach P-1W SW	Pueblo	ca	Arsenic	µg/L	6	3.63	0.0369	0.0599
PU-10070	Lower Reach P-1W SW	Pueblo	nc	Arsenic	µg/L	6	3.63	0.00191	0.00755
PU-10071	Upper Reach P-1E SW	Pueblo	ca	Arsenic	µg/L	4	6.1	0.062	0.101
PU-10071	Upper Reach P-1E SW	Pueblo	nc	Arsenic	µg/L	4	6.1	0.00322	0.0127
PU-10071	Upper Reach P-1E SW	Pueblo	nc	Iron	µg/L	4	5200	0.00274	0.0108
PU-10071	Upper Reach P-1E SW	Pueblo	nc	Manganese	µg/L	4	6200	0.00878	0.0335
PU-10155	Lower Reach AC-3 SW (near Acid Weir)	Acid	ca	Benzo(a)anthracene	µg/L	4	0.65	0.0659	0.047
PU-10155	Lower Reach AC-3 SW (near Acid Weir)	Acid	ca	Benzo(a)pyrene	µg/L	4	0.63	1.07	0.745
PU-10155	Lower Reach AC-3 SW (near Acid Weir)	Acid	ca	Benzo(b)fluoranthene	µg/L	4	0.49	0.0847	0.0587
PU-10155	Lower Reach AC-3 SW (near Acid Weir)	Acid	ca	Dibenz(a,h)anthracene	µg/L	4	0.43	1.12	0.766
PU-10155	Lower Reach AC-3 SW (near Acid Weir)	Acid	ca	Indeno(1,2,3-cd)pyrene	µg/L	4	0.47	0.0813	0.0564
PU-10155	Lower Reach AC-3 SW (near Acid Weir)	Acid	rad	Americium-241	pCi/L	4	0.134	0.000488	0.000854
PU-10155	Lower Reach AC-3 SW (near Acid Weir)	Acid	rad	Plutonium-239	pCi/L	4	2.58	0.00913	0.016

Table E-5.3-15 (continued)

Location	Name	Canyon	Class ^a	Analyte	Units	Number of Samples	EPC ^b	Trail User RBC Ratio	Extended Backyard RBC Ratio
PU-10155	Lower Reach AC-3 SW (near Acid Weir)	Acid	rad	Strontium-90	pCi/L	4	19.2	0.00294	0.00514
PU-10175	Upper S. Fork Acid Canyon SW	Acid	ca	Arsenic	µg/L	2	3.2	0.0325	0.0528
PU-10175	Upper S. Fork Acid Canyon SW	Acid	nc	Arsenic	µg/L	2	3.2	0.00169	0.00666
PU-10175	Upper S. Fork Acid Canyon SW	Acid	nc	Uranium	µg/L	2	10.3	0.000541	0.00214
PU-10175	Upper S. Fork Acid Canyon SW	Acid	rad	Plutonium-239	pCi/L	2	7.11	0.0252	0.044
PU-10175	Upper S. Fork Acid Canyon SW	Acid	rad	Uranium-234	pCi/L	2	7.3	0.00207	0.00362
PU-10175	Upper S. Fork Acid Canyon SW	Acid	rad	Uranium-238	pCi/L	2	3.4	0.000915	0.0016
PU-10176	Lower S. Fork Acid Canyon SW	Acid	ca	Arsenic	µg/L	2	1.8	0.0183	0.0297
PU-10176	Lower S. Fork Acid Canyon SW	Acid	nc	Arsenic	µg/L	2	1.8	0.000949	0.00375
PU-10176	Lower S. Fork Acid Canyon SW	Acid	rad	Plutonium-239	pCi/L	2	5.17	0.0183	0.032
PU-10229	Pueblo at SR-502	Pueblo	ca	Arsenic	µg/L	4	8.4	0.0854	0.139
PU-10229	Pueblo at SR-502	Pueblo	nc	Aluminum	µg/L	4	4000	0.000633	0.0025
PU-10229	Pueblo at SR-502	Pueblo	nc	Arsenic	µg/L	4	8.4	0.00443	0.0175
PU-10229	Pueblo at SR-502	Pueblo	nc	Boron	µg/L	2	384	0.000675	0.00266
PU-10229	Pueblo at SR-502	Pueblo	nc	Iron	µg/L	4	5990	0.00316	0.0125
PU-10229	Pueblo at SR-502	Pueblo	nc	Manganese	µg/L	4	1760	0.00249	0.00952
PU-10229	Pueblo at SR-502	Pueblo	nc	Uranium	µg/L	3	2.62	0.000138	0.000544
PU-10230	Pueblo 3	Pueblo	ca	Arsenic	µg/L	4	10.4	0.106	0.172
PU-10230	Pueblo 3	Pueblo	ca	Bis(2-ethylhexyl)phthalate	µg/L	4	6.8	0.0814	0.0548
PU-10230	Pueblo 3	Pueblo	nc	Arsenic	µg/L	4	10.4	0.00549	0.0216
PU-10230	Pueblo 3	Pueblo	nc	Bis(2-ethylhexyl)phthalate	µg/L	4	6.8	0.00678	0.0226
PU-10230	Pueblo 3	Pueblo	nc	Boron	µg/L	2	347	0.00061	0.00241
PU-10230	Pueblo 3	Pueblo	nc	Iron	µg/L	4	2550	0.00134	0.00531
PU-10230	Pueblo 3	Pueblo	nc	Manganese	µg/L	4	1240	0.00176	0.00671
PU-10230	Pueblo 3	Pueblo	nc	Thallium	µg/L	4	3	0.00593	0.0234
PU-10231	Pueblo 2	Pueblo	ca	Benzo(a)anthracene	µg/L	1	0.79	0.0801	0.0571
PU-10231	Pueblo 2	Pueblo	ca	Benzo(a)pyrene	µg/L	1	0.56	0.954	0.662
PU-10231	Pueblo 2	Pueblo	ca	Benzo(b)fluoranthene	µg/L	1	0.58	0.1	0.0695
PU-10231	Pueblo 2	Pueblo	ca	Indeno(1,2,3-cd)pyrene	µg/L	1	0.57	0.0987	0.0684

^a rad = Radionuclide; ca = carcinogen; nc = noncarcinogen.

^b The maximum detected value is used as the EPC when the data are insufficient to calculate UCLs.

Table E-5.3-16
Groundwater Ratios of EPCs to RBCs

Field Preparation	Location	Name	Canyon	Risk Class ^a	Analyte	Units	Number of Samples	EPC ^b	Residential RBC Ratio
Filtered	02-01022	LAO-0.91	Los Alamos	ca	Arsenic	µg/L	1	1.8	4.78
Filtered	02-01022	LAO-0.91	Los Alamos	nc	Arsenic	µg/L	1	1.8	0.578
Filtered	02-01076	LAO-1	Los Alamos	ca	Arsenic	µg/L	3	3.73	9.9
Filtered	02-01076	LAO-1	Los Alamos	nc	Arsenic	µg/L	3	3.73	1.2
Filtered	21-01811	LAUZ-1	DP	ca	Arsenic	µg/L	8	3.18	8.44
Filtered	21-01811	LAUZ-1	DP	ca	Bis(2-ethylhexyl)phthalate	µg/L	1	22	37.3
Filtered	21-01811	LAUZ-1	DP	nc	Arsenic	µg/L	8	3.18	1.02
Filtered	21-01811	LAUZ-1	DP	nc	Bis(2-ethylhexyl)phthalate	µg/L	1	22	5.62
Filtered	21-01811	LAUZ-1	DP	nc	Fluoride	µg/L	6	696	1.12
Filtered	21-01811	LAUZ-1	DP	rad	Strontium-90	pCi/L	9	169	4.52
Filtered	21-01812	LAUZ-2	DP	ca	Arsenic	µg/L	4	3.3	8.76
Filtered	21-01812	LAUZ-2	DP	ca	Bis(2-ethylhexyl)phthalate	µg/L	1	36	61.1
Filtered	21-01812	LAUZ-2	DP	nc	Arsenic	µg/L	4	3.3	1.06
Filtered	21-01812	LAUZ-2	DP	nc	Bis(2-ethylhexyl)phthalate	µg/L	1	36	9.19
Filtered	21-01812	LAUZ-2	DP	nc	Fluoride	µg/L	1	1300	2.09
Filtered	21-01812	LAUZ-2	DP	nc	Manganese	µg/L	4	818	0.622
Filtered	21-01812	LAUZ-2	DP	rad	Strontium-90	pCi/L	4	189	5.06
Filtered	41-01002	LAO-0.6	Los Alamos	ca	Arsenic	µg/L	4	0.71	1.88
Filtered	41-01002	LAO-0.6	Los Alamos	nc	Arsenic	µg/L	4	0.71	0.228
Filtered	41-01003	LAO-0.3	Los Alamos	ca	Arsenic	µg/L	8	2.18	5.79
Filtered	41-01003	LAO-0.3	Los Alamos	nc	Arsenic	µg/L	8	2.18	0.7
Filtered	41-01004	LAO-C	Los Alamos	ca	Arsenic	µg/L	4	2.29	6.08
Filtered	41-01004	LAO-C	Los Alamos	nc	Arsenic	µg/L	4	2.29	0.735
Filtered	41-01045	LAO-B	Los Alamos	ca	Arsenic	µg/L	11	1.36	3.61
Filtered	41-01045	LAO-B	Los Alamos	nc	Arsenic	µg/L	11	1.36	0.437
Filtered	41-01045	LAO-B	Los Alamos	nc	Perchlorate	µg/L	8	15.3	14.7
Filtered	41-01045	LAO-B	Los Alamos	nc	Thallium	µg/L	11	0.373	0.449
Filtered	LA-00001	LAO-1.6g	Los Alamos	ca	Arsenic	µg/L	8	1.29	3.42
Filtered	LA-00001	LAO-1.6g	Los Alamos	nc	Arsenic	µg/L	8	1.29	0.414
Filtered	LA-00001	LAO-1.6g	Los Alamos	nc	Fluoride	µg/L	5	541	0.868

Table E-5.3-16 (continued)

Field Preparation	Location	Name	Canyon	Risk Class ^a	Analyte	Units	Number of Samples	EPC ^b	Residential RBC Ratio
Filtered	LA-00001	LAO-1.6g	Los Alamos	nc	Molybdenum	µg/L	3	140	2.7
Filtered	LA-00001	LAO-1.6g	Los Alamos	nc	Thallium	µg/L	8	0.636	0.766
Filtered	LA-00002	LLAO-5	Los Alamos	ca	Arsenic	µg/L	9	2.07	5.5
Filtered	LA-00002	LLAO-5	Los Alamos	nc	Arsenic	µg/L	9	2.07	0.665
Filtered	LA-00002	LLAO-5	Los Alamos	nc	Barium	µg/L	9	287	0.418
Filtered	LA-00002	LLAO-5	Los Alamos	nc	Fluoride	µg/L	7	393	0.631
Filtered	LA-00002	LLAO-5	Los Alamos	nc	Nitrite	µg/L	1	3990	3.84
Filtered	LA-00002	LLAO-5	Los Alamos	nc	Thallium	µg/L	9	2.1	2.53
Filtered	LA-00002	LLAO-5	Los Alamos	nc	Uranium	µg/L	6	9.4	0.302
Filtered	LA-00045	LLAO-2	Los Alamos	ca	Arsenic	µg/L	1	3.9	10.4
Filtered	LA-00045	LLAO-2	Los Alamos	nc	Arsenic	µg/L	1	3.9	1.25
Filtered	LA-00046	LLAO-4	Los Alamos	ca	Arsenic	µg/L	5	1.6	4.25
Filtered	LA-00046	LLAO-4	Los Alamos	nc	Arsenic	µg/L	5	1.6	0.514
Filtered	LA-00215	LLAO-1	Los Alamos	ca	Arsenic	µg/L	9	8.81	23.4
Filtered	LA-00215	LLAO-1	Los Alamos	nc	Arsenic	µg/L	9	8.81	2.83
Filtered	LA-00215	LLAO-1	Los Alamos	nc	Fluoride	µg/L	7	610	0.979
Filtered	LA-00215	LLAO-1	Los Alamos	nc	Nitrate	µg/L	1	7400	0.445
Filtered	LA-00215	LLAO-1	Los Alamos	nc	Thallium	µg/L	9	2.59	3.12
Filtered	LA-00215	LLAO-1	Los Alamos	nc	Uranium	µg/L	6	0.907	0.0291
Filtered	LA-10008	LAO-1.2	Los Alamos	nc	Chromium	µg/L	1	16	0.11
Filtered	LA-10008	LAO-1.2	Los Alamos	nc	Thallium	µg/L	1	4.4	5.3
Filtered	LA-10035	LAO-3a	Los Alamos	ca	Arsenic	µg/L	4	4.61	12.2
Filtered	LA-10035	LAO-3a	Los Alamos	nc	Arsenic	µg/L	4	4.61	1.48
Filtered	LA-10035	LAO-3a	Los Alamos	nc	Fluoride	µg/L	4	653	1.05
Filtered	LA-10035	LAO-3a	Los Alamos	nc	Molybdenum	µg/L	3	1970	37.9
Filtered	LA-10035	LAO-3a	Los Alamos	nc	Thallium	µg/L	4	3.3	3.97
Filtered	LA-10035	LAO-3a	Los Alamos	rad	Strontium-90	pCi/L	4	40.9	1.1
Filtered	LA-10066	LAO-0.7	Los Alamos	ca	Arsenic	µg/L	4	3.36	8.92
Filtered	LA-10066	LAO-0.7	Los Alamos	nc	Arsenic	µg/L	4	3.36	1.08
Filtered	LA-10067	LAO-2	Los Alamos	nc	Fluoride	µg/L	3	600	0.963
Filtered	LA-10067	LAO-2	Los Alamos	nc	Molybdenum	µg/L	2	2000	38.5
Filtered	LA-10068	LAO-4	Los Alamos	ca	Arsenic	µg/L	3	2.7	7.17

Table E-5.3-16 (continued)

Field Preparation	Location	Name	Canyon	Risk Class ^a	Analyte	Units	Number of Samples	EPC ^b	Residential RBC Ratio
Filtered	LA-10068	LAO-4	Los Alamos	nc	Arsenic	µg/L	3	2.7	0.867
Filtered	LA-10068	LAO-4	Los Alamos	nc	Fluoride	µg/L	3	1600	2.57
Filtered	LA-10068	LAO-4	Los Alamos	nc	Molybdenum	µg/L	3	582	11.2
Filtered	LA-10069	LAO-4.5c	Los Alamos	ca	Arsenic	µg/L	3	1.38	3.66
Filtered	LA-10069	LAO-4.5c	Los Alamos	nc	Arsenic	µg/L	3	1.38	0.443
Filtered	LA-10069	LAO-4.5c	Los Alamos	nc	Fluoride	µg/L	4	1600	2.57
Filtered	LA-10069	LAO-4.5c	Los Alamos	nc	Molybdenum	µg/L	3	32.8	0.632
Filtered	LA-10069	LAO-4.5c	Los Alamos	nc	Uranium	µg/L	2	2.84	0.0913
Filtered	PU-00177	PAO-5N	Pueblo	ca	Arsenic	µg/L	6	9.6	25.5
Filtered	PU-00177	PAO-5N	Pueblo	nc	Arsenic	µg/L	6	9.6	3.08
Filtered	PU-00177	PAO-5N	Pueblo	nc	Boron	µg/L	1	379	0.406
Filtered	PU-00177	PAO-5N	Pueblo	nc	Fluoride	µg/L	3	560	0.899
Filtered	PU-00177	PAO-5N	Pueblo	nc	Iron	µg/L	6	1650	0.53
Filtered	PU-00177	PAO-5N	Pueblo	nc	Manganese	µg/L	6	3620	2.75
Filtered	PU-00177	PAO-5N	Pueblo	nc	Nitrate	µg/L	1	3100	0.187
Filtered	PU-00177	PAO-5N	Pueblo	nc	Perchlorate	µg/L	4	6.18	5.95
Filtered	PU-00178	PAO-1	Pueblo	ca	Arsenic	µg/L	8	1.6	4.25
Filtered	PU-00178	PAO-1	Pueblo	nc	Antimony	µg/L	8	4	0.987
Filtered	PU-00178	PAO-1	Pueblo	nc	Arsenic	µg/L	8	1.6	0.514
Filtered	PU-00178	PAO-1	Pueblo	nc	Manganese	µg/L	8	1230	0.935
Filtered	PU-00178	PAO-1	Pueblo	nc	Thallium	µg/L	8	3	3.61
Filtered	PU-00181	PAO-3	Pueblo	ca	Arsenic	µg/L	1	2.9	7.7
Filtered	PU-00181	PAO-3	Pueblo	nc	Arsenic	µg/L	1	2.9	0.931
Filtered	PU-00182	PAO-4	Pueblo	ca	Arsenic	µg/L	9	6.99	18.6
Filtered	PU-00182	PAO-4	Pueblo	nc	Arsenic	µg/L	9	6.99	2.24
Filtered	PU-00182	PAO-4	Pueblo	nc	Boron	µg/L	3	383	0.41
Filtered	PU-00182	PAO-4	Pueblo	nc	Fluoride	µg/L	6	664	1.07
Filtered	PU-00182	PAO-4	Pueblo	nc	Iron	µg/L	9	3370	1.08
Filtered	PU-00182	PAO-4	Pueblo	nc	Manganese	µg/L	9	1780	1.35
Filtered	PU-00182	PAO-4	Pueblo	nc	Perchlorate	µg/L	7	5.74	5.53
Filtered	PU-00182	PAO-4	Pueblo	nc	Thallium	µg/L	9	3.3	3.97
Filtered	PU-10228	APCO-1	Pueblo	ca	Arsenic	µg/L	3	6.51	17.3

Table E-5.3-16 (continued)

Field Preparation	Location	Name	Canyon	Risk Class ^a	Analyte	Units	Number of Samples	EPC ^b	Residential RBC Ratio
Filtered	PU-10228	APCO-1	Pueblo	nc	Arsenic	µg/L	3	6.51	2.09
Filtered	PU-10228	APCO-1	Pueblo	nc	Boron	µg/L	2	375	0.401
Filtered	PU-10228	APCO-1	Pueblo	nc	Fluoride	µg/L	3	450	0.722
Filtered	PU-10228	APCO-1	Pueblo	nc	Iron	µg/L	3	1580	0.507
Filtered	PU-10228	APCO-1	Pueblo	nc	Manganese	µg/L	3	2540	1.93
Unfiltered	02-01022	LAO-0.91	Los Alamos	ca	Arsenic	µg/L	1	1.7	4.51
Unfiltered	02-01022	LAO-0.91	Los Alamos	nc	Arsenic	µg/L	1	1.7	0.546
Unfiltered	02-01076	LAO-1	Los Alamos	ca	Arsenic	µg/L	3	3.85	10.2
Unfiltered	02-01076	LAO-1	Los Alamos	nc	Arsenic	µg/L	3	3.85	1.24
Unfiltered	21-01811	LAUZ-1	DP	ca	Arsenic	µg/L	8	3.23	8.57
Unfiltered	21-01811	LAUZ-1	DP	nc	Arsenic	µg/L	8	3.23	1.04
Unfiltered	21-01811	LAUZ-1	DP	rad	Americium-241	pCi/L	8	1.43	0.911
Unfiltered	21-01811	LAUZ-1	DP	rad	Plutonium-239	pCi/L	9	0.817	0.506
Unfiltered	21-01811	LAUZ-1	DP	rad	Strontium-90	pCi/L	9	146	3.91
Unfiltered	21-01812	LAUZ-2	DP	ca	Arsenic	µg/L	4	8	21.2
Unfiltered	21-01812	LAUZ-2	DP	nc	Arsenic	µg/L	4	8	2.57
Unfiltered	21-01812	LAUZ-2	DP	nc	Fluoride	µg/L	1	1300	2.09
Unfiltered	21-01812	LAUZ-2	DP	nc	Iron	µg/L	4	6000	1.93
Unfiltered	21-01812	LAUZ-2	DP	nc	Manganese	µg/L	4	870	0.661
Unfiltered	21-01812	LAUZ-2	DP	rad	Plutonium-239	pCi/L	4	0.16	0.0991
Unfiltered	21-01812	LAUZ-2	DP	rad	Strontium-90	pCi/L	4	98.9	2.65
Unfiltered	41-01002	LAO-0.6	Los Alamos	ca	Arsenic	µg/L	4	1.12	2.97
Unfiltered	41-01002	LAO-0.6	Los Alamos	nc	Arsenic	µg/L	4	1.12	0.36
Unfiltered	41-01003	LAO-0.3	Los Alamos	ca	Arsenic	µg/L	8	1.16	3.08
Unfiltered	41-01003	LAO-0.3	Los Alamos	nc	Arsenic	µg/L	8	1.16	0.372
Unfiltered	41-01004	LAO-C	Los Alamos	ca	Arsenic	µg/L	4	2.41	6.4
Unfiltered	41-01004	LAO-C	Los Alamos	nc	Arsenic	µg/L	4	2.41	0.774
Unfiltered	41-01045	LAO-B	Los Alamos	ca	Arsenic	µg/L	9	0.44	1.17
Unfiltered	41-01045	LAO-B	Los Alamos	nc	Arsenic	µg/L	9	0.44	0.141
Unfiltered	LA-00001	LAO-1.6g	Los Alamos	ca	Arsenic	µg/L	8	2.87	7.62
Unfiltered	LA-00001	LAO-1.6g	Los Alamos	nc	Arsenic	µg/L	8	2.87	0.921
Unfiltered	LA-00001	LAO-1.6g	Los Alamos	nc	Fluoride	µg/L	1	611	0.981

Table E-5.3-16 (continued)

Field Preparation	Location	Name	Canyon	Risk Class ^a	Analyte	Units	Number of Samples	EPC ^b	Residential RBC Ratio
Unfiltered	LA-00001	LAO-1.6g	Los Alamos	nc	Molybdenum	µg/L	3	140	2.7
Unfiltered	LA-00001	LAO-1.6g	Los Alamos	nc	Thallium	µg/L	8	2.1	2.53
Unfiltered	LA-00002	LLAO-5	Los Alamos	ca	Arsenic	µg/L	9	2.06	5.47
Unfiltered	LA-00002	LLAO-5	Los Alamos	nc	Antimony	µg/L	9	3.5	0.864
Unfiltered	LA-00002	LLAO-5	Los Alamos	nc	Arsenic	µg/L	9	2.06	0.661
Unfiltered	LA-00002	LLAO-5	Los Alamos	nc	Barium	µg/L	9	286	0.416
Unfiltered	LA-00002	LLAO-5	Los Alamos	nc	Nitrite	µg/L	1	3070	2.96
Unfiltered	LA-00002	LLAO-5	Los Alamos	nc	Thallium	µg/L	9	2.8	3.37
Unfiltered	LA-00002	LLAO-5	Los Alamos	nc	Uranium	µg/L	6	8.82	0.283
Unfiltered	LA-00045	LLAO-2	Los Alamos	ca	Arsenic	µg/L	1	3.5	9.29
Unfiltered	LA-00045	LLAO-2	Los Alamos	nc	Arsenic	µg/L	1	3.5	1.12
Unfiltered	LA-00046	LLAO-4	Los Alamos	ca	Arsenic	µg/L	5	1.8	4.78
Unfiltered	LA-00046	LLAO-4	Los Alamos	nc	Arsenic	µg/L	5	1.8	0.578
Unfiltered	LA-00215	LLAO-1	Los Alamos	ca	Arsenic	µg/L	9	7.38	19.6
Unfiltered	LA-00215	LLAO-1	Los Alamos	nc	Arsenic	µg/L	9	7.38	2.37
Unfiltered	LA-00215	LLAO-1	Los Alamos	nc	Fluoride	µg/L	1	450	0.722
Unfiltered	LA-00215	LLAO-1	Los Alamos	nc	Iron	µg/L	9	3750	1.2
Unfiltered	LA-00215	LLAO-1	Los Alamos	nc	Manganese	µg/L	9	235	0.179
Unfiltered	LA-00215	LLAO-1	Los Alamos	nc	Nitrate	µg/L	1	7300	0.439
Unfiltered	LA-00215	LLAO-1	Los Alamos	nc	Thallium	µg/L	9	3	3.61
Unfiltered	LA-00215	LLAO-1	Los Alamos	nc	Uranium	µg/L	6	1.04	0.0334
Unfiltered	LA-10035	LAO-3a	Los Alamos	ca	Arsenic	µg/L	4	4.95	13.1
Unfiltered	LA-10035	LAO-3a	Los Alamos	nc	Arsenic	µg/L	4	4.95	1.59
Unfiltered	LA-10035	LAO-3a	Los Alamos	nc	Molybdenum	µg/L	3	1970	37.9
Unfiltered	LA-10035	LAO-3a	Los Alamos	nc	Perchlorate	µg/L	1	1.17	1.13
Unfiltered	LA-10035	LAO-3a	Los Alamos	rad	Strontium-90	pCi/L	4	47.2	1.26
Unfiltered	LA-10066	LAO-0.7	Los Alamos	ca	Arsenic	µg/L	4	3.77	10
Unfiltered	LA-10066	LAO-0.7	Los Alamos	nc	Arsenic	µg/L	4	3.77	1.21
Unfiltered	LA-10067	LAO-2	Los Alamos	nc	Molybdenum	µg/L	2	2000	38.5
Unfiltered	LA-10068	LAO-4	Los Alamos	ca	Arsenic	µg/L	3	3.16	8.39
Unfiltered	LA-10068	LAO-4	Los Alamos	nc	Arsenic	µg/L	3	3.16	1.01
Unfiltered	LA-10068	LAO-4	Los Alamos	nc	Molybdenum	µg/L	3	586	11.3

Table E-5.3-16 (continued)

Field Preparation	Location	Name	Canyon	Risk Class ^a	Analyte	Units	Number of Samples	EPC ^b	Residential RBC Ratio
Unfiltered	LA-10068	LAO-4	Los Alamos	nc	Thallium	µg/L	3	2.4	2.89
Unfiltered	LA-10069	LAO-4.5c	Los Alamos	ca	Arsenic	µg/L	3	1.32	3.5
Unfiltered	LA-10069	LAO-4.5c	Los Alamos	nc	Arsenic	µg/L	3	1.32	0.424
Unfiltered	PU-00177	PAO-5N	Pueblo	ca	Arsenic	µg/L	6	9.65	25.6
Unfiltered	PU-00177	PAO-5N	Pueblo	nc	Arsenic	µg/L	6	9.65	3.1
Unfiltered	PU-00177	PAO-5N	Pueblo	nc	Boron	µg/L	1	396	0.424
Unfiltered	PU-00177	PAO-5N	Pueblo	nc	Fluoride	µg/L	1	390	0.626
Unfiltered	PU-00177	PAO-5N	Pueblo	nc	Manganese	µg/L	6	3600	2.74
Unfiltered	PU-00177	PAO-5N	Pueblo	nc	Nitrate	µg/L	1	2900	0.175
Unfiltered	PU-00178	PAO-1	Pueblo	ca	Arsenic	µg/L	8	1.3	3.45
Unfiltered	PU-00178	PAO-1	Pueblo	ca	Dibenz(a,h)anthracene	µg/L	4	0.0235	8.75
Unfiltered	PU-00178	PAO-1	Pueblo	nc	Arsenic	µg/L	8	1.3	0.417
Unfiltered	PU-00178	PAO-1	Pueblo	nc	Manganese	µg/L	8	2220	1.69
Unfiltered	PU-00178	PAO-1	Pueblo	nc	Thallium	µg/L	8	2.3	2.77
Unfiltered	PU-00181	PAO-3	Pueblo	ca	Arsenic	µg/L	2	2.4	6.37
Unfiltered	PU-00181	PAO-3	Pueblo	nc	Arsenic	µg/L	2	2.4	0.77
Unfiltered	PU-00182	PAO-4	Pueblo	ca	Arsenic	µg/L	9	7.41	19.7
Unfiltered	PU-00182	PAO-4	Pueblo	nc	Arsenic	µg/L	9	7.41	2.38
Unfiltered	PU-00182	PAO-4	Pueblo	nc	Boron	µg/L	3	395	0.423
Unfiltered	PU-00182	PAO-4	Pueblo	nc	Fluoride	µg/L	1	530	0.851
Unfiltered	PU-00182	PAO-4	Pueblo	nc	Iron	µg/L	9	5600	1.8
Unfiltered	PU-00182	PAO-4	Pueblo	nc	Manganese	µg/L	9	1890	1.44
Unfiltered	PU-10228	APCO-1	Pueblo	ca	Arsenic	µg/L	3	7.14	19
Unfiltered	PU-10228	APCO-1	Pueblo	nc	Arsenic	µg/L	3	7.14	2.29
Unfiltered	PU-10228	APCO-1	Pueblo	nc	Boron	µg/L	2	376	0.402
Unfiltered	PU-10228	APCO-1	Pueblo	nc	Iron	µg/L	3	1800	0.578
Unfiltered	PU-10228	APCO-1	Pueblo	nc	Manganese	µg/L	3	2510	1.91
Unfiltered	PU-10228	APCO-1	Pueblo	nc	Uranium	µg/L	2	0.788	0.0253

^a rad = Radionuclide; ca = carcinogen; nc = noncarcinogen.

^b The maximum detected value is used as the EPC when the data are insufficient to calculate UCLs.

Table E-5.3-17
Groundwater Ratios of EPCs to RBCs, Arsenic Removed

Field Preparation	Location	Name	Canyon	Risk Class ^a	Analyte	Units	Number of Samples	EPC ^b	Residential RBC Ratio
Filtered	PU-10228	APCO-1	Pueblo	nc	Fluoride	µg/L	3	450	0.722
Filtered	PU-10228	APCO-1	Pueblo	nc	Iron	µg/L	3	1580	0.507
Filtered	PU-10228	APCO-1	Pueblo	nc	Manganese	µg/L	3	2540	1.93
Filtered	PU-10228	APCO-1	Pueblo	nc	Boron	µg/L	2	375	0.401
Filtered	LA-10008	LAO-1.2	Los Alamos	nc	Chromium	µg/L	1	16	0.11
Filtered	LA-10008	LAO-1.2	Los Alamos	nc	Thallium	µg/L	1	4.4	5.3
Filtered	LA-00001	LAO-1.6g	Los Alamos	nc	Fluoride	µg/L	5	541	0.868
Filtered	LA-00001	LAO-1.6g	Los Alamos	nc	Molybdenum	µg/L	3	140	2.7
Filtered	LA-00001	LAO-1.6g	Los Alamos	nc	Thallium	µg/L	8	0.636	0.766
Filtered	LA-10067	LAO-2	Los Alamos	nc	Fluoride	µg/L	3	600	0.963
Filtered	LA-10067	LAO-2	Los Alamos	nc	Molybdenum	µg/L	2	2000	38.5
Filtered	LA-10035	LAO-3a	Los Alamos	nc	Fluoride	µg/L	4	653	1.05
Filtered	LA-10035	LAO-3a	Los Alamos	nc	Molybdenum	µg/L	3	1970	37.9
Filtered	LA-10035	LAO-3a	Los Alamos	nc	Thallium	µg/L	4	3.3	3.97
Filtered	LA-10035	LAO-3a	Los Alamos	rad	Strontium-90	pCi/L	4	40.9	1.1
Filtered	LA-10068	LAO-4	Los Alamos	nc	Fluoride	µg/L	3	1600	2.57
Filtered	LA-10068	LAO-4	Los Alamos	nc	Molybdenum	µg/L	3	582	11.2
Filtered	LA-10069	LAO-4.5c	Los Alamos	nc	Fluoride	µg/L	4	1600	2.57
Filtered	LA-10069	LAO-4.5c	Los Alamos	nc	Molybdenum	µg/L	3	32.8	0.632
Filtered	LA-10069	LAO-4.5c	Los Alamos	nc	Uranium	µg/L	2	2.84	0.0913
Filtered	41-01045	LAO-B	Los Alamos	nc	Thallium	µg/L	11	0.373	0.449
Filtered	41-01045	LAO-B	Los Alamos	nc	Perchlorate	µg/L	8	15.3	14.7
Filtered	21-01811	LAUZ-1	DP	nc	Fluoride	µg/L	6	696	1.12
Filtered	21-01811	LAUZ-1	DP	rad	Strontium-90	pCi/L	9	169	4.52
Filtered	21-01812	LAUZ-2	DP	nc	Manganese	µg/L	4	818	0.622
Filtered	21-01812	LAUZ-2	DP	nc	Fluoride	µg/L	1	1300	2.09
Filtered	21-01812	LAUZ-2	DP	rad	Strontium-90	pCi/L	4	189	5.06

Table E-5.3-17 (continued)

Field Preparation	Location	Name	Canyon	Risk Class ^a	Analyte	Units	Number of Samples	EPC ^b	Residential RBC Ratio
Filtered	LA-00215	LLAO-1	Los Alamos	nc	Fluoride	µg/L	7	610	0.979
Filtered	LA-00215	LLAO-1	Los Alamos	nc	Thallium	µg/L	9	2.59	3.12
Filtered	LA-00215	LLAO-1	Los Alamos	nc	Uranium	µg/L	6	0.907	0.0291
Filtered	LA-00215	LLAO-1	Los Alamos	nc	Nitrate	µg/L	1	7400	0.445
Filtered	LA-00002	LLAO-5	Los Alamos	nc	Barium	µg/L	9	287	0.418
Filtered	LA-00002	LLAO-5	Los Alamos	nc	Fluoride	µg/L	7	393	0.631
Filtered	LA-00002	LLAO-5	Los Alamos	nc	Uranium	µg/L	6	9.4	0.302
Filtered	LA-00002	LLAO-5	Los Alamos	nc	Nitrite	µg/L	1	3990	3.84
Filtered	LA-00002	LLAO-5	Los Alamos	nc	Thallium	µg/L	9	2.1	2.53
Filtered	PU-00178	PAO-1	Pueblo	nc	Manganese	µg/L	8	1230	0.935
Filtered	PU-00178	PAO-1	Pueblo	nc	Antimony	µg/L	8	4	0.987
Filtered	PU-00178	PAO-1	Pueblo	nc	Thallium	µg/L	8	3	3.61
Filtered	PU-00182	PAO-4	Pueblo	nc	Boron	µg/L	3	383	0.41
Filtered	PU-00182	PAO-4	Pueblo	nc	Fluoride	µg/L	6	664	1.07
Filtered	PU-00182	PAO-4	Pueblo	nc	Iron	µg/L	9	3370	1.08
Filtered	PU-00182	PAO-4	Pueblo	nc	Manganese	µg/L	9	1780	1.35
Filtered	PU-00182	PAO-4	Pueblo	nc	Perchlorate	µg/L	7	5.74	5.53
Filtered	PU-00182	PAO-4	Pueblo	nc	Thallium	µg/L	9	3.3	3.97
Filtered	PU-00177	PAO-5N	Pueblo	nc	Fluoride	µg/L	3	560	0.899
Filtered	PU-00177	PAO-5N	Pueblo	nc	Iron	µg/L	6	1650	0.53
Filtered	PU-00177	PAO-5N	Pueblo	nc	Manganese	µg/L	6	3620	2.75
Filtered	PU-00177	PAO-5N	Pueblo	nc	Boron	µg/L	1	379	0.406
Filtered	PU-00177	PAO-5N	Pueblo	nc	Nitrate	µg/L	1	3100	0.187
Filtered	PU-00177	PAO-5N	Pueblo	nc	Perchlorate	µg/L	4	6.18	5.95
Unfiltered	PU-10228	APCO-1	Pueblo	nc	Iron	µg/L	3	1800	0.578
Unfiltered	PU-10228	APCO-1	Pueblo	nc	Manganese	µg/L	3	2510	1.91
Unfiltered	PU-10228	APCO-1	Pueblo	nc	Boron	µg/L	2	376	0.402
Unfiltered	PU-10228	APCO-1	Pueblo	nc	Uranium	µg/L	2	0.788	0.0253
Unfiltered	LA-00001	LAO-1.6g	Los Alamos	nc	Molybdenum	µg/L	3	140	2.7

Table E-5.3-17 (continued)

Field Preparation	Location	Name	Canyon	Risk Class ^a	Analyte	Units	Number of Samples	EPC ^b	Residential RBC Ratio
Unfiltered	LA-00001	LAO-1.6g	Los Alamos	nc	Fluoride	µg/L	1	611	0.981
Unfiltered	LA-00001	LAO-1.6g	Los Alamos	nc	Thallium	µg/L	8	2.1	2.53
Unfiltered	LA-10067	LAO-2	Los Alamos	nc	Molybdenum	µg/L	2	2000	38.5
Unfiltered	LA-10035	LAO-3a	Los Alamos	nc	Molybdenum	µg/L	3	1970	37.9
Unfiltered	LA-10035	LAO-3a	Los Alamos	nc	Perchlorate	µg/L	1	1.17	1.13
Unfiltered	LA-10035	LAO-3a	Los Alamos	rad	Strontium-90	pCi/L	4	47.2	1.26
Unfiltered	LA-10068	LAO-4	Los Alamos	nc	Molybdenum	µg/L	3	586	11.3
Unfiltered	LA-10068	LAO-4	Los Alamos	nc	Thallium	µg/L	3	2.4	2.89
Unfiltered	21-01811	LAUZ-1	DP	rad	Americium-241	pCi/L	8	1.43	0.911
Unfiltered	21-01811	LAUZ-1	DP	rad	Plutonium-239	pCi/L	9	0.817	0.506
Unfiltered	21-01811	LAUZ-1	DP	rad	Strontium-90	pCi/L	9	146	3.91
Unfiltered	21-01812	LAUZ-2	DP	nc	Iron	µg/L	4	6000	1.93
Unfiltered	21-01812	LAUZ-2	DP	nc	Manganese	µg/L	4	870	0.661
Unfiltered	21-01812	LAUZ-2	DP	nc	Fluoride	µg/L	1	1300	2.09
Unfiltered	21-01812	LAUZ-2	DP	rad	Strontium-90	pCi/L	4	98.9	2.65
Unfiltered	21-01812	LAUZ-2	DP	rad	Plutonium-239	pCi/L	4	0.16	0.0991
Unfiltered	LA-00215	LLAO-1	Los Alamos	nc	Iron	µg/L	9	3750	1.2
Unfiltered	LA-00215	LLAO-1	Los Alamos	nc	Manganese	µg/L	9	235	0.179
Unfiltered	LA-00215	LLAO-1	Los Alamos	nc	Uranium	µg/L	6	1.04	0.0334
Unfiltered	LA-00215	LLAO-1	Los Alamos	nc	Fluoride	µg/L	1	450	0.722
Unfiltered	LA-00215	LLAO-1	Los Alamos	nc	Nitrate	µg/L	1	7300	0.439
Unfiltered	LA-00215	LLAO-1	Los Alamos	nc	Thallium	µg/L	9	3	3.61
Unfiltered	LA-00002	LLAO-5	Los Alamos	nc	Barium	µg/L	9	286	0.416
Unfiltered	LA-00002	LLAO-5	Los Alamos	nc	Uranium	µg/L	6	8.82	0.283
Unfiltered	LA-00002	LLAO-5	Los Alamos	nc	Antimony	µg/L	9	3.5	0.864
Unfiltered	LA-00002	LLAO-5	Los Alamos	nc	Nitrite	µg/L	1	3070	2.96
Unfiltered	LA-00002	LLAO-5	Los Alamos	nc	Thallium	µg/L	9	2.8	3.37
Unfiltered	PU-00178	PAO-1	Pueblo	nc	Manganese	µg/L	8	2220	1.69
Unfiltered	PU-00178	PAO-1	Pueblo	nc	Thallium	µg/L	8	2.3	2.77

Table E-5.3-17 (continued)

Field Preparation	Location	Name	Canyon	Risk Class ^a	Analyte	Units	Number of Samples	EPC ^b	Residential RBC Ratio
Unfiltered	PU-00182	PAO-4	Pueblo	nc	Boron	µg/L	3	395	0.423
Unfiltered	PU-00182	PAO-4	Pueblo	nc	Iron	µg/L	9	5600	1.8
Unfiltered	PU-00182	PAO-4	Pueblo	nc	Manganese	µg/L	9	1890	1.44
Unfiltered	PU-00182	PAO-4	Pueblo	nc	Fluoride	µg/L	1	530	0.851
Unfiltered	PU-00177	PAO-5N	Pueblo	nc	Manganese	µg/L	6	3600	2.74
Unfiltered	PU-00177	PAO-5N	Pueblo	nc	Boron	µg/L	1	396	0.424
Unfiltered	PU-00177	PAO-5N	Pueblo	nc	Fluoride	µg/L	1	390	0.626
Unfiltered	PU-00177	PAO-5N	Pueblo	nc	Nitrate	µg/L	1	2900	0.175

^a rad = Radionuclide; ca = carcinogen; nc = noncarcinogen.

^b The maximum detected value is used as the EPC when the data are insufficient to calculate UCLs.

Table E-5.3-18
Resource User RME Multimedia Sums, by Reach and Sampling Station

Sediment Reach	Water Station Name	Water Location	Carcinogen Sum ^a	Noncarcinogen Sum	Radionuclide Sum ^b
DP-1W	DP-1W SW	21-10929	167	0.0058	— ^c
DP-1C	DP-1W SW	21-10929	19.3	0.0058	—
DP-1E	DP-1W SW	21-10929	41	0.0058	—
DP-1W	DP-1C SW	21-11226	167	0.0151	—
DP-1C	DP-1C SW	21-11226	19.3	0.0151	—
DP-1E	DP-1C SW	21-11226	41	0.0151	—
LA-2E	DP Spring	21-01854	20	0.203	0.578
LA-2FE	DP Spring	21-01854	0.0285	0.0126	0.621
LA-2W	DP Spring	21-01854	0.0285	0.0126	0.363
LA-3	DP Spring	21-01854	0.0285	0.0126	0.0168
LA-3FE	DP Spring	21-01854	0.0285	0.0126	0.0168
DP-2	DP Spring	21-01854	0.0285	0.0126	1.36
DP-3	DP Spring	21-01854	9.06	0.0126	0.913
DP-4	DP Spring	21-01854	0.0285	0.0126	0.455
AC-1	AC-2 SW	00-10241	231	0.338	—
AC-2	AC-2 SW	00-10241	143	0.335	—
AC-1	Upper S. Fork Acid SW	PU-10175	231	0.332	0.0281
AC-2	Upper S. Fork Acid SW	PU-10175	143	0.329	0.0281
ACS	Upper S. Fork Acid SW	PU-10175	11.8	2.07	0.449
AC-1	Lower S. Fork Acid SW	PU-10176	231	0.331	0.0183
AC-2	Lower S. Fork Acid SW	PU-10176	143	0.328	0.0183
ACS	Lower S. Fork Acid SW	PU-10176	11.8	2.07	0.439
AC-3	lower AC-3 SW	PU-10155	35.8	10.5	0.525
P-1W	lower AC-3 SW	PU-10155	10.9	0.169	0.0126
P-1E	lower AC-3 SW	PU-10155	17.8	0.0492	0.162
P-1W	Upper P-1W SW	PU-10069	8.54	0.176	—
P-1W	Lower P-1W SW	PU-10069	8.54	0.176	—
P-1E	P-1E SW	PU-10071	15.5	0.0639	0.149
P-1W	P-1E SW	PU-10071	8.56	0.184	—
AC-3	P-1E SW	PU-10071	33.5	10.5	0.512
P-3W	Pueblo 3	PU-10230	0.187	0.0219	—
P-4W	Pueblo 3	PU-10230	15.9	0.0473	—
P-4E	Pueblo 3	PU-10230	0.187	0.0219	—
P-3W	Pueblo at 502	PU-10229	0.0854	0.0115	—
P-4W	Pueblo at 502	PU-10229	15.8	0.0369	—
P-4E	Pueblo at 502	PU-10229	0.0854	0.0115	—

^a Convert to risk: Value x (1x10⁻⁵).

^b Convert to dose: Value from sediment component (value from Table E-5.3-9 x 15 mrem) + water component (value from Table E-5.3-12 x 4 mrem).

^c — = COPC class is not carried forward from Section 6 of this report for this reach and water location combination.

Table E-5.3-19
Residential RME Multimedia Sums for Filtered Water Data, by Reach and Sampling Station

Sediment Reach	Water Station Name	Water Location	Carcinogen Sum ^a	Noncarcinogen Sum	Radionuclide Sum ^b
DP-2	LAUZ-1	21-01811	45.8	7.75	12.3
DP-4	LAO-2	LA-10067	— ^c	39.5	2.5
LA-2W	LAO-2	LA-10067	—	39.5	0.655
LA-2E	LAO-3a	LA-10035	41.3	45.9	3.68
LA-2FE	LAO-4	LA-10068	7.17	14.6	3.46
LA-3W	LAO-4.5c	LA-1069	—	—	1.79
LA-4W	LLAO-1b	LA-00215	23.4	7.41	—
P-1W	PAO-1	PU-00178	29.8	7.42	—
P-1E	PAO-2	PU-10174	0.839	0.0054	0.776
AC-3	PAO-2	PU-10174	2.73	1.15	2.78
P-4W	PAO-5n/APCO-1	PU-00177	30.1	14	—

^a Convert to risk: Value x (1x10⁻⁵).

^b Convert to dose: Value from sediment component (value from Table E-5.3-10 x 15 mrem) + water component (value from Table E-5.3-13 x 4 mrem).

^c — = COPC class is not carried forward from Section 6 of this report for this reach and water location combination.

Table E-5.3-20
Residential RME Multimedia Sums for Unfiltered Water Data, by Reach and Sampling Station

Sediment Reach	Water Station Name	Water Location	Carcinogen Sum ^a	Noncarcinogen Sum	Radionuclide Sum ^b
DP-2	LAUZ-1	21-01811	8.57	1.04	13.1
DP-4	LAO-2	LA-10067	— ^c	38.5	2.5
LA-2W	LAO-2	LA-10067	—	38.5	0.655
LA-2E	LAO-3a	LA-10035	42.2	42.2	3.84
LA-2FE	LAO-4	LA-10068	8.39	15.2	3.46
LA-3W	LAO-4.5c	LA-1069	—	—	1.79
LA-4W	LLAO-1b	LA-00215	19.6	8.56	—
P-1W	PAO-1	PU-00178	37.7	6.24	—
P-1E	PAO-2	PU-10174	0.839	0.0054	0.776
AC-3	PAO-2	PU-10174	2.73	1.15	2.78
P-4W	PAO-5n/APCO-1	PU-00177	30.2	7.26	—

^a Convert to risk: Value x (1x10⁻⁵).

^b Convert to dose: Value from sediment component (value from Table E-5.3-10 x 15 mrem) + water component (value from Table E-5.3-13 x 4 mrem).

^c — = COPC class is not carried forward from Section 6 of this report for this reach and water location combination.

Table E-5.3-21
Residential RME Multimedia Sums with
Filtered Water Data, Arsenic Removed, by Reach and Sampling Station

Sediment Reach	Water Station Name	Water Location	Carcinogen Sum ^a	Noncarcinogen Sum	Radioinclide Sum ^b
DP-2	LAUZ-1	21-01811	— ^c	1.12	12.3
DP-4	LAO-2	LA-10067	—	39.5	2.5
LA-2W	LAO-2	LA-10067	—	39.5	0.655
LA-2E	LAO-3a	LA-10035	29.1	44.5	3.68
LA-2FE	LAO-4	LA-10068	—	13.8	3.46
LA-3W	LAO-4.5c	LA-1069	—	—	1.79
LA-4W	LLAO-1b	LA-00215	—	4.58	—
P-1W	PAO-1	PU-00178	25.5	6.9	—
P-1E	PAO-2	PU-10174	0.839	0.0054	0.776
AC-3	PAO-2	PU-10174	2.73	1.15	2.78
P-4W	PAO-5n/APCO-1	PU-00177	4.58	10.9	—

^a Convert to risk: Value x (1x10⁻⁵).

^b Convert to dose: Value from sediment component (value from Table E-5.3-10 x 15 mrem) + water component (value from Table E-5.3-13 x 4 mrem).

^c — = COPC class is not carried forward from Section 6 of this report for this reach and water location combination.

Table E-5.3-22
Residential RME Multimedia Sums for
Unfiltered Water Data, Arsenic Removed, by Reach and Sampling Station

Sediment Reach	Water Station Name	Water Location	Carcinogen Sum ^a	Noncarcinogen Sum	Radioinclide Sum ^b
DP-2	LAUZ-1	21-01811	— ^c	—	13.1
DP-4	LAO-2	LA-10067	—	38.5	2.5
LA-2W	LAO-2	LA-10067	—	38.5	0.655
LA-2E	LAO-3a	LA-10035	29.1	40.6	3.84
LA-2FE	LAO-4	LA-10068	—	14.2	3.46
LA-3W	LAO-4.5c	LA-1069	—	—	1.79
LA-4W	LLAO-1b	LA-00215	—	6.19	—
P-1W	PAO-1	PU-00178	25.5	5.83	—
P-1E	PAO-2	PU-10174	0.839	0.0054	0.776
AC-3	PAO-2	PU-10174	2.73	1.15	2.78
P-4W	PAO-5n/APCO-1	PU-00177	4.58	4.17	—

^a Convert to risk: Value x (1x10⁻⁵).

^b Convert to dose: Value from sediment component (value from Table E-5.3-10 x 15 mrem) + water component (value from Table E-5.3-14 x 4 mrem).

^c — = COPC class is not carried forward from Section 6 of this report for this reach and water location combination.

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Appendix F

Los Alamos Canyon Alluvial Water-Level Study

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F-1.0 INTRODUCTION

This appendix documents an investigation of water-level behavior in the saturated alluvium in upper Los Alamos Canyon. A series of piezometers and piezometer nests were installed at several locations during the initial phase of the investigation in March and May 2001. The installation of piezometer nests in upper Los Alamos Canyon was stipulated in the Los Alamos National Laboratory's (LANL's or the Laboratory's) work plan for Operable Unit 1049, Los Alamos Canyon and Pueblo Canyon (LANL 1995, 50290). The purpose for installing the piezometer nests was to investigate groundwater seepage from the alluvial aquifer to underlying geologic strata, potentially providing a source of recharge to intermediate-depth perched aquifers and the regional aquifer. Groundwater seepage is hypothesized to occur where the alluvium overlies bedrock fault zones and subcrops of relatively permeable stratigraphic horizons such as the Cerro Toledo interval, the Guaje Pumice Bed, the Puye Formation, and the Cerros del Rio basalt. Zones with elevated seepage losses may be identified by observing significant declines in hydraulic head over short distances.

Piezometer nests were installed at eight locations within upper Los Alamos Canyon (Figure F-1.0-1) between Omega Bridge on Diamond Drive and State Highway NM 4, and water levels were monitored in each piezometer. These data were used to compute vertical gradients and seepage velocities within the alluvial aquifer in an effort to identify reaches where water losses caused by seepage from the alluvial system may occur within the canyon. Single piezometers were also installed at additional locations to help characterize varying alluvial aquifer behavior with respect to recharge and groundwater flow processes for different canyon segments. The following sections discuss previous and ongoing investigations pertinent to the study, describe the field activities conducted and data collection procedures employed during the study, and present the investigation results and conclusions that form the basis of a conceptual model for water loss in upper Los Alamos Canyon.

English units (e.g., feet [ft], inches [in.], and miles [mi]) are used for most parameters in this appendix, to be consistent with standard usage in source documents and relevant literature. An exception is the use of metric units for hydraulic conductivity (cm/s), which is also consistent with usage in source documents. Where English units are cited, equivalent metric units are also provided.

Previous and Ongoing Investigations

Manual water-level measurements have been performed in Los Alamos Canyon since the mid-1990s in several alluvial wells installed by the former Environmental Restoration (ER) Project (now the Risk Reduction and Environmental Stewardship Division—Remediation Services [RRES-RS]). Regular monitoring on a generally monthly basis began in Los Alamos Canyon in November 1996 for most wells and, except for a nine-month hiatus from September 1999 through May 2000, continued through September 2002. Information regarding the manual water-level data collected from Los Alamos Canyon alluvial wells is presented in Section B-2 of Appendix B.

The Laboratory's Water Quality and Hydrology Group (RRES-WQH) operated pressure transducers in selected alluvial wells in Los Alamos Canyon from July 1994 through February 2002. The Laboratory's Environmental Characterization and Remediation Group (RRES-ECR) has also operated pressure transducers in selected alluvial wells in Los Alamos Canyon since August 2000. The RRES-ECR alluvial well transducer data are discussed in Section B-2 of Appendix B.

Gray (1997, 58208) computed a water balance for the upper Los Alamos Canyon watershed and used it to provide input parameters for numerical modeling of the alluvial aquifer in upper Los Alamos Canyon. A steady-state model was calibrated to manual water-level measurements and pressure transducer data from April 1995. Under steady-state conditions (i.e., for maximum saturation conditions such as those that

might occur during an extended period of snowmelt runoff), this study computed infiltration losses from the alluvial aquifer for nine separate canyon reaches extending from Los Alamos Reservoir eastward to a point about 3000 ft (0.9 km) east of the eastern Laboratory boundary near State Highway NM 4. Computed infiltration rates varied from a minimum of 0.02 in. (0.5 mm) per day to a maximum of 0.12 in. (3 mm) per day with the maximum infiltration amount occurring in a reach that includes parts of Technical Area (TA) 2 and TA-41 (Gray 1997, 58208). Gray hypothesized that the elevated infiltration rate in this reach may be caused by seepage into bedrock fractures associated with the Guaje Mountain fault zone. Although recent studies have mapped the Guaje Mountain fault only as far south as Bayo Canyon, located about 1.2 mi. (2 km) north of upper Los Alamos Canyon, a small segment of the Pajarito fault system is indicated near the TA-2/TA-41 boundary in upper Los Alamos Canyon (Gardner, et al. 2003, 85527). This area is also located near zones of increased fracture density measured in the north wall of Los Alamos Canyon coinciding with the projected trace of the Guaje Mountain fault (Wohletz 1996, 58846).

Gray (2000, 85218) updated the 1997 study by adding a river simulation package to explicitly simulate recharge to the alluvial aquifer from the stream channel as well as movement of groundwater from the alluvium into the stream channel. Steady-state infiltration losses from the base of the alluvial aquifer computed by the revised model varied from a minimum of zero to a maximum of 0.32 in. (8 mm) per day. The highest computed infiltration rate was determined for an upper canyon reach between Diamond Drive and TA-41 that includes the Rendija Canyon fault zone as mapped by Gardner et al. (1999, 63492). This study also found elevated infiltration rates for the reach that includes the TA-2 and TA-41 facilities (0.24 in. [6 mm] per day) and the reach between Los Alamos Reservoir and Diamond Drive (0.19 in. [5 mm] per day) that includes the projected location of the Pajarito fault zone as mapped by Gardner et al. (1999, 63492).

F-2.0 INVESTIGATION DESCRIPTION

This section discusses the field activities undertaken during the course of the investigation including

- Piezometer installations
- Well development activities
- Water-level monitoring
- Slug testing

F-2.1 Piezometer Installations

Piezometer nests or single piezometers were installed in 2001 at eight locations in upper Los Alamos Canyon between Diamond Drive and State Highway NM 4). Location maps plus surveyed location and elevation information are provided in the "Report on Alluvial Well Completions 1994–2001" (LANL 2001, 73307). Piezometer locations are also shown on Figure F-1.0-1 and Plate 1. Sites for piezometer installations were selected to target areas of the canyon where seepage losses from the alluvium were suspected based on previous studies and knowledge of local stratigraphy. Table F-2.1-1 presents the rationale used for site selection.

Each piezometer or piezometer nest was installed in an 8-in. (20 cm)-diameter borehole drilled to the base of the alluvium using a CME-750 hollow-stem auger drill rig. A split-spoon sampler was used to obtain core samples of the drilled sediments for the purpose of logging the intercepted lithology. An on-

site geologist prepared borehole logs that described the encountered lithology and saturation conditions at each drill site (LANL 2001, 73307).

Piezometer nests consisted of 3 piezometers, each constructed from 2-in. (5.0-cm)-diameter flush-threaded schedule-40 polyvinyl chloride (PVC) pipe with a bottom cap and a 6-in. (15-cm) length of hand-cut slots to allow the entry of groundwater into the pipe. In each piezometer nest (except for LAP-1.7), the screened section of piezometer #1 was placed at a depth near the base of encountered saturation; the screened section of piezometer #2 was placed at a shallower depth near the middle of the saturated zone; and the screened section of piezometer #3 was placed above the second piezometer near the top of the saturated zone at a depth where the distance between the #3 and #2 screens was equivalent to the distance between the #2 and #1 screens. A filter pack consisting of 8/12-grade Colorado silica sand was emplaced adjacent to each screen and the screened intervals were isolated from each other with intervening bentonite seals. Thin layers of 30/70-grade silica sand were placed between the filter-pack zones and bentonite seals.

A unique screen configuration was employed in the LAP-1.7 nest where the screened section of piezometer #1 was placed just below the alluvium-tuff contact to investigate potential saturation extending into the tuff at this location. The screened section of piezometer #2 was then placed in the saturated alluvium near the base of encountered saturation; and the screened section of piezometer #3 was placed in the saturated alluvium near the middle of the saturated zone.

Single piezometer installations were constructed similarly but utilized a single screened section of varying length extending to the base of saturation. Construction details for each piezometer installation are documented by the Laboratory (LANL 2001, 73307).

F-2.2 Well Development

Well development activities were undertaken to remove drilling debris from the aquifer formation and minimize well-bore skin effects (smearing of the borehole wall during drilling) adjacent to the piezometer screens and to facilitate flow from the formation through the filter pack. Initial well development efforts entailed operating a surge block consisting of a 2-in. (5.0-cm)-diameter rubber gasket attached to a steel rod, which was vigorously moved up and down within the water column inside the piezometer casing, and then extracting water from the piezometer using a centrifugal pump to draw water through the well screen at a high velocity. Discharge water was initially highly turbid and each piezometer was surged and pumped multiple times until the discharge water cleared up (visible turbidity was minimal) or until partial clarity had stabilized. Declining water levels in the alluvial aquifer, after the piezometer installations were completed, hindered this activity in some of the shallower piezometers where persistent flow could not be maintained under the force of pumping. Additional well development activities undertaken subsequent to slug testing consisted of surging and bailing with a 1.5-in. (3.8-cm)-diameter plastic bailer until turbidity levels were minimized. Well development activities were documented in the project field book.

F-2.3 Water-Level Monitoring

Water levels in selected piezometers were monitored with pressure transducers and by periodic manual measurements made with a water-level meter. MiniTROLL Pro and MPTROLL 8000 probes manufactured by In-Situ Corporation were used to record water levels at 30-minute intervals. These instruments use silicon strain-gauge pressure sensors with an operating range of 0 to 30 pounds per square inch (psi) for the MiniTROLLs and 0 to 15 psi for the MPTROLLs. They also include temperature sensors so pressure readings are temperature compensated. The pressure sensors have a documented performance accuracy of $\pm 0.05\%$ of full scale (approximately 35 ft [11 m] at 15 psi and approximately 69 ft

[21 m] at 30 psi). Each instrument incorporates an integrated datalogger and was deployed using a communications cable that permitted downloading data without disturbing the water-level equilibrium in the piezometer. Vented cables were used to compensate for barometric pressure fluctuations in the pressure readings. Each transducer was programmed to measure water levels based on a depth below top of casing reference level. The reference level was established by performing a manual water-level measurement at the time the transducer was installed and/or programmed. Water-level hydrographs developed from the transducer data are presented in Section F-3.

Quality Assurance

Monitoring transducer accuracy was important for the purposes of defining head differentials and determining vertical gradients in the piezometer nests. Quality assurance (QA) procedures were implemented during the water-level monitoring program to ensure data quality. Transducer operational accuracy was verified by checking each instrument's performance according to LANL-ER-SOP (Standard Operating Procedure)-7.01, "Pressure Transducers." Results of the transducer accuracy verification tests were recorded in a laboratory notebook. Instrument accuracy was also checked at the time of each download by comparing the current transducer reading with a concurrent manual water-level measurement. This occurred approximately monthly through mid-2002 and then approximately quarterly thereafter. The water-level QA comparisons were recorded in the project field book. In cases where a drift was observed in the transducer readings that exceeded instrument accuracy specifications (± 0.035 ft [11 mm] for the MiniTROLLs and ± 0.018 ft [6 mm] for the MPTROLLs), the currently running data acquisition program was terminated. The reference level was then reset, the instrument was reprogrammed, and a new data acquisition program was started. Repeated instances of drift caused by clogging of the pressure ports were occasionally observed with some transducers. The QA procedures permitted the identification of malfunctioning equipment, which was then removed from service and returned to the factory for repair. Tables F-2.3-1 through F-2.3-4 provide a summary of the transducer versus manual water-level comparison data for each of the four piezometer nests in which multiple transducers were deployed.

These data show that, for the most part, transducer error fell within the instruments' accuracy ranges and the relative difference between the transducer readings and manual measurements generally averaged well below 0.5 percent for each piezometer. Exceptions to this occurred in LAP-1.5#2 where significant errors were caused by blockage of the transducer pressure ports by silt or mud, and in LAP-4#3 where the transducer was installed in a dry well and an initial reference level could not be established accurately. Tables F-2.3-1 through F-2.3-4 document several cases where errors in pressure readings near or exceeding the instruments' accuracy specifications were observed. In these cases a data correction process was applied. Except where noted otherwise in Tables F-2.3-1 through F-2.3-4, the applied corrections assumed a linear pattern of drift from zero error at the initiation of the pertinent data acquisition program to the magnitude of error observed at the time of downloading. The error magnitude was divided by the number of intervening transducer readings and incrementally added to the recorded water levels so that the final reading at the time of downloading matched the manual measurement. This procedure maintained relative head differentials between piezometers as determined by the manual water-level measurements while preserving the pattern of water-level fluctuations recorded by the transducer.

F-2.4 Slug Testing

Slug tests were performed in all piezometers to the extent possible (dependent on the availability of water in the piezometers at the time of testing). The goals of the slug testing program were to establish the effectiveness of prior well development efforts and to determine hydraulic conductivity values for the

different aquifer zones monitored by each piezometer. The hydraulic conductivity values obtained from the slug tests were then used in subsequent computations of seepage velocity.

Sufficient well development is necessary to obtain reliable test results and to ensure that the piezometers show valid hydraulic head relations. Normalized recovery plots (head displacement divided by the initial displacement) of multiple tests using slugs with different displacement volumes will coincide in a sufficiently developed well. A significant divergence between normalized displacement plots of multiple tests is indicative of remnant drilling debris or the persistence of well-bore skin effects near the well screen. Under these circumstances, conventional slug test theory is not valid and parameter estimates obtained from such analyses are unreliable.

F-2.4.1 Slug Test Procedures

Four slugs of varying displacement volumes were constructed of PVC tubing filled with lead shot or silica sand and attached to cords. The slugs produced water-level displacements of 0.27, 0.53, 0.92, and 1.3 linear ft (8.3, 16, 28, and 40 cm) within the 2-in. (5.0-cm)-diameter piezometer casings. Depending on the available water-column height and transducer position, two different slugs with appropriate displacements were used in a series of tests performed in each piezometer. Falling and rising head tests were performed with each slug. A falling head test consisted of rapidly dropping the slug into the piezometer and monitoring the water level as it fell back to equilibrium. This was followed by a rising head test in which the slug was rapidly pulled from the piezometer and the rising water level was monitored. Where it was feasible, a second set of falling and rising head tests was performed using a different slug, followed by a third set of tests with the original slug. Water levels were allowed to recover to at least 90% of preceding static levels prior to subsequent tests. Water levels were monitored at 0.5-second intervals during the tests using a pressure transducer.

Normalized displacement plots of the initial test data showed a need for additional development efforts in the LAP-1.5#1, LAP-3.5#3, LAP-4#1 and LAP-4#2 piezometers. Water was added to these piezometers followed by surging and bailing to improve flow, as discussed in Section F-2.2. Additional slug tests were then performed in these piezometers, and normalized recovery plots verified consistent post-development behavior except in LAP-3.5#3 and LAP-4#2, where insufficient saturation in the aquifer inhibited adequate development. Similar efforts were employed in the LAP-1#1 piezometer, which had previously exhibited poor performance because of an apparent clogged screen. Redevelopment efforts resulted in significantly different head relations for the LAP-1#1 and LAP-1.5#1 piezometers. Prior water-level data are therefore unreliable in these piezometers. Insufficient saturation precluded slug testing in the LAP-4#3, LAP-5.7, and LAP-6 piezometers. Tests with different size slugs could not be performed in the LAP-3#3, LAP-4#1, and LAP-4#2 piezometers because of low water levels. The slug testing and redevelopment activities were documented in the project field book.

F-2.4.2 Slug Test Analysis

Test data were analyzed using the 2003 AQTESOLV aquifer test software package from HydroSOLVE, Inc. The data were initially analyzed using the Bouwer and Rice (1976, 64056) solution modified by Zlotnik (1994, 85219) for anisotropic conditions. This method is commonly used to evaluate slug tests in wells screened below the water table under unconfined conditions. In this method, a logarithmic plot of normalized displacement against time is fitted to a straight line, the slope of which is applied to an analytical solution to determine the radial component of hydraulic conductivity. A significant issue with the application of this method concerns the estimation of the effective radius (R_e) of the test. AQTESOLV assigns a value to R_e based on the borehole radius. However, R_e should be viewed as an empirical

parameter that may be estimated from a figure in the original paper by Bouwer and Rice (1976, 64056). Therefore, the simplified approach used by AQTESOLV with this method may be questionable.

Also, during this analysis it became apparent that uncertainty with regard to anisotropy within the aquifer formation led to a significant degree of uncertainty in the test results. AQTESOLV computes an equivalent borehole radius using the specified anisotropy value. Some degree of anisotropy caused by layered heterogeneity in the alluvium undoubtedly exists, as shown by the distinct layering of fine and coarse sediments observed during the borehole drilling and documented in the borehole lithology logs (LANL 2001, 73307). The bedded character of fluvial deposits generally imparts a strong anisotropy to the system, and previous studies employing laboratory analysis of core samples have shown horizontal conductivities (K_h) between 2 and 10 times greater than vertical conductivities (K_v) in these systems (Freeze and Cherry 1979, 64057). These data have not been developed for the alluvial sediments at the Laboratory, necessitating the application of literature values. Anisotropy (K_v/K_h) values of 0.1 and 0.5 were thus assumed for the initial test analyses. The initial analysis results showed that assuming an anisotropy of 0.1 yielded conductivity values that were roughly double the values obtained with an anisotropy of 0.5, and results varied by nearly half an order of magnitude in some cases. Because of the level of uncertainty in the Bouwer-Rice analysis results, an alternative solution was pursued.

The Hyder et al. (1994, 85220) solution describes the water-level response to the instantaneous injection or withdrawal of water from a partially penetrating well in an unconfined aquifer. This method, often referred to as the Kansas Geological Survey (KGS) model, employs a series of integral transforms (a Laplace transform in time and a Fourier cosine transform in the vertical direction) to solve the groundwater flow equation. In this method, displacement is plotted against the logarithm of time since the test began and is matched to a solution type-curve. An advantage of this solution is that the effects of anisotropy do not significantly affect the shape of the type-curve and, in the absence of other supporting data, the anisotropy ratio is typically assumed equal to one (Butler 1998, 73641). The KGS model was thus used to analyze the slug test data, assuming unity for anisotropy. An example AQTESOLV output of the KGS model analysis for a falling head test in the LAP-1#2 piezometer is provided in Figure F-2.4-1.

Excellent matches to the type-curves for this solution were obtained with most data, and the analysis results were generally consistent for multiple tests performed in each piezometer. Exceptions occurred in LAP-4#2, where the KGS model was unable to match the rising head test displacement plot (in this case the Hvorslev (1951, 70101) method yielded results similar to those determined by the KGS model for the falling head test), and in LAP-3.5#3, where the results are unreliable because of inadequate well development. Results from tests performed prior to redevelopment efforts or early tests where normalized plots appeared anomalous were not used. Table F-2.4-1 presents a summary of the results obtained from the slug test analyses with comments pertaining to the quality of the matches between the test data and the solution type-curves, along with average hydraulic conductivity values determined for each piezometer.

F-3.0 WATER-LEVEL DATA

Multiple transducers were deployed in piezometer nests at four sites (LAP-1, LAP-1.5, LAP-3.5, and LAP-4), and transducers were also deployed at two sites where single piezometers were installed (LAP-3 and LAP-6). Because water levels were low in the LAP-5.7 nest, a single transducer was deployed in the #1 piezometer at that site. Because two of the piezometers in the LAP-1.7 nest failed to produce water, regular monitoring was not performed at that site. The water-level data are presented here as time-series hydrographs for each of the sites at which transducers were deployed. The methods employed for analyzing the transducer data collected during the course of this study are discussed in Section F-3.1. Data plots and a discussion of the results of data analysis for each site are presented in Section F-3.2.

F-3.1 Data Analysis

At sites where single piezometers were monitored, the transducer data provide a detailed record of alluvial water levels and water-level variation at those locations. These data are useful for determining varying aquifer conditions in different parts of the canyon and how those conditions relate to water losses from the alluvial system. Integration of these observations into a conceptual model for water losses in upper Los Alamos Canyon is discussed in Section F-4.

At sites with piezometer nests in which multiple transducers were deployed, combined hydrograph plots were prepared that depict the separate water levels measured in each of the three piezometers screened at different depths. These hydrographs thus show how hydraulic head relations vary with depth in the alluvial aquifer.

The presence of significant vertical gradients may indicate zones where substantial seepage losses from the alluvial aquifer occur. To evaluate this hypothesis, initial data analysis consisted of plotting head differentials and vertical gradients between adjacent screens for the piezometer nests in which multiple transducers were deployed. This analysis permitted an assessment of conditions that may indicate the presence of a significant vertical component of groundwater movement in different canyon segments and is discussed in Section F-3.1.1. Additional data analysis consisted of performing seepage velocity computations for the zones between adjacent screens in these piezometer nests by applying Darcy's law in the vertical dimension. This analysis is discussed in Section F-3.1.2.

F-3.1.1 Differential Heads and Gradients

Differences between the individual water levels measured in each piezometer nest were used to quantify vertical gradients within the alluvial aquifer. The differences between measured heads are sometimes difficult to distinguish in the water-level hydrographs presented here. Thus, in order to better portray these relations, time-series plots of head differentials and vertical gradients between adjacent piezometer screens were also prepared. In these plots, head differential magnitudes are depicted on the left y-axis, while equivalent vertical gradients (head difference divided by the vertical distance between screens) are shown on the right y-axis. Gaps in these plots occur where one or both of the pertinent screens were dry or were lacking data. The screens in the piezometer nests are numbered from the bottom up (i.e., #1 is the lowest screen and #3 is the uppermost screen). The plots for the #3-#2 screen pair therefore show the hydraulic head relations in the upper part of the aquifer, while the plots for the #2-#1 pair indicate the hydraulic head relations in the lower portion of the aquifer. For example, when the head in the #3 (upper) screen is higher than the head in the #2 (middle) screen, a positive head differential (∂h) is depicted along with an equivalent positive (downward) gradient ($\partial h/\partial z$). In cases where the head in the lower screen is higher than the head in the upper screen, a negative ∂h is depicted along with an equivalent negative (upward) $\partial h/\partial z$. Thus, a positive $\partial h/\partial z$ indicates downward groundwater movement while a negative $\partial h/\partial z$ indicates upward movement. Table F-3.1-1 provides a summary of basic statistical measures for these parameters for each screen pair in each piezometer nest.

F-3.1.2 Seepage Velocity Computations

In order to assess magnitudes and variability in rates of flow for the vertical component of groundwater movement in the alluvial system, computations of seepage velocity employing Darcy's law in the vertical direction were performed using the differential heads and vertical gradients determined from the transducer data and the hydraulic conductivities determined from the slug testing program. Darcy's law,

which describes the relation between groundwater flow and aquifer conditions, is expressed by the equation (Freeze and Cherry 1979, 64057)

$$Q = -K A \frac{dh}{dl} \quad \text{Equation 1}$$

where, Q is the volumetric flux (units of length $[L]^3/\text{time } [T]$),

K is the hydraulic conductivity of the aquifer medium (units of L/T),

A is the cross-sectional area of flow (units of L^2), and

dh/dl is the hydraulic gradient in the horizontal plane (unitless).

The Darcy velocity or specific discharge (q) with units of L/T is obtained by dividing the flux by the cross-sectional area (A) of flow:

$$q = \frac{Q}{A} = -K \frac{dh}{dl} \quad \text{Equation 2}$$

However, because water can flow only through the void spaces in the cross-sectional area, a determination of the average linear velocity (v) must take into account the effective porosity (n_e) of the aquifer medium, such that

$$v = \frac{q}{n_e} = -\frac{K}{n_e} \frac{dh}{dl} \quad \text{Equation 3}$$

To determine the vertical seepage velocity (v_z), the vertical gradient dh/dz is substituted for the gradient in Equation 3 and downward velocity is assumed to be positive, yielding the expression

$$v_z = \frac{K}{n_e} \frac{dh}{dz} \quad \text{Equation 4}$$

Equation 4 was implemented in spreadsheet computations using the transducer data and slug test results to generate values of seepage velocity for the stratigraphic intervals between screen pairs in each piezometer nest. To determine appropriate hydraulic conductivity values for the stratigraphic intervals between screen pairs, the effect of layered heterogeneity was accounted for with a harmonic mean calculation, i.e., (modified after Freeze and Cherry 1979, 64057)

$$K_{mean} = \frac{b_{total}}{\sum_{i=1}^n \frac{b_i}{K_i}} \quad \text{Equation 5}$$

where K_{mean} is the mean hydraulic conductivity of a hydraulically equivalent, homogeneous, anisotropic aquifer matrix,

b_{total} is the total thickness of the interval between a screen pair from the top of the upper screen to the bottom of the lower screen,

b_i is the thickness of the i th stratigraphic interval,

K_i is the hydraulic conductivity of the i th interval with homogeneous and isotropic conditions assumed for each layer.

The resultant K_{mean} values were used to implement Equation 4 to compute seepage velocities.

Because no site-specific data were available for porosity, literature values were assumed for the effective porosity of the aquifer medium within each interval. Minimum, mean, and maximum values were determined from the range of literature values reported for a representative lithology and were applied to the seepage velocity computations. This process resulted in a range of possible seepage velocity values that reflect the uncertainty in the porosity parameter. The mean hydraulic conductivity calculations and assumed porosity values for each interval are summarized in Table F-3.1.2.

The seepage velocity data for each piezometer nest are presented in the following sections as time-series plots. These plots show the maximum, mean, and minimum seepage velocity values (using the minimum, mean, and maximum assumed porosity values, respectively) computed for the stratigraphic intervals between each screen pair. Comparative plots of mean seepage velocities (computed from the mean assumed porosity values) for the upper (#3-#2 screen pair) and lower (#2-#1 screen pair) intervals and water levels in each piezometer are also presented.

F-3.2 Site Specific Results

Plots of the water-level hydrographs for each piezometer are presented in this section along with discussions of the head differential analysis and the vertical gradient and seepage velocity computations performed for each piezometer nest data set.

F-3.2.1 LAP-1

Comparative water-level hydrographs for the LAP-1 piezometer nest, located in reach LA-1FW between Diamond Drive and TA-41, are shown in Figure F-3.2-1. Figure F-3.2-2 shows the head differentials and vertical gradients between each screen pair determined from the transducer data. In this plot, the ∂h between the #3 (upper) and #2 (middle) screens is relatively consistent throughout the monitoring period, averaging about 0.04 ft (1.2 cm) with an average $\partial h/\partial z$ of about 0.02. The ∂h between the #2 and #1 (lower) screens is shown for only the period after redevelopment efforts were performed on the #1 piezometer on April 1, 2003. As seen in Figure F-3.2-1, prior to that date, there were low water levels in this piezometer throughout most of the monitoring period, and the piezometer had dried up completely beginning in mid-2002, probably because a screen was clogged with fine sediment. After redevelopment efforts were conducted on April 1, 2003, water levels in the #1 piezometer initially rose very rapidly and then rapidly dropped until reaching an apparent equilibrium in mid-April. During the subsequent period from mid-April through late July 2003, the #2-#1 ∂h decreased at a fairly constant rate until it stabilized in early August 2003 at approximately 1 ft (31 cm), resulting in a #2-#1 $\partial h/\partial z$ of about 0.5. After this, several moderate #2-#1 ∂h fluctuations coincided with recharge events. The data collected after July 2003 is likely most representative of stable conditions in piezometer #1. The #3-#2 ∂h was generally confined to a small range of positive values, occasionally approaching zero. A few small negative values are less than the instruments' accuracy range and are therefore not significant. The LAP-1 data thus indicate that the vertical component of groundwater movement at this location during the monitoring period is exclusively downward.

Figure F-3.2-2 also shows several short-lived increases in ∂h and $\partial h/\partial z$ occurred in both the #3-#2 and #2-#1 screen pairs that coincide with major recharge events depicted in Figure F-3.2-1. These rapid water-level responses correspond with major runoff events and are seen as steep rises in the hydrographs followed by equally steep recessions back to static levels. During such events, the apparent magnitudes of ∂h and $\partial h/\partial z$ increased by roughly 2 to 5 times above the long-term, generally static levels observed in the #3-#2 screen pair, while the relative responses during these events in the #2-#1 screen pair were more muted. The lag time for seepage from the streambed to be seen at the different screen

depths is responsible for the apparent ∂h spikes during recharge events. During such events, a wetting front moves downward from the streambed, and elevated saturation levels are first seen in the shallowest screen. Responses are then seen in successively deeper screens as the wetting front advances downward. During the time after the wetting front passes an upper screen and before it reaches a lower screen, the ∂h between the different screen depths exhibits a spike in magnitude that lasts only until the wetting front reaches the lower screen. These ∂h spikes are thus indicators of advancing wetting fronts during short-lived recharge events and should not be viewed as representative indicators of the velocity of vertical groundwater movement within a continuum of saturated conditions.

The maximum, mean, and minimum seepage velocities computed for the #3-#2 and #2-#1 intervals are plotted in Figures F-3.2-3 and F-3.2-4, respectively. Comparative plots of measured water levels for each piezometer and mean seepage velocities computed for each interval are shown in Figure F-3.2-5. Figure F-3.2-3 shows that, aside from the apparent velocity spikes associated with wetting front movement during rapid recharge events, the mean #3-#2 interval seepage velocity during the monitoring period generally ranged between zero and about 0.3 ft (9.1 cm) per day (ft/day; cm/day), and the error range associated with the uncertainty in porosity is about ± 0.15 ft (4.6 cm)/day. Figure F-3.2-4 shows only the results subsequent to the apparent equilibrium reached in piezometer #1 after redevelopment on April 1, 2003. The mean computed #2-#1 interval seepage velocity during this period gradually fell from about 0.4 ft (12 cm)/day until it stabilized at about 0.3 ft (9.1 cm)/day in early August. The error range associated with the uncertainty in porosity for the #2-#1 interval is about ± 0.1 ft (3.0 cm)/day. Figure F-3.2-5 shows that the #2-#1 ∂h is much greater than the #3-#2 ∂h , but similar mean computed seepage velocities were determined for both intervals. This outcome is the result of a significantly lower K_{mean} for the #2-#1 interval (see Table F-3.1-2). These results suggest that a generally consistent downward flow component of moderate magnitude (about 0.3 ft (9.1 cm)/day ± 0.1 ft (3.0 cm)/day) exists at this location.

F-3.2.2 LAP-1.5

Comparative water-level hydrographs for the LAP-1.5 piezometer nest, located between TA-41 and TA-2, are shown in Figure F-3.2-6. Figure F-3.2-7 depicts the ∂h and $\partial h/dz$ values computed from the transducer data. Data prior to June 22, 2002, for the #3-#2 screen pair are excluded because persistent dry conditions in piezometer #3 since late 2001 and a malfunctioning transducer in piezometer #2 rendered most of the early data unreliable for this analysis. Data prior to April 1, 2003, for the #2-#1 screen pair are excluded because the #1 piezometer had markedly higher heads than were previously measured after redevelopment efforts were conducted on that date. Figure F-3.2-7 shows that several ∂h spikes associated with rapid recharge events were also detected in the LAP-1.5 data. This plot also shows that, besides these anomalies, the #3-#2 ∂h was primarily positive and generally varied from close to zero up to about 0.1 ft (3.0 cm), averaging about 0.05 ft (1.5 cm) with an equivalent $\partial h/dz$ of about 0.02 during the monitoring period. The #3-#2 ∂h fell close to zero during several weeks in November and December 2002 and again during February and March 2003, both times coinciding with periods of near-maximum saturation conditions. During an approximately two-week period in early August 2002, the water levels measured in piezometer #2 exceeded those measured in piezometer #3 resulting in a small negative #3-#2 ∂h . As seen in Figure F-3.2-6, this occurred during the early part of the falling limbs of the water-level hydrographs about 5 weeks after a major recharge event that occurred on June 22, 2002. The average #3-#2 ∂h of about -0.05 ft (1.5 cm) during this period is about double the magnitude of the transducer water level errors observed then in these piezometers (see Table F-2.3-2; Piezometer #2, Date/Time = 9/12/02 11:06; Piezometer #3, Date/Time = 9/12/02 10:41). Otherwise, only occasional brief occurrences of negative #3-#2 ∂h were detected, most of which are very small values that fall below the pressure transducers' accuracy range.

Figure F-3.2-7 shows that the #2-#1 interval exhibited a generally stable ∂h of approximately 0.1 ft (3.0 cm) with an equivalent $\partial h/dz$ of about 0.04 for about 7 weeks following redevelopment of the #1 piezometer, after which the #2-#1 ∂h began increasing. The beginning of this behavior coincided with a steep recession in the water-level hydrographs following a brief recharge event that occurred simultaneously with a major runoff event on May 19, 2003. The trend of increasing #2-#1 ∂h then continued during a lengthy period of hydrograph recession that extended through mid-August 2003. Responses to recharge events that began in late August 2003 generated several spikes in the #2-#1 ∂h , after which it stabilized at about 0.3 ft (9.1 cm) with an equivalent $\partial h/dz$ of 0.13. The climb in the magnitude of the #2-#1 ∂h after the recession that began on May 19, 2003, is attributable to an apparent decline of the #1 head relative to the heads measured in piezometers #2 and #3. It is suspected that this behavior may have been caused by gradual clogging of the #1 screen from silt in the aquifer mobilized by intermittent recharge events. In general, the LAP-1.5 data indicate that the vertical component of groundwater movement at this location during the monitoring period is predominantly downward.

The maximum, mean, and minimum seepage velocities computed for the LAP-1.5 #3-#2 interval are plotted in Figure F-3.2-8, and the seepage velocities computed for the #2-#1 interval are plotted in Figure F-3.2-9. Comparative plots of measured water levels for each piezometer and seepage velocities computed for each interval are shown in Figure F-3.2-10. Figure F-3.2-8 shows that, aside from the apparent velocity spikes associated with wetting-front movement during rapid recharge events, the mean #3-#2 interval seepage velocity during the monitoring period generally ranged between zero and about 3 ft (91 cm)/day, and the error range associated with the uncertainty in porosity is about +1 to -0.5 ft (+30 to -15 cm)/day. The mean computed seepage velocity for the #3-#2 interval during the monitoring period averaged about 1.8 ft (55 cm)/day.

Figure F-3.2-9 shows only the computed seepage velocities for the #2-#1 interval during the period subsequent to the rise in water levels seen in piezometer #1 after redevelopment was performed on April 1, 2003. The mean computed #2-#1 seepage velocity during this period varied from about 2 ft (61 cm)/day to about 7 ft (2.1 m)/day (exclusive of apparent velocity spikes during rapid recharge events). The error range associated with the uncertainty in porosity varies from about +1 to -0.5 ft (+30 to -15 cm)/day to as much as +2.5 to -1.5 ft (+76 to -46 cm)/day for this interval. Computed seepage velocities for the #2-#1 interval were fairly stable for a 7-week period subsequent to redevelopment coinciding with roughly steady-state, near-maximum saturation levels at this site. During the following hydrograph recession that extended through late August 2003, the #2-#1 mean computed seepage velocity increased to about 5 ft (1.5 m)/day. Several recharge events then occurred in the late August and early September 2003, after which the #2-#1 mean computed seepage velocity stabilized at about 7 ft (2.1 m)/day. As noted above, the apparent increase in seepage velocity for the #2-#1 interval during this period may have been caused by potentially inaccurate head measurements in piezometer #1, affected by silt clogging the screen. The most reliable data for piezometer #1 are likely those collected in April and May 2003 immediately after redevelopment. The #2-#1 mean computed seepage velocity during this period was about 2 ft (61 cm)/day +1 to -0.5 ft (+30 to -15 cm)/day.

Figure F-3.2-10 shows that the mean computed seepage velocities for both the #3-#2 and #2-#1 intervals were approximately equal at about 2 ft (61 cm)/day immediately following redevelopment of the #1 piezometer on April 1, 2003. However, while the #2-#1 seepage velocity remained stable over the following 7-week period, the #3-#2 seepage velocity gradually declined to about 0.5 ft (15 cm)/day because of a consistent decrease in the #3-#2 ∂h during this period. Both intervals then exhibited increases in computed seepage velocity of approximately equivalent magnitudes following the hydrograph recession that began on May 20, 2003 until the #3 piezometer dried up in mid-June. During this period, the #2-#1 interval mean computed seepage velocity increased to a maximum rate of about 5 ft (1.5 m)/day while the #3-#2 interval mean computed seepage velocity increased to a maximum rate of

about 4 ft (1.2 m)/day. Following recharge events in late August and early September 2003, the #3-#2 interval mean computed seepage velocity fell to about 3 ft (91 cm)/day while the apparent #2-#1 interval mean computed seepage velocity stabilized at about 7 ft (2.1 m)/day. The apparent increases in the #3-#2 interval computed seepage velocity following the recession that began in May 2003 may also be related to screen-clogging problems, as discussed earlier in this section.

The average mean computed seepage velocity for the #3-#2 interval during the entire monitoring period (about 1.8 ft [55 cm]/day) agrees well with the mean computed velocity for the #2-#1 interval during the stable 7-week period in April and May 2003 (about 2 ft [61 cm]/day). Similar error ranges are also associated with each interval during these time frames, as discussed previously. The data also indicate that seepage velocities in the 3 to 5 ft (0.9 to 1.5 m)/day range or higher likely exist at times. These results thus support the existence of a strong component of downward flow in the alluvial aquifer at this location.

F-3.2.3 LAP-3

The water-level hydrograph for the LAP-3 piezometer, located between TA-41 and TA-2, is shown in Figure F-3.2-11. As noted in Table F-2.1-1, a primary objective for monitoring alluvial water levels at this site is to verify whether or not persistently low saturation levels previously measured in alluvial observation well LAO-0.8 accurately represent aquifer conditions in this canyon segment. The lack of significant saturation levels and the ephemeral nature of saturation in LAO-0.8 as compared with a relatively thick and more stable saturated zone upgradient from its location has been used to support the thesis that significant seepage losses from the alluvial system occur in this canyon segment (Gray 1997, 58208). LAP-3 is located 43 ft (13 m) southeast of LAO-0.8 and 40 ft (12 m) farther from the stream channel. The screens at both sites are placed just above the base of the alluvium. In order to facilitate a comparison of the LAP-3 and LAO-0.8 data, manual water-level measurements collected from LAO-0.8 on a roughly monthly basis are superimposed on the plot in Figure F-3.2-11. Because there is little overlap between the two data sets, water levels measured in LAO-0.8 for the year prior to beginning data collection in LAP-3 are shown in order to better demonstrate the historical water-level behavior observed in LAO-0.8.

Figure F-3.2-11 shows that the transducer data collected from July through November 2001 in LAP-3 generally mimic the manual data collected in LAO-0.8 during this period, with two exceptions. First, the peak saturation level recorded in early August 2001 was only about 2 ft (61 cm) in LAP-3 while it was about 3.5 ft (1.1 m) in LAO-0.8. Secondly, whereas LAO-0.8 was continually dry after the August measurement, LAP-3 experienced only a short episode of dry conditions after which low levels of saturation (less than 1 ft [30 cm]) were observed during this period. Similar results were obtained in August and September 2002 before the manual measurements in LAO-0.8 were suspended. Though a significant gap in the LAP-3 data between December 2001 and August 2002 limits the period of comparison, these results generally show similar behavior with the exception that LAO-0.8 apparently goes dry, while intermittent periods of minimal saturation are still seen at LAP-3. The discrepancies between these sites are likely caused by local heterogeneity in the alluvium. Subsequent transducer data show that, aside from the appearance of several recharge events from February through May 2003 when peak saturation levels reached nearly 4 ft (1.2 m) in thickness, the water levels in LAP-3 were generally low, ranging from 0 to about 1.5 ft (46 cm) in saturated thickness. This behavior is similar to that seen in the LAO-0.8 record, which shows a peak saturated thickness of about 3.5 ft (1.1 m) while water levels generally ranged from 0 to about 1.5 ft (46 cm) in saturated thickness. Thus, the LAP-3 data generally corroborate the LAO-0.8 results verifying the persistence of relatively low saturation levels at this site.

It is interesting to note that, although these sites are in close proximity to each other, the peak water levels measured in early August 2001 have an elevation discrepancy of approximately 4 ft (1.2 m) while the base of the alluvium at LAP-3 is only about 2.5 ft (76 cm) lower than the base of the alluvium at LAO-0.8. The lower basal elevation at LAP-3 suggests that this site is nearer the axis of the bedrock channel underlying the alluvium. Because LAP-3 is at a greater distance from the stream channel, the higher head recorded in LAO-0.8 indicates that the stream channel is the primary source of recharge to the alluvial aquifer in this canyon segment and that a significant lateral gradient away from the recharge source is present.

F-3.2.4 LAP-3.5

Comparative water-level hydrographs for the LAP-3.5 piezometer nest, located immediately upstream from TA-2, are shown in Figure F-3.2-12. The ∂h and $\partial h/dz$ values computed from the transducer data for the LAP-3.5 piezometer nest are plotted in Figure F-3.2-13. Data prior to July 31, 2002 are excluded from Figure F-3.2-13 because of predominantly dry conditions before that date. Both the #3-#2 and #2-#1 intervals exhibited a very small ∂h at this site, with positive and negative values occurring in both intervals. Except for occasional spikes associated with short-term wetting-front movement during rapid recharge events, the #3-#2 ∂h generally varied from about 0.08 ft (24 mm) to -0.05 ft (15 mm), and the #2-#1 ∂h generally varied from about 0.1 ft (30 mm) to -0.02 ft (6 mm). The average $\partial h/dz$ was only about 0.01 for both screen pairs. The negative ∂h values are generally near or below the pressure transducers' accuracy specifications. However, the accuracy of the instruments at this site was good, with average errors of less than 0.01 ft (3 mm) for each piezometer (see Table F-2.3-3). The LAP-3.5 data thus indicate a variable vertical component of groundwater movement with both downward and upward flow at this location. Although the magnitudes of measured ∂h were often near the performance accuracy range of the transducers, the level of accuracy demonstrated by the QA program is such that most of the data should be reliable.

The maximum, mean, and minimum seepage velocities computed for the LAP-3.5 #3-#2 screen pair are plotted in Figure F-3.2-14, while the seepage velocities computed for the #2-#1 screen pair are plotted in Figure F-3.2-15. Comparative plots of measured water levels for each piezometer and seepage velocities computed for each screen pair are shown in Figure F-3.2-16.

As was seen at the LAP-1 and LAP-1.5 sites, Figure F-3.2-14 shows the presence of several apparent velocity spikes associated with recharge events. Unlike those depicted in the LAP-1 and LAP-1.5 plots, apparent negative (upward) velocities of significant magnitude were computed for several events within the LAP-3.5 #3-#2 interval. Inspection of the data files revealed that these events are related to a time lag between responses to recharge in the #2 and #3 screens. In each instance where a negative velocity spike occurs, a rising hydrograph was initially seen in the #2 (middle) screen before the #3 (upper) screen, with time lags ranging from 1 hour to 9 hours. These data suggest that the source of recharge during these events was underflow from within the alluvium rather than from streambed seepage. As discussed in Section F-3.2.1, the apparent velocities computed during these transient events should not be considered as representative of true flow velocities. Following the events in March and April 2003, apparent negative seepage velocities persisted for several weeks, averaging about -1 ft (30 cm)/day. Otherwise, the #3-#2 interval data generated positive (downward) mean computed seepage velocities generally ranging from less than 0.5 ft (15 cm)/day to about 3 ft (91 cm)/day at this location. The error range associated with the uncertainty in porosity for this interval is roughly ± 1 ft (30 cm)/day. The mean computed seepage velocity for the #3-#2 interval during the monitoring period averaged about 0.8 ft (24 cm)/day.

Although the head differentials and gradients for the #3-#2 interval were generally small, the computed seepage velocities have significant magnitudes because of the high K_{mean} applied to this interval (see Table F-3.1-2). The average hydraulic conductivity determined from the #2 piezometer slug tests was 1.27×10^{-2} cm/s (36 ft/day), the highest found during the slug testing program (see Table F-2.4-1). This value falls in the middle of the representative range of conductivity values for a clean sand (Freeze and Cherry 1979, 64057). However, the test results from the #3 piezometer were unreliable (see Table F-2.4-1), likely because low water levels prevented adequate development of the #3 screen. The hydraulic conductivity assumed for the #3 piezometer was thus based on an average of the results from the nearest alluvial wells (see Table F-3.1-2), similar in magnitude to the conductivity measured in piezometer #2. Therefore, the K_{mean} applied to the #3-#2 interval is considered reasonable. However, the #3-#2 head differentials may be questionable because of inefficient performance of the #3 screen. The inadequately developed #3 screen may also be a factor in the apparent lag times for head responses seen between the #3 and #2 screens.

Figure F-3.2-15 shows that computed seepage velocities for the LAP-3.5 #2-#1 interval were predominantly positive (downward) during the monitoring period. Negative velocities were computed for this interval during the first three weeks of August 2002 after all three piezometers had been dry for several months, and then again for a few weeks in July and September 2003. Aside from those periods, the mean computed seepage velocity generally varied from about 0.5 ft (15 cm)/day to about 1 ft (30 cm)/day with a maximum value of nearly 2 ft (61 cm)/day for the #2-#1 interval. Negative mean computed velocities were less than -0.5 ft (15 cm)/day. The error range associated with the uncertainty in porosity for this interval is roughly ± 0.2 ft (6.1 cm)/day when mean computed velocities are less than 1 ft (30 cm)/day and about ± 0.5 ft (15 cm)/day when they exceed 1 ft (30 cm)/day. The mean computed seepage velocity for the #2-#1 interval averaged about 0.5 ft (15 cm)/day during the monitoring period.

Figure F-3.2-16 shows that the mean computed seepage velocities for the upper interval were significantly greater than those determined for the lower interval. However, the #3 screen was frequently dry for extended periods, and the highest velocities computed for the #3-#2 interval always occurred immediately following the conclusion of a dry period. Because the #3 screen was never adequately developed, these results may be questionable. It is likely that silt clogging the #3 screen affected measured heads and influenced the timing of measured responses to recharge events. The mean computed seepage velocities for the lower interval were much more consistent and are felt to better represent seepage behavior at this site. After the short period of apparent negative velocity computed during the first two weeks of this plot (which followed an extended dry period), the velocities in the #2-#1 interval were consistently positive from August 2002 through April 2003. Afterward, a significant data gap for the #1 piezometer exists because of a malfunctioning transducer. The malfunction was caused by clogging of the pressure ports by a viscous, orange-brown colored substance that had the appearance of a rusty, silty mud (possibly the result of iron reducing bacteria growth in the #1 piezometer). After the #3 piezometer went dry in June 2003, the transducer was pulled from the #3 piezometer and installed in the #1 piezometer. Shortly afterward, the computed seepage velocities for the #2-#1 interval turned negative. The water-level data from the #1 piezometer after the new transducer was installed may be questionable because no attempt was made to clean out the #1 screen after the pressure ports in the first transducer were clogged. Focusing on the prior data for the #2-#1 interval, the results generally indicate a moderately significant component of downward flow at this site with a seepage velocity averaging about 0.5 ± 0.2 ft (15 $\pm$ 6.1 cm)/day. Indications of apparent upward flow at the LAP-3.5 site may or may not be significant.

F-3.2.5 LAP-4

Comparative water-level hydrographs for the LAP-4 piezometer nest, located downstream from DP Canyon, are shown in Figure F-3.2-17. Figure F-3.2-18 depicts the ∂h and $\partial h/\partial z$ values computed from

the transducer data. Figure F-3.2-17 shows that piezometer #3 dried up approximately two months after monitoring began in April 2001. Afterward, the #3 piezometer was dry except during a short period from November 2002 through January 2003 when saturation levels peaked at less than 1 ft (30 cm). As is seen in Figure F-3.2-18, the sparse data for the #3-#2 screen pair yielded very small ∂h values, averaging about 0.05 ft (15 mm) during the early period of screen #3 saturation and about -0.05 ft (15 mm) during the latter period. Both values fall near the performance accuracy range of the pressure sensors and thus may be questionable. The average #3-#2 $\partial h/dz$ was about 0.02 during the limited available record. These data suggest a minimal vertical component of groundwater movement in the upper aquifer zone at this location. Figure F-3.2-18 shows comparatively large and variable magnitudes of ∂h and $\partial h/dz$ for the #2-#1 interval. The #2-#1 ∂h generally ranged from about 1.5 ft (46 cm) to 3.5 ft (1.1 m) and averaged about 2.6 ft (79 cm) during the monitoring period. The #2-#1 $\partial h/dz$ generally varied from about 0.5 to slightly more than 1.0, averaging about 0.8. The relatively large magnitudes of ∂h and $\partial h/dz$ are related to the low hydraulic conductivity of this interval (see Table F-2.4-1), and thus do not necessarily indicate a substantial vertical component of groundwater movement in this zone.

The maximum, mean, and minimum seepage velocities computed for the LAP-4 #2-#1 interval are plotted in Figure F-3.2-19. Comparative plots of measured water levels for each piezometer and the seepage velocities computed for the #2-#1 interval are shown in Figure F-3.2-20. Seepage velocities were not computed for the #3-#2 interval because persistently low water levels during the monitoring period at this site prevented well development and slug testing in the #3 piezometer and the results of slug testing in the #2 piezometer indicated inadequate development of the #2 screen. Although the slug test results for the #2 piezometer are questionable, a conventional Hvorslev analysis of the recovery data yielded results that were similar to those obtained for the #1 piezometer (see Table F-2.4-1). Therefore, the seepage velocities computed for the #2-#1 interval are considered to be reasonable. Apparent velocity spikes associated with only two major recharge events recorded at this site during the monitoring period are less prevalent and considerably muted in magnitude compared with the other piezometer nests.

The results depicted in Figure F-3.2-19 verify a minimal vertical component of flow at this site. The #2-#1 interval mean computed seepage velocity generally varied between 0.1 ft (3.0 cm)/day and 0.12 ft (3.7 cm)/day, while the error range associated with the uncertainty in porosity for this interval is roughly ± 0.01 ft (3.0 mm)/day. Figure F-3.2-20 shows that the maximum computed seepage velocities occurred during the initiation of recharge events and tended to decline afterward at this site.

F-3.2.6 LAP-5.7

The water-level hydrograph for the LAP-5.7#1 piezometer, located downstream from the TA-53 drainage, is shown in Figure F-3.2-21. Because of low water levels at this location, data were not obtained from the #2 and #3 piezometers. Figure F-3.2-21 shows that following an initial saturated thickness of about 4.5 ft (1.4 m) in July and August 2001, the water level then declined over a 6-month period after which dry conditions persisted at this site. An initial gradual rate of decline became more rapid in January 2002 until the water level dropped below the bottom of the screen on February 22, 2002. There was an apparent small amount of recharge in response to runoff events in August 2001. Otherwise, occasional runoff events of generally small magnitude during the monitoring period failed to provide any detectable recharge to the alluvial aquifer at this location, suggesting that upgradient underflow is the prevalent recharge mechanism in this canyon segment.

F-3.2.7 LAP-6

The water-level hydrograph for the LAP-6 piezometer, located downstream from the TA-53 drainage, is shown in Figure F-3.2-22. It is seen that following an initial saturated thickness of about 3.5 ft (1.1 m) to

4 ft (1.2 m) during the period from March through June 2001, the water level then declined over a 9-month period after which dry conditions persisted at this site. Though a significant data gap exists for the period from December 2001 through February 2002, the transducer record shows a generally gradual rate of decline that continued until the piezometer dried up completely on April 2, 2002. As was seen in LAP-5.7, there was an apparent small amount of recharge in response to runoff events in August 2001. Otherwise, occasional runoff events of generally small magnitude during the monitoring period failed to provide any detectable recharge to the alluvial aquifer at this location, again suggesting that upgradient underflow is the prevalent recharge mechanism in this canyon segment.

F-3.3 Overview of Computed Seepage Velocity Results

This section provides an overview discussion of the results of the transducer data analyses discussed in the preceding sections. Section F-3.3.1 addresses a statistical analysis of the mean computed seepage velocities that was performed to eliminate extreme values from the results and better represent the range of flow velocities occurring within a saturated continuum. Section F-3.3.2 addresses the range of error associated with the uncertainty in assumed effective porosity values used in the seepage value computations as well as other potential sources of uncertainty.

F-3.3.1 Statistical Analysis

Table F-3.3-1 provides basic statistical measures for the mean computed seepage velocities for each interval between screen pairs in each piezometer nest (computed using the mean values of representative ranges of literature values for effective porosity). Mean velocities vary substantially within the different canyon segments represented by each piezometer nest. The lowest computed velocities occur in the upper canyon area upstream from TA-41 at LAP-1 and downstream from DP Canyon at LAP-4. The highest velocities were found at LAP-1.5 near the boundary between TA-2 and TA-41 where elevated water losses from the alluvial aquifer have been previously hypothesized (Gray 1997, 58208; 2000, 85218). The ranges between the maximum and minimum mean computed seepage velocities are generally large because of the frequent occurrence of apparent velocity spikes associated with wetting-front movement during recharge events at most sites. As discussed in the preceding sections, these apparent maximum and minimum values should not be viewed as representative of true flow velocities within a continuously saturated aquifer medium. In order to better represent the upper and lower bounds of vertical flow velocities in a saturated continuum, the 5th and 95th percentile values were determined for each screen pair's mean computed velocity data set. By excluding the lower and upper extreme values, which arise from time lags for wetting-front movement between screens, these statistical measures represent a more realistic range of vertical flow velocities that occur in the saturated alluvium. The results that fall between the 5th and 95th percentiles represent the range of mean computed seepage velocities that are considered to be statistically significant.

Figure F-3.3-1 depicts these results graphically. This plot compares the average and median values determined from the mean computed velocity results for each evaluated stratigraphic interval plus the range of fluctuation in mean computed velocities represented by the 5th and 95th percentile values. The average and median values of mean computed velocity are nearly identical in all cases except for the LAP-1.5 #2-#1 interval in which the median value is slightly greater than the average value. The similarity of the average and median values indicates that the data sets are normally distributed. Figure F-3.3-1 shows that similar velocities occur at the LAP-1 and LAP-4 sites, both having a small range of statistically significant values generally falling between 0.1 ft (3.0 cm)/day and 0.3 ft (9.1 cm)/day. By far, the highest mean computed velocities and the greatest range of fluctuation occurs at LAP-1.5, between TA-41 and TA-2, where statistically significant values ranged from about 0.1 ft (3.0 cm)/day to 4.6 ft (1.4 m)/day in the upper stratigraphic interval and from about 1.8 ft (55 cm)/day to 8.7 ft (2.7 m)/day in the lower interval.

Relatively high mean computed velocities were also found at the LAP-3.5 site, which is located 540 ft (165 m) downgradient from LAP-1.5. Statistically significant mean computed seepage velocities at LAP-3.5 ranged from about -2.4 ft (73 cm)/day to 3.4 ft (1.0 m)/day in the upper stratigraphic interval and between about -0.3 ft (9.1 cm)/day and 1.2 ft (37 cm)/day in the lower interval. LAP-3.5 is also the only site where statistically significant negative mean velocities were computed. However, as discussed in Section F-3.2.4, some of the LAP-3.5 results may be questionable because of possible screen clogging and inadequate development. The relatively stable lower interval data collected prior to the development of clogging problems indicate the likelihood of a downward seepage velocity generally ranging from about 0.3 ft (9.1 cm)/day to 1 ft (30 cm)/day at the LAP-3.5 site.

F-3.3.2 Potential Sources of Error

Figure F-3.3-2 graphically depicts the average and median values of the maximum, mean, and minimum computed seepage velocities for each evaluated interval (computed using the minimum, mean, and maximum values, respectively, of representative ranges of literature values for effective porosity) to illustrate potential sources of error related to uncertainties in porosity. For example, the average mean velocity is the average of the set of velocities computed assuming an effective porosity equal to the mean of a representative range of literature values for the porosity of a given lithology. Likewise, the median mean velocity is the median value determined from this data set. The average and median values for the minimum and maximum computed velocities were determined similarly from computed velocity sets in which the porosity was assumed to equal the maximum and minimum values, respectively, of an appropriate porosity range. This plot thus illustrates the potential range of error associated with the uncertainty in assumed porosity for each stratigraphic interval.

The potential error range attributable to porosity uncertainty is small at both the LAP-1 and LAP-4 sites. Both the LAP-1 #3-#2 and #2-#1 intervals have an average mean velocity of about 0.3 ft (9.1 cm)/day and a potential error range of about ± 0.1 ft (3.0 cm)/day. At LAP-4, the average mean velocity of about 0.2 ft (6.1 cm)/day for the #2-#1 interval has a potential error range of about ± 0.05 ft (15 mm)/day. Slightly greater potential error ranges are seen in the LAP-3.5 results. The average mean velocity of 0.8 ft (24 cm)/day for the LAP-3.5 #3-#2 interval has a potential error range of about +0.3 ft (9.1 cm)/day to -0.2 ft (6.1 cm)/day associated with the uncertainty in porosity, while the average mean velocity of about 0.5 ft (15 cm)/day for the #2-#1 interval has a potential error range of about +0.2 ft (6.1 cm)/day to -0.1 ft (3.0 cm)/day. The largest potential error ranges associated with porosity uncertainty are seen in the LAP-1.5 results. The average mean velocity of about 1.8 ft (55 cm)/day for the LAP-1.5 #3-#2 interval has a potential error range of about +0.6 ft (18 cm)/day to -0.4 ft (12 cm)/day, while the average mean velocity of about 4.5 ft (1.4 m)/day for the #2-#1 interval has a potential error range of about +1.6 ft (49 cm)/day to -0.9 ft (27 cm)/day attributable to porosity uncertainty.

An additional potential source of error for the computed seepage velocity results is instrument performance accuracy. Pressure sensor accuracy was previously addressed in Section F-2.3. The QA program established the accuracy of the transducer readings on a regular basis, as documented in Tables F-2.3-1 through F-2.3-4. As discussed in Section F-2.3.1, the QA measurements occasionally revealed a drift in the transducer readings that was near or exceeded instrument accuracy specifications. In these cases, a data correction procedure was employed that maintained relative head differentials between piezometers as determined by the manual water-level measurements while preserving the pattern of water-level fluctuations recorded by the transducer. In some cases (i.e., the #3-#2 interval at LAP-1 and both intervals at LAP-3.5), the average ∂h was less than or near the accuracy range of the pressure sensors (see Table F-3.1-1). Therefore the computed seepage velocities from these data sets should be viewed with some degree of caution. However, the 95th percentile ∂h values for all evaluated intervals exceed the instruments' accuracy specifications, while extensive QA and data correction

procedures were employed to maintain relative head differential accuracy with respect to periodic manual measurements. Therefore, the range of error in computed seepage velocity due to instrument accuracy should be minimal.

Another potential source of error for the computed seepage velocity results is the reliability of the hydraulic conductivity values derived from the slug testing program. Slug tests are often viewed skeptically because the small stresses imparted by slug displacement can only measure the character of a small portion of the aquifer near the well screen and may be significantly influenced by filter-pack characteristics if the well is not sufficiently developed (Butler 1998, 73641). However, the slug testing program in this study incorporated a QA process that made use of multiple tests with slugs of varying displacement at each site and superposition of normalized displacement plots to verify repeatability of results. In cases where poor repeatability indicated inadequate well development, additional development efforts were undertaken prior to subsequent testing. Furthermore, the K_{mean} results obtained at most sites agree well with published conductivity ranges for similar materials. Certainly the heterogeneity of the alluvial system is such that average aquifer characteristics within a large canyon segment will not precisely match those determined for a specific site. However, the results of several site-specific analyses such as those performed during the course of this study can be viewed as a reasonable depiction of a likely range of representative characteristics for the system with better confidence in accordance with the number of tests and sites tested. On balance, the hydraulic conductivity values determined from the slug testing program appear reasonable while the QA process permitted the identification and exclusion of questionable results.

Another potential source of error applies more to the interpretation of results than to the quantification process. The degree to which the seepage velocity determined at a particular site is attributable to vertical seepage flow is uncertain. Other conditions that may contribute to the vertical flow component include variations in local heterogeneity and the local gradient of the aquifer. The bedrock slope in upper Los Alamos Canyon imparts a local gradient that varies generally between 0.01 and 0.05, and averages about 0.03. The values of $\partial h/\partial z$ shown in Table F-3.3-1 suggest that this range of values could contribute a major portion of the average vertical gradient in the upper interval in each piezometer nest and for the lower interval as well at LAP-3.5. However, a direct relation does not exist between the local aquifer gradient and the vertical gradient observed at a particular site because of the effect of anisotropy with respect to hydraulic conductivity in the alluvial sediments. As previously discussed in Section F-2.4.2, the bedded character of fluvial deposits imparts a strong anisotropy to the system, and documented studies have shown K_h values ranging between 2 and 10 times greater than K_v in these systems. Furthermore, it is not uncommon for the effects of layered heterogeneity to result in anisotropy values on the order of 100:1 ($K_h: K_v$) or larger (Freeze and Cherry 1979, 64057). Therefore, at best, the magnitude of the contribution of the local aquifer gradient to the vertical head gradient at a single site is likely to be on the order of 10% to 50% and could be much less. If one were to assume a worst-case scenario, then a rough estimate of 50% of the apparent computed seepage velocity at a site may be considered as the maximum level of error due to inclusion of the vertical component of flow attributable to the local aquifer gradient in the seepage velocity computations.

The effects of local heterogeneity on the measured vertical gradients at each site cannot be quantified. If such effects are similar throughout the system, then the results as a whole can be considered as valid on a relative basis. However, if there are major local variations in average hydraulic conductivity of the alluvial aquifer materials (e.g., a change from low average conductivity upstream to high average conductivity downstream), then some of the variations between piezometer nests could be related to heterogeneity on this scale. Nevertheless, the internally consistent patterns displayed in Figures F-3.3-1 and F-3.3-2 suggest that these data indicate true variations in vertical seepage velocity related to loss from the alluvial aquifer into bedrock.

F-4.0 OBSERVATIONS AND CONCLUSIONS

This section provides a discussion relating to observations and conclusions drawn from this study as well as other ongoing work monitoring water levels in the upper Los Alamos Canyon alluvial system. The conclusions are then used as the basis for describing a conceptual model for water losses from the canyon.

F-4.1 Previous and Ongoing Investigation Conclusions

The most comprehensive previous analysis of the alluvial system in Los Alamos Canyon was by Gray (2000, 85218), briefly discussed in Section F-1.0. This study determined steady-state rates of water loss to evapotranspiration (ET), discharge to the stream channel, and infiltration seepage for seven separate canyon reaches extending from Los Alamos reservoir eastward to the Laboratory boundary near State Highway NM 4. The groundwater model developed for this study was calibrated to alluvial groundwater levels recorded in May 1995 during the peak of a major snowmelt runoff event that created more or less steady-state saturation in the alluvial system from early March through June. These results thus represent maximum saturation conditions throughout the canyon that were not seen during the time period of the current study. Therefore, the rates of loss to modeled head-dependent pathways such as ET (modeled loss rates decrease linearly with increasing water table depth below surface) and from the alluvial aquifer to the streambed (modeled discharges are computed using aquifer head above streambed elevation) represent maximum potential rates that likely exceed the rates for these pathways during most of the current study period. Nonetheless, it is useful to note that the Gray (2000, 85218) study estimated that ET comprised only approximately 5% of total losses, while discharges to the streambed represented about 33% and seepage losses to bedrock were 62% of the total water losses from the alluvial aquifer.

ET thus does not appear to represent a significant output pathway for the alluvial system in upper Los Alamos Canyon. And whereas streambed discharges were found to account for one-third of the total water losses in the upper canyon, much of the streamflow generated in gaining reaches is likely to infiltrate back into the alluvium farther downstream. Furthermore, the streambed discharge rates generated from the Gray (2000, 85218) study represent conditions when streamflow was continuous throughout the canyon for several months. The elevated streamflow conditions represented in the earlier work are not comparable to those observed during the current study.

As discussed in Section F-1.0, previous investigations have identified the canyon segment between TA-2 and TA-41 (located near alluvial well LAO-0.8 and piezometer LAP-3; Figure F-1.0-1) as an area where significant water losses from the alluvial system may occur (Gray, 1997, 58208; 2000, 85218). Additional water-level data collected from various alluvial wells in upper Los Alamos Canyon (Section B-2.3 of Appendix B) show a pattern of relatively stable saturation in the alluvium upgradient from the LAO-0.8 location, while saturation is seen to fluctuate widely and experience significantly dry conditions in the alluvium downgradient from this location.

Based on an analysis of manual measurements of alluvial water levels performed between 1994 and 2002, the alluvial aquifer in the areas located upgradient from LAO-0.8 has exhibited an average saturated thickness of about 10.8 ft (3.3 m) with a standard deviation of 0.86 ft (26 cm) (using data from wells LAO(b), LAO-0.3, and LAO-0.6; Figure F-1.0-1), while saturated thickness averaged only about 4.1 ft (1.2 m) with a standard deviation of 2.6 ft (79 cm) from the LAO-0.8 site eastward [based on data from wells LAO-0.8, LAO-0.91, and LAO-1.6(g); Figure F-1.0-1]. The standard deviation is about 8% of the average saturated thickness for the upgradient wells, whereas it represents about 63% of the average saturated thickness for the downgradient wells. The average saturated thickness for the upgradient wells is more than twice that for the downgradient wells. These results depict a fairly stable level of saturation in the upper canyon alluvium. This condition may be attributed to a combination of intermittent recharge from the streambed and a generally constant level of recharge from upgradient groundwater flow fed by

recharge in the upper part of the watershed. The high standard deviation for saturated thickness downgradient from LAO-0.8 suggests a higher dependency on intermittent streambed recharge and the absence of persistent groundwater flow from upgradient in the canyon alluvium in this area. The absence of the groundwater flow component of recharge in the downgradient canyon segment may be inferred as caused by elevated seepage losses in the area between TA-41 and TA-2. As noted in Section F-1.0, a small segment of the Pajarito fault system is indicated near the TA-2/TA-41 boundary by Gardner, et al. (2003, 85527), and zones of increased fracture density were measured in the north wall of upper Los Alamos Canyon in the TA-2/TA-41 vicinity by Wohletz (1996, 58846). Seepage into fractures in the underlying bedrock is a possible mechanism for the apparent water loss from the alluvial aquifer in this area. Another possibility for water loss in this area is by infiltration into the porous nonwelded Otowi Member of the Bandelier Tuff below the Cerro Toledo interval, which crops out at the base of the north canyon wall above TA-41.

F-4.2 Current Investigation Conclusions

Results obtained from the current study also support the premise of elevated seepage losses between TA-41 and TA-2 reflected by a marked decrease in saturated thickness between the canyon segments located upgradient and downgradient of LAO-0.8. The transition zone between these segments lies within the area including the LAP-1.5, LAP-1.7, LAO-0.8, LAP-3 and LAP-3.5 locations (Figure F-1.0-1). Regular monitoring of the LAP-1.7 piezometer nest was not performed because two of the piezometers failed to produce water as a result of installation difficulties related to high water pressures and unstable, flowing sands. However, a saturated thickness of 14.6 ft (4.5 m) was encountered during the drilling of the LAP-1.7 borehole, which is located only 190 ft (58 m) west of LAP-3 where only 1.6 ft (49 cm) of saturation was encountered. Although it is possible that varying bedrock topography and aquifer geometry, or varying aquifer conductivity, might be called upon to account for some or all of the large variation in saturated thickness occurring over such a short distance, these results may also suggest that a significant volume of water is exiting the alluvial system somewhere within this transition zone.

Additional areas of the canyon where elevated seepage losses have been hypothesized include zones where the alluvium overlies relatively permeable formations such as the Otowi Member of the Bandelier Tuff (underlying the location of LAP-4 downstream from DP Canyon) and the subcrops of the Guaje Pumice Bed, Puye Formation, and Cerros del Rio Basalt (projected to occur near the locations of LAP-5.7 and LAP-6 downstream from the TA-53 drainage).

As discussed in Section F-3.2.5, the LAP-4 results do not support the existence of significant seepage losses in this canyon segment. Although the LAP-4 location (Figure F-1.0-1) was dry during much of the monitoring period, the available data indicate that only a minimal vertical component of flow occurs at this site. The transducer data from LAP-5.7 and LAP-6 (discussed in Sections F-3.2.6 and F-3.2.7) are inconclusive with regard to the measurement of vertical flow. Because multiple transducers could not be deployed in the LAP-5.7 piezometer nest before the aquifer dried out in February 2002, time-series differential head data were not collected at this site. A piezometer nest was not installed at the LAP-6 site because a thick clay zone underlying the alluvium was encountered that essentially precluded any significant downward seepage at that location. However, water levels were measured in all three piezometers at the LAP-5.7 site in April 2001, approximately three weeks after installation. At that time, the LAP-5.7 #3-#2 interval ∂h was 0.02 ft (6 mm) and the #2-#1 interval ∂h was zero. These data suggest at best a small vertical component of groundwater movement at this site, although that condition might be temporary as the alluvium was underlain by saturated decomposed tuff at the time the LAP-5.7 borehole was drilled.

The fact that the LAP-5.7 and LAP-6 sites were completely dry during most of the monitoring period when upgradient sites experienced saturated conditions suggests that significant water losses from the alluvial

system have occurred in the intervening canyon reaches. It is interesting to note that the aquifer dried up at the LAP-6 site (on April 2, 2002) later than it did at the LAP-5.7 site (on February 22, 2002), the discrepancy amounting to 39 days. The findings discussed in Section B-2.2 of Appendix B show that the alluvial aquifer dried up at LAO-1.6(g) (located 1.8 mi west of LAP-5.7) on about February 11, 2002, and at LAO-0.91 [located 1.4 mi west of LAO-1.6(g) near the eastern boundary of TA-41] on December 11, 2001.

These results indicate that when the upgradient source of underflow recharge was eliminated as the alluvial aquifer dried up downstream from TA-2 in the winter of 2001–2002, essentially a disconnected slug of saturation existed downstream from the TA-53 drainage that then appears to have retreated downgradient as a “drying” front advanced behind it. However, the distance between the LAP-5.7 and LAP-6 sites is only 771 ft (235 m). If this condition is viewed as a slug of saturation flowing downgradient with little seepage loss occurring in this canyon segment, the time discrepancy equates to a lateral flow velocity of about 20 ft (6.1 m)/day. This is equivalent to an annual velocity of 7300 ft (2.2 km) per year (ft/yr), a magnitude that significantly exceeds previous average flow velocity estimates of 900 ft (274 m)/yr (Gallaher 1995, 49679) and 727 ft (222 m)/yr (Gray 1997, 58208) for the upper Los Alamos Canyon alluvial aquifer. Because downgradient flow cannot account for this rapid loss, this result suggests that significant seepage losses from the alluvium also occur in this canyon segment. The fact that the aquifer dried out at the LAP-6 site later than the LAP-5.7 site suggests that seepage losses were higher at LAP-5.7 than at LAP-6. It is likely that water losses in the LAP-5.7 area occurred because of seepage through underlying permeable contacts with the Puye Formation in areas that were not found during the piezometer drilling program, while losses in the LAP-6 area occurred because of seepage through more permeable Cerros del Rio basalt in areas where the thick clay encountered at LAP-6 was not present.

The results from the piezometer nests installed in the TA-2/TA-41 area appear to support the existence of significant water losses from the alluvial system in this canyon segment. Although the LAP-3.5 upper interval data were questionable, moderately significant mean seepage velocities averaging about 0.5 ft (15 cm)/day were computed for the lower interval in LAP-3.5. Substantially significant mean seepage velocities were determined for the LAP-1.5 site where the most reliable data indicated mean velocities of about 1.8 ft (55 cm)/day to 2 ft (61 cm)/day, an order of magnitude greater than the mean velocities found in the LAP-1 and LAP-4 piezometer nests representing the canyon reaches located upgradient and downgradient of the TA-2/TA-41 vicinity. The major results of the piezometer study thus indicate that elevated infiltration losses from the alluvial aquifer as indicated by high measured seepage velocities occur in the canyon segment immediately west of TA-2 that includes the LAP-1.5, LAP-1.7, LAP-3, and LAP-3.5 piezometer sites and the location of alluvial well LAO-0.8 (Figure F-1.0-1).

F-4.3 Conceptual Model for Water Losses in Upper Los Alamos Canyon

This section integrates the results and conclusions drawn from the current study with those from previous investigations and other ongoing work to describe a general conceptual model for water losses from the alluvial system in upper Los Alamos Canyon. The conceptual model developed here is essentially a summation of the output components of a water balance for the alluvial aquifer. The current study focuses on an analysis of canyon bottom areas limited to the west and east by Laboratory property boundaries. Section F-4.3.1 outlines the basis of the conceptual model, while Section F-4.3.2 summarizes the information pertinent to seepage losses for the different canyon segments within the study area.

F-4.3.1 Conceptual Model Outline

The conceptual model of a water budget for the Los Alamos Canyon alluvial system is based on the application of a basic hydrologic equation, simply stated: the sum of water inputs minus the sum of water outputs is equivalent to change in storage. Water inputs to the alluvial system in upper Los Alamos

Canyon are from upgradient groundwater flow and infiltration of surface water derived from meteoric and anthropogenic sources. There are only four possible pathways for water outputs from the saturated alluvium. These are

- groundwater flow through the downgradient boundary of the system,
- ET,
- discharges from the aquifer to the stream channel, and
- seepage from the base of the alluvium to underlying strata.

As previously discussed, the alluvial aquifer downgradient from the TA-53 drainage was completely dry during most of the monitoring period. This essentially eliminates the first pathway as a significant output component for this study. And, as discussed in Section F-4.1, a previous study suggests that ET losses are likely a minor component of total water losses. It is possible that the relative proportion of ET may be greater during the current study in which drier conditions than those during the earlier study period prevailed. However, this was not quantified during the current study.

Recent streamflow data (discussed in Section B-2.3 of Appendix B) show that extensive and prolonged streamflow conditions throughout upper Los Alamos Canyon last occurred during March and April 2001. This timeframe overlaps with only the first few weeks of alluvial water level monitoring downstream from DP Canyon (at LAP-4, LAP-5.7, and LAP-6; Figure F-1.0-1) in the current study. Afterward, streamflow in the upper canyon downstream from TA-2 has generally maintained only minimal flow levels for occasional short periods of a few weeks punctuated by occasional short-lived storm runoff events that last a day or two. During most of the study, streamflow downgradient from the TA-53 drainage has been minimal to nonexistent except for occasional short-lived storm runoff events. No streamflow was measured in at the lower stream gage (near State Highway NM 4) more than 97% of the days after September 15, 2001. It is thus clear that streambed discharge losses from the alluvial system were negligible or nonexistent during the current study period. Consequently, seepage loss into underlying bedrock units is by far the primary pathway for water loss from the alluvial aquifer under the conditions prevalent during this study.

F-4.3.2 Conceptual Model Seepage Estimates

Estimated seepage losses to bedrock in upper Los Alamos Canyon between the western Laboratory boundary and TA-41 are based on the results from the LAP-1 site, and its data indicate that a downward component of flow velocity of approximately 0.3 ft (9.1 cm)/day $\pm$ 0.1 ft (3.0 cm)/day may exist at this location. Factoring in potential uncertainty caused by the local aquifer gradient may reduce the lower bound of this estimate to a moderate rate of about 0.1 ft (3.0 cm)/day.

The results from the LAP-1.5 site indicate the highest rate of seepage loss found in upper Los Alamos Canyon for this canyon segment (between TA-41 and TA-2; Figure F-1.0-1), demonstrated by the high computed seepage velocities for this site relative to the other evaluated sites. The most reliable data suggest a seepage velocity of approximately 1 ft (30 cm)/day to 2 ft (61 cm)/day $\pm$ 0.5 ft (15 cm)/day at this location. Uncertainty caused by the local aquifer gradient may reduce the lower bounds of this estimate to about 0.25 ft (7.6 cm)/day to 0.5 ft (15 cm)/day. As noted earlier, the apparent existence of elevated rates of vertical flow at this site supports a conceptual model of enhanced seepage losses in this canyon segment, which may be related to the subcrop of the permeable Otowi Member of the Bandelier Tuff in this area and/or its proximity to zones of increased fracture density in the Bandelier Tuff and a small segment of the Pajarito fault system. The model thus incorporates elevated rates of seepage flow from the alluvium presumably into relatively permeable rock units, possibly enhanced by localized fractures in the bedrock that may or may not be related to fault movement. The water-level data from other nearby wells and piezometers (described in Sections F-4.1 and F-4.2) further support this model.

The results from the nearby LAP-3.5 site (just west of the former Omega West Reactor site in TA-2; Figure F-1.0-1) generally indicate a significant but less elevated component of downward flow (relative to the LAP-1.5 results) at this site with a seepage velocity averaging about 0.5 ft (15 cm)/day $\pm$ 0.2 ft (6.1 cm)/day. Uncertainty caused by the aquifer gradient may reduce the lower bound of this estimate to about 0.15 ft (4.6 cm)/day. Relative to the other sites evaluated in this study, these results also support the model of enhanced seepage losses in the canyon segment located between TA-41 and TA-2, although the major losses appear to occur in the upgradient area between this site and LAP-1.5.

The LAP-4 data represent the area downstream from DP Canyon (Figure F-1.0-1) where the alluvium overlies the Otowi Member of the Bandelier Tuff. These data indicate that a downward component of flow velocity of approximately 0.1 ft (3.0 cm)/day $\pm$ 0.01 ft (3.0 mm)/day exists at this location. Factoring in potential uncertainty caused by the local aquifer gradient may reduce the lower bound of this estimate to about 0.05 ft (15 mm)/day. The model thus does not incorporate significant seepage losses in this canyon segment.

The canyon segments downstream from the TA-53 drainage represented by LAP-5.7 and LAP-6 (Figure F-1.0-1) were dry throughout most of the study period. Though data were not available for the computation of seepage velocities, the timing of the drying out of the alluvial aquifer in the spring of 2002 at these sites supports the model of enhanced seepage losses to underlying contacts with the Puye Formation and Cerros del Rio basalt in this canyon segment, or possibly into the Guaje Pumice Bed upstream.

In summary, the data collected during this study and other previous and ongoing investigations indicate that water losses to seepage from the alluvium in upper Los Alamos Canyon vary widely and high rates of water loss are concentrated in certain canyon segments. The highest loss rates appear to occur in the canyon segment between TA-41 and TA-2, and a likely pathway for these losses is through seepage into the underlying bedrock. Elevated losses are also indicated downstream from the TA-53 drainage and west of State Highway NM 4 where the likely pathways are seepage into permeable zones where the alluvium overlies the Guaje Pumice Bed, the Puye Formation, or the Cerros del Rio basalt. The study indicates only minor potential seepage losses for the intervening canyon segments.

F-5.0 REFERENCES

The following list includes all documents cited in this report. Parenthetical information following each reference provides the author, publication date, and ER ID number. This information is also included in text citations. ER ID numbers are assigned by the RRES-RS Records Processing Facility (RPF) and are used to locate the document at the RPF and, where applicable, in the RRES-RS project reference set titled "Reference Set for Canyons Investigations."

Copies of the reference sets are maintained at the NMED Hazardous Waste Bureau; the DOE Los Alamos Site Office; US Environmental Protection Agency, Region 6; and RRES-RS project. The sets were developed to ensure that the administrative authority has all material needed to review this document, and they are updated periodically as needed. Documents previously submitted to the administrative authority are not included.

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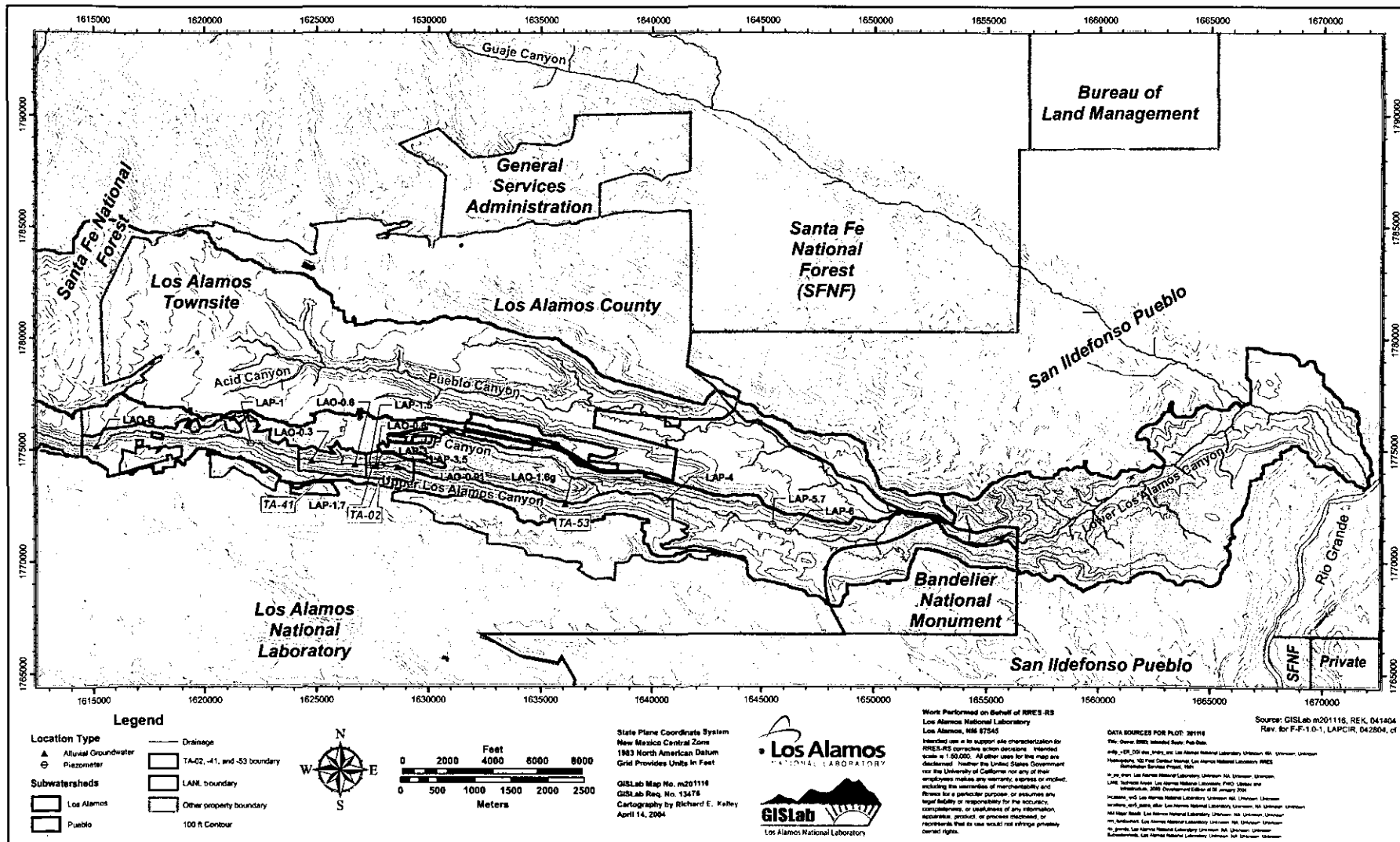
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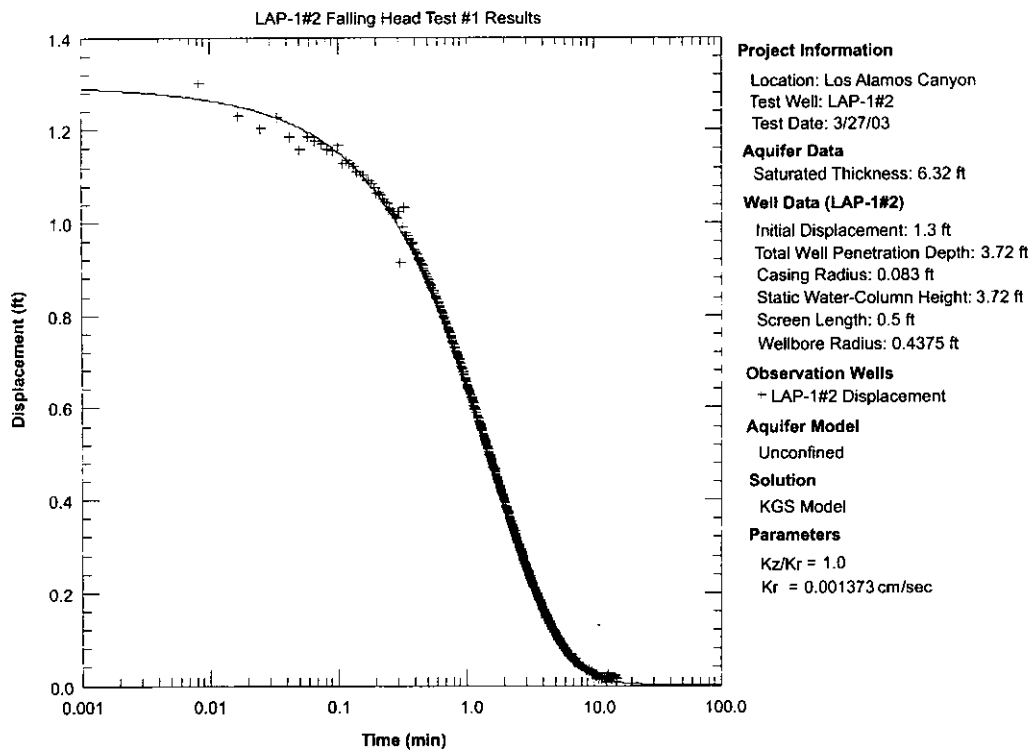


Figure F-2.4-1. Example AQTESOLV slug test analysis output

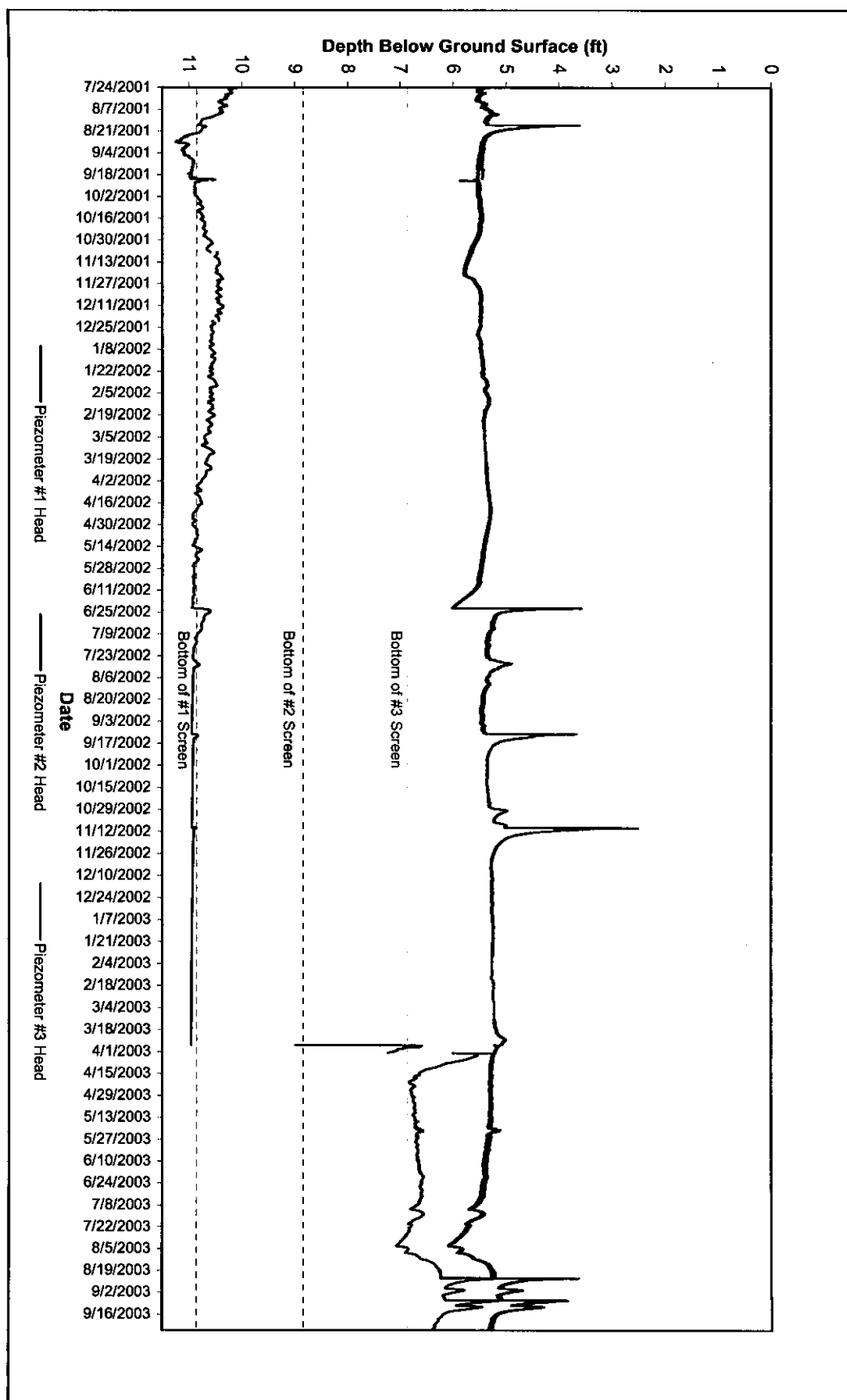


Figure F-3.2-1. LAP-1 piezometer nest water level comparison, July 24, 2001, to September 25, 2003

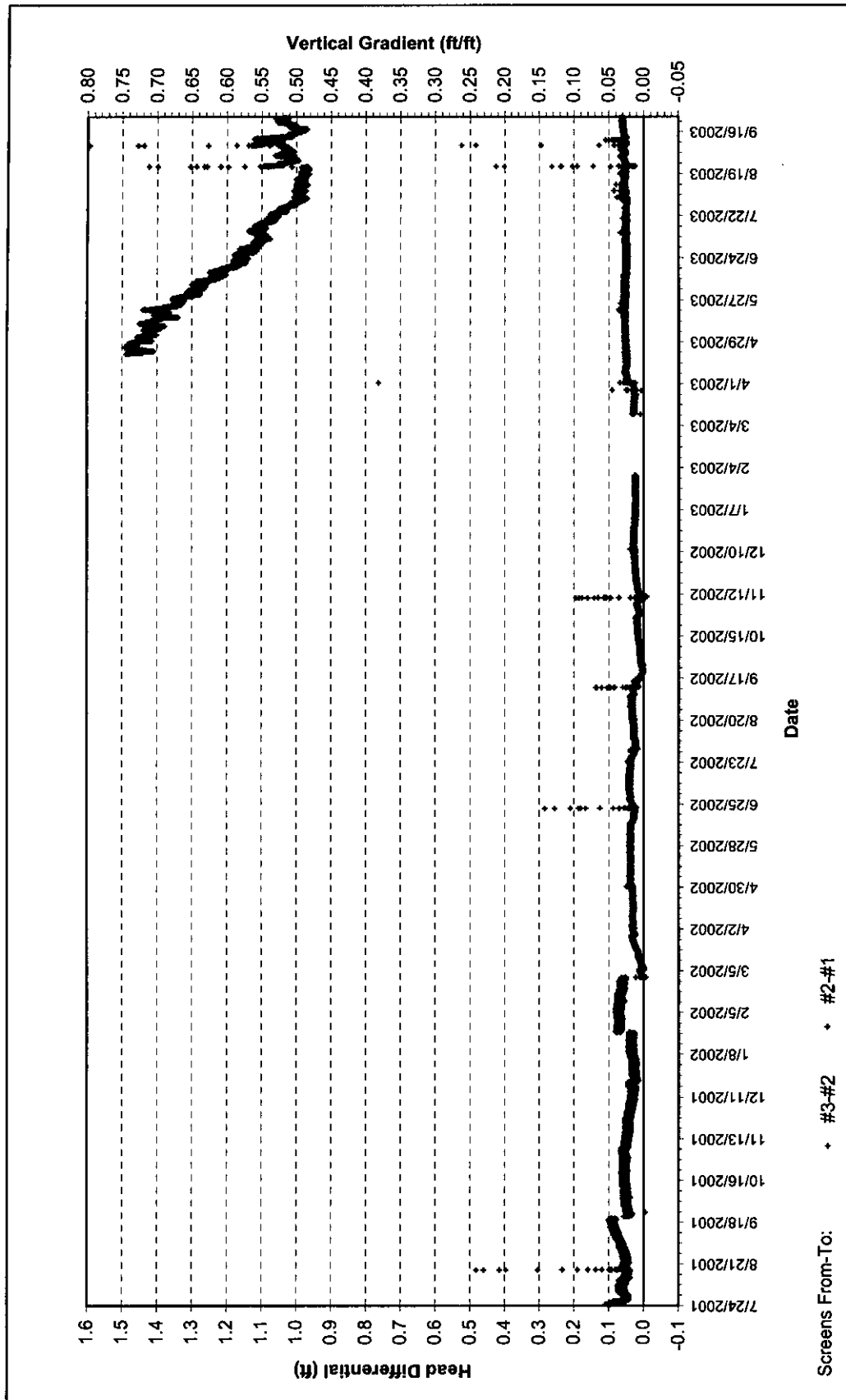


Figure F-3.2-2. LAP-1 piezometer nest head differentials and gradients, July 24, 2001, to September 25, 2003

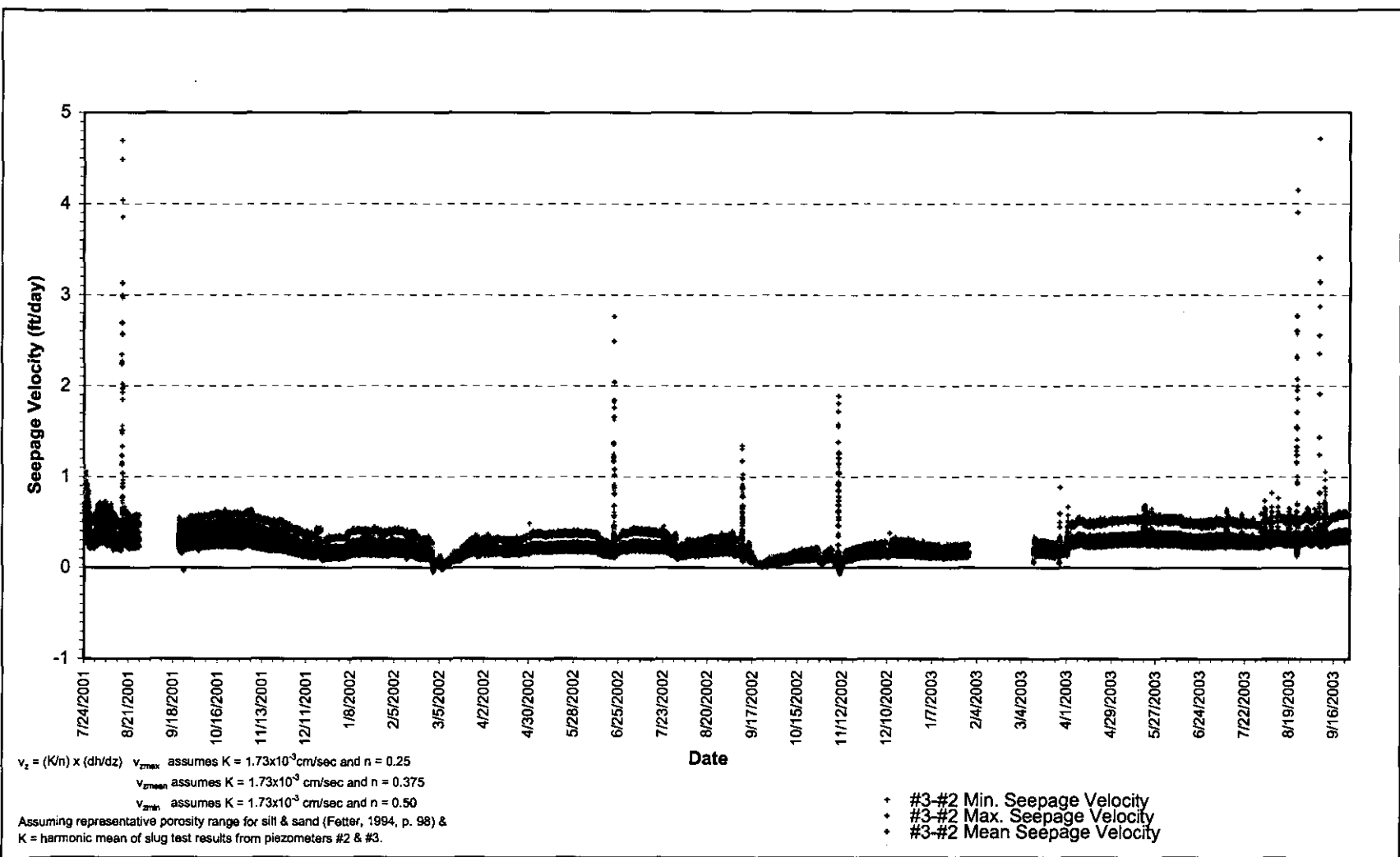


Figure F-3.2-3. LAP-1 piezometers #3 to #2 seepage velocity range, July 24, 2001, to September 25, 2003

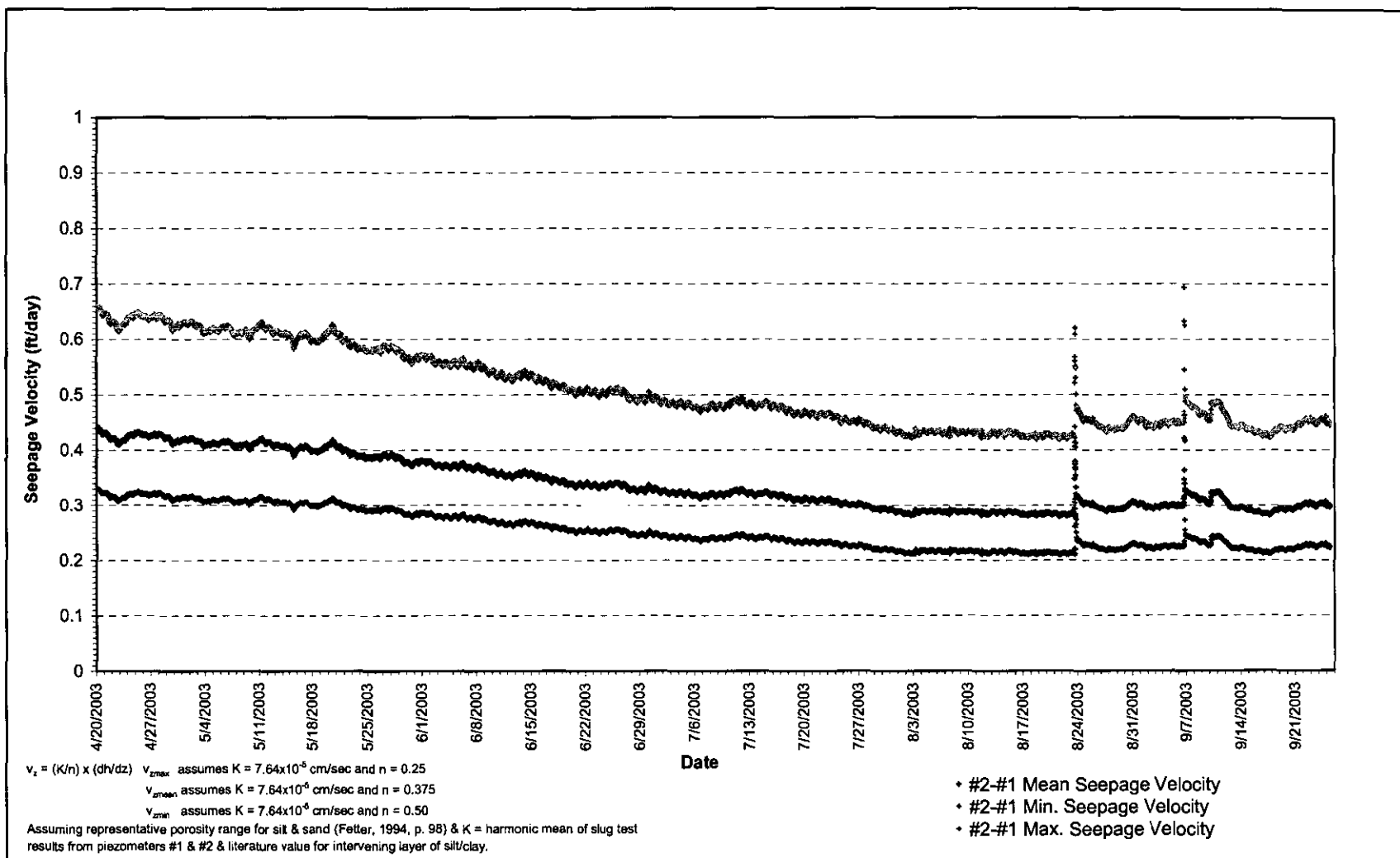


Figure F-3.2-4. LAP-1 piezometers #2 to #1 seepage velocity range, April 20, 2003, to September 25, 2003

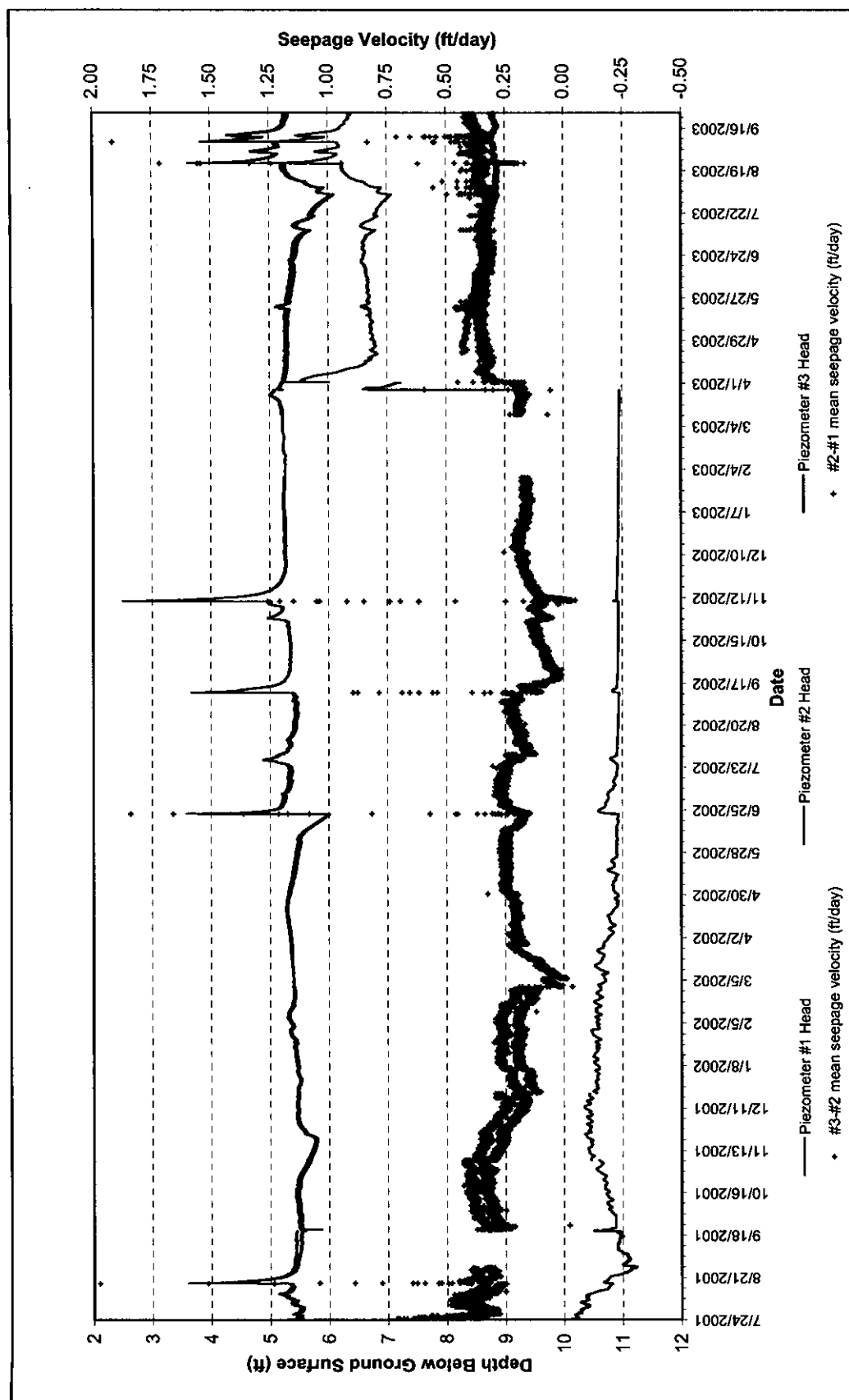


Figure F-3.2-5. LAP-1 piezometer nest water levels and mean seepage velocity comparison, April 21, 2003, to September 25, 2003

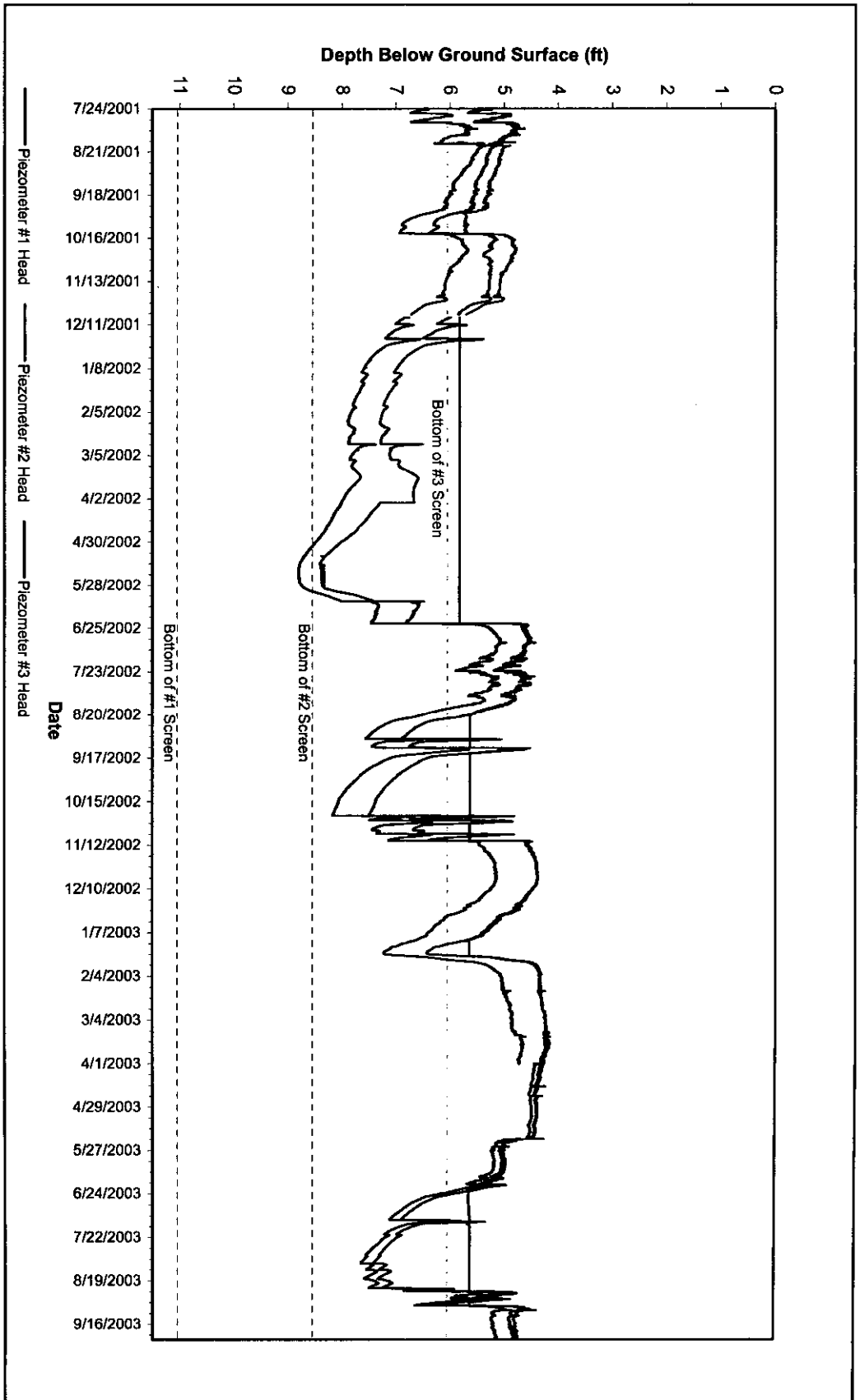


Figure F-3.2-6. LAP-1.5 piezometer nest water level comparison, July 24, 2001, to September 25, 2003

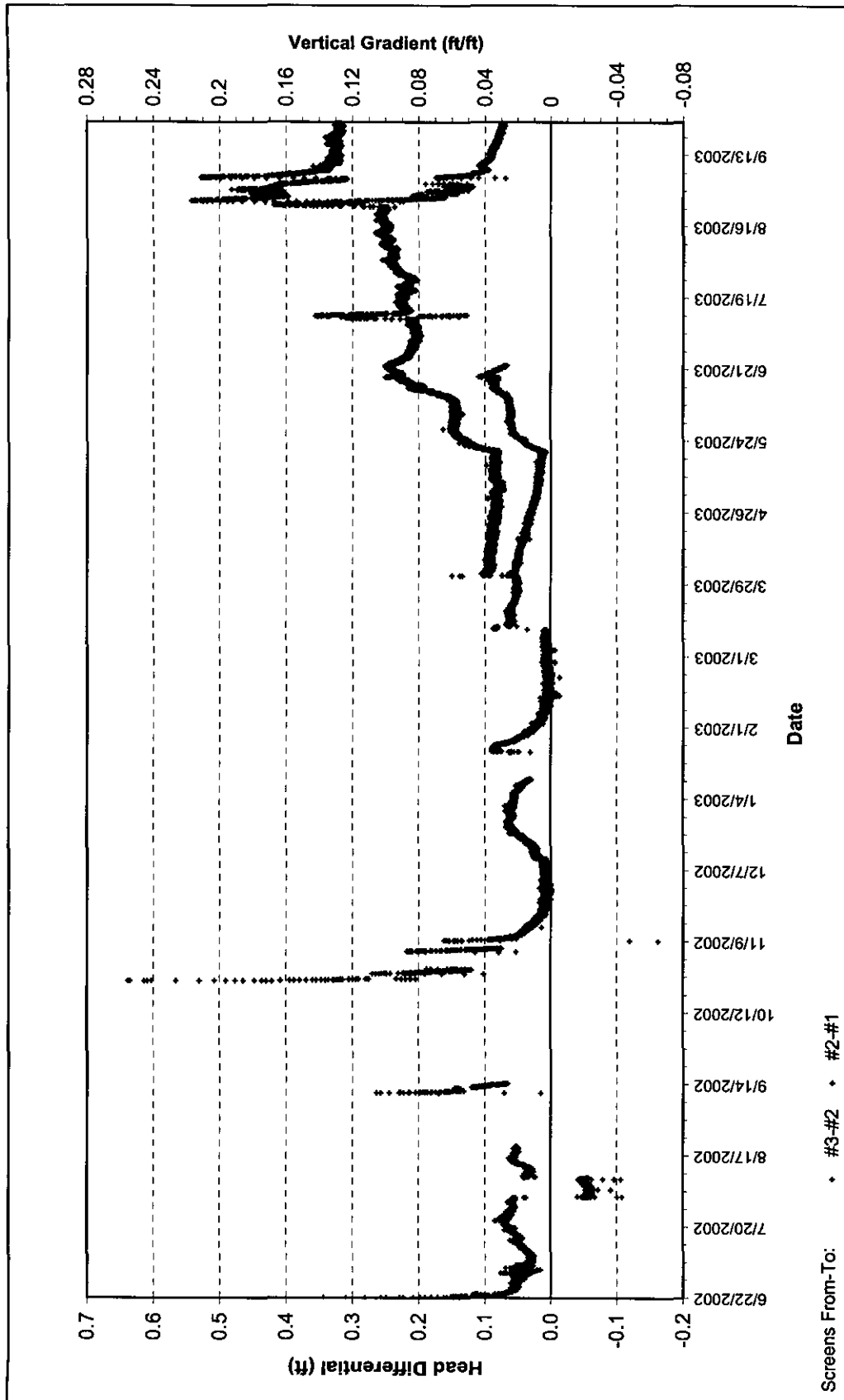


Figure F-3.2-7. LAP-1.5 piezometer nest head differentials and gradients, June 22, 2002, to September 25, 2003

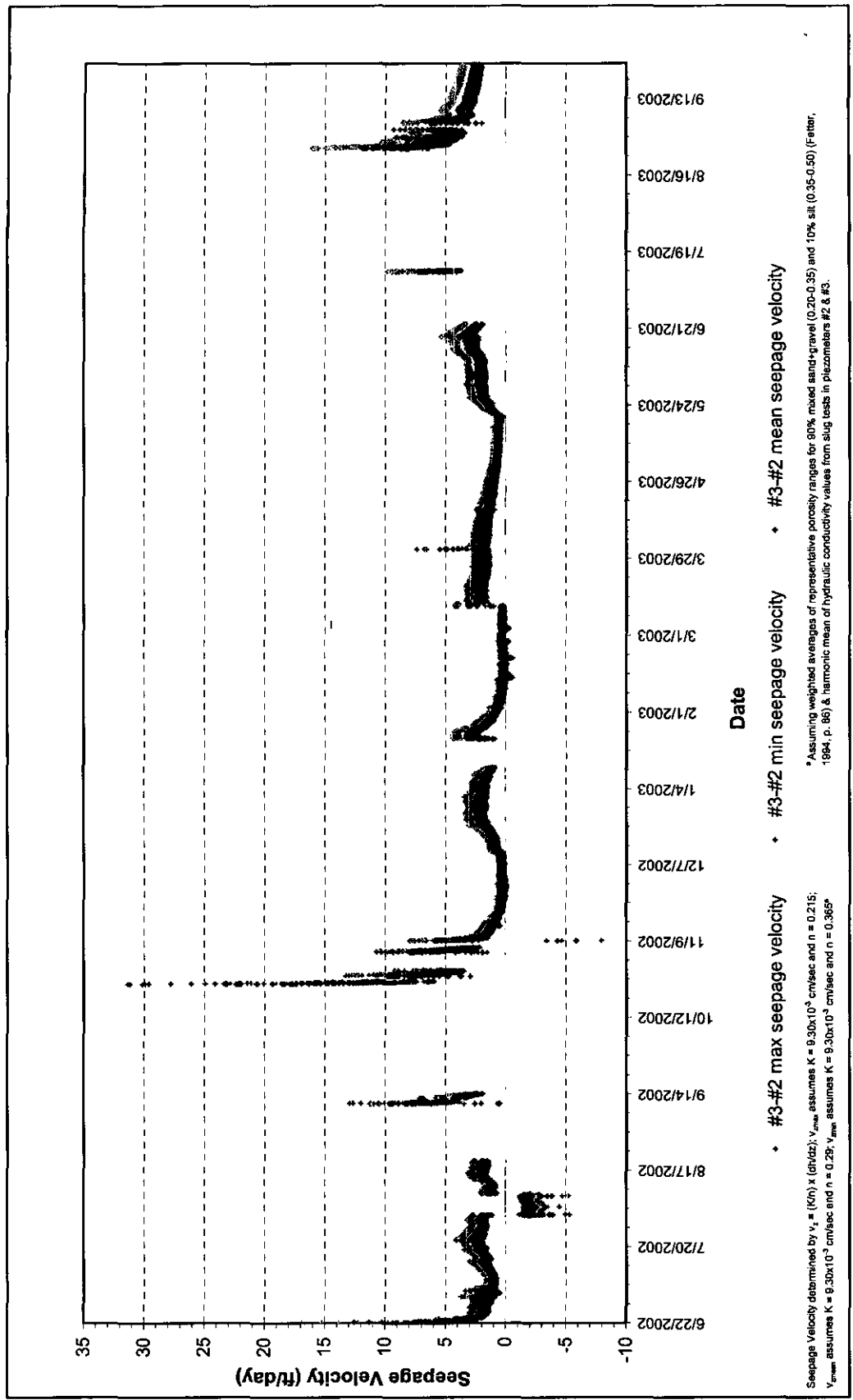


Figure F-3.2-8. LAP-1.5 piezometer nest #3 to #2 seepage velocity range, June 22, 2002, to September 25, 2003

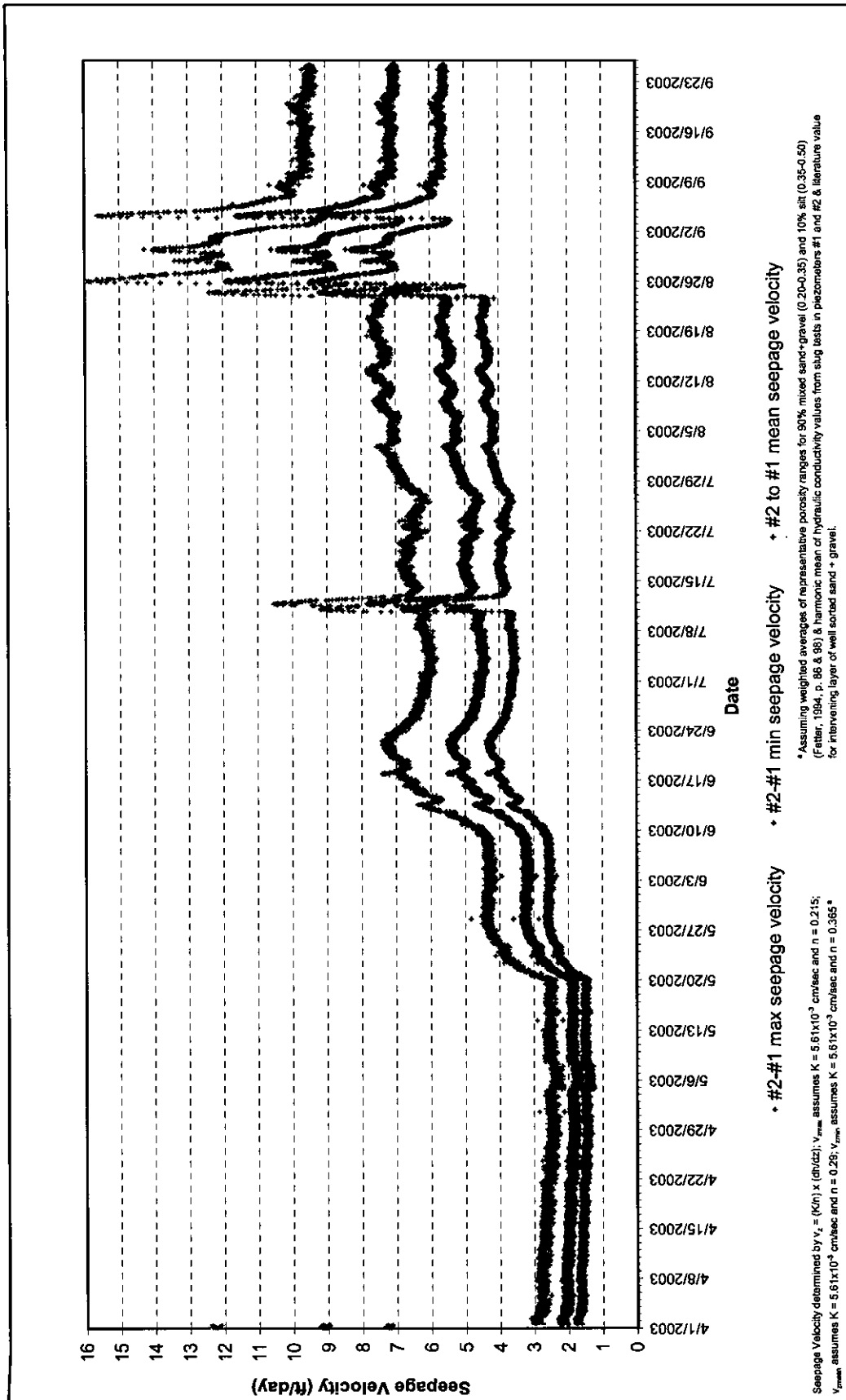


Figure F-3-2-9. LAP-1.5 piezometer nest #2 to #1 seepage velocity range, April 1, 2003, to September 25, 2003

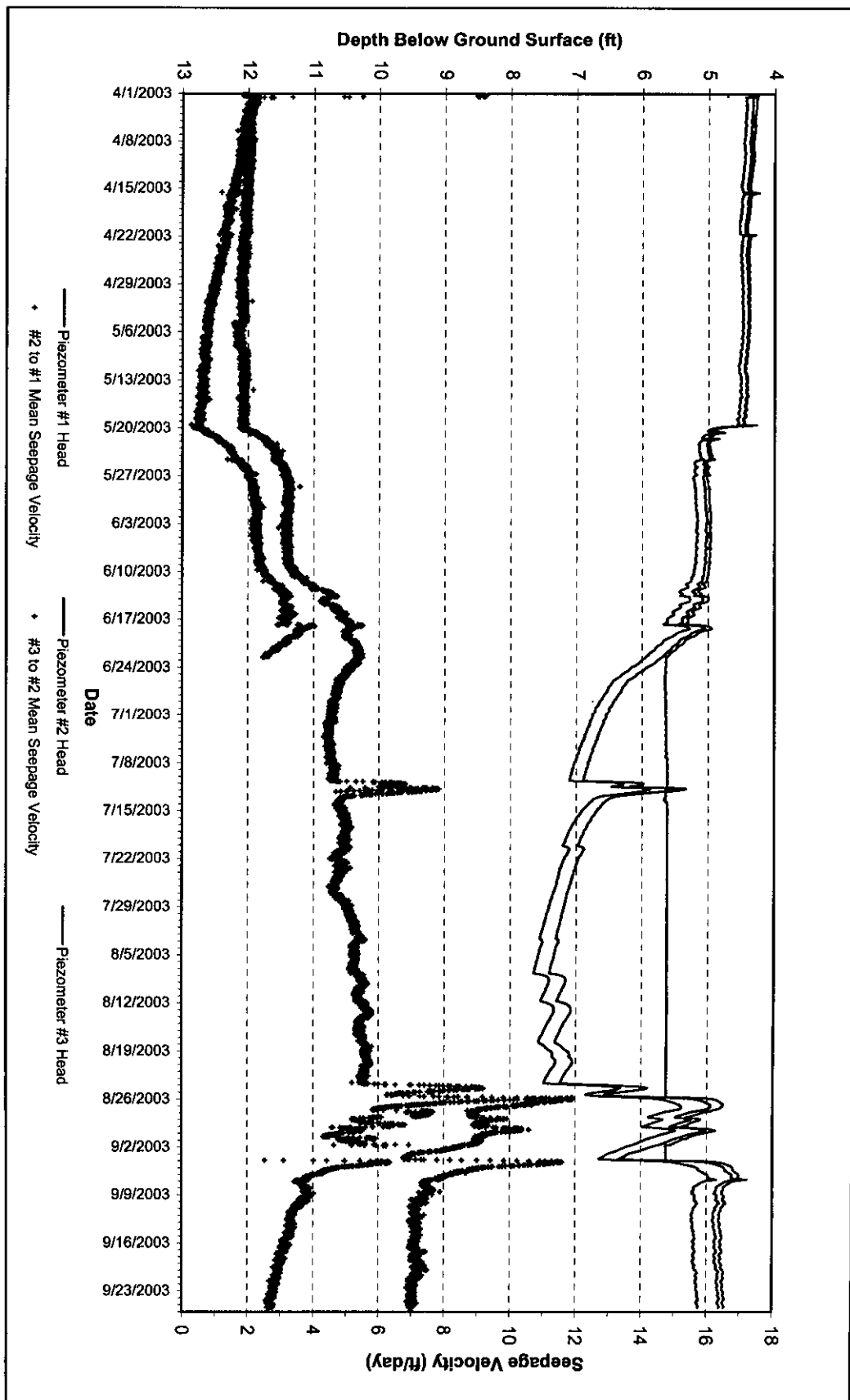


Figure F-3.2-10. LAP-1.5 piezometer nest water levels and mean seepage velocity comparison, April 1, 2003, to September 25, 2003

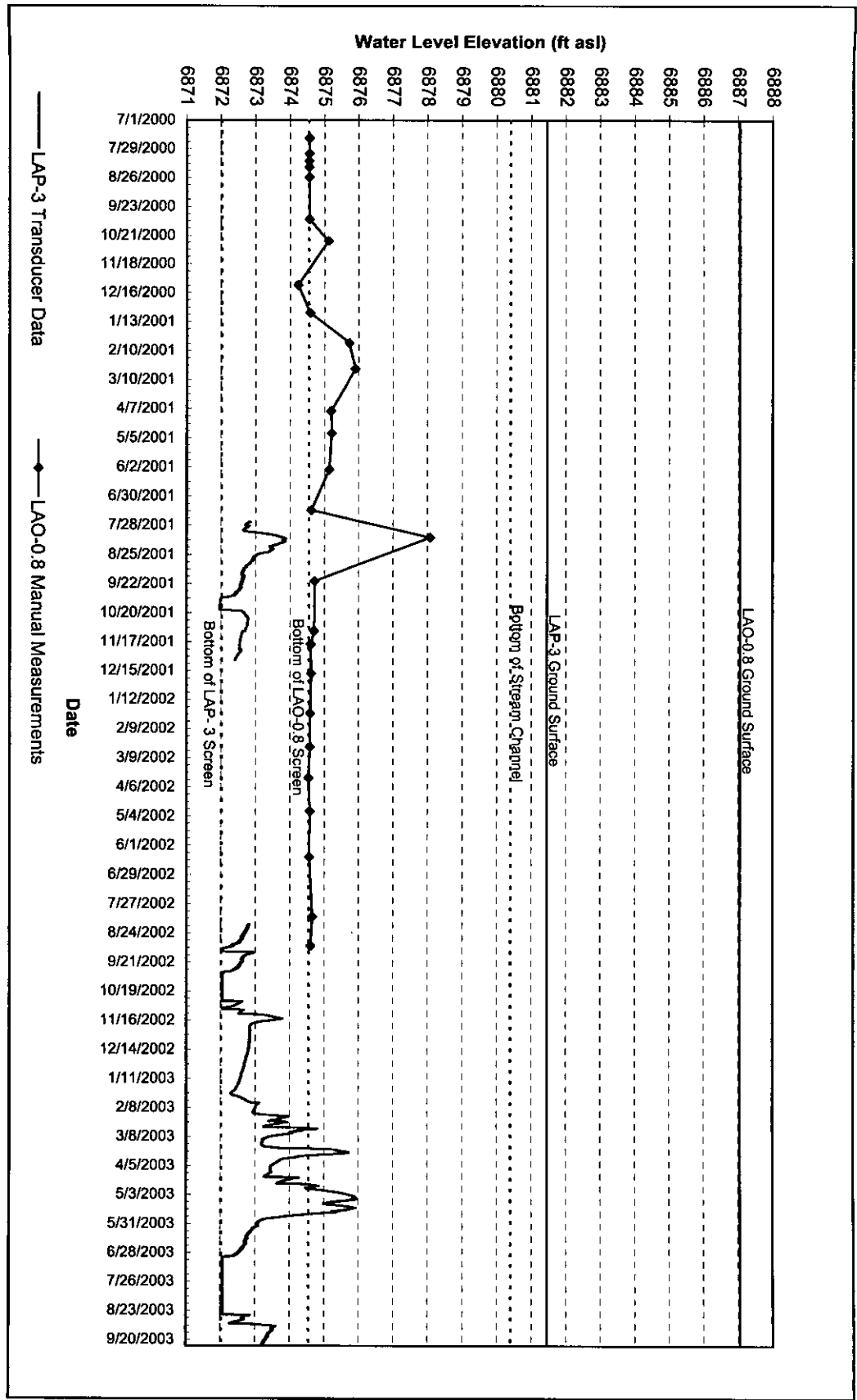


Figure F-3.2-11. LAP-3 piezometer and LAO-0.8 alluvial observation well water levels, July 1, 2000, to September 25, 2003

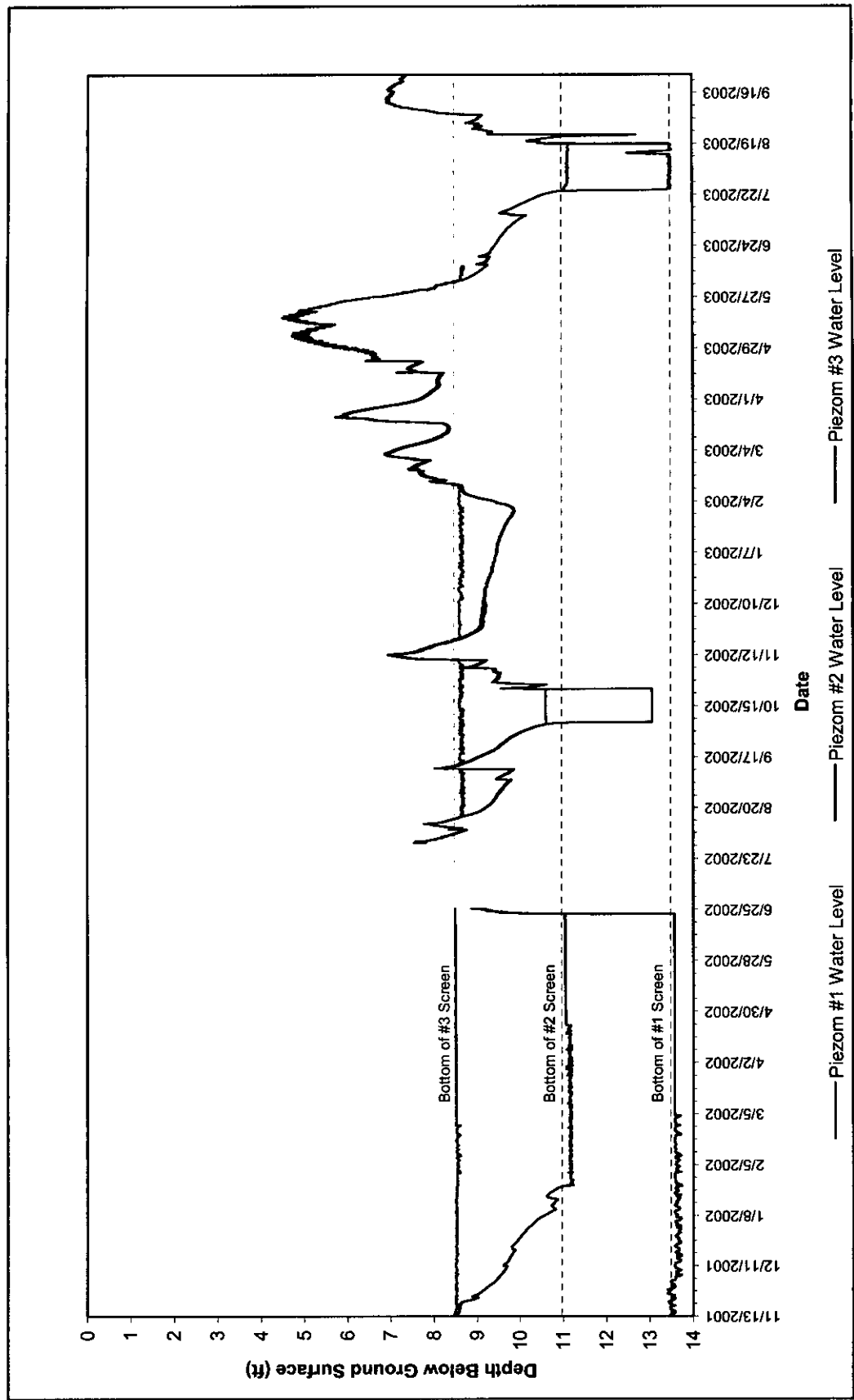


Figure F-3.2-12. LAP-3.5 piezometer nest water-level comparison, November 13, 2001, to September 25, 2003

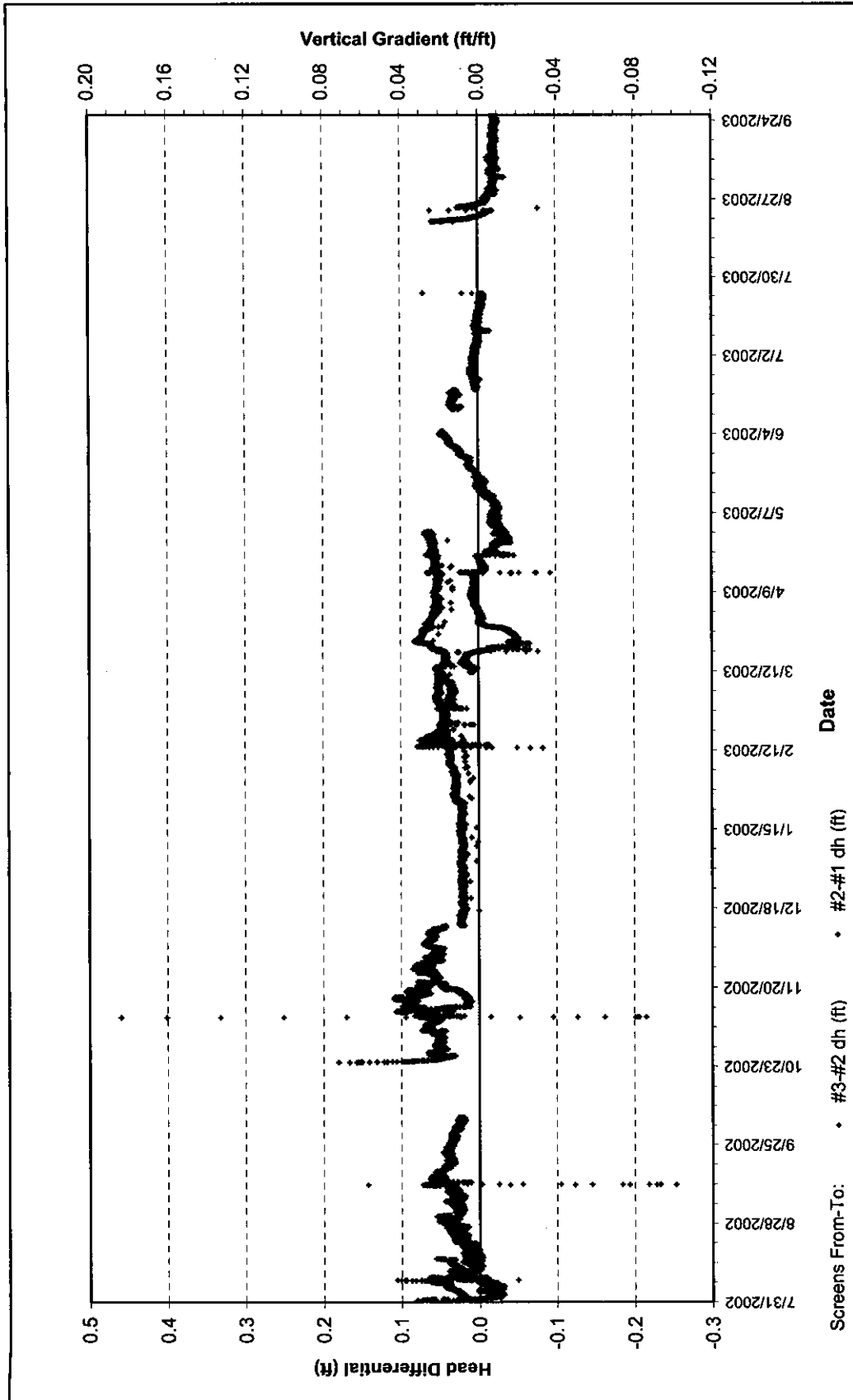


Figure F-3.2-13. LAP-3.5 piezometer nest head differentials and gradients, July 31, 2002, to September 25, 2003

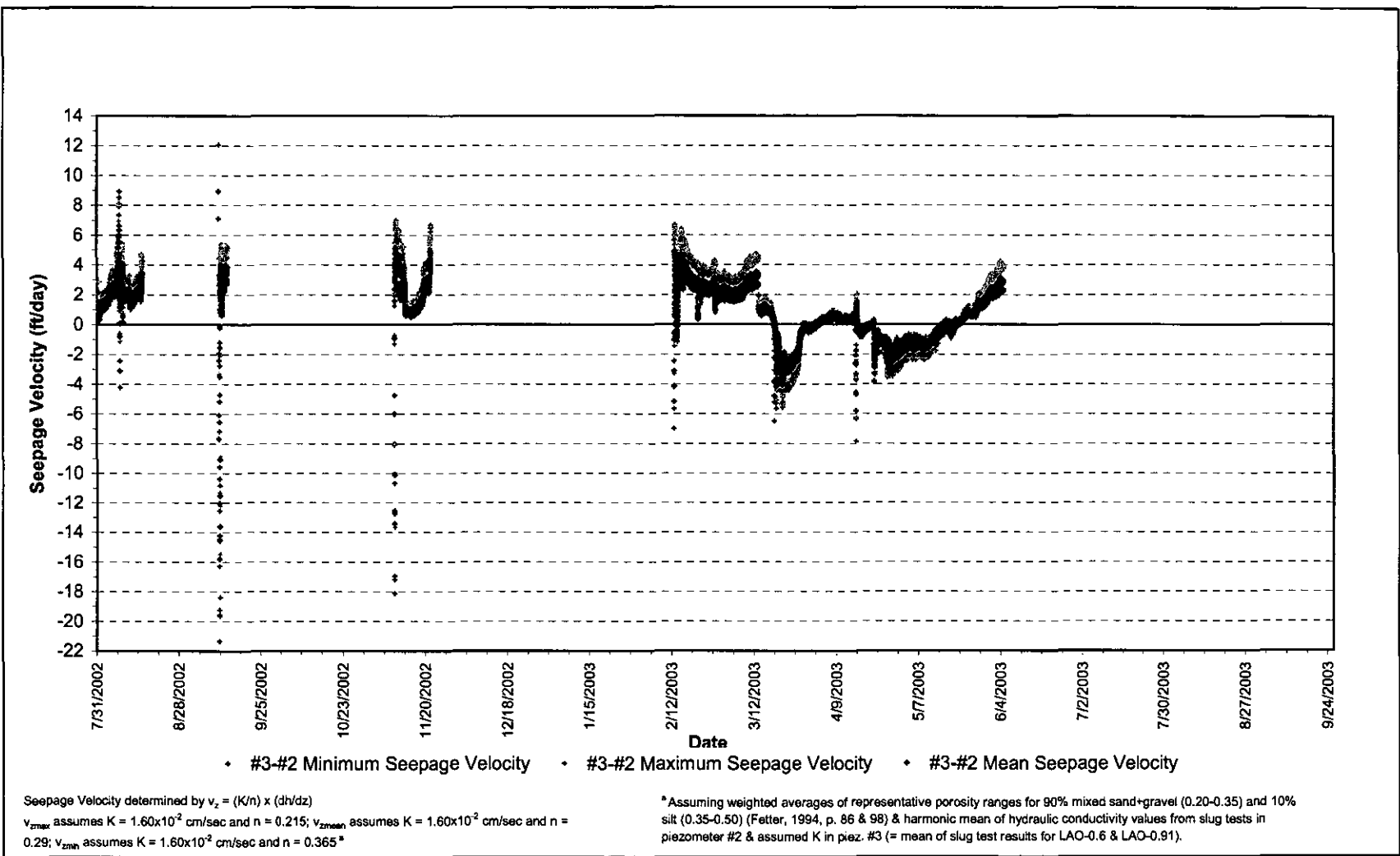


Figure F-3.2-14. LAP-3.5 piezometer nest #3 to #2 seepage velocity range, July 31, 2002, to September 25, 2003

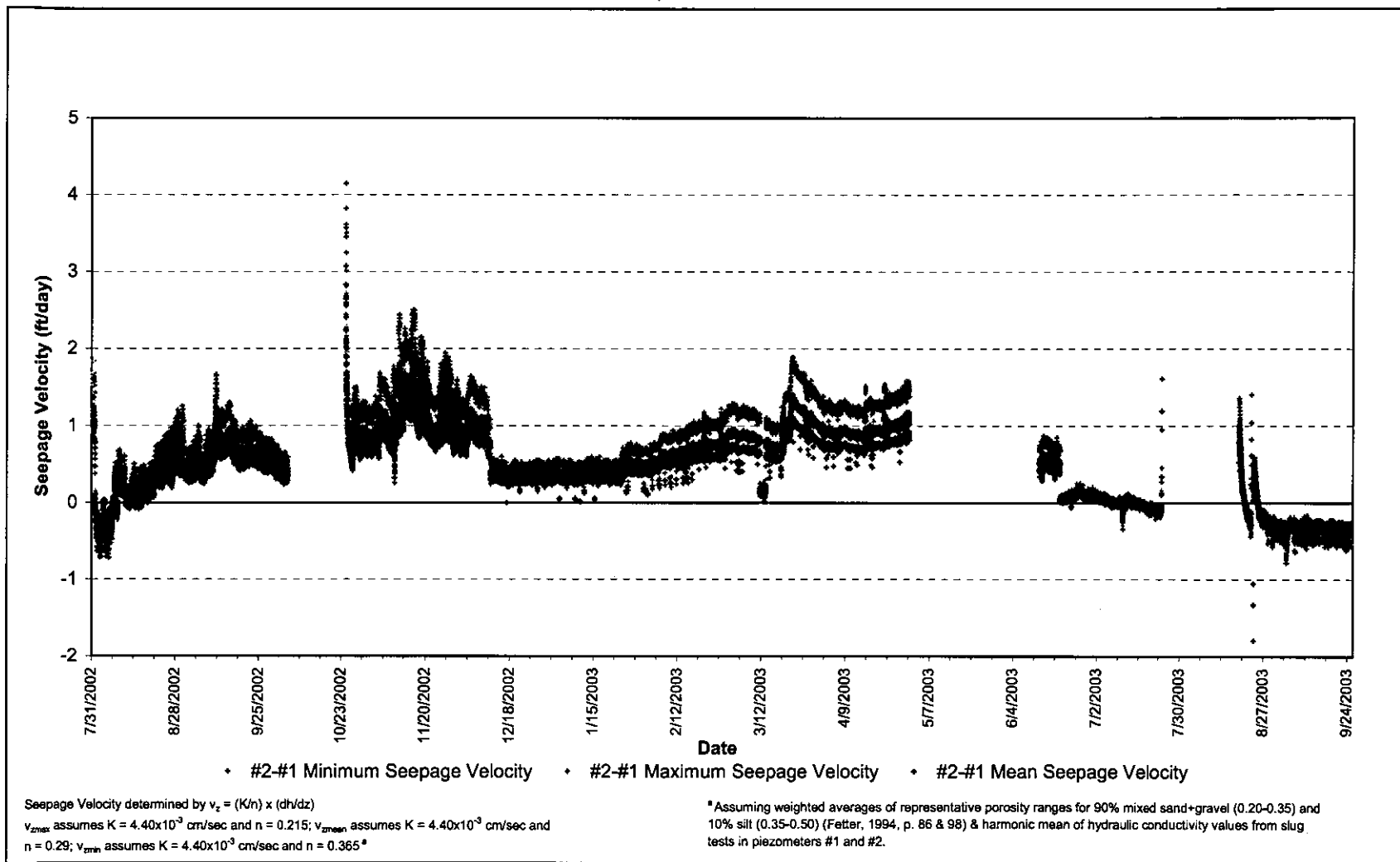


Figure F-3.2-15. LAP-3.5 piezometer nest #2 to #1 seepage velocity range, July 31, 2002, to September 25, 2003

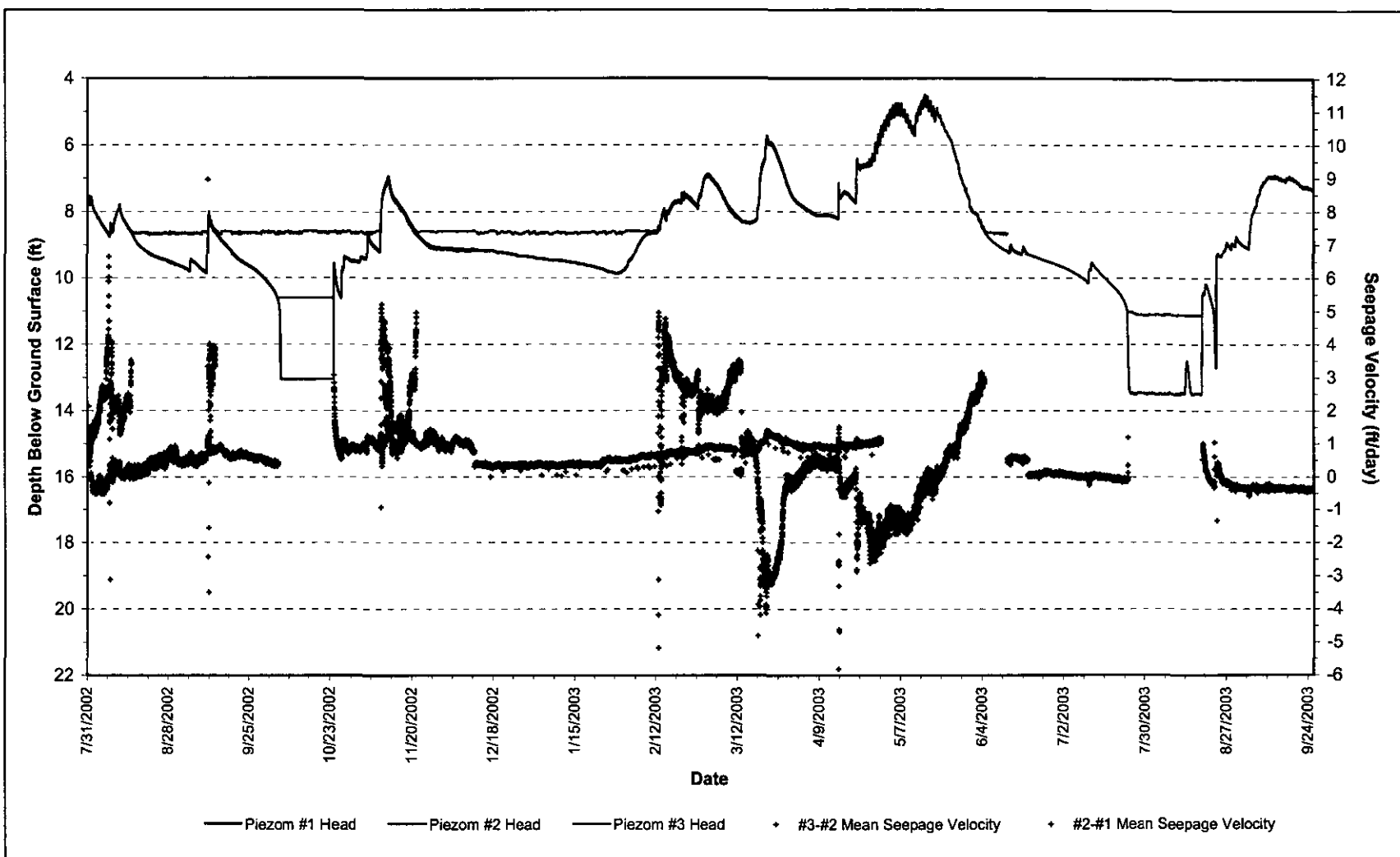


Figure F-3.2-16. LAP-3.5 piezometer nest water levels and mean seepage velocity comparison, July 31, 2002, to September 25, 2003

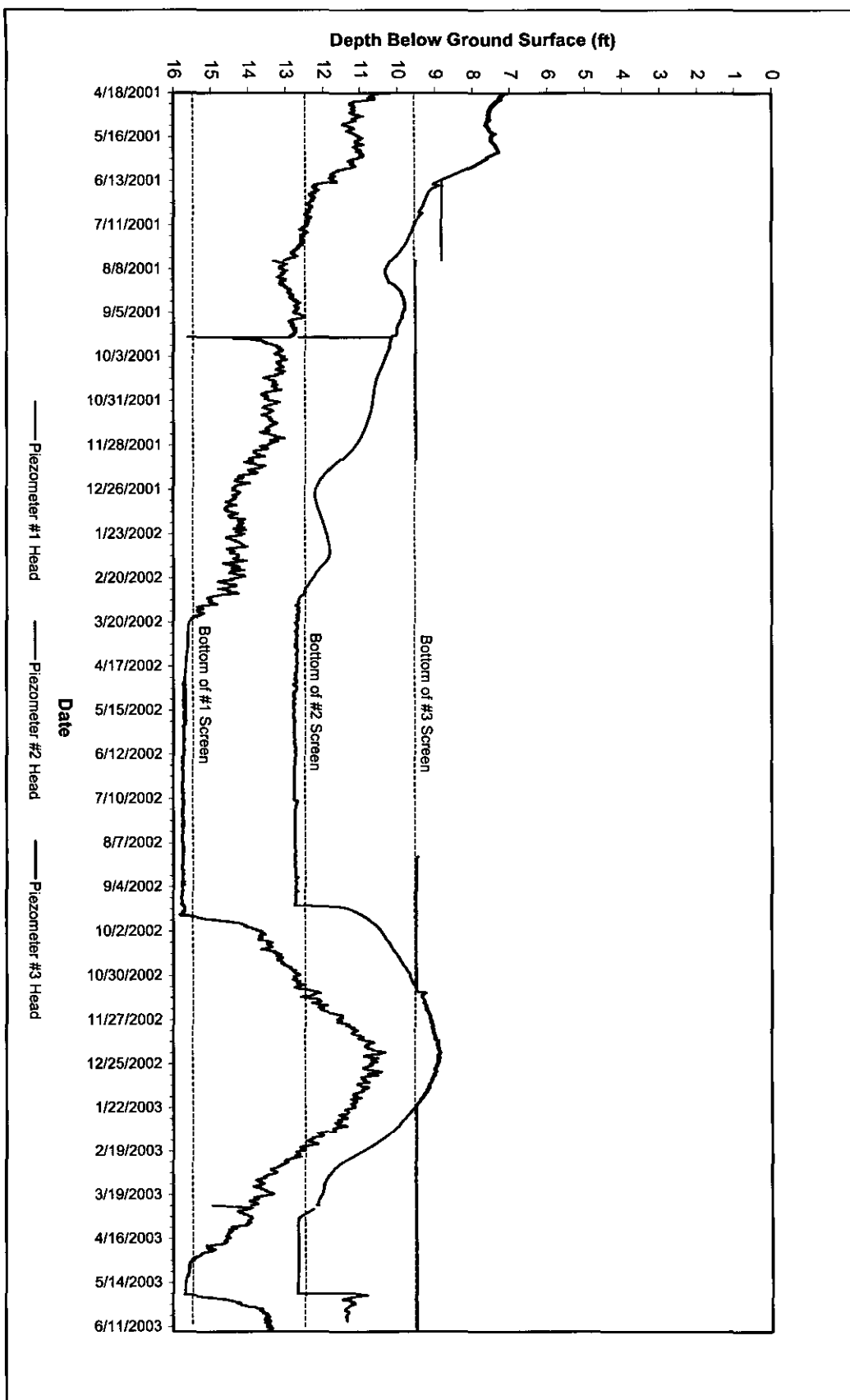


Figure F-3.2-17. LAP-4 piezometer nest water-level comparison, April 18, 2001, to June 13, 2003

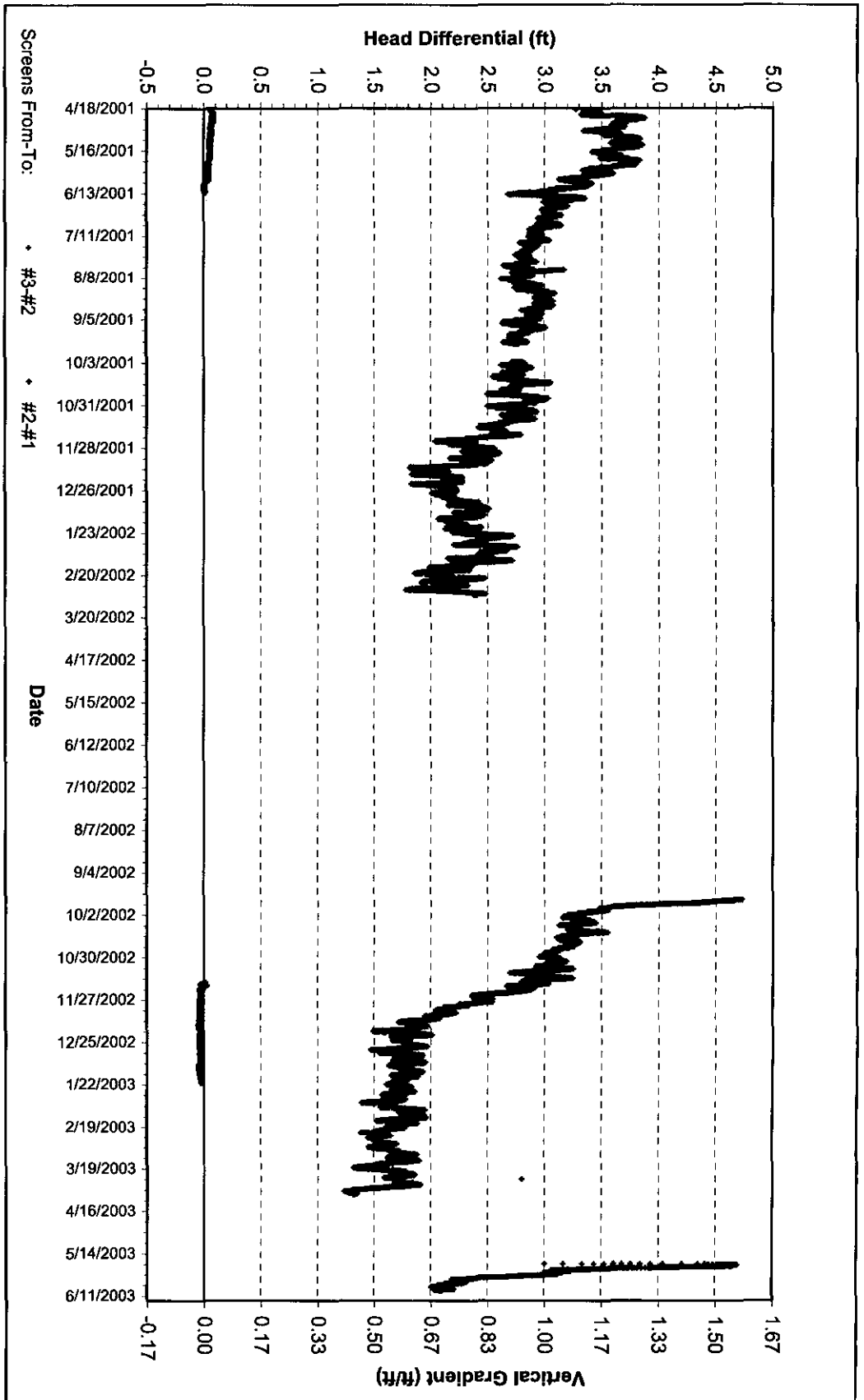


Figure F-3.2-18. LAP-4 piezometer nest head differentials and gradients, April 18, 2001, to June 13, 2003

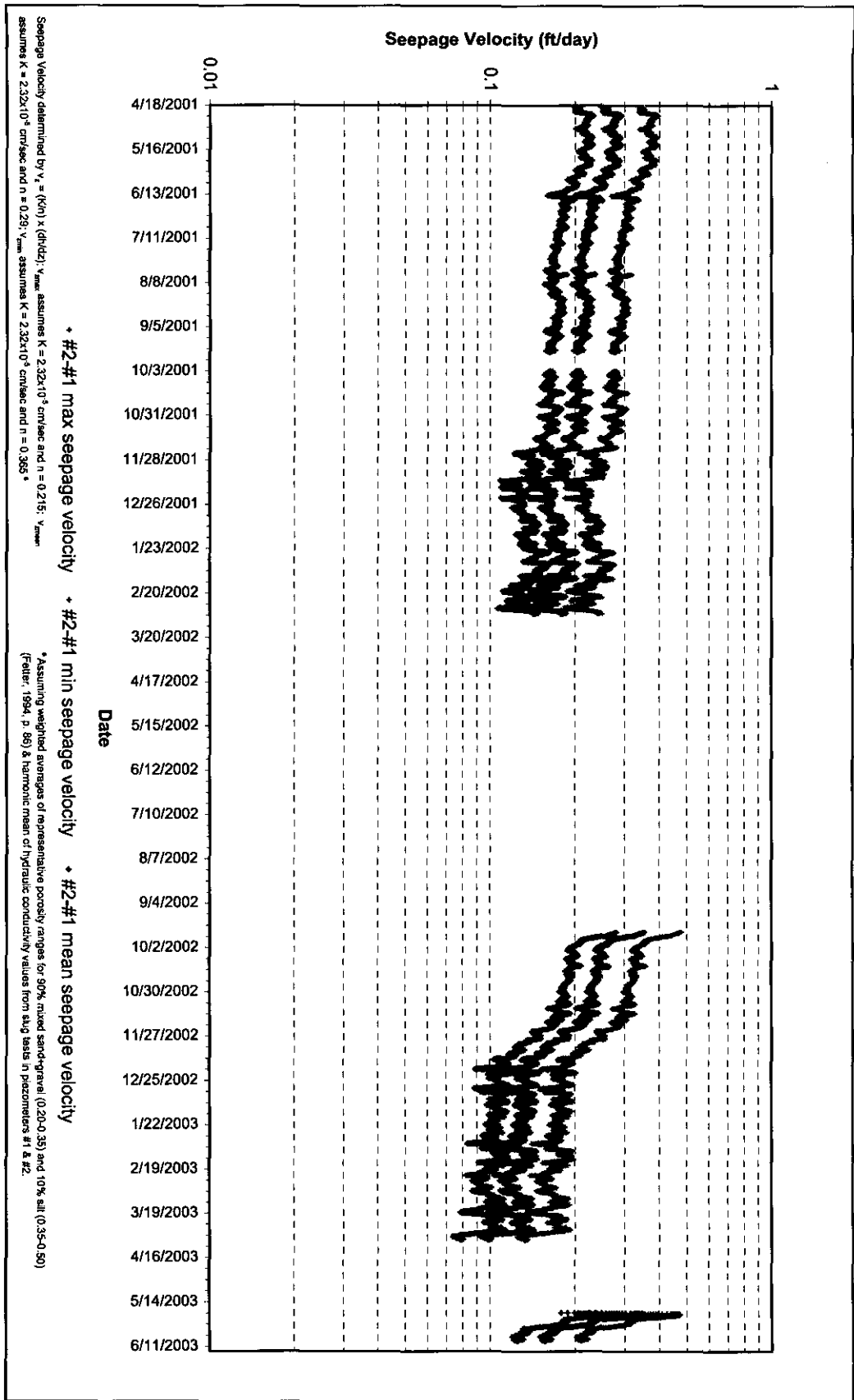


Figure F-3.2-19. LAP-4 piezometer nest #2 to #1 seepage velocity range, April 18, 2001, to June 13, 2003

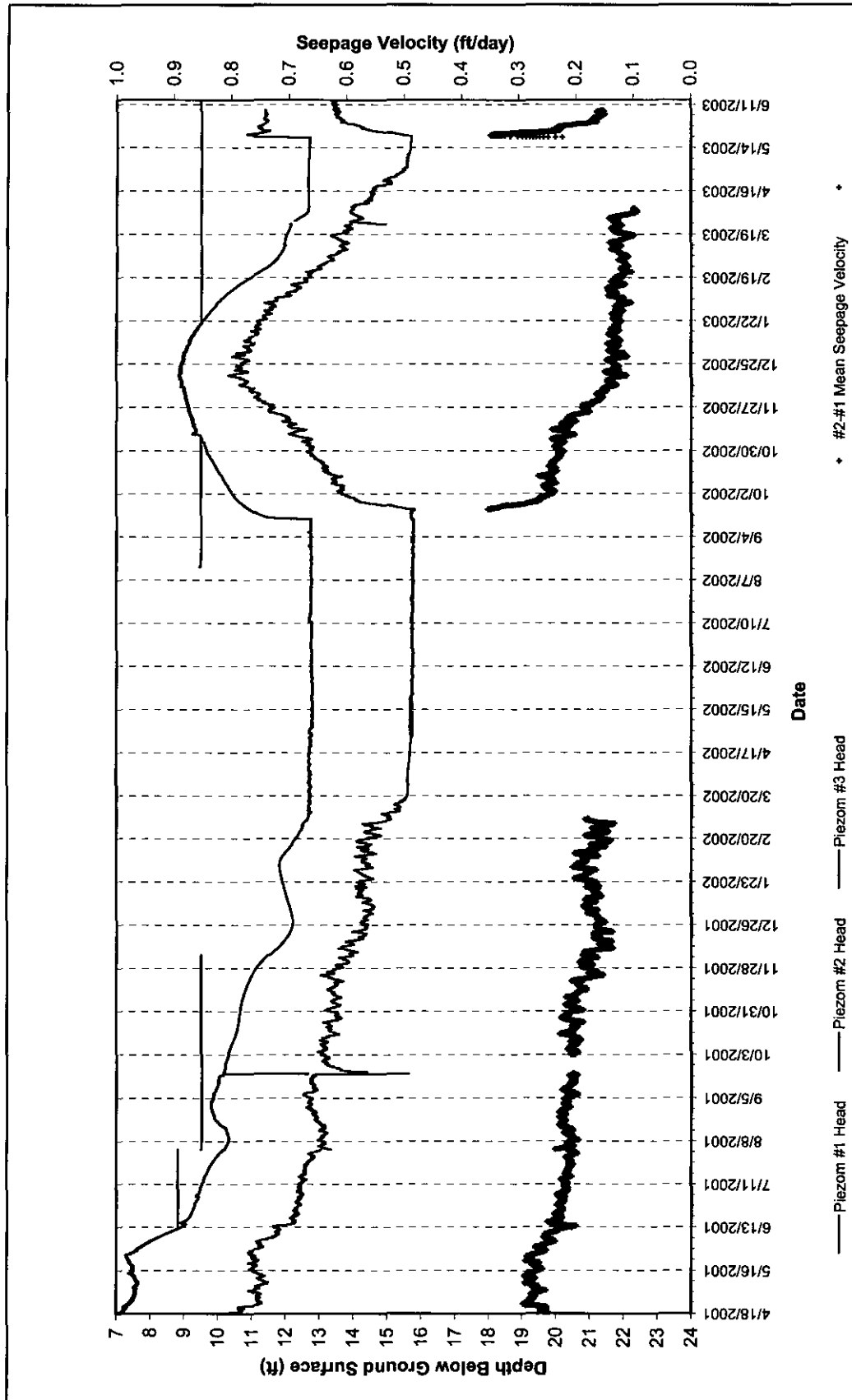


Figure F-3.2-20. LAP-4 piezometer nest water levels and seepage velocity comparison, April 18, 2001, to June 13, 2003

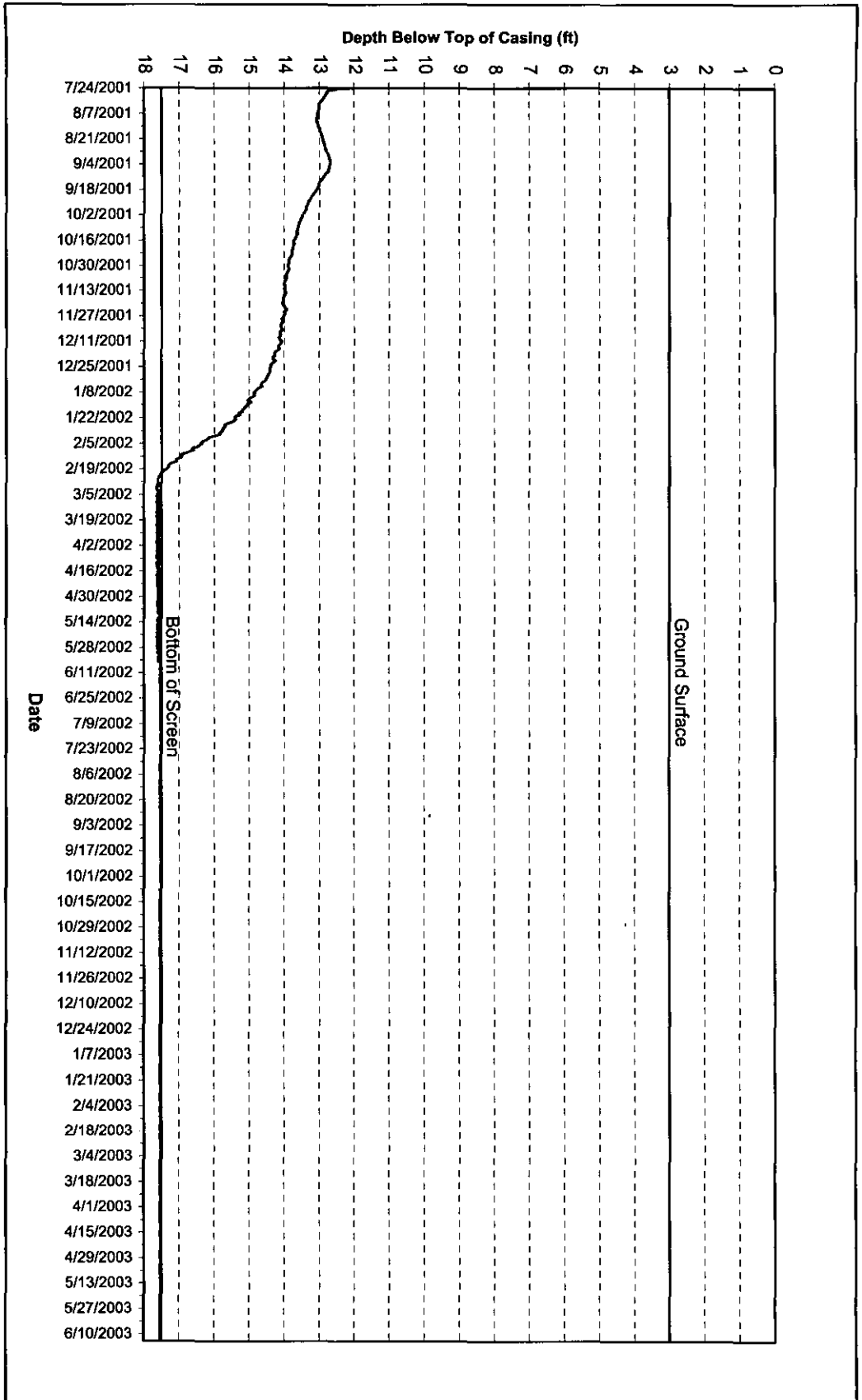


Figure F-3.2-21. LAP-5.7-#1 water level, July 24, 2001, to June 13, 2003

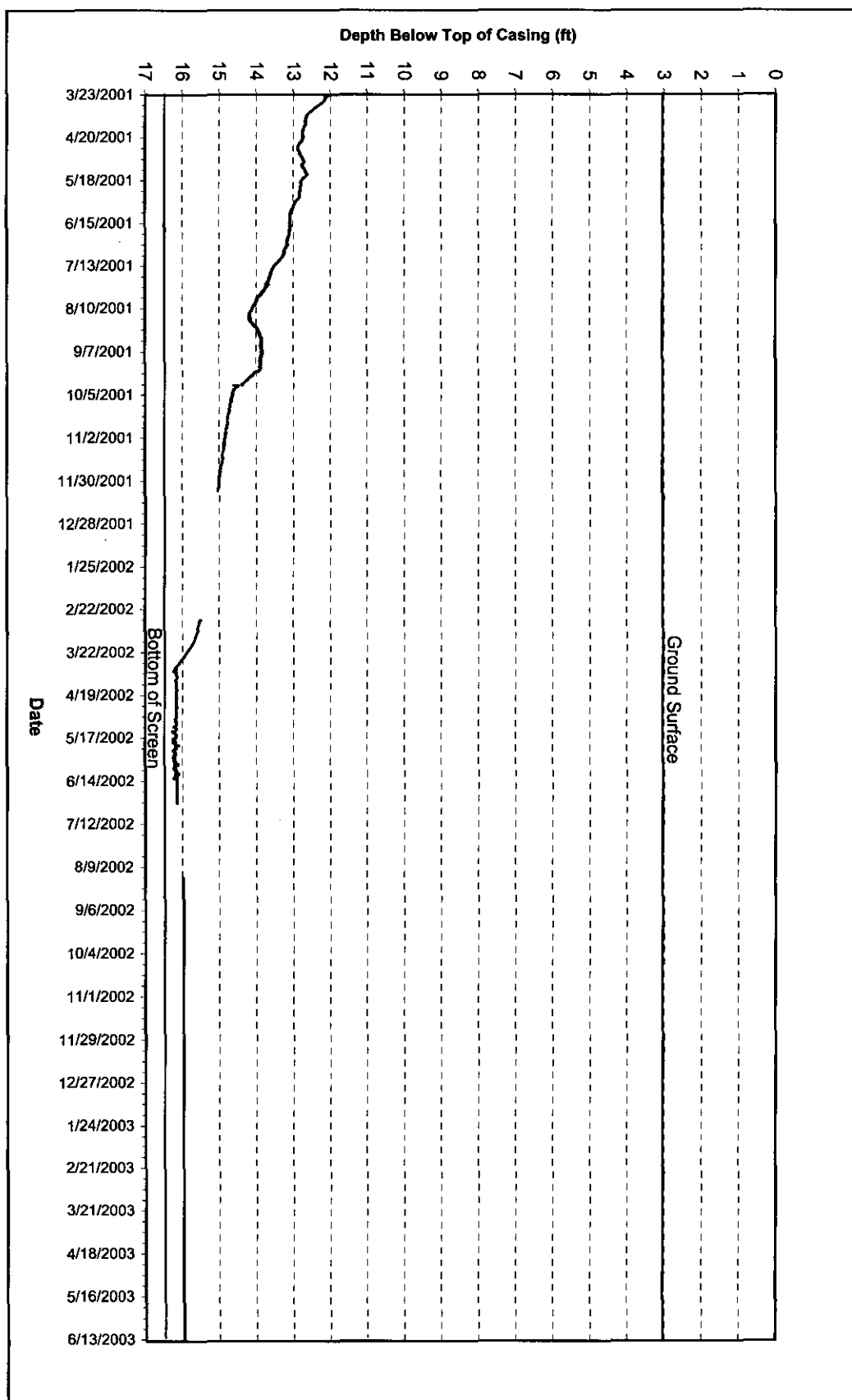


Figure F-3.2-22. LAP-6 water level, March 23, 2001, to June 13, 2003

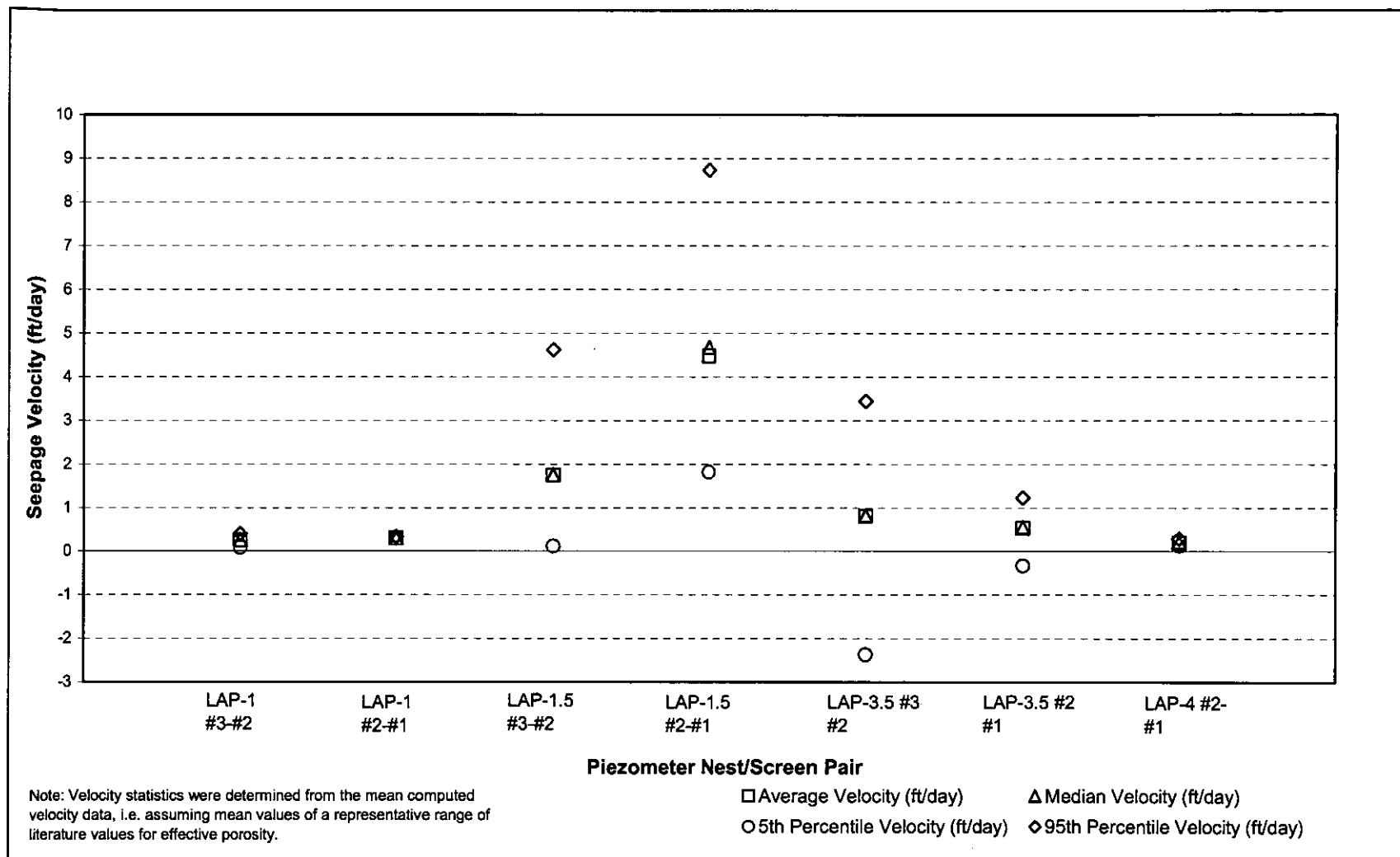


Figure F-3.3-1. Los Alamos Canyon piezometer nest mean computed seepage velocity statistics

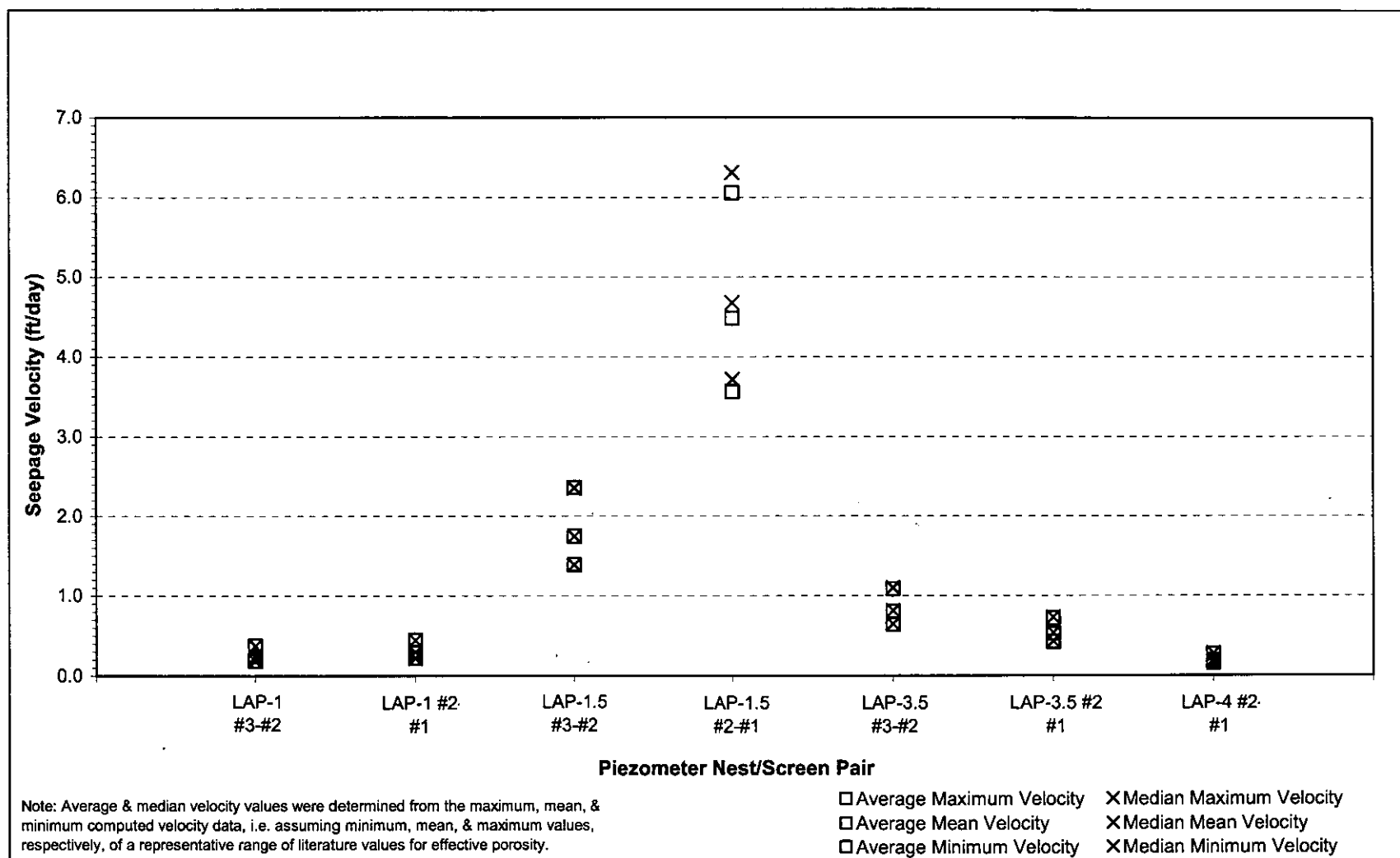


Figure F-3.3-2. Los Alamos Canyon piezometer nest average and median computed seepage velocity range

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